

# WELLS 2, 3, AND 4 WATER TREATMENT PLANT

CONTRACT NO. 2025-101

Department of Public Works  
Town of Sharon, MA

April 2024



## ENVIRONMENTAL

 **PARTNERS**

— An Apex Company —



**TOWN OF SHARON, MASSACHUSETTS  
WELLS 2, 3 AND 4 WATER TREATMENT PLANT**

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SECTION 00020

INVITATION TO BID

1. The Town of Sharon, Massachusetts, the Awarding Authority, invites bids for the **Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF Project #12443)** in accordance with the documents prepared by Environmental Partners Group.
2. Electronic Bids from pre-qualified Subcontractors for the filed sub-bid categories designated herein will be received until **2:00 PM prevailing time on May 7, 2024** for the following filed sub-bids:
  - Masonry
  - Miscellaneous and Ornamental Iron
  - Waterproofing, Damp Proofing and Caulking
  - Metal Windows
  - Painting
  - Plumbing
  - Heating, Ventilation and Air Conditioning
  - Fire Protection
  - Electrical Work

All filed sub-bids shall be submitted online at [www.Projectdog.com](http://www.Projectdog.com) and entitled “**[Filed Sub-bid Classification] Filed Sub-bid for Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF Project #12443)**” All electronic bids are compiled in real time upon bid close and published forthwith on ProjectDog. Official sub-bid tabulations shall be posted on ProjectDog.

3. Electronic Bids from pre-qualified General Bidders will be received until **2:00 p.m.** prevailing time on **May 21, 2024**. All bids shall be submitted online at [www.Projectdog.com](http://www.Projectdog.com) and entitled “**Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF Project #12443)**” All electronic bids are compiled in real time upon bid close and published forthwith on ProjectDog. Official bid tabulations shall be posted on ProjectDog.
4. Pre-qualified General Bidder shall be certified by the Division of Capital Asset Management and Maintenance (DCAMM) in ***Sewage and Water Treatment Plants***. Pre-qualified Filed Sub-bidders shall be certified by the Division of Capital Asset Management and Maintenance (DCAMM) in the category applicable to the filed sub-bid. Each Bid Proposal and Filed Sub-bid Proposal must include a Certificate of Eligibility in their respective category of eligibility.
5. A non-mandatory pre-bid meeting will be held at the project site, 15 Tree Lane, Sharon, MA 02067 on **April 29, 2024 at 2:00 p.m.** Bidders are strongly encouraged to attend the pre-bid meeting.

6. The Work under this Contract includes, but is not necessarily limited to, the construction of the Wells 2, 3, and 4 Water Treatment Plant and modifications to existing Well Stations. The Wells 2, 3, and 4 WTP will include: a pre-fabricated metal building system; chemical storage tanks and chemical feed systems; an iron and manganese filtration system; a PFAS treatment system; air scour blower; backwash waste tank; finished water wet well; recycle, backwash waste, sludge, and finished water pumps; and associated structural, architectural, process piping, instrumentation and controls, plumbing, fire protection, HVAC, and electrical work to provide a fully functional water treatment plant as specified in the Contract Documents. Modifications to Well Stations 2, 3, and 4 include selective demolition of chemical feed systems; instrumentation and controls; and replacement of process mechanical equipment, pumps, piping, and appurtenances. Additional well station work includes miscellaneous demolition, miscellaneous HVAC work, miscellaneous plumbing work, miscellaneous electrical work, yard piping, and appurtenances, as shown in the Contract Drawings. All proposed work at the well stations shall be sequenced as described in the Contract Drawings.
7. All sub-bids and general bids shall be submitted electronically online at [www.Projectdog.com](http://www.Projectdog.com) no later than the date and time specified above. Hard copy bids will not be accepted by the Awarding Authority.
8. This project is being Electronically Bid (E-Bid). All bids shall be submitted online at [www.Projectdog.com](http://www.Projectdog.com). Hard copy bids will not be accepted by the Awarding Authority. Tutorials, instructions, and videos on how to complete the electronic bid documents are available online as well as in Section 00100 - Instructions to Bidders and Supplemental Instructions to Bidders for Electronic Bid Projects. For assistance, contact Projectdog, Inc. at (978) 499-9014.
9. Bid forms and contract documents are available online at [www.Projectdog.com](http://www.Projectdog.com). Enter Project **Code 861012** in the project locator box and select “Acquire Documents” to download documents or to purchase hard copies. New users to Projectdog.com must first select Sign Up to create an online account. Contract documents may also be viewed, but not removed, from the offices of Projectdog, Inc., 18 Graf Road - Unit 8, Newburyport, MA 01950, Monday – Friday, 8:30 a.m. to 5:00 p.m beginning **April 12, 2024**.
10. Any and all addenda shall be posted online at Projectdog.com. Each individual or firm recorded as having received the contract documents will be notified by email if and when addenda are issued. Hard copies of addenda will not be mailed or faxed to plan holders. It is the sole responsibility of the Bidder to review any and all addenda prior to the bid opening either online or at the offices of Projectdog, Inc.
11. All documents shall be submitted in PDF format only. All bidders must complete and digitally sign (Adobe) or print, complete, sign and scan bid form Signature page(s) and upload as a PDF file.
12. Construction must be complete **870 calendar days** from and including issuance of a notice to proceed, and/or receipt of fully executed contract. All proposed work shall be sequenced as described in the Contract Drawings.
13. Contract payment will be by the unit price method and the lump sum price method as indicated on the Bid Form. No Bidder may withdraw his/her Bid for a period of forty-five (45) calendar days after the actual date of the opening of the Bids.

14. Bidders shall certify that they do not, and will not, maintain or provide for their employees any facility that is segregated on a basis of race, color, creed, sex, national origin, or sexual preference.
15. The bidding and award of the Contract shall be in full compliance with Sections 44A to 44J inclusive of Chapter 149 of the General Laws of the Commonwealth of Massachusetts as last revised.
16. This project shall also comply with Sections 39F, 39K, 39N, and 39O of Chapter 30 of the General Laws of the Commonwealth of Massachusetts as last revised and included in Appendix B.
17. This project shall also comply with Sections 39I, 39J, 39L, 39M, 39P, and 39R of Chapter 30 and Sections 34 of Chapter 149 and Section 40 of Chapter 82 of the General Laws of the Commonwealth of Massachusetts as last revised.
18. Each bid shall also be accompanied by a bid security in the form of a certified, treasurer's or cashier's check issued by a responsible bank or trust company, payable to the commonwealth or public agency or bid bond in the amount of 5 percent (5%) of the value of the Bid. Bid Bonds issued by a surety company must be uploaded with the other required forms. Bidders providing bid bonds in the form of cash or check must complete and upload the Bid Bond Affidavit Form.
19. Minimum Wage Rates as determined by the Executive Office of Labor and Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project.
20. Disadvantaged Business Enterprise (DBE) goals are applicable to the total dollars paid to the construction contract. The goals for this project are a minimum of 4.20 percent D/MBE participation and 4.50 percent D/WBE participation by certified DBEs. The two low Bidders shall submit completed DBE forms (EEO-DEP-190C, EEO-DEP-191C and the DBE Certification of United States Citizenship form) by the close of business on the third business day after Bid opening. Failure to comply with the requirements of this paragraph may be deemed to render a proposal non-responsive. No waiver of any provision of this section will be granted unless approved by the Department of Environmental Protection (MassDEP).
21. The successful Bidder must furnish 100 percent (100%) Construction Performance Bond and 100 percent (100%) Construction Payment Bond.
22. Complete instructions for filing Bids are included in the Instructions to Bidders, Section 00100.
23. The Owner reserves the right to waive any informality in or to reject any or all Bids if deemed to be the best interest of the Town of Sharon.

24. The Owner reserves the right to omit part or whole of any proposed work to be performed, as described in the Contract Documents, as may be required to maintain the total cost of work within available funds.
25. This project requires compliance with the Department of Environmental Protection's Diesel Retrofit Program.
26. This project is funded in part by the Massachusetts Clean Water Trust (the "Trust"). The Contractor shall comply with all funding requirements.

**SHARON, MASSACHUSETTS**

END OF SECTION 00020

SECTION 00100

INSTRUCTIONS TO BIDDERS

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27. American Iron and Steel (AIS)
28. Build America Buy America (BABA)

1. Receipt and Opening of Bids:

The Town of Sharon (herein called the "Owner") invites bids on the form attached hereto, all blanks of which must be appropriately filled in. All filed sub-bids and general bids shall be submitted electronically online at [www.Projectdog.com](http://www.Projectdog.com) no later than the date and time specified. No hard copy bids will be accepted. All electronic bids are compiled in real time upon bid close and published forthwith on ProjectDog. Official bid tabulations shall be posted on ProjectDog. The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered.

No Sub-Bidder or Bidder may withdraw a bid within forty-five (45) calendar days after the actual date of the opening thereof. If a bidder chooses to withdraw a bid, based on a “clerical or mathematical error,” the awarding authority is able to retain their bid bond up to the value of the bond, up to the delta between the bidder and the next low bidder. In this case, the awarding authority will ask for evidence of a clerical error.

## 2. Preparation of Bid:

Bids shall be submitted electronically at [www.Projectdog.com](http://www.Projectdog.com) as appropriate and at no cost. There are PDF and video tutorials available online. For additional assistance call Projectdog, Inc 978-499-9014.

All bidders must complete and digitally sign (Adobe) or print, complete, sign and scan bid form Signature page(s) and upload as a PDF file.

All documents must be in PDF format only.

Sums shall be expressed in both words and figures in the space indicated on the bid form. Where there is a discrepancy between the bid sum expressed in words and the bid sum expressed in figures, the words shall control. Note: The online form will automatically match the word value to the numeric figure entered in whole dollar amounts with no punctuation.

Each bid must be submitted on the prescribed form. All blank spaces for bid prices must be filled in both words and figures. Each bid must be submitted electronically online at [www.Projectdog.com](http://www.Projectdog.com) no later than the date and time specified bearing the name of the Bidder, his address, the name of the project for which the bid is submitted, and containing the bid security as specified in paragraph 5 below.

Enclosed with the bid shall be:

- Bid Security (5%), and Bid Bond Affidavit if check
- List of Proposed Subcontractors
- Completed and signed Bid Proposal and Project Reference List (Section 00301)
- MGL Chapter 149, Section 44D (1)(b) and Section 44E (2) (3) Bid Certification Statement (Appendix I, also attached to Section 00301)
- Diesel Retrofit Program Form (Appendix I, also attached to Section 00301)
- Completed Form of Non-Collusive Affidavit (Section 00480);
- Completed Certificate of Corporate Vote (Corporation Only) (Section 00481)
- Completed Certificate as to Payment of State Taxes (Section 00482)
- Completed Certificate of 10 Hour OSHA Training (Section 00483)
- Completed State “Debarment Disclosure Form for Public Contracts” (Section 00484)
- Required DCAMM Certificate of Eligibility and Update Statement (Appendix N)
- Disadvantaged Business Enterprises Program Forms (Appendix I) – Required by the two lowest bidders within 3 days of the bid opening

All Bids shall be submitted online at <http://www.Projectdog.com>. No hard copy bids will be accepted. The Bidder will receive a convenience email confirmation upon clicking the submit



bid or retract bid link for informational purposes only. The bidder shall be solely responsible for contacting Projectdog, Inc at 978-499-9014 (M-F, 9:00AM - 5:00PM) if the bidder does not receive a convenience email. It is the bidder's responsibility to review and confirm online that their bid has been Submitted and/or Retracted successfully and accurately.

Date and time for receipt of bids is set forth in the Invitation to Bid.

Timely submission of a bid online shall be the full responsibility of the Bidder. The server clock is the time of record.

Any bid may be withdrawn (retracted) prior to the time designated for receipt of bids upon clicking the "Retract Bid" link. The Bidder will receive a convenience email confirmation upon clicking the Retract link for informational purposes only. The bidder shall be solely responsible for contacting Projectdog, Inc at 978-499-9014 (M-F, 9:00AM -5:00PM) if the bidder does not receive a convenience email. It is the bidder's responsibility to review and confirm online that their bid has been Submitted and/or Retracted successfully and accurately.

Withdrawn bids may be modified and submitted up to the time designated for the receipt of bids.

### 3. Subcontracts:

The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner.

### 4. Qualifications of Bidders:

Pre-qualified General Bidders shall be certified by the Division of Capital Asset Management and Maintenance (DCAMM) in *Sewage and Water Treatment Plants*. Pre-qualified Filed Sub-bidders shall be certified by the Division of Capital Asset Management and Maintenance (DCAMM) in the category applicable to the filed sub-bid.

The Owner shall make such investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

The low bidder shall be required to provide proof that his bid is based on paying workers the Massachusetts prevailing wages. Failure to provide such proof to the Owner's satisfaction may be cause for rejection of the bid. Bids shall be based on the current prevailing wage rates. The Owner reserves the right to request proof that the bidder has the ability to pay the prevailing wage rate at their bid price.

#### 5. Bid Security:

Each bid must be accompanied by a bid bond or a certified check, treasurer's or cashier's check issued by a responsible bank or trust company in the amount not less than five (5) percent of the bid price, payable to the Town of Sharon. Bid bonds shall be submitted electronically via ProjectDog. Bidders submitting the 5% Bid Deposit in the form of certified check, treasurer's or cashier's check issued by a responsible bank or trust company shall include the Bid Bond Affidavit form and ensure that these documents are received by the Procurement Department prior to the closing of the electronic bid.

Bid securities will be returned to all except the three lowest Bidders within five days, Saturdays, Sundays, and legal holidays excluded after the opening of bids, and the remaining checks of the Bidders will be returned promptly after the Owner and the accepted Bidder have executed the contract, or if all bids are rejected.

#### 6. Liquidated Damages for Failure to Enter into Contract:

The successful Bidder, upon his failure or refusal to execute and deliver the contract and bonds required within ten days after he has received notice of the acceptance of his bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid, provided that the amount of the security which becomes the property of the Owner shall not, in any event, exceed the difference between his bid price and the bid price of the next lowest responsible Bidder.

#### 7. Time of Completion and Liquidated Damages:

Construction must be complete **870 calendar days** from and including issuance of a notice to proceed, and/or receipt of fully executed contract. All proposed work at the well stations shall be sequenced as described in the Contract Drawings. Bidders must agree also to pay liquidated damages as stated in the Agreement, in the amount of \$4,300 for each day beyond the Contract Completion date, for which Substantial Completion is not achieved. In addition, bidders must agree to pay a lump sum in additional liquidated damages as stated in the Agreement, in the amount of \$225,000 if Phase 2, as outlined in the Sequence of Work on sheet G-2 of the Contract Documents, is not complete by November 2, 2026.

#### 8. Conditions of Work:

Each Bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his contract. Insofar as possible the Contractor in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

#### 9. Addenda and Interpretations:

No interpretation of the meaning of the Drawings, Specifications or other pre-bid documents

will be made to any Bidder orally.

Every request for such interpretation in relation to the filed sub-bid work should be in writing addressed to Environmental Partners, [Sharonwtp@envpartners.com](mailto:Sharonwtp@envpartners.com), and to be given consideration must be received by the close of business (4pm) at least seven (7) calendar days prior to the date fixed for the opening of filed sub-bids. Every request for such interpretation in relation to the general bid should be in writing addressed to Environmental Partners, [Sharonwtp@envpartners.com](mailto:Sharonwtp@envpartners.com), and to be given consideration must be received by the close of business (4pm) at least seven (7) calendar days prior to the date fixed for the opening of general bids. No requests for interpretations shall be submitted to ProjectDog.

Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Specifications, not later than three days prior to the date fixed for the opening of bids. All addenda must be acquired electronically at [www.Projectdog.com](http://www.Projectdog.com). Each individual or firm recorded as having requested a set of Contract Documents will be electronically notified via email when addenda are issued. Failure of any Bidder to receive any such addendum or interpretation shall not relieve any Bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

#### 10. Security for Faithful Performance:

Simultaneously with his delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner and shall be in the full amount of the accepted proposal.

#### 11. Power of Attorney:

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

#### 12. Notice of Special Conditions:

Attention is particularly called to those parts of the Contract Documents which deal with the following:

- a. Inspection and Testing of Materials;
- b. Insurance Requirements;
- c. Wage Rates;
- d. Coordination of the Work;
- e. Health and Safety;
- f. Underground Utilities; and
- g. Guarantee.

13. Laws and Regulations:

Applicable provisions of Massachusetts General Laws and Regulations, the United States Code of Federal Regulations, and/or municipal ordinances, bylaws, and rules and regulations of all authorities having jurisdiction govern this Contract and any provision in violation of the foregoing shall be deemed null, void and of no effect. Where conflict between the Code of Federal Regulations and State Laws and Regulations exist, the more stringent requirements shall apply.

14. Site Examination:

The Bidder is expected to examine the site, stockpiles, borrow source, material test results, and the subsurface information, and then, based upon his own inspections, interpretations, and such other investigations, as he may desire, decide for himself the character of material to be encountered and excavated, the suitability of the materials to be used for backfilling and other purposes, groundwater conditions, difficulties or obstacles likely to be encountered, and other conditions affecting the work.

The Bidder is expected to be familiar with all sites for completion of the project. Failure to visit the sites will not be a means for additional compensation. Contact the Engineer to arrange visits to each site. Three days minimum notice shall be required for all requests.

15. Obligation of Bidder:

At the time of the opening of bids, each Bidder will be presumed to have inspected the sites and to have read and to be thoroughly familiar with the Contract Documents (including all addenda). The failure or omission of any Bidder to examine any form, instrument, or documents shall in no way relieve any Bidder from any obligation in respect to their bid.

16. Minimum Wage Rates:

Minimum Wage Rates as determined by the Executive Office of Labor and Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project.

The Contractor shall submit certified payroll records to the Department of Labor standards and the Owner on a weekly basis. Failure to submit records will be cause for the withholding of payment due the Contractor.

17. Manufacturer's Experience:

Whenever it is written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide an

“Efficiency Guarantee Bond” or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

18. Equal Products Acceptable:

Wherever in the Drawings and Specifications any item of equipment or material is designated by reference to a particular brand, manufacturer, or trade name, it is understood that an approved equal product, acceptable to the Engineer may be substituted by the Bidder or Contractor. It shall be the Contractor's responsibility to coordinate all submittals to eliminate any conflicts which might arise due to the use of the "or equal" item. Any additional costs incident to the use of "or equal" items, including re-design, will be paid by the Contractor.

19. Sales Tax Exemption:

Materials and equipment purchased for permanent installation in this project will be exempt from the Massachusetts Sales and Use Tax. The exemption certificate number will be furnished to the Contractor. Each bidder shall take exemption into account in calculating his/her bid for the work.

20. Guarantee:

The Contractor guarantees that the Work and Services to be performed under the Contract, and all workmanship, materials, and equipment performed, furnished, used, or installed in the construction of the same shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other contract documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one (1) year from and after the date of completion and acceptance of the Work as stated in the final estimate. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled “Partial Acceptance”, the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.

If at any time within the said period of guarantee any part of the Work requires repairing, correction or replacement, the Owner may notify the contractor in writing to make the required repairs, correction, or replacements. If the Contractor neglects to commence making such repairs, corrections, or replacements to the satisfaction of the Owner within seven (7) days from the date of receipt of such notice or having commence fails to prosecute such Work with diligence, the Owner may employ other persons to make said repairs, corrections or replacements, and charge the costs, including compensation for additional professional services, to the Contractor.

It is expressly understood, however, that these guarantee provisions shall not absolve the Contractor from any liability to the Owner arising out of a failure to substantially complete the work in accordance with the Drawings and Specifications.

In addition, the Contractor shall remain responsible for providing any special warranties required by the Contract Documents.

21. Bonding and Insurance:

The Contractor must furnish Performance and Payment Bonds, each of which shall be in an amount not less than one hundred (100) percent of the contract price. Contractors should obtain such construction insurance (e.g., Fire and Extended Coverage, Workmen's Compensation, Public Liability and Property Damage, and "All Risk" Builder's Risk) as indicated in the Supplemental Conditions (Section 00800).

22. Health and Safety Regulations:

This project is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to any applicable Massachusetts regulations. Contractors shall be familiar with the requirements of these regulations, as well as the Occupational Safety and Health Administration's (OSHA) 29 CFR 1910.120.

23. Access to the Project:

The successful Bidder shall provide full and complete access to the project site or any portion thereof by any authorized agent of the Town of Sharon at any time during normal working hours throughout the duration of the Contract.

24. Traffic Police:

Traffic control, when required by the Chief of Police or the Owner, will normally be paid for by the Town of Sharon directly. The Contractor is required to directly coordinate all Police details with the Town of Sharon Department of Public Works. However, any police overtime expenses incurred by the Town due to the Contractor electing to work longer than the normal workday (eight consecutive hours, weekends, or holidays) shall be the responsibility of the Contractor, the cost of which will be deducted from the monthly pay requisition. The Contractor will also be charged for any police expenses when police coverage is requested or scheduled in advance by the Contractor, but the Contractor does not work.

25. Third Party Work:

The Contractor is responsible for maintaining a safe and secure worksite at all times, and for expeditiously repairing any damage done to private property. If, in the opinion of the Owner, the Contractor is negligent in these duties the Owner shall have the right to employ a third party to remedy the problem.

Situations which develop and require the services of and payment to a third party will be handled in the following manner:

The Contractor will be given a reasonable period of time determined at the discretion of the Owner to remedy the situation without third party involvement. If the Contractor is unavailable the Owner will authorize work by a third party on the Contractor's behalf.

Third party work authorized on the Contractor's behalf by the Owner shall be paid for by the Contractor within a reasonable time period (generally two weeks). If payment is not made within a reasonable time period the Owner will make payment and deduct the cost from the next pay requisition.

In the case of inadequately secured worksites necessitating extra or increase police details or other public safety personnel, the following procedure will be followed. The Contractor (if available) will be notified that the worksite needs to be secured in order to prevent the need for weekend/night police coverage. If the area is not immediately secured as determined by the Owner or Engineer, a police, fire, or highway department detail will be used and the Contractor will be charged for the cost. It is understood that in many instances worksites cannot realistically be secured to a point where police or other safety personnel are not needed. In these instances, the Owner will continue to pay for the coverages.

26. Massachusetts Diesel Retrofit Program (MDRP):

This project is subject to the requirements of the Department of Environmental Protection's Diesel Retrofit Program. Bidders must submit a signed and dated Statement of Intent to Comply form as part of their bid proposal documents.

27. American Iron and Steel (AIS):

This project is subject to the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014.

28. Build America, Buy America (BABA):

This project is subject to the Build America, Buy America (BABA) requirements. The amendments to the Clean Water Act, as part of WRRDA, apply the American Iron and Steel (AIS) requirements to all treatment works projects. Furthermore, BIL extends this procurement requirement to all SRF construction projects going forward with the inclusion of the Build America, Buy America (BABA). Starting on May 14, 2022, all steel, iron, manufactured products, non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), glass (including optic glass), lumber, and drywall used in infrastructure projects for federal financial assistance programs must be produced in the United States. MassDEP ensures that the required procurement language is included in contracts and conducts field verifications of project compliance.

**The BABA requirements are waived for this Project based on EPA's Decision Memorandum titled Amended Public Interest Waiver of Section 70914(a) of P.L. 117-58, Build America, Buy America Act, 2021 for State Revolving Fund and Water Infrastructure Projects that have Initiated Design Planning prior to May 14, 2022 issued November 13, 2023.**

END OF SECTION 00100

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# Projectdog, Inc

## Supplemental Instructions to Bidders for Electronic Bid Projects (E-Bid)

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## Sign Up

Every user of [Projectdog.com](http://Projectdog.com) has a unique username and password for their account. **MANDATORY: All users must keep usernames and passwords PRIVATE and SECURE. Do not share accounts.**

1. Go to [www.Projectdog.com](http://www.Projectdog.com).
2. Select the “Sign Up” (Fig 1).
3. Complete all required form fields and press Submit.  
An automatic email will be sent to the registered email.
4. Select the confirmation link in the email to complete the registration.

## Login

1. Go to [www.Projectdog.com](http://www.Projectdog.com).
2. Enter a registered email address and password (Fig 1).
3. Press Login.

## Logoff

1. Hover over Home (Fig 2).
2. Select “Logoff”.

## Forgotten Password


1. Select “Forgot your password?” (Fig 3).
2. Enter the e-mail address.
3. Select “Send Info”. An automated e-mail will be sent with the password.

## Account Information

View and edit user contact information. To change an email address, users must register a new account. Call Projectdog to have the old account removed.

1. Hover over Home (Fig 4).
2. Click “My Information”.
3. Edit information as needed.
4. Click “Save” to finalize edits.

Fig 1



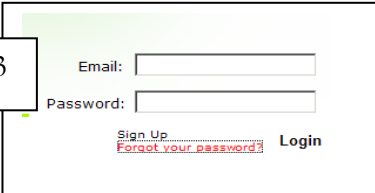
The form contains two input fields: 'Email:' and 'Password:'. Below the fields are two buttons: 'Sign Up' and 'Login'. A link 'Forgot your password?' is positioned between the two buttons. At the bottom of the form, the text 'Customer Support 978-499-9014' is displayed.

Fig 2



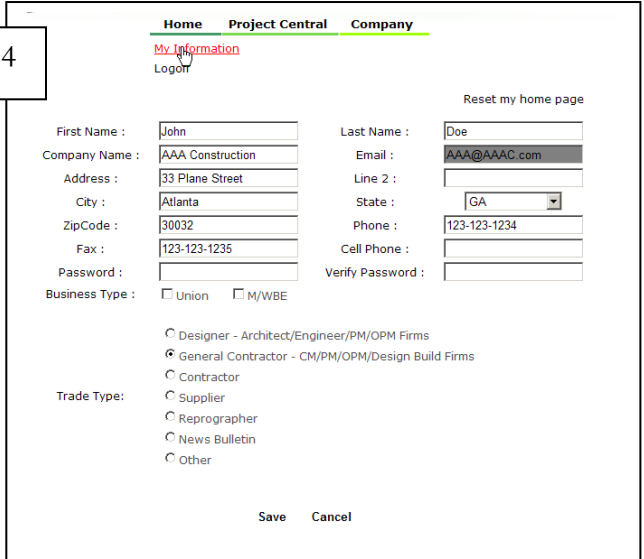
The navigation menu features the Projectdog logo on the left. To the right, there are three main menu items: 'Home', 'Project Central', and 'Company'. Underneath 'Home', there are sub-menu items: 'My Information' and 'Logoff'.

Fig 3



The form contains two input fields: 'Email:' and 'Password:'. Below the fields are two buttons: 'Sign Up' and 'Login'. A link 'Forgot your password?' is positioned between the two buttons.

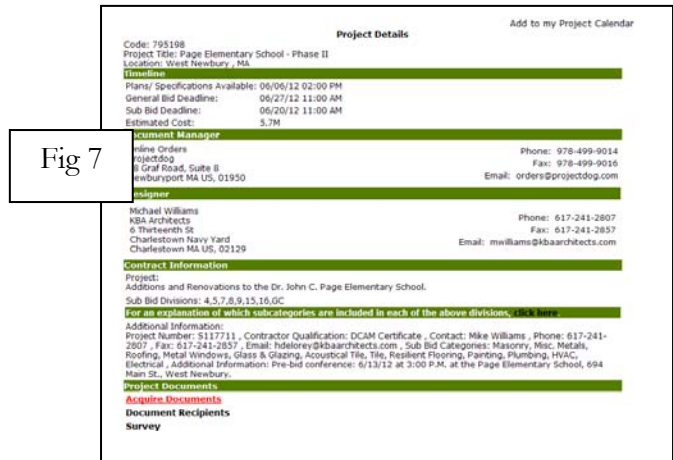
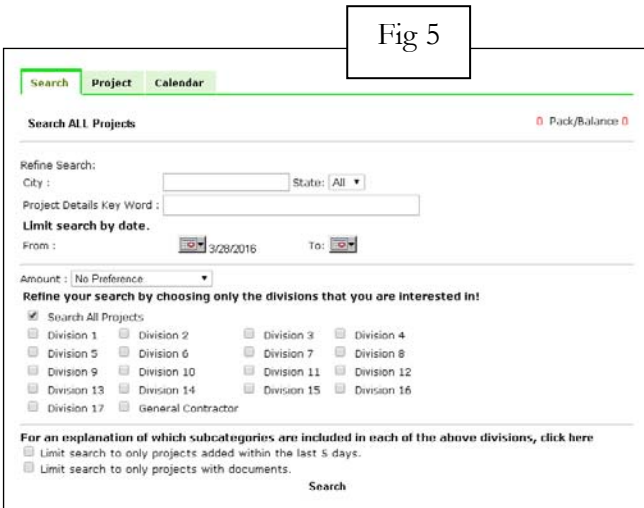
Fig 4



The form is titled 'My Information' and includes a 'Logoff' link. It contains several input fields for user details: First Name (John), Last Name (Doe), Company Name (AAA Construction), Email (AAA@AAAC.com), Address (33 Plane Street), City (Atlanta), Zip Code (30032), Fax (123-123-1235), and Password. There are also dropdown menus for State (GA) and Line 2. Below the input fields, there are radio buttons for Business Type (Union, M/WBE) and Trade Type (Designer - Architect/Engineer/PM/OPM Firms, General Contractor - CM/PM/OPM/Design Build Firms, Contractor, Supplier, Reprographer, News Bulletin, Other). A 'Reset my home page' link is located at the top right. At the bottom, there are 'Save' and 'Cancel' buttons.

# Project Details

Utilize the search page (Fig 5) or enter a Project Code (Fig 6) to view a project's "Project Details" page (Fig 7).



# Acquire Documents

Download all project documents.

1. Click "Acquire Documents" link found on a project's "Project Details" page (Fig 7).
2. Respond to the Legal Notice after reviewing.
3. Click on any file description to open, review, or save a document (Fig 8).

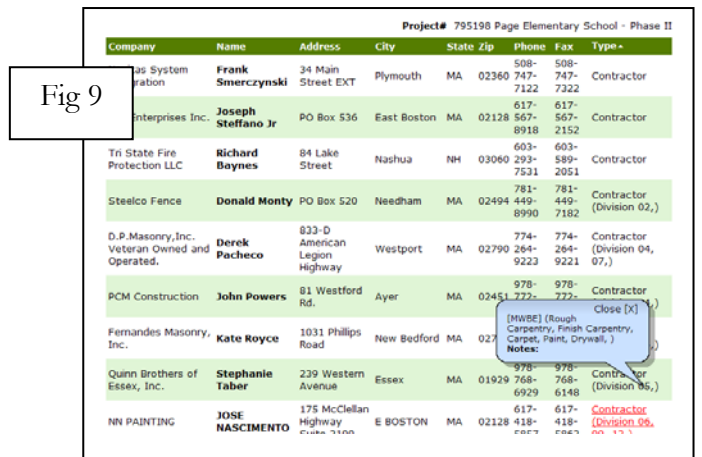
Users are automatically added to the project's "Document Recipients" list to receive update notifications upon viewing any document online.



# Document Recipients

Review all plan holders who have acquired documents.

1. Click "Document Recipients" link found on a project's "Project Details" page (Fig 7).
2. All potential bidders are listed and sorted by company type (Fig 9). Click on a column title to sort alphabetically.



# Electronic Bid (E-Bid)

This project is being **Electronically Bid** at [www.Projectdog.com](http://www.Projectdog.com). Hard copy bids will not be accepted by the Awarding Authority. Go to [www.Projectdog.com](http://www.Projectdog.com) and Login with an existing account or click [Sign Up](#) to register for free. Enter a project code or search by keyword to access the “Project Details” page. Select “Acquire Documents” to download all bidding documents.

**Projectdog**  
 Home Project Central Company  
 Add to my Project Calendar

**Project Details**

Code: 799090  
 Project Title: Ebid  
 Location: Newburyport, MA

**Timeline**  
 Plans/ Specifications Available: 05/22/13 10:00 AM  
 General Bid Deadline: 06/21/13 04:00 PM  
 Sub Bid Deadline: 06/19/13 04:00 PM  
 Estimated Cost: Negotiated

**Project Owner**  
 Sales Department  
 Projectdog  
 18 Graf Road  
 Suite 8  
 Newburyport MA US, 01950  
 Phone: 978-499-9014  
 Fax: 978-499-9014  
 Email: sales@projectdog.com

**Document Manager**  
 Online Orders  
 Projectdog  
 18 Graf Road, Suite 8  
 Newburyport MA US, 01950  
 Phone: 978-499-9014  
 Fax: 978-499-9016  
 Email: orders@projectdog.com

**Contract Information**  
 Project:  
 Ebid Test Demo for Sales Department.  
 Additional Information:  
 THIS PROJECT IS BEING ELECTRONICALLY BID AND HARD COPY BIDS WILL NOT BE ACCEPTED. The bids are to be prepared and submitted at [www.Projectdog.com](http://www.Projectdog.com). Tutorials and instructions on how to complete the electronic bid documents are available online along with all project documentation.

**Project Documents**  
 Acquire Documents  
 Document Recipients  
 GC E-Bid  
 Sub E-Bid

## How to Submit an E-Bid

Complete and save all required forms as PDF files. Please be sure to sign all required signatures either digitally or manually.

1. Select the **GC E-Bid** or **Sub E-Bid** link located on the “Project Details” page.  
 Subcontractors select a bidding trade;
2. Answer / enter / upload all required areas. Enter all dollar value amounts as a whole dollar values only.
3. Select “Submit My E-Bid.” Review the submitted bid package via the “View My Bid Package” link.

**Bidding Trades**  
 Please select trade(s) you are bidding.

Section#	Description	Status	Bidding
220000	Plumbing	Incomplete	GO
230000	HVAC	Incomplete	GO
260000	Electrical	Incomplete	GO

**It's that simple!**

You will not be able to Submit your bid unless all mandatory fields are complete. Please allow yourself sufficient time to upload all information. You will receive an automated email once completed. Please save this for your records.  
 DHCD 016128 Roof Replacement & Vinyl Siding, Project #811541

Acknowledge Addendum 0,  Yes  No

Bid Price (Whole Dollar)

Form for General Bid (Signature page) Add File -  
 Bid Bond Add File -  
 Bidders Reference Form Add File -

Item 2 Sub-bids as follows:  
 There are no Sub bids for this project.

**Bid Closes in:**  
**0 Days 2 Hours 20 Minutes 20 Seconds.**

Save [Submit my E-Bid](#) Close

You will not be able to Submit your bid unless all mandatory fields are complete. Please allow yourself sufficient time to upload all information. You will receive an automated email once completed. Please save this for your records.  
 DHCD 016128 Roof Replacement & Vinyl Siding, Project #811541

Acknowledge Addendum 0,1,  Yes  No 4/6/2016

Bid Price (Whole Dollar)  twenty-five thousand Dollars.

Form for General Bid (Signature page) View File  
 Bid Bond View File  
 Bidders Reference Form View File

Item 2 Sub-bids as follows:  
 There are no Sub bids for this project.

**Bid Closes in:**  
**0 Days 2 Hours 11 Minutes 20 Seconds.**

Retract [View My Bid Package](#) Close

**Add File**

Click “Add File” on the E-Bid page to open the Upload Assistant window. Then click “Browse” or “Choose File” to upload a PDF file.

**Warning**

E-Bids cannot be submitted unless all areas are complete.

Save before adding files or closing the window or E-Bid data may need to be re-entered.

Projectdog.com server time is set to industry standards at time-a.nist.gov. Bidders are encouraged to update their computer clock.

Bidders may save, submit or modify an Electronic Bid (E-Bid) at any time prior to bid close. Once submitted, a bid cannot be edited. To modify a bid the bidder must retract the bid, make any necessary changes, and then submit the bid again. Upon submitting or retracting the bidder will receive a convenience email for informational purposes only. Bidders are encouraged to contact Projectdog if an email is not received.

It is the bidder’s responsibility to review and confirm online that a bid has been submitted and/or retracted and that the bid is 100% true, complete and accurate. All bidders are required to review their submitted E-Bid via the “[View My Bid Package](#)” link.

If a bid is submitted prior to an addendum being issued the bidder will receive an automated email for informational purposes only stating the bidder must review the addendum, retract the bid, acknowledge all addenda, and submit the bid again. If a bidder fails to acknowledge addenda their bid may be rejected by the Awarding Authority.

Once the bid deadline has closed the E-Bid links are no longer available. All E-Bids are compiled in real time upon bid close and published forthwith on the “Project Details” page titled as “List of Bids Received”. Official bid tabulations are posted at the discretion of the Awarding Authority.

For additional assistance, call Projectdog at (978) 499-9014 (M-F, 9AM-5PM).

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SECTION 00301

BID FORM

To: Town of Sharon, Department of Public Works, Sharon, Massachusetts

Regarding: Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF Project #12443)

**The Owner reserves the right to reject any bid in the event that any bid item or items are obviously unbalanced or appear to the Owner to be so unbalanced as to affect or to be liable to affect adversely any interest of the Owner.**

**The Owner reserves the right to reject any or all bids if it deems it to be in its best interest to do so. The Owner reserves the right to award the Contract based on sufficiency of appropriated funds to complete the work.**

**The undersigned states that no officer, agent, or employee of the Owner directly or indirectly has a financial interest in this Bid.**

The Undersigned, as Bidder, declares as follows:

- The only parties interested in this BID as Principals are named herein;
- this BID is made without collusion with any other person, firm, or corporation;
- no officer, agent, or employee of the Owner is directly or indirectly interested in this BID;
- the Bidder has carefully examined the proposed Work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed Work, the difficulties attendant upon its execution and the accuracy of all estimated quantities stated in this BID, and has carefully read and examined the annexed proposed AGREEMENT and the Specifications and other Contract Documents therein referred to and knows and understands the terms and provisions thereof;
- the Bidder understands that information relative to subsurface and other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) has been furnished only for his/her information and convenience without any warranty or guarantee, expressed or implied, that the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered will be the same as those shown within the Contract Documents and agrees that the Bidder shall not use or be entitled to use any such information made available to him through the Contract Documents or otherwise or obtained by him/her in his/her own examination of the site, as a basis of or ground for any claim against the Owner or the Engineer arising from or by reason of any variance which may exist between the aforesaid information made available to or acquired by him and the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered during the construction work, and has made due allowance therefore in this BID;

- the Bidder understands that the quantities of work tabulated in this BID or indicated in the Specifications or other Contract Documents are only approximate and are subject to increase or decrease as deemed necessary by the Engineer;
- and agrees that, if this BID is accepted will contract with the Owner, as provided in the copy of the Contract Documents deposited in the office of the Engineer, this BID form being part of said Contract Documents, and that the Bidder will perform all the work and furnish all the materials and equipment, and provide all labor, services, plant, machinery, apparatus, appliances, tools, supplies and all other things required by the Contract Documents in the manner and within the time therein prescribed and according to the requirements of the Engineer as therein set forth, and that the Bidder will take in full payment therefore the lump sum or unit price applicable to each item of the Work as stated in the schedule below:

**Bidders must bid on each item of the Bid. Unbalanced bids may be rejected.** All entries in the entire BID must be made clearly; prices bid must be written in both words and figures. In case of discrepancy, the amount shown in words will govern.

Bidders shall insert extended item prices obtained from quantities and unit prices. In case of discrepancy between the products obtained by multiplying the estimated quantity by the unit price, the actual product shall apply. In case of discrepancy between the sum of the total figure of the items and the total amount listed, the actual sum shall apply.

In the event the lowest bids from responsive and responsible bidders are tied, the following methods of breaking the tie shall be employed unless otherwise provided for in these bid documents: The bidder's names shall be entered on a slip of paper and placed in a hat. The award shall then be made to the bidder whose slip is drawn from the hat. The drawing of the slip from the hat shall be performed in the presence of the tied bidders unless they waive their right to be present in writing.

Refer to Section 01024 - Measurement and Payment for Item Descriptions.

Addenda: This BID includes Addenda numbered \_\_\_\_\_ to \_\_\_\_\_ (To be filled in by Bidder if Addenda are issued.)

(Bidder) \_\_\_\_\_

(by) \_\_\_\_\_

(Title) \_\_\_\_\_



**BASE BID**

PART 1: GENERAL BID

The work of the General Bidder, being all work covered by Items 1 through 8, inclusive.

Item No.	Item Description and Unit Price in Words	Units	Estimated Quantity	Unit Price (In Figures)	Extended Amount (In Figures)
1	Mobilization and Demobilization	Lump Sum	1		
	_____ Dollars and _____ Cents				
2	Wells 2, 3, and 4 Water Treatment Plant and Appurtenant Work	Lump Sum	1		
	_____ Dollars and _____ Cents				
3	Well Station 2 and Appurtenant Work (SRF Ineligible Item)	Lump Sum	1		
	_____ Dollars and _____ Cents				
4	Well Station 3 and Appurtenant Work (SRF Ineligible Item)	Lump Sum	1		
	_____ Dollars and _____ Cents				
5	Rock Excavation	Cubic Yard	20		
	_____ Dollars and _____ Cents				
6	Exploratory Excavation	Cubic Yard	20		
	_____ Dollars and _____ Cents				
7	Owner's Electric Utility Contingency Allowance	Allowance	1	\$50,000	\$50,000
	<u>Fifty Thousand Dollars and Zero Cents</u>				
	_____ Dollars and _____ Cents				

Item No.	Item Description and Unit Price in Words	Units	Estimated Quantity	Unit Price (In Figures)	Extended Amount (In Figures)
8	Owner's Natural Gas Utility Contingency Allowance	Allowance	1	\$75,000	\$75,000
	<u>Seventy Five Thousand Dollars and Zero Cents</u>				
	Dollars and _____ Cents				

Total (Part 1) \$ \_\_\_\_\_  
(Figures)

PART 2: SUB-BIDS

Sub-Bids as Follows:

Item No.	Sub-Trade & Name of Sub-Bidder	Sub-Item No.	Sub-Bid Amount (In Figures)	Bond Required? (Yes/No)
9	Masonry	9A Wells 2, 3, and 4 Water Treatment Plant		
	_____ Name of Sub-Bidder	<b>Total Item 9</b>		
10	Miscellaneous and Ornamental Iron	10A Wells 2, 3, and 4 Water Treatment Plant		
	_____ Name of Sub-Bidder	<b>Total Item 10</b>		
11	Waterproofing Damp Proofing and Caulking	11A Wells 2, 3, and 4 Water Treatment Plant		
	_____ Name of Sub-Bidder	<b>Total Item 11</b>		
12	Metal Windows	12A Wells 2, 3, and 4 Water Treatment Plant		
	_____ Name of Sub-Bidder	<b>Total Item 12</b>		
13	Painting	13A Wells 2, 3, and 4 Water Treatment Plant		

Item No.	Sub-Trade & Name of Sub-Bidder	Sub-Item No.	Sub-Bid Amount (In Figures)	Bond Required? (Yes/No)
	Name of Sub-Bidder	13B Well Station 2 <u>(SRF Ineligible Item)</u>		
		13C Well Station 3 <u>(SRF Ineligible Item)</u>		
		<b>Total Item 13</b>		
14	Plumbing	14A Wells 2, 3, and 4 Water Treatment Plant		
	Name of Sub-Bidder	<b>Total Item 14</b>		
15	HVAC  Name of Sub-Bidder	15A Wells 2, 3, and 4 Water Treatment Plant		
		15B Well Station 3 <u>(SRF Ineligible Item)</u>		
		<b>Total Item 15</b>		
16	Fire Protection	16A Wells 2, 3, and 4 Water Treatment Plant		
	Name of Sub-Bidder	<b>Total Item 16</b>		
17	Electrical  Name of Sub-Bidder	17A Wells 2, 3, and 4 Water Treatment Plant		
		17B Well Station 2 <u>(SRF Ineligible Item)</u>		
		17C Well Station 3 <u>(SRF Ineligible Item)</u>		
		<b>Total Item 17</b>		

Total Sub-bids (Part 2) \$ \_\_\_\_\_  
(Figures)

**TOTAL FOR BASE BID**

Total Amount of Base Bid (Items 1 through 17, inclusive).

\$

\_\_\_\_\_

(Amount in figures)

\_\_\_\_\_

(Amount in words)

Basis of Award: The basis of award shall be at the Owner’s sole discretion, contingent on the Base Bid Price. The grand total of the Base Bid, items 1 through 17 inclusive, shall be used to determine the lowest responsive bidder. Contract to be awarded to the lowest responsible and eligible bidder in full compliance with Sections 44A to 44J inclusive of Chapter 149 of the General Laws of the Commonwealth of Massachusetts as last revised. Add Alternate shall be awarded at the Owner’s sole discretion.

Requirements: Specific items of this Contract may be eliminated or reduced in quantity to keep within limits of available funding, at the OWNER’S option. All of the above items shall include all labor, materials, equipment, hauling, disposal, transportation, overhead, profit and insurance to cover the work as required in the Contract Documents.

The undersigned agrees that extra work, if any, will be performed in accordance with Article 11 of the General Conditions of the Contract and will be paid for in accordance with Article 13 of the General Conditions of the Contract.

An unbalanced or unreasonable lump sum and/or unit price submitted herein may be considered as non-responsive to the Instructions to Bidders.

The bid security accompanying this BID shall be in the amount of five percent (5%) of the BID.

As provided in the INSTRUCTIONS TO BIDDERS, the Bidder hereby agrees that he will not withdraw this BID within forty-five (45) consecutive calendar days after the actual date of the opening of Bids and that, if the Owner shall accept this BID, the Bidder will duly execute and acknowledge the AGREEMENT and furnish, duly executed and acknowledged, the required CONTRACT BONDS within ten (10) days after notification that the AGREEMENT and other Contract Documents are ready for signature.

If this BID is accepted by the Owner, the undersigned agrees to complete the entire work provided to be done under the Contract within **870 calendar days**, as stipulated in the AGREEMENT. Liquidated damages shall be \$4,300 for each calendar day of delay and a lump sum of \$225,000 for delays after November 2, 2026 as stipulated in the AGREEMENT.

A performance bond in an amount equal to 100 percent of the total amount of the bid with a surety company qualified to do business in the Commonwealth of Massachusetts will be required for the faithful performance of the contract, as well as a labor and materials bond in an amount equal to 100 percent of the total bid amount.

Should the Bidder fail to fulfill any of his/her agreements as hereinabove set forth, the Owner shall have the right to retain as liquidated damages the amount of the bid check which shall become the Owner's property. If a performance bond was given, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety.

The undersigned as Bidder, hereby certifies that he is aware of the applicable requirements of the Williams-Steiger Occupational Safety and Health Act of 1970. (O.S.H.A.), and all latest revisions thereto, and that this Proposal is prepared on the basis of compliance with those requirements.

The undersigned as Bidder, hereby certifies that he will maintain records in reasonable detail, which accurately and fairly reflect the financial transactions and disposition of the Bidder, in accordance with M.G.L. Chapter 30, Section 30R.

The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to MGL Ch. 149, Section 44D and Section 44E. The bidding and award of the contract will be in full compliance with Section 44D and Section 44E inclusive of Chapter 149 of the General Laws of the Commonwealth of Massachusetts as last revised.

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The attached FORM OF NON-COLLUSION AFFIDAVIT must be signed and submitted as part of the Bid Proposal.

This Proposal must bear the written signature of the Bidder or that of his/her duly authorized agent. If the Bidder is a corporation or a partnership, the bid must be signed by a duly authorized officer of such corporation or by a Partner and the title of such officer must be stated. Satisfactory completion of the following data is an essential part of submission of this Proposal and is required. Bid must be stamped with corporate seal.

The time period for holding bids, where Federal approval is not required is 30 days, Saturdays, Sundays and legal holidays excluded, after the opening of bids and where Federal approval is required, the time period for holding bids is 30 days, Saturdays, Sundays and holidays excluded after Federal approval.

Pursuant to G.L. c.62C, §49A, the undersigned bidder certifies that he/she/it, to the best of their knowledge and belief, have filed all state tax returns and paid all State Taxes required under law and has complied with all laws of the commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

The undersigned bidder hereby certifies he/she will comply with the specific affirmative action steps contained in the EEO/AA provisions of this Contract, including compliance with the Disadvantaged Business Enterprise provisions as required under these contract provisions. The contractor receiving the award of the contract shall incorporate the EEO/AA provisions of this contract into all subcontracts and purchase orders so that such provisions will be binding upon each subcontractor or vendor.

The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulation promulgated thereunder; and is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

Bidders must fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). Contractors, subcontractors, or suppliers that appear on the Excluded Parties List System at <https://www.dol.gov/ofccp/regs/compliance/preaward/debarlst.htm> are not eligible for award of any contracts funded by the Massachusetts State Revolving Fund. <https://www.mass.gov/debarred-suspended-or-decertified-contractors>

(SEAL)

\_\_\_\_\_  
(Name of Bidder)

By \_\_\_\_\_  
(Signature and title of authorized representative)

Date \_\_\_\_\_

\_\_\_\_\_  
Telephone)

\_\_\_\_\_  
(Business address)

\_\_\_\_\_  
(Fax Number)

\_\_\_\_\_  
(City and State)

The following documents are attached to and made a condition of the bid, and shall be filed with the bid:

- Bid Security (5%), and Bid Bond Affidavit if check
- List of Proposed Subcontractors
- Completed and signed Bid Proposal and Project Reference List (Section 00301)
- MGL Chapter 149, Section 44D (1)(b) and Section 44E (2) (3) Bid Certification Statement (Appendix I, also attached to Section 00301)
- Diesel Retrofit Program Form (Appendix I, also attached to Section 00301)
- Completed Form of Non-Collusive Affidavit (Section 00480);
- Completed Certificate of Corporate Vote (Corporation Only) (Section 00481)
- Completed Certificate as to Payment of State Taxes (Section 00482)
- Completed Certificate of 10 Hour OSHA Training (Section 00483)
- Completed State “Debarment Disclosure Form for Public Contracts” (Section 00484)
- Required DCAMM Certificate of Eligibility and Update Statement (Appendix N)
- Disadvantaged Business Enterprises Program Forms (Appendix I) – Required by the two lowest bidders within 3 days of the bid opening

The Bidder is required to list six or more of your firm's recent projects of a similar scale to be deemed an acceptable bid. References will enable the Owner to judge his/her experience, skill, and business standing.

Project Name:	_____
Project Location:	_____
Contract Amount: \$	_____ Completion Date _____
Owner:	_____
Contact Name:	_____ Telephone: _____
Architect/Engineer:	_____
Contact Name:	_____ Telephone: _____

Project Name:	_____
Project Location:	_____
Contract Amount: \$	_____ Completion Date _____
Owner:	_____
Contact Name:	_____ Telephone: _____
Architect/Engineer:	_____
Contact Name:	_____ Telephone: _____

Project Name:	_____
Project Location:	_____
Contract Amount: \$	_____ Completion Date _____
Owner:	_____
Contact Name:	_____ Telephone: _____
Architect/Engineer:	_____
Contact Name:	_____ Telephone: _____

Project Name:	_____
Project Location:	_____
Contract Amount: \$	_____ Completion Date _____
Owner:	_____
Contact Name:	_____ Telephone: _____
Architect/Engineer:	_____
Contact Name:	_____ Telephone: _____



Project Name: \_\_\_\_\_  
Project Location: \_\_\_\_\_  
Contract Amount: \$ \_\_\_\_\_ Completion Date \_\_\_\_\_  
Owner: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Telephone: \_\_\_\_\_  
Architect/Engineer: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Telephone: \_\_\_\_\_

Project Name: \_\_\_\_\_  
Project Location: \_\_\_\_\_  
Contract Amount: \$ \_\_\_\_\_ Completion Date \_\_\_\_\_  
Owner: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Telephone: \_\_\_\_\_  
Architect/Engineer: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Telephone: \_\_\_\_\_

Add supplementary page if necessary.

**FORM FOR SUB-BID**

To All General Bidders Except Those Excluded:

A. The undersigned proposes to furnish all labor and materials required to complete, in accordance with the Drawings, specifications and addenda, all the work for the following category of work:

\_\_\_\_\_

(a filed sub-bid) specified in Section No(s) \_\_\_\_\_

\_\_\_\_\_ of the specifications and in any plan referred to, prepared by Environmental Partners Group, LLC for the **Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF Project #12443).**

For the construction of the Wells 2, 3, and 4 Water Treatment Plant, for the contract sum of:

\_\_\_\_\_ dollars (\$ \_\_\_\_\_).

For the modification of Well Station 2, if applicable, for the contract sum of:

\_\_\_\_\_ dollars (\$ \_\_\_\_\_).

For the modification of Well Station 3, if applicable, for the contract sum of:

\_\_\_\_\_ dollars (\$ \_\_\_\_\_).

All inclusive contract sum of:

\_\_\_\_\_ dollars (\$ \_\_\_\_\_).

B. This sub-bid includes addenda numbered \_\_\_\_\_ of \_\_\_\_\_

C. This sub-bid

\_\_\_\_\_ may be used by any general bidder except:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ may only be used by the following general bidders:

---



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[To exclude general bidders, insert "X" in one box only and fill in blank following that box. Do not answer C if no general bidders are excluded.]

- D. The undersigned agrees that, if he is selected as a sub-bidder, he will, within 5 days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested so to do in the general bid by the general bidder, who shall pay the premiums therefor, or if prequalification is required pursuant to section 44D 3/4, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority, in the full sum of the subcontract price.
  
- E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications the name of each such class of work or part thereof and the bid price for each such class of work or part thereof are:

Name	Class of Work	Bid Price
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

[Do not give bid price for any class or part thereof furnished by the undersigned.]

- F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner (awarding authority).

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the Owner (awarding authority).

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

1. Have been in business under present business name \_\_\_\_\_ years.
2. Ever failed to complete any work awarded? \_\_\_\_\_
3. List three or more recent buildings/projects with names of general contractor and architect/engineer on which you served as subcontractor for work of similar character as required for the above-named building/project.

Building/Project	General Architect	Contractor	Amount of Contract
(a) _____	_____	_____	_____
(b) _____	_____	_____	_____
(c) _____	_____	_____	_____

4. Bank reference \_\_\_\_\_

Contact Name: \_\_\_\_\_

Telephone: \_\_\_\_\_

- I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section forty-four

The undersigned further certifies under penalties of perjury that this sub-bid is in all respects bona fide and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Name of Sub-Bidder)

By \_\_\_\_\_  
(Title and Name of Person)

\_\_\_\_\_  
(Business Address)

\_\_\_\_\_  
(City and State)

Filed sub-bidders shall submit the following completed forms with their bid:

- Bid Security (5%), and Bid Bond Affidavit if check
- Completed and signed Bid Proposal and Project Reference List (Section 00301)
- Evidence of authority to do business in the state or jurisdiction of the Project; or a written covenant to obtain such license within the time frame for acceptance of Bids
- Completed Form of Non-Collusive Affidavit (Section 00480);
- Completed Certificate of Corporate Vote (Corporation Only) (Section 00481)
- Completed Certificate as to Payment of State Taxes (Section 00482)
- Completed Certificate of 10 Hour OSHA Training (Section 00483)
- Required DCAMM Certificate of Eligibility and Update Statement (Appendix N)

END OF SECTION 00301

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# Bid Bond Affidavit

This document is an affidavit form that is drafted to serve as a statement wherein the person (Bidder) who signs it swears under penalty of perjury that the facts and information that are identified in this affidavit are true. **This affidavit is in lieu of an insurance Bid Bond certificate.**

Bidders submitting the Bid Bond Affidavit form and the 5% Bid Deposit in the form of cash, certified check, treasurer's or cashier's check issued by a responsible bank or trust company shall ensure that these documents are received by the Awarding Authority prior to the closing of the electronic bid.

Both the completed Bid Bond Affidavit form and the Bid Deposit shall be enclosed in a sealed envelope with the following information plainly marked on the outside:

**DO NOT OPEN BEFORE:** *[indicate DATE and TIME of bid opening]*

**Project Name:** \_\_\_\_\_  
**Project Number:** \_\_\_\_\_  
**Bidder's Name:** \_\_\_\_\_  
**Business Address:** \_\_\_\_\_  
**Phone Number:** \_\_\_\_\_

It is the Bidder's responsibility to ensure that the completed Bid Bond Affidavit form and Bid Deposit are submitted as stated above and received by the Awarding Authority prior to the closing of electronic bids. The completed Bid Bond Affidavit form must also be uploaded via the project E-bid "Bid Bond" link at [www.Projectdog.com](http://www.Projectdog.com).

The Bidder understands and consents that any failure to do so whether his own or other fault may result in the rejection of said bid. The Bidder is solely responsible for the accuracy and value of the Bid Deposit. In the event that the Bid Deposit is less than the required amount as outlined in the project specifications the bid may be rejected.

**Bid Deposit Amount (in figures):** \_\_\_\_\_

**CASH**

*or*

**Certified, Treasurer's, or Cashier's Check**

**Date:** \_\_\_\_\_

**Bidder's Name:** \_\_\_\_\_

**Business Address:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**APPENDIX A2**

Certification Statements wording required in the BID PROPOSAL of contracts bid under the provisions of c.149 s 44A – 44J (Building Contract with filed Sub-bids)

Pursuant to M.G.L. Ch. 62C, s 49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes Required under law.

The undersigned bidder hereby certifies he/she will comply with the specific affirmative action steps contained in the Equal Employment Opportunity/Affirmative Action (EEO/AA) provisions of this Contract, including compliance with the Disadvantaged Business Enterprise provisions as required under these contract provisions. The contractor receiving the award of the contract shall incorporate the EEO/AA provisions of this contract into all subcontracts and purchase orders so that such provisions will be binding upon each subcontractor or vendor.

The undersigned certifies under penalties of perjury that there have been no substantial changes in his financial position or business organization other than those changes noted within the application since the applicant's most recent pre-qualification statement and that the bid is in all respects bonafide, fair and made without collusion or fraud with any other person.

c149 s44D (1)(b) "Person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity which sells materials, equipment or supplies used in or for, or engages in the performance of, the same or similar construction, reconstruction, installation, demolition, maintenance or repair work or any part thereof.

c149 s44E (2) The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to section forty-four A.

c149 s44E (3) The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provision of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulation promulgated thereunder; and is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(Date)

(Name of General Bidder)

(Federal Employer Identification No.)

By: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Title & Name of person signing bid)

\_\_\_\_\_  
(Business Address)

\_\_\_\_\_  
(City State, Zip)



**APPENDIX B (cont.)  
DIESEL RETROFIT PROGRAM**

**STATEMENT OF INTENT TO COMPLY**

*This form must be signed and submitted by the bidder as part of the bid.*

**Local Governmental Unit** \_\_\_\_\_ **SRF Project No.** \_\_\_\_\_

**Contract No.** \_\_\_\_\_ **Contact Title** \_\_\_\_\_

**Bidder** \_\_\_\_\_

**The undersigned, on behalf of the above-named Bidder, agrees that, if awarded the Contract:**

- 1. the Bidder shall comply with the Massachusetts Department of Environmental Protection’s (“MassDEP”) Diesel Retrofit Program by ensuring that all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard;**
- 2. the Bidder shall require all Subcontractors to comply with MassDEP’s Diesel Retrofit Program by ensuring all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard; and**
- 3. The Bidder shall submit and shall require each Subcontractor to submit a Diesel Retrofit Program Contractor Certification (form attached) with a Diesel Retrofit List to MassDEP Municipal Services and the Bidder within 10 days of the bidder being notified that it has been awarded the Contract. The Bidder shall require each Subcontractor to update such Certification and List within 2 days of using additional Diesel Construction Equipment on the project under the Contract.**

\_\_\_\_\_  
**(Signature of Bidder’s Authorized Representative)** **(Date)**

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SECTION 00480

FORM OF NON-COLLUSIVE AFFIDAVIT  
(AFFIDAVIT FOR BIDDER)

State of \_\_\_\_\_

County of \_\_\_\_\_

\_\_\_\_\_ being first duly sworn, deposes and says,

That it is \_\_\_\_\_, the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or a sham; that said bidder has not colluded, conspired, connived or agreed directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of its bid or any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against the Town of Sharon, or any person interested in the proposed contract, and that all statements in said proposal or bid are true.

Signature of:

if bidder is an individual

\_\_\_\_\_ Bidder,

if bidder is a partnership

\_\_\_\_\_ Partner,

if bidder is a Corporation

\_\_\_\_\_ Officer,

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Notary Public

My commission expires: \_\_\_\_\_, 20\_\_\_\_

END OF SECTION 00480

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SECTION 00481

CERTIFICATE OF CORPORATE VOTE  
(CORPORATION ONLY)

At a duly authorized meeting of the Board of Directors of \_\_\_\_\_  
held on \_\_\_\_\_, it was VOTED that, \_\_\_\_\_,  
(Name)

\_\_\_\_\_ of this company, be and hereby is authorized to execute  
(Officer)

bidding, documents, contracts, and bonds in the name and on behalf of said company, and  
affix its corporate seal hereto; and such execution of any contract or obligation in this  
company's name on its behalf by such officer under seal of the company, shall be valid and  
binding upon this company.

I hereby certify that I am the clerk of the above named corporation and that  
\_\_\_\_\_ is the duly elected officer as above of said company, and  
that the above vote has not been amended or rescinded and remains in full force and effect as  
the date of this contract.

\_\_\_\_\_  
Clerk

\_\_\_\_\_  
Date

Affix Corporate Seal

END OF SECTION 00481

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SECTION 00482

CERTIFICATE AS TO PAYMENT OF STATE TAXES

Pursuant to M.G.L. Ch. 62C, sec. 49A, the undersigned certifies under the penalties of perjury that the said undersigned, to my best knowledge and belief, have filed all state tax returns and paid all state taxes required under law.

\_\_\_\_\_  
Social Security Number or Federal  
Identification Number

\_\_\_\_\_  
Signature of Individual or Corporate Name

By: \_\_\_\_\_  
Corporate Officer (if applicable)

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Notary Public

My commission expires: \_\_\_\_\_, 20\_\_\_\_

END OF SECTION 00482

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SECTION 00483

OSHA 10 HOUR TRAINING

A contractor will not be eligible for award of a contract unless such contractor has submitted the following certification, which is deemed a part of the resulting contract:

\_\_\_\_\_ certifies that:

All employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

\_\_\_\_\_  
(Signature of authorized representative of Contractor)

END OF SECTION 00483

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SECTION 00484

STATE DEBARMENT DISCLOSURE FORM

The undersigned certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of Section 29F of Chapter 29 of the General Laws, or any other applicable debarment provisions of any other Chapter of the General Laws, or any Rule or Regulation promulgated thereunder.

Date \_\_\_\_\_

Name of Bidder \_\_\_\_\_

By: \_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name & Title of Person Signing

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State, Zip

END OF SECTION 00484

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AGREEMENT

SECTION 00500

INDEX

- ARTICLE 1 WORK
- ARTICLE 2 ENGINEER
- ARTICLE 3 CONTRACT TIMES
- ARTICLE 4 CONTRACT PRICE
- ARTICLE 5 PAYMENT PROCEDURES
- ARTICLE 6 CONTRACTOR'S REPRESENTATIONS
- ARTICLE 7 CONTRACT DOCUMENTS
- ARTICLE 8 MISCELLANEOUS

AGREEMENT

SECTION 00500

WELLS 2, 3, AND 4 WATER TREATMENT PLANT

SHARON DEPARTMENT OF PUBLIC WORKS  
SHARON, MASSACHUSETTS

THIS AGREEMENT is dated as of the \_\_\_\_\_ day of \_\_\_\_\_ in the year 2024 by and between the Town of Sharon, acting by and through the Standing Building Committee, duly authorized therefore, who acts herein solely for the Sharon Department of Public Works and without personal liability to itself, (hereinafter called OWNER) and \_\_\_\_\_ (hereinafter called CONTRACTOR).

OWNER AND CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

**ARTICLE 1. WORK**

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is as described in SECTION 01010, SUMMARY OF WORK.

The work done and materials and equipment furnished shall be strictly pursuant to and in conformity with the specifications and plans; said plans are signed and accompany this contract and these specifications, and are intended to complement each other. Any work appearing in or upon the one and not mentioned in the other shall be executed according to the true intent and meaning of said specifications and plans, the same as though the work was contained and described in all and as reasonably implied by the plans.

The Work under this Contract includes, but is not necessarily limited to the construction of the Wells 2, 3, and 4 Water Treatment Plant and modifications to Well Stations 2, 3, and 4.

**ARTICLE 2. ENGINEER**

The Project has been designed by Environmental Partners Group, LLC, 1900 Crown Colony Drive, Suite 402, Quincy, Massachusetts 02169, who is hereinafter called ENGINEER and who is to act as OWNER'S representative, assume all duties and responsibilities, and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

**ARTICLE 3. CONTRACT TIMES**

- 3.1 Time of completion is set at **870 calendar days** from and including issuance of a notice to proceed, and/or receipt of fully executed contract. All proposed work at the well stations shall be sequenced as described in the Contract Drawings.
- 3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is

not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER four thousand three hundred dollars (\$4,300) for each day that expires after the time specified in paragraph 3.1 for Contract Completion until the work is complete. In addition, bidders must agree to pay a lump sum in additional liquidated damages as stated in the Agreement, in the amount of \$225,000 if Phase 2, as outlined in the Sequence of Work on sheet G-2 of the Contract Documents, is not complete by November 2, 2026.

#### **ARTICLE 4. CONTRACT PRICE**

The OWNER shall pay CONTRACTOR for completion of the work in accordance with the Contract Documents in current funds as follows:

For unit price items, the extended total resulting from the product of the actual measured quantities suitably installed and accepted and the unit prices from the accepted bid form herein referred to as Section 00301 BID FORM dated \_\_\_\_\_. The total of the Bid Form accepted by the Owner is:

---

(\$ \_\_\_\_\_).

#### **ARTICLE 5. PAYMENT PROCEDURES**

CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

- 5.1 For unit price bid items the product of the actual measured quantities suitably installed and accepted and the unit prices from the accepted bid proposal constitutes the extended total for payment. The extended total is the unit price times the quantity indicated. An adjustment of the unit price bid for an item in the proposal will only be considered if the actual quantity furnished and installed is greater than 25% above or below the estimated quantity. Said adjustment will only be applicable to that measured quantity which is 25% above or below the estimated quantity. For Lump Sum items suitably installed and completed the lump sum amount listed in the accepted bid proposal constitutes the total for payment.
- 5.2 Progress Payments; Retainage. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by ENGINEER, and in accordance with the applicable Massachusetts General Law during construction. All such payments will be measured by the schedule of values established in paragraph 2.05 of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

- 5.3 Progress payments will be made in an amount equal to 95 percent of Work completed (with the balance being retainage) but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 15.01.C.5 of the General Conditions.
- 5.4 Final Payment. Upon final completion and acceptance of the Work in accordance with paragraph 15.06 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 15.06.

## **ARTICLE 6. CONTRACTOR'S REPRESENTATIONS**

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

- 6.1 CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in paragraph 7) and the other related data identified in the Bidding Documents including "technical data."
- 6.2 CONTRACTOR has visited the sites and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work.
- 6.3 CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.
- 6.4 CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Article 5 of the General conditions. CONTRACTOR accepts the determination set forth in paragraph SC-5.04 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 4.03 of the General Conditions. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground utilities and facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional



examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

- 6.5 CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.
- 6.6 CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports, and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 6.7 CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

#### **ARTICLE 7. CONTRACT DOCUMENTS**

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

- 7.1 Invitation to Bid.
- 7.2 Instructions to Bidders.
- 7.3 CONTRACTOR's Bid Form.
- 7.4 This Agreement.
- 7.5 Exhibits to this Agreement.
- 7.6 Performance, Payment, and other Bonds.
- 7.7 General Conditions EJCDC Document C-700, 2013 edition.
- 7.8 Supplemental Conditions.
- 7.9 Specifications and appendices as listed in table of contents thereof.
- 7.10 Drawings entitled "Wells 2, 3, and 4 Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF #12443)" dated April 2024.
- 7.11 Addenda numbers \_\_\_ to \_\_\_, inclusive.

- 7.12 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents pursuant to paragraph 11.01 of the General Conditions.

## **ARTICLE 8. MISCELLANEOUS**

- 8.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 8.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically, but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment with release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 8.3 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.
- 8.4 Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- 8.5 No officer or employee of the OWNER shall participate in any decision relating to this Contract which affects his/her personal interest or the interest of any corporation, partnership, or association in which she/he is directly or indirectly interested. No officer or employee of the OWNER shall have any interest, direct or indirect, in this Contract or the proceeds thereof. The CONTRACTOR understands that any key personnel individually named to provide services under the Contract may become municipal employees subject to the provisions of M.G.L. c. 268A.
- 8.6 Appropriations for expenditures by the OWNER to spend for a particular purpose are ordinarily made on a fiscal year basis. The fiscal year of the OWNER is the twelve (12) month period ending June 30 of each year. The obligations of the OWNER under the Contract for the present or any subsequent fiscal year following the fiscal year in which the Contract is executed are subject to the appropriation to the OWNER of funds sufficient to discharge the OWNER's obligations, which accrue in this or any subsequent fiscal year. In the absence of such appropriation or authorization, this Contract shall be terminated immediately without liability for damages, penalties or other charges arising from early termination. Expenditures for contracted services, which will extend beyond a single fiscal year shall not exceed in any fiscal year the

amount appropriated and authorized for said fiscal year. The CONTRACTOR's yearly costs, as set out herein, may not exceed the amount appropriated for said year.

- 8.7 Prior to execution of this Contract, the Contractor shall provide the documented direct labor markup to establish the Direct Labor Cost percentage for Change Orders as required in Construction Grant Policy Memorandum No. CG-10. The Direct Labor Cost Percentage is \_\_\_\_\_ (to be filled in by the Contractor).
- 8.8 The Contractor agrees that it will fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). The Contractor shall not award any subcontracts or purchase any materials from suppliers that appear on the Excluded Parties List System. The Contractor shall include this requirement in each subcontract and require it to be included in all subcontracts regardless of tier. The Contractor shall maintain reasonable records to demonstrate compliance with these requirements.
- 8.9 The fair share goals for disadvantaged business enterprise (DBE) participation for this contract are a minimum of 4.20 percent Disadvantaged Minority Business Enterprise (D/MBE) participation and 4.50 percent Disadvantaged Women Business Enterprise (D/WBE) participation, applicable to the total dollar amount paid for the construction contract. The CONTRACTOR shall take all affirmative steps necessary to achieve this goal, and shall provide reports documenting the portion of contract and subcontract dollars paid to DBEs, and its efforts to achieve the goals, with each invoice submitted or at such greater intervals as specified by the Town of Sharon. The contractor shall require similar reports from its sub-contractors.
- 8.10 During the performance of this contract, the CONTRACTOR agrees as follows:
- 8.10.1 The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The CONTRACTOR agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.
- 8.10.2 The CONTRACTOR will, in all solicitations or advancements for employees placed by or on behalf of the CONTRACTOR, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
- 8.10.3 The CONTRACTOR will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the

CONTRACTOR's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

- 8.10.4 The CONTRACTOR will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 8.10.5 The CONTRACTOR will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Comp., p. 684, EO 12086 of Oct. 5, 1978, 43 FR 46501, 3 CFR, 1978 Comp., p. 230.
- 8.10.6 In the event of the CONTRACTOR's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the CONTRACTOR may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 8.10.7 The CONTRACTOR will include the provisions of paragraphs (8.10.1) through (8.10.7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each sub-contractor or vendor. The CONTRACTOR will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the CONTRACTOR becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the CONTRACTOR may request the United States to enter into such litigation to protect the interests of the United States." [Sec. 202 amended by EO 11375 of Oct. 13, 1967, 32 FR 14303, 3 CFR, 1966-1970]
- 8.11 The CONTRACTOR shall not participate in or cooperate with an international boycott, as defined in Section 999 (b)(3) and (4) of the Internal Revenue code 1986, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General Laws.
- 8.12 The CONTRACTOR acknowledges to and for the benefit of the Town of Sharon (the "Purchaser") and the Commonwealth of Massachusetts (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as

“American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contactor pursuant to this Agreement. The CONTRACTOR hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the CONTRACTOR has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the CONTRACTOR will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the CONTRACTOR shall permit the Purchaser or State to recover as damages against the CONTRACTOR any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the CONTRACTOR has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the CONTRACTOR agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

- 8.13 All construction contracts are subject to the Davis Bacon wage rate requirements and must include the provisions found in Appendix B in the Contract. The Davis Bacon Act Requirements are included in Appendix B.
- 8.14 The contractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in termination of this contract or other legally available remedies.
- 8.15 The CONTRACTOR acknowledges to and for the benefit of the Town of Sharon (“Purchaser”) and the Commonwealth of Massachusetts (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “Build America, Buy America Act;” that requires all steel, iron, manufactures products, non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables, glass (including optic glass), lumber, and drywall used in infrastructure project to be produced in the United States (“Build America, Buy America Act”) including these products provided by the CONTRACTOR pursuant to this Agreement. The CONTRACTOR hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the CONTRACTOR has reviewed and

understands the Build America, Buy America Act, (b) all steel, iron, manufactures products, non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables, glass (including optic glass), lumber, and drywall used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Act, unless a waiver of the requirement is approved, and (c) the CONTRACTOR will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Act, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the CONTRACTOR shall permit the Purchaser or State to recover as damages against the CONTRACTOR any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the CONTRACTOR has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the CONTRACTOR agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

**The BABA requirements are waived for this Project based on EPA's Decision Memorandum titled Amended Public Interest Waiver of Section 70914(a) of P.L. 117-58, Build America, Buy America Act, 2021 for State Revolving Fund and Water Infrastructure Projects that have Initiated Design Planning prior to May 14,2022 issued November 13, 2023.**

- 8.16 All contracts must have a clause requiring compliance with American Iron and Steel and the Build America, Buy America Act (BABA). The amendments to the Clean Water Act, as part of WRRDA, apply the American Iron and Steel (AIS) requirements to all treatment works projects. Furthermore, BIL extends this procurement requirement to all SRF construction projects going forward with the inclusion of the Build America, Buy America Act (BABA). Starting on May 14, 2022, all steel, iron, manufactured products, non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), glass (including optic glass), lumber, and drywall used in infrastructure projects for federal financial assistance programs must be produced in the United States. MassDEP ensures that the required procurement language is required in contracts and conducts field verifications of project compliance.
- 8.17 Project signs or other means of publicizing the project to comply with the "Guidelines for Enhanced Public Awareness of SRF Assistance Agreements" issued by the United States Environmental Protection Agency on June 3, 2015, or the "Guidelines for Implementing the Bipartisan Infrastructure Law Signage Term and Condition for the State Revolving Fund Programs" issued by the United States Environmental Protection Agency on December 8, 2022, as applicable, regarding the use of signs or

other methods of enhancing awareness of SRF project. Refer to Appendix I for the Guidelines.

IN WITNESS HEREOF, the parties of this AGREEMENT have hereunto set their hands and seals as of the day and year first above written.

**FOR THE STANDING BUILDING COMMITTEE**  
**SHARON, MASSACHUSETTS**

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_  
Print or type name and title

**CONTRACTOR**

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_  
Print or type name and title

TAX ID#: \_\_\_\_\_  
(Social Security # or FEID #)

**CERTIFICATE PURSUANT TO GL C44 & 31C**

In accordance with M.G.L. C44, Section 31C, this is to certify that an appropriation in the amount of this contract is available therefor and that the Town Manager has been authorized to execute the contract and approve all requisitions and change orders.

BY \_\_\_\_\_  
Town Accountant



SECTION 00550

NOTICE OF AWARD

TO:

DATE:

**PROJECT DESCRIPTION: Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF #12443)**

The Owner has considered the Bid submitted by you for the above described Work on \_\_\_\_\_ in response to its Advertisement for Bids and Instructions to Bidders.

You are hereby notified that your Bid has been accepted for Items totaling the amount of \$ \_\_\_\_\_

You are required by the Instructions to Bidders to execute the Contract Agreement and furnish the required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten (10) days from the date of this Notice of Award.

If you fail to execute said Agreement and to furnish said Bonds and Insurance within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner. Dated this \_\_\_\_\_ day of \_\_\_\_\_, 2024.

**FOR THE STANDING BUILDING COMMITTEE**  
**SHARON, MASSACHUSETTS**

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_  
Print or type name and title

**ACCEPTANCE OF NOTICE**

Receipt of the above Notice of Award is hereby acknowledged, this, the \_\_\_\_\_ day of \_\_\_\_\_, 2024.

By: \_\_\_\_\_

Title: \_\_\_\_\_

NOTICE TO PROCEED

TO:

DATE:

**PROJECT DESCRIPTION: Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF #12443)**

You are hereby notified to commence the Work in accordance with the Agreement dated \_\_\_\_\_, on or before \_\_\_\_\_, you are to reach Completion on all work within eight hundred and seventy (870) consecutive calendar days thereafter. The date of completion of all work is, therefore, \_\_\_\_\_.

**FOR THE STANDING BUILDING COMMITTEE**  
**SHARON, MASSACHUSETTS**

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_  
Print or type name and title

END OF SECTION 00550

SECTION 00610

PERFORMANCE BOND

**KNOW ALL MEN BY THESE PRESENTS,**

That we, \_\_\_\_\_, organized under the laws of the State of \_\_\_\_\_, and having a usual place of business in \_\_\_\_\_, as principal, and \_\_\_\_\_ organized under the laws of the State of \_\_\_\_\_ and having a usual place of business in \_\_\_\_\_, as surety, are holden and stand firmly bound and obligated unto the Town of Sharon as obligee, in the sum of \_\_\_\_\_ (\$\_\_\_\_\_) Dollars, lawful money of the United States of America, to and for the true payment whereof, we hereby bind ourselves, and each of us, our heirs, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said principal has, by means of a written agreement, dated \_\_\_\_\_, entered into a contract with the said obligee for the **Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF #12443)** a copy of which agreement is attached hereto and by reference made a part hereof.

**NOW, THEREFORE,** the conditions of this obligation is such that if the said principal shall well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of said contract on his part to be kept and performed, during the original term of said contract and any extensions thereof that may be granted by the Town of Sharon, Massachusetts with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, alterations, changes or additions to said contract that may hereafter be made, notice to the surety of such modifications, alterations, changes or additions being hereby waived, then this obligation shall be null and void; otherwise it shall be and remain in full force, virtue and effect.

In the event that the work under said contract is abandoned by the principal or is terminated by the Town of Sharon under the provisions of Sections of said Contract, said surety hereby further agrees that said surety shall, if requested in writing by the Town of Sharon take such action as is necessary to complete the work under said contract.

And the said surety, for value received, hereby stipulates and agrees that no change in, or extension of time, alteration, or addition to the terms of the contract or to the work to be performed thereunder, or to the Specifications accompanying the same shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the Specifications.

**IN WITNESS WHEREOF**, we have hereunto set our hands and seals this \_\_\_\_ day of \_\_\_\_\_ in the year Two Thousand and Twenty Four.

Important: Attach herewith proof of authority of officers or agents to sign Bond.

**PRINCIPAL:**

**SURETY:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

(Title) \_\_\_\_\_

(Title) \_\_\_\_\_

END OF SECTION 00610

SECTION 00620

PAYMENT BOND

**KNOW ALL MEN BY THESE PRESENTS,**

That we, \_\_\_\_\_ organized under the laws of the State of \_\_\_\_\_ and having a usual place of business in \_\_\_\_\_, as principal, and \_\_\_\_\_ organized under the laws of the State of \_\_\_\_\_ and having a usual place of business in \_\_\_\_\_, as surety, are holden and stand firmly bound unto the Town of Sharon as obligee, in the sum of \_\_\_\_\_ (\$ \_\_\_\_\_) Dollars lawful money of the United States of America, to and for the true payment whereof, we hereby bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

**WHEREAS,** the said principal has, by means of a written agreement, dated \_\_\_\_\_ entered into a contract with the said obligee for the **Wells 2, 3, and 4 Water Treatment Plant, Town of Sharon, Massachusetts, Contract No. 2025-101 (DWSRF #12443)** a copy of which agreement is attached hereto and by reference made a part hereof.

**NOW THEREFORE,** The conditions of this obligation is such that if the principal shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the surety of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any purposes of items set out in, and to be subject to, the provisions of Massachusetts General Laws Chapter 30 Section 39A and Chapter 149 Section 29, then this obligation shall be null and void; otherwise it shall be and remain in full force, virtue and effect.

**IN WITNESS WHEREOF,** the above-bounded parties have hereunto set our hands and seals this \_\_\_\_\_ day of \_\_\_\_\_ in the year Two Thousand and Twenty

Four.

Important: Attach herewith proof of authority of officers or agents to sign Bond.

**PRINCIPAL:**

**SURETY:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

(Title) \_\_\_\_\_

(Title) \_\_\_\_\_

END OF SECTION 00620

---

***SECTION 00700 - GENERAL CONDITIONS OF CONTRACT***

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This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

## STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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## ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

### 1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
  3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
  4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  5. *Bidder*—An individual or entity that submits a Bid to Owner.
  6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
  7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
  8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
  9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
  10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.



26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

## 1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives*:
  1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,”

“acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - a. does not conform to the Contract Documents; or
  - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
  - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

## ARTICLE 2 – PRELIMINARY MATTERS

### 2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

- B. *Evidence of Contractor's Insurance:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner's Insurance:* After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

## 2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

## 2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
  - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
  - 2. a preliminary Schedule of Submittals; and
  - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

## 2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

## 2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
  - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
  - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
  - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

## 2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

## **ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE**

### 3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

### 3.02 *Reference Standards*

#### A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

### 3.03 *Reporting and Resolving Discrepancies*

#### A. *Reporting Discrepancies:*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

#### B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

- a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

#### 3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

#### 3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
  1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
  2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

### **ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK**

#### 4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day

after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

#### 4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

#### 4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

#### 4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
  - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
  - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

#### 4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:



1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
  2. abnormal weather conditions;
  3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
  4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

## **ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### *5.01 Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

### *5.02 Use of Site and Other Areas*

#### *A. Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
  - C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
  - D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

### 5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
  1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
  2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
  3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
  1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and

procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

#### 5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
  2. is of such a nature as to require a change in the Drawings or Specifications; or
  3. differs materially from that shown or indicated in the Contract Documents; or
  4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

- b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
  - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
    - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
    - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
    - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
  3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
  4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

#### 5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
  2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
    - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
    - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
    - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming

aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
    - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
    - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
    - d. Contractor gave the notice required in Paragraph 5.05.B.
  2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
  3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
  2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
  2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
  3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related

- thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

## **ARTICLE 6 – BONDS AND INSURANCE**

### *6.01 Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the

Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

#### 6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and



documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

#### 6.03 *Contractor's Insurance*

- A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
  - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
  - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
  - 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
  - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
  - 2. claims for damages insured by reasonably available personal injury liability coverage.
  - 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:
    - a. Such insurance shall be maintained for three years after final payment.
    - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
  2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
  3. Broad form property damage coverage.
  4. Severability of interest.
  5. Underground, explosion, and collapse coverage.
  6. Personal injury coverage.
  7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
  8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be

maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

- I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:
1. include at least the specific coverages provided in this Article.
  2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
  3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
  4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
  5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

#### 6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

#### 6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
  2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials

and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
  4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
  5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
  6. extend to cover damage or loss to insured property while in transit.
  7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
  8. allow for the waiver of the insurer's subrogation rights, as set forth below.
  9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
  10. not include a co-insurance clause.
  11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
  12. include performance/hot testing and start-up.
  13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

- C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

#### 6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
  1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
  2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of

payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

#### 6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

### **ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES**

#### 7.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

#### 7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor

may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
  - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that:
      - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
      - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
      - 3) it has a proven record of performance and availability of responsive service; and
      - 4) it is not objectionable to Owner.
    - b. Contractor certifies that, if approved and incorporated into the Work:
      - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
      - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

- B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or-equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

#### 7.05 *Substitutes*

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
  - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
  - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
  - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
    - a. shall certify that the proposed substitute item will:
      - 1) perform adequately the functions and achieve the results called for by the general design,
      - 2) be similar in substance to that specified, and
      - 3) be suited to the same use as that specified.
    - b. will state:
      - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
      - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct



- contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
- 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
- c. will identify:
    - 1) all variations of the proposed substitute item from that specified, and
    - 2) available engineering, sales, maintenance, repair, and replacement services.
  - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

#### 7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

#### 7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

#### 7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
  - 1. all persons on the Site or who may be affected by the Work;
  - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
  - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss;

and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

#### 7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

#### 7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
  - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
  - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*

- a. Contractor shall submit the number of Samples required in the Specifications.
- b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

- C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review*:
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
  2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
  3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
  4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
  5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
  6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
  7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
  8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.
- E. *Resubmittal Procedures*:
1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
  2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
  3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner

may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
  - 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  - 1. observations by Engineer;
  - 2. recommendation by Engineer or payment by Owner of any progress or final payment;
  - 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
  - 4. use or occupancy of the Work or any part thereof by Owner;
  - 5. any review and approval of a Shop Drawing or Sample submittal;
  - 6. the issuance of a notice of acceptability by Engineer;
  - 7. any inspection, test, or approval by others; or
  - 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor



or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

#### 7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

## **ARTICLE 8 – OTHER WORK AT THE SITE**

### 8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

#### 8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
  - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
  - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
  - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

#### 8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility

owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

## **ARTICLE 9 – OWNER'S RESPONSIBILITIES**

### **9.01 *Communications to Contractor***

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

### **9.02 *Replacement of Engineer***

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

### **9.03 *Furnish Data***

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

### **9.04 *Pay When Due***

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

## **ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION**

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

#### 10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

#### 10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

#### 10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

#### 10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

#### 10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

#### 10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will

not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

#### 10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

#### 10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

### **ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

#### 11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
  - 1. *Change Orders:*
    - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
    - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
3. *Field Orders:* Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

#### 11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

#### 11.03 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

#### 11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
  1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
  3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
  2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
    - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
    - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
    - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
    - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
    - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
    - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

#### 11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

#### 11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the



requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
  2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
  3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

#### 11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
  2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
  3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
  4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

## ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
  - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
  - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
  - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
  - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
  - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
  - 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

## **ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

### *13.01 Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
  - 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
  - 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
  - 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
  - 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns

from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
  - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
  - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
  - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
  - g. The cost of utilities, fuel, and sanitary facilities at the Site.
  - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:
1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
  2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
  3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
  5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.
- E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

### 13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:* Contractor agrees that:
1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
  2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance:* Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

#### 13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
  - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
  - 2. there is no corresponding adjustment with respect to any other item of Work; and
  - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

### **ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

#### 14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

#### 14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required

by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
  - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
  - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
  - 3. by manufacturers of equipment furnished under the Contract Documents;
  - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
  - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

#### 14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

- F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

#### 14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

#### 14.05 *Uncovering Work*

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
  2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.



#### 14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

#### 14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

### **ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD**

#### 15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
  - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for

Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
  - a. the Work has progressed to the point indicated;
  - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
  - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
  - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
  - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
  - a. to supervise, direct, or control the Work, or
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

- c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
  - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
  - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
  6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
    - a. the Work is defective, requiring correction or replacement;
    - b. the Contract Price has been reduced by Change Orders;
    - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
    - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
    - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

*D. Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

*E. Reductions in Payment by Owner:*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
  - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
  - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
  - c. Contractor has failed to provide and maintain required bonds or insurance;
  - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
  - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
  - f. the Work is defective, requiring correction or replacement;

- g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
  - h. the Contract Price has been reduced by Change Orders;
  - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
  - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
  - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
  - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

#### 15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

#### 15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons

therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

#### 15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
  - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
  - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
  - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
  - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

#### 15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### 15.06 *Final Payment*

##### A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents;
  - b. consent of the surety, if any, to final payment;
  - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
  - d. a list of all disputes that Contractor believes are unsettled; and
  - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

##### B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner

and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

- C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

#### 15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

#### 15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
  - 1. correct the defective repairs to the Site or such other adjacent areas;
  - 2. correct such defective Work;
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
  - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

## ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

### 16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

### 16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
  1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
  2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
  3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
  4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
  1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
  2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.



- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
  1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
  2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
  3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

## **ARTICLE 17 – FINAL RESOLUTION OF DISPUTES**

### *17.01 Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
  2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
  2. agree with the other party to submit the dispute to another dispute resolution process; or
  3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

## **ARTICLE 18 – MISCELLANEOUS**

### *18.01 Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
  2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

### *18.02 Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

### *18.03 Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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***SECTION 00800 - SUPPLEMENTAL CONDITIONS***

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SECTION 00800

SUPPLEMENTAL CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC No. C-700, 2013 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not specifically amended or supplemented hereby remain in full force and effect.

**ARTICLE 1. DEFINITIONS AND TERMINOLOGY**

**SC-1.01.A.13**

Add the following language at the beginning of the definition entitled "Contract Documents" in the General Conditions:

The Invitation to Bid, Instructions to Bidders

**SC-1.01.A.28**

Add the following language to the definition entitled "Owner" in the General Conditions:

The "Owner" shall mean the Town of Sharon, Massachusetts acting through its Standing Building Committee.

**SC-1.01.A.40**

Delete the definition of Substantial Completion in the General Conditions in its entirety and add the following in its place:

The Work required by the Contract has been completed except for work having a Contract Price of less than one percent of the then adjusted total contract price, or substantially all of the Work has been completed and opened to Owner's use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work required by the Contract.

**SC-1.01.A.49**

Add the following definition to the General Conditions:

"State" shall mean the Commonwealth of Massachusetts.

**ARTICLE 2. PRELIMINARY MATTERS**

**SC-2.01.C**

Delete this paragraph

**SC-2.01.D**

Add a new paragraph immediately after paragraph 2.01.C of the General Conditions, which is to read as follows:

D. Non-Resident Contractor: The CONTRACTOR, if a corporation established under laws other than the State in which the proposed construction is located, shall file with the OWNER, notice of the name of its resident attorney-in-fact, appointed as required by the laws of the State in which the proposed construction is located. The CONTRACTOR, if a resident of a State other than that in which the proposed construction is located and not a corporation, shall file, at the time of execution of the Agreement, with the OWNER a written appointment of a resident of the State in which the construction is located, having an office or place of business therein, to be his true and lawful attorney upon whom all lawful processes in any actions or proceedings against him may be served; and in such writing, which shall set forth said attorney's place of residence, shall agree that any lawful process against him which is served on said attorney shall be of the same legal force and validity as if served on him and that the authority shall continue in force so long as any liability remains outstanding against him in said State. The power of attorney shall be filed in the office of the Secretary of the State if required, and copies certified by the Secretary shall be sufficient evidence thereof. Such appointment shall continue in force until revoked by an instrument in writing, designating in a like manner some other person upon whom such processes may be served, which instrument shall be filed in the manner provided herein for the original appointment.

#### **SC-2.05**

Add the following paragraphs immediately after paragraph 2.05.A.3 of the General Conditions which is to read as follows:

**2.05.A.4** Before any work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates of insurance (and other evidence of insurance requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 6.

**2.05.A.5** Contractor shall include and identify on the certificate of insurance, indemnification as required by Article 7.18.

### **ARTICLE 3. DOCUMENTS: INTENT, REQUIREMENTS, REUSE**

#### **SC-3.01**

Add the following paragraphs immediately after paragraph 3.01.A of the General Conditions which is to read as follows:

3.01.A.1 Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though they were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

3.01.A.2 Sections of Division 1 - General Requirements govern the execution of the work of all sections of the specifications.



### **SC-3.02.A.1**

Delete the portion of the paragraph starting at “shall mean” through the end of this sentence and insert the following:

“shall mean the standard, specification, manual, code, or Laws or Regulations in effect and applicable at the time in question, except as may be otherwise specifically stated in the Contract Documents.”

### **SC-3.03.A.3**

Delete Paragraph 3.03.A.3 in its entirety and insert the following:

“CONTRACTOR shall be liable to OWNER and/or ENGINEER for failure to report any such conflict, error, ambiguity or discrepancy if Contractor knew or reasonably should have known thereof.”

## **ARTICLE 4. COMMENCEMENT AND PROGRESS OF THE WORK**

### **SC 4.01**

Delete paragraph 4.01 in its entirety and insert the following in its place:

4.01 The Contract Time will commence to run on the day indicated in the Notice to Proceed.

### **SC-4.03.A**

Add a new paragraph at the end of paragraph 4.03.A of the General Conditions which is to read as follows:

“4.03.B ENGINEER may check the lines, elevations, reference marks, batter boards, etc., set by CONTRACTOR, and CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered as approval of CONTRACTOR's work and shall not relieve CONTRACTOR of the responsibility for accurate and satisfactory construction and completion of the entire Work. CONTRACTOR shall furnish personnel to assist ENGINEER in checking lines and grades.”

### **SC-4.04**

Add the following paragraph after paragraph 4.04.A.2 of the General Conditions:

"3. The CONTRACTOR's resident superintendent shall attend monthly progress meetings at the site of the work with the ENGINEER and others as appropriate to review schedule status and such other pertinent subjects as may be listed on the agenda by the ENGINEER."

### **SC- 4.05.A**

Delete Paragraph 4.05.A in its entirety.

**SC-4.05.G**

Delete Paragraph 4.05.G and insert the following in its place:

“Delays caused by or within the control of the OWNER: In such event, the CONTRACTOR’S sole remedy shall be an extension of the Contract Time. Notwithstanding anything to the contrary in the Contract Documents, CONTRACTOR shall not be eligible for any increase in the Contract Price on account of any delay in the Work, no matter by whom such delay is caused, and CONTRACTOR shall make no claim for such an increase, whether such claim is styled as a claim for delay damages, acceleration of work, loss of production, or otherwise.”

**ARTICLE 5. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS;  
HAZARDOUS ENVIRONMENTAL CONDITIONS**

**SC-5.01**

Add a new paragraph immediately after paragraph 5.01.A of the General Conditions which is to read as follows:

“5.01.A.1 If all lands and rights-of-way are not obtained as herein contemplated before construction begins, CONTRACTOR shall begin the Work upon such land and rights-of-way as OWNER has previously acquired and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining lands and rights-of-way. Should OWNER be prevented or enjoined from proceeding with the Work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the Work, CONTRACTOR shall not be entitled to make or assert claim for damage by reason of said delay, or to withdraw from the Agreement except by consent of OWNER. Time for completion of the Work will be extended as provided in Article 11, to such time as OWNER determines will compensate for the time lost by such delay.”

**SC-5.01.B**

Delete Paragraph 5.01.B in its entirety.

**SC-5.03**

In paragraph 5.03.B insert the word “reasonably” before the word “rely” in the first line and insert the following at the end of the first sentence:

“; the OWNER does not warrant or guarantee the accuracy or completeness of the information therein, and the CONTRACTOR may not so rely to the extent that the CONTRACTOR knows, or reasonably should have known, of any inaccuracy or omission therein.”

**SC-5.04**

Insert the following paragraph before Paragraph 5.04.A

“5.04 Differing Subsurface or Physical Conditions

In accordance with Massachusetts General Laws Chapter 30, Section 39N, if, during the progress of the Work, the CONTRACTOR or the OWNER discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on

the plans or indicated in the Contract Documents either the CONTRACTOR or the OWNER may request an equitable adjustment in the Contract Price applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such request to the other party as soon as possible after such conditions are discovered. Upon receipt of such a request from the CONTRACTOR, or upon its own initiative, the OWNER will make an investigation of such physical conditions, and if they differ substantially or materially from those shown on the plans or indicated in the Contract Documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and Contract Documents and are of such a nature as to cause an increase or decrease in the cost of performance of the Work or a change in the construction methods required for the performance of the Work which results in an increase or decrease in the cost of the Work, the OWNER will make an equitable adjustment in the Contract Price and the Contract shall be modified in writing accordingly.”

#### **SC-5.04.D.1**

Delete Paragraph 5.04.D.1 in its entirety.

Add a new paragraph immediately after paragraph 5.04.D of the General Conditions which is to read as follows:

“5.04.E Adjustments resulting from actual subsurface or latent physical conditions from those indicated will be in accordance with Massachusetts General Law, Chapter 30, Section 39N and the applicable provisions of the Contract Documents.”

#### **SC-5.05.A**

Insert the following new paragraph immediately after Paragraph 5.05.A.2:

“3. CONTRACTOR’s attention is directed to the requirements of Massachusetts General Laws Chapter 82, Section 40, regarding the notification of owners of underground facilities.”

#### **SC-5.05.B**

Delete the phrase “or was not shown or indicated with reasonable accuracy” following the words “Contract Documents” in the first sentence of Paragraph 5.05.B.

#### **SC-5.06.B**

Delete Paragraph 5.06.B in its entirety.

#### **SC-5.06.C**

Add the following at the end of Paragraph 5.06.C: “, or unless CONTRACTOR caused or contributed to such Hazardous Environmental Condition.”

#### **SC-5.06.E**

Delete the second and third sentences of Paragraph 5.06.E.

#### **SC-5.06.I**

Delete Paragraph 5.06.I in its entirety.

**SC-5.06.J**

Delete the last sentence of Paragraph 5.06.J.

**ARTICLE 6. BONDS AND INSURANCE**

**SC-6.02**

Delete Paragraph 6.02.D in its entirety.

Add a new paragraph immediately after paragraph 6.02.J of the General Conditions which is to read as follows:

"K. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with this Article 6 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within thirty days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.01.B CONTRACTOR will provide such additional information in respect of insurance provided by him as OWNER may reasonably request."

**SC-6.03**

The limits of liability for the insurance required by paragraph 6.03 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulations:

6.03.A Workers' Compensation.

- (1) Worker's Compensation \$1,000,000
- (2) Employer's Liability \$1,000,000

6.03.B and 6.03.C Comprehensive General Liability including Operations/Premises, Contractor's Protective, Products/Completed Operations, and Personal Injury liabilities:

- (1) Bodily injury:
 

	\$1,000,000	Each occurrence
	\$3,000,000	Annual aggregate
- (2) Property damage, including explosion, collapse and underground coverage:
 

	\$1,000,000	Each occurrence
	\$3,000,000	Annual aggregate

Property damage liability insurance shall provide coverage for property in the care, custody and control of the insured.

- (3) Personal injury, with employment exclusion deleted:
 

	\$3,000,000	Annual aggregate
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The Contractual Liability required by paragraph 6.03.C of the General Conditions shall provide coverage for not less than the following amounts:

(1)	Bodily injury:	\$2,000,000 \$3,000,000	Each occurrence Annual aggregate
(2)	Property damage, including explosion, collapse and underground coverage:	\$1,000,000 \$3,000,000	Each occurrence Annual aggregate
(3)	General Aggregate	\$2,000,000	

6.03.D Comprehensive Automobile Liability including owned, hired and non-owned vehicles:

(1)	Bodily injury:	\$1,000,000 \$1,000,000	Each person Each accident
(2)	Property damage	\$1,000,000	Each occurrence

**SC-6.04**

Delete paragraph 6.04 of the General Conditions in its entirety and insert the following in its place:

6.04.A CONTRACTOR shall purchase and maintain a separate Owner's Protective Liability policy, issued to OWNER at the expense of CONTRACTOR, including OWNER and ENGINEER as named insured. This insurance shall provide coverage for not less than the following amounts:

6.04.A.1	Bodily Injury:		
	Each Occurrence		\$1,000,000
6.04.A.2	Property Damage:		
	Each Occurrence		\$1,000,000
	Annual Aggregate		\$1,000,000

**SC-6.05**

Delete Paragraph 6.05.A of the General Conditions in its entirety and insert the following in its place:

"A. CONTRACTOR shall purchase and maintain, until final payment, property insurance upon the Work at the site in an amount equal to the total bid price for the completed construction. This insurance shall include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER and ENGINEER's consultants in the Work, shall insure against the perils of fire and extended coverage, shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and shall include damages, losses and expenses rising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). This insurance shall be provided on the completed value form. If not covered under the "all risk" insurance or otherwise provided in these Supplementary

Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment."

Delete Paragraph 6.05.B of the General Conditions in its entirety and insert the following in its place:

"B. All the policies of insurance (or the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER by certified mail and will contain waiver provisions in accordance with paragraph 6.06.B."

#### **SC-6.05.D**

Delete Paragraph 6.05.D in its entirety and insert the following:

"OWNER may occupy or use a portion of the Work prior to Substantial Completion."

#### **SC-6.06A**

Delete Paragraph 6.06A in its entirety and insert the following:

"OWNER and CONTRACTOR intend that all policies of insurance purchased in accordance with the provisions of Article 6 will protect OWNER, CONTRACTOR, Subcontractors, and ENGINEER, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and officers, director, members, partners, employees, agents, consultants, and subcontractors or each and any of them) in such policies and will, where required to provided such insurance, provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby."

#### **SC-6.06.C**

Delete Paragraph 6.06.C in its entirety and replace with the following:

"The CONTRACTOR shall pay for all costs not covered because of the application of a policy deductible due under any of its insurance policies required hereunder."

#### **SC-6.07**

Delete paragraph 6.07.A of the General Conditions in its entirety.

Delete paragraph 6.07.B of the General Conditions in its entirety.

Delete paragraph 6.07.C of the General Conditions in its entirety.

### **ARTICLE 7. CONTRACTOR'S RESPONSIBILITIES**

#### **SC-7.01**

Add the following new paragraph as follows:

“7.01.C The site superintendent may be a direct employee of the subcontractor provided that this individual has the full authority and responsibility of the general contractor’s specified superintendent. The General Contractor shall submit a letter to the Engineer stating who the supervisor is and defining his/her authority during all construction related activities.”

**SC-7.02.C – 7.02.G**

Insert the following new paragraphs immediately after Paragraph 7.02.B:

“C. Regular working hours are defined as Monday through Friday, excluding holidays, between the hours of 7:00 AM and 4:00 PM. Requests to work other than regular working hours shall be submitted to ENGINEER not less than 48 hours prior to any proposed change. Occasional unscheduled overtime on weekdays may be permitted provided it is approved by ENGINEER.”

“D. CONTRACTOR shall reimburse the OWNER for additional engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours stipulated in Paragraph SC-7.02.C. At OWNER’s option, overtime costs may either be deducted from the CONTRACTOR’s monthly payment or deducted from the retainage held by OWNER until release of final payment. Overtime costs for the OWNER’s personnel shall be based on the individual’s current overtime wage rate. Overtime costs for personnel employed by the ENGINEER or OWNER’s independent testing laboratory shall be calculated in accordance with the terms of their respective contracts with the OWNER.”

“E. This agreement is subject to the applicable provisions of the Contract Work Hours and Safety Standards Act, Public Law 87-581 87<sup>th</sup> Congress. No Contractor or Subcontractor contracting for any part of the Work shall require or permit any laborer or mechanic to be employed on the Work in excess of forty hours in any work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half times that person’s basic rate of pay for all hours worked in excess of forty hours in such work week.”

“F. CONTRACTOR and Subcontractors shall, insofar as practicable, give preference in the hiring of workers for the Project to qualified local residents with first preference being given to citizens of the United States who have served in the armed forces of the United States and have been honorably discharged therefrom or released from active duty therein.

“G. CONTRACTOR shall employ only competent persons to do the work and whenever OWNER shall notify CONTRACTOR, in writing, that any person on the Work appears to be incompetent, disorderly, or otherwise unsatisfactory, such person shall be removed from the Project and shall not again be employed on it except with the consent of OWNER.”

**SC-7.04.A**

Insert the following at the end of the third sentence of Paragraph 7.04.A: “, and in accordance with G.L. c.30, §39M.”

Add a new paragraph SC-7.04.A.1.c immediately after paragraph 7.04A.1.b, which is to read as follows:

“c. It shall be CONTRACTOR’s responsibility to coordinate all submittals to ENGINEER for approval to eliminate any conflicts which might arise due to the use of “or equal” items. Any additional costs incidental to the use of “or equal” items shall be paid by CONTRACTOR.”

**SC-7.06**

Add the following to Paragraph 7.06.A:

“CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization, (including those who are to furnish the principal items of materials or equipment), whether initially or as a substitute, against whom OWNER makes reasonable objection. Acceptance of any Subcontractor, other person or organization by OWNER shall not constitute a waiver of any right of OWNER to reject defective Work.”

#### **7.06.H.1**

Add the following paragraph immediately after paragraph 7.06.H:

“1.CONTRACTOR shall make payments to Subcontractors in accordance with Massachusetts General Laws Chapter 30, Section 39F.”

Add the following new paragraph as follows:

“7.06.J.1 OWNER or ENGINEER may furnish to any such Subcontractor, Supplier, or other person or organization, to the extent practicable, information about amounts paid to CONTRACTOR in accordance with CONTRACTOR’s Applications for Payment on account of the particular Subcontractor’s, Suppliers, other person’s, or other organization’s Work.”

#### **SC-7.06**

Add the following language at the beginning of paragraph 7.06.L of the General Conditions:

“Except as otherwise required by Massachusetts General Law, Chapter 149, Section 44F,”

**SC-7.07.A** Delete the second sentence of Paragraph 7.07.A.

**SC-7.07.B** Delete this subparagraph.

#### **SC-7.09**

Add the following language at the end of paragraph 7.09.A of the General Conditions:

“7.09.A.1 The materials and supplies to be used in the Work under this Contract are exempt from the Sales and Use Tax of the Commonwealth of Massachusetts. Contractor shall obtain the proper certificates, maintain the necessary records, and otherwise comply with all applicable requirements governing the exemption from sales tax.”

#### **SC-7.10C**

Delete the last sentence of Paragraph 7.10C.

#### **SC-7.11.B – C**

Insert the following new paragraphs immediately after Paragraph 7.11.A:

“B. The CONTRACTOR shall return to the ENGINEER one set of the Contract Drawings marked in colored pencil, showing all changes made during construction and including the



location, by dimensions and elevations, of installed equipment, and underground facilities that will become concealed or buried by the construction. This shall include ties to all concealed work, etc. measured from permanent structures. Additionally, the CONTRACTOR shall be required to keep marked-up drawings current and on site and to provide mark-ups to the OWNER on a monthly basis.

C. CONTRACTOR shall comply with all applicable provisions of Chapter 30, Section 39R of the Massachusetts General Laws regarding CONTRACTOR's records."

#### **SC-7.12.E**

Delete the text in parentheses in Paragraph 7.12.E.

#### **SC-7.16**

Add the following new paragraph immediately after paragraph 7.16.E of the General Conditions, which is to read as follows:

"7.16.F The accuracy of all such information submitted by the Contractor is the responsibility of the Contractor. In reviewing Shop Drawings, Samples, and similar submittals, the Engineer shall be entitled to rely upon the Contractor's representation that such information is correct and accurate."

#### **SC-7.17.E**

Add the following new paragraph 7.17.E, immediately after paragraph 7.17.D of the General Conditions:

"E. CONTRACTOR shall guarantee all materials and equipment furnished and Work performed for a period of one (1) year from the date of Substantial Completion. CONTRACTOR warrants and guarantees for a period of one (1) year from the date of Substantial Completion that the completed Work is free from all defects due to faulty materials or workmanship and CONTRACTOR shall promptly make such corrections as may be necessary by reason of any such defects including the repairs of any damage to other parts of the Work resulting from such defects. In the event that CONTRACTOR should fail to make such repairs, adjustments, or other work that may be made necessary by such defects, OWNER may do so and charge CONTRACTOR the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period."

#### **SC-7.18.A**

Delete the phrase in parentheses: "(other than the Work itself)" in Paragraph 7.18.A.

Change the phrase "negligent act or omission" to "negligent or willful or wrongful act or omission."

#### **SC-7.18.B**

Insert the following at the end of Paragraph 7.18.B:

"If, through the acts or neglect of CONTRACTOR, any other Contractor or any Subcontractor shall suffer loss or damage on the Work, CONTRACTOR shall settle with such other Contractor or Subcontractor by agreement if such other Contractor or Subcontractor will so settle. If such other Contractor or Subcontractor shall assert any claim against OWNER on account of any

damage alleged to have been sustained, OWNER shall notify CONTRACTOR, who shall indemnify and hold harmless OWNER against any such claims.”

## **ARTICLE 8. OTHER WORK AT THE SITE**

### **SC-8.02**

Delete Paragraph 8.02 in its entirety.

### **SC-8.03**

Delete paragraph 8.03.D of the General Conditions in its entirety, and insert the following in its place:

“8.03.D Should CONTRACTOR cause damage to the work or property of any separate contractor at the site, or should any claim arising out of CONTRACTOR'S performance of the Work at the site be made by any separate contractor against CONTRACTOR, OWNER, ENGINEER, ENGINEER'S Consultants, or any other person, CONTRACTOR shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER, ENGINEER, and ENGINEER'S Consultants, harmless from and against all claims, damages, losses, and expenses (including, but not limited to, fees of engineers, architects, attorneys, and other professionals, and court and arbitration costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any separate contractor against OWNER, ENGINEER, or ENGINEER'S Consultants, to the extent based on a claim arising out of the CONTRACTOR'S performance of the Work. Should a separate contractor cause damage to the Work or property of CONTRACTOR or should the performance of Work by any separate contractor at the site give rise to any other claim, CONTRACTOR shall not institute any action, legal or equitable, against OWNER, ENGINEER, or ENGINEER'S Consultants or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from OWNER, ENGINEER, or ENGINEER'S Consultants, on such action or claim. If CONTRACTOR is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor and OWNER and CONTRACTOR are unable to agree to the extent of any adjustment in Contract Times attributable thereto, CONTRACTOR may make a claim for an extension of times in accordance with Article 12.02. An extension of the Contract Times shall be CONTRACTOR'S exclusive remedy with respect to OWNER, ENGINEER, and ENGINEER'S Consultants, for any delay, disruption, interference or hindrance caused by any separate contractor. This paragraph does not prevent recovery from OWNER, ENGINEER, or ENGINEER'S Consultant, for activities that are their respective responsibilities.”

## **ARTICLE 9. OWNER'S RESPONSIBILITIES**

### **SC-9.02.A**

Delete the phrase “provided Contractor makes no reasonable objection to the replacement engineer” in Paragraph 9.02.A.

### **SC-9.06**

Delete paragraph 9.06 of the General Conditions in its entirety.

## **SC-9.09**

Insert the following after the first sentence of Paragraph 9.09.A:

“However, the OWNER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto.”

## **ARTICLE 10. ENGINEER'S STATUS DURING CONSTRUCTION**

### **SC-10.01**

Add a new paragraph 10.01.B after paragraph 10.01.A of the General Conditions, which is to read as follows:

"B. Nothing contained in the Contract Documents shall be construed to create a contractual relationship of any kind (1) between the ENGINEER and CONTRACTOR, (2) between the OWNER and a Subcontractor or Subcontractors, or (3) between any person or entities other than the OWNER and CONTRACTOR. The ENGINEER shall, however, be entitled to performance and enforcement of obligations under the CONTRACT DOCUMENTS intended to facilitate performance of the ENGINEER'S duties."

### **SC-10.02B**

Insert the following at the end of Paragraph 10.02.B:

“However, the ENGINEER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto.”

### **SC-10.03**

Delete the last sentence of Paragraph 10.03.A

Add a new paragraph immediately after paragraph 10.03.A of the General Conditions as follows:

“10.03.B ENGINEER will furnish a Resident Project Representative and assistants to assist ENGINEER in observing the performance of the Work. The duties and responsibilities of the Resident Project Representative will be as enumerated in a document entitled "Duties, Responsibilities, and Limitations of the Authority of Resident Project Representative" and will be made available to CONTRACTOR at the start of his work.”

### **SC-10.08.B**

Insert the following after the first sentence in Paragraph 10.08.B:

“However, the ENGINEER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto.”

#### **SC-10.08.F**

Add a new paragraph immediately after paragraph 10.08.E of the General Conditions which is to read as follows:

“ENGINEER'S interpretations will be made in accordance with Massachusetts General Laws Chapter 30, Section 39P.”

### **ARTICLE 11. AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

#### **SC-11.02**

Add a new paragraph immediately after paragraph 11.02.A of the General Conditions which is to read as follows:

“11.02.A.1 ENGINEER'S interpretations will be made in accordance with Massachusetts General Law, Chapter 30, Section 39P.”

#### **SC-11.02**

Add the following new paragraph immediately after paragraph 11.02.A of the General Conditions, which is to read as follows:

“11.02.B Upon request of the Owner or Engineer, the Contractor shall without cost to the Owner submit to the Engineer, in such form as the Engineer may require, an accurate written estimate of the cost of any such proposed extra Work or change. The estimate shall indicate the quantity and unit cost of each item of materials, and the number of hours of work and hourly rate for each class of labor, as well as the description and amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of materials shall be shown if required by the Engineer. The Contractor shall promptly revise and resubmit such estimate if the Engineer determines that it is not in compliance with the requirements of this Article, or that it contains errors of facts or mathematical errors. If required by the Engineer, in order to establish the exact cost of new Work added or previously required Work omitted, the Contractor shall obtain and furnish to the Engineer bona fide proposals from recognized suppliers for furnishing any material included in such Work, and shall be furnished at Contractor's expense. The Contractor shall state in the estimate any extension of time required for the completion of the Work if the change or extra work is ordered.”

#### **SC-11.04**

In paragraph 11.04.C.2.a change “15 percent” to “10 percent”.

Delete paragraph 11.04.C.2.c

## **ARTICLE 12. CLAIMS**

### **SC-12.01**

Add a new paragraph immediately after paragraph 12.01.D.1 of the General Conditions to read as follows:

“12.01.D.1.a CONTRACTOR shall carry on the Work and maintain the progress schedule during the dispute resolution proceedings unless otherwise agreed in writing by OWNER and CONTRACTOR.”

## **ARTICLE 13. COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

### **SC-13.01**

Add the following to the end of paragraph 13.01.B of the General Conditions to read as follows:

“Following the Notice of Award and prior to the execution of the AGREEMENT the OWNER, prospective contractor and, if any, each prospective filed sub bid contractor shall agree on what percentage markup shall be used as direct labor costs in determination of extra work costs.”

In the second sentence of paragraph 13.01.B.1 delete the word "superintendents".

### **SC-13.01.B.5**

Delete subparagraphs a, d, e, f, g, and h of Paragraph 13.01.B.5.

### **SC-13.03.E**

Delete Paragraph 13.03.E in its entirety.

### **SC-13.02**

Delete paragraph 13.02 of the General Conditions in its entirety.

### **SC-13.03.E**

Delete Paragraph 13.03.E in its entirety.

## **ARTICLE 14. TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

### **SC-14.02.F**

Delete the remainder of Paragraph 14.02.F after the words “Contractor’s expense.”

## **SC-14.05.C.2**

Delete Paragraph 14.05.C.2 in its entirety.

## **SC-14.06.B**

Insert the following new paragraph immediately after Paragraph 14.06.A:

“B. If Owner stops Work under paragraph 14.06.A, CONTRACTOR shall not be entitled to any extension of Contract Time or increase in Contract Price.”

## **ARTICLE 15. PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD**

### **SC-15.01**

Delete the first phrase prior to the words “Contractor shall” in the first sentence of Paragraph 15.01.B.1 and insert the following:

“On a monthly basis and in accordance with G.L. c.30, §39G.”.

Add new paragraphs immediately after paragraph 15.01.B.1 of the General Conditions to read as follows:

“15.01.B.1.a Only the following items of material and equipment will be accepted for delivery at the site or at a local bonded warehouse and included in progress estimates in advance of actual requirement, subject to all conditions stated below.

15.01.B.1.b Materials and equipment listed above will not be included in progress estimates until the requirements stated herein have been fulfilled.

15.01.B.1.c The Contractor must present an invoice to the Engineer for each item of material or equipment he is requesting payment for. The invoice must be broken down to show the costs for the actual equipment, and reasonable costs for O&M Manuals, spare parts, start-up certification, training, testing, final acceptance testing, and any other services required by Contract.

15.01.B.1.d Sufficient monies have been allocated in the payment requisition line items to cover all of the costs listed in "a" above, plus the costs of physically installing the equipment.

15.01.B.1.e The equipment has been submitted and approved for use in this Project.

15.01.B.1.f The Contractor has, at the time of delivery, given the Engineer written notice of the delivery using the form provided by the Engineer.

15.01.B.1.g The equipment is acceptably stored and protected. Storage in a bonded warehouse will require proof of bonding, and insurance coverage specifically for the item being stored.

15.01.B.1.h The manufacturer's short and/or long term storage requirements have been received by the Engineer, prior to payment.

15.01.B.1.i The Contractor has established a program to implement the manufacturer's required storage procedures. Said program to consist of at the very least a written schedule of daily,

weekly, monthly, routine maintenance requirements for each piece of equipment. A copy of this schedule to be presented to the Engineer prior to each requisition submittal, signed by the Contractor, stating that the required maintenance has been performed.

15.01.B.1.j Signed, notarized Title Transfers, format to be furnished by the Engineer, must be furnished for each item of equipment.

15.01.B.1.k When the above have been complied with to the satisfaction of the Engineer, payment will be authorized for the full invoice values of the item of equipment, less normal retainage and less all costs for O&M Manuals, spare parts, start-up certification, training, testing, final acceptance testing, and installation.”

Delete paragraph 15.01.B.3 and insert the following in its place:

"15.01.B.3. Retainage with respect to progress payments will be five percent or, if stipulated, the maximum allowed by law."

#### **SC-15.01.B.4**

Insert the following new paragraph immediately after Paragraph 15.01.B.3:

“4. CONTRACTOR shall furnish evidence that payment received on the basis of materials and equipment not incorporated and suitably stored, has in fact been paid to the respective supplier(s) within ten (10) days of payment by OWNER. Failure to provide such evidence of payment may result in the withdrawal of previous approval(s) and removal of the cost of related materials and equipment from the next submitted Application for Payment.

#### **SC-15.01.C.1**

Delete Paragraph 15.01C.1 and insert the following:

“1. Progress Payments shall be made in accordance with Massachusetts General Laws, Chapter 30, Section 39G.”

#### **SC-15.01.D.1**

Delete Paragraph 15.01.D.1 and insert the following:

“1. Payment shall be made in accordance with G.L. c.30, §39G.”

#### **SC-15.01.E.2**

Delete the words “immediate” and “promptly” in the first sentence of Paragraph 15.01.E.2.

#### **SC-15.01.E.3**

Delete this Paragraph in its entirety.

#### **SC-15.02**

Insert the following new paragraphs immediately after Paragraph 15.02.A:

“B. No materials or supplies for the Work shall be purchased by CONTRACTOR or Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. CONTRACTOR warrants that CONTRACTOR has good title to all materials and supplies used by CONTRACTOR in the Work, free from all liens, claims or encumbrances.”

“C. CONTRACTOR shall indemnify and save OWNER harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. CONTRACTOR shall, at OWNERS request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If CONTRACTOR fails to do so, then OWNER may, after having served written notice on the CONTRACTOR, either pay unpaid bills, of which OWNER has written notice, or withhold from the CONTRACTOR’s unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to CONTRACTOR shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligation upon OWNER to either CONTRACTOR, or CONTRACTOR’s Surety. In paying any unpaid bills of the CONTRACTOR, OWNER’s payment shall be considered as payment made under the Contract by OWNER to CONTRACTOR and OWNER shall not be liable to CONTRACTOR for any such payment made in good faith.”

### **SC-15.03.C**

Delete the third sentence of Paragraph 15.03.C and insert the following:

“OWNER may review the preliminary certificate and make written objection to ENGINEER as to any provisions of the certificate or attached list.”

Delete the phrase “, within 14 days after submission of the preliminary certificate to OWNER,” in the fourth sentence of paragraph 15.03.C.

Delete the phrase “, within said 14 days,” in the fifth sentence of Paragraph 15.03.C.

### **SC-15.04.A**

Delete the phrase “subject to the following conditions” at the end of the first sentence of Paragraph 15.04.A.

Delete Paragraph 15.04.A.2 in its entirety.

### **SC-15.06**

Delete Paragraph 15.06.B.1 and insert the following:

“1. If, on the basis of ENGINEER’s observations of the Work during construction and final inspection, and ENGINEER’s review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR’s other obligations under the Contract Documents have been fulfilled, ENGINEER will indicate in writing ENGINEER’s recommendation of payment and present the Application for Payment to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the



provisions of paragraph 15.07. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment. If the Application and accompanying documentation are appropriate as to form and substance, OWNER will, in accordance with the applicable provisions of Massachusetts General Laws, pay CONTRACTOR the amount recommended by the ENGINEER.”

#### **SC-15.06.D**

Insert the following at the end of Paragraph 15.06.D:

“Final payment shall be made in accordance with G.L. c.30, §39G.”

### **ARTICLE 16. SUSPENSION OF WORK AND TERMINATION**

#### **SC-16.01.A**

Delete Paragraph 16.01.A in its entirety and insert the following:

“A. OWNER may suspend the work or any portion thereof in accordance with G.L. c.30, §39O.”

#### **SC-16.02.A.5**

Insert new paragraph immediately after Paragraph 16.02.A.4:

“5. If CONTRACTOR abandons the Work, or sublets this Contract or any part thereof, without the previous written consent of OWNER, or if the Contract or any claim thereunder shall be assigned by CONTRACTOR otherwise than as herein specified.”

#### **SC-16.03.A.1**

Delete the phrase “including fair and reasonable sums for overhead and profit on such Work” in Paragraph 16.03.A.1.

#### **SC-16.03.A.2**

Delete the phrase “plus fair and reasonable sums for overhead and profit on such expenses” in Paragraph 16.03.A.2.

#### **SC-16.03.A.3**

Delete Paragraph 16.03.A.3 in its entirety.

#### **SC-16.04.B**

Delete the last sentence of Paragraph 16.04.B.

### **ARTICLE 17. FINAL RESOLUTION OF DISPUTES**

#### **SC-17.01.C**

Insert a new sub-paragraph after Paragraph 17.01.B:

“CONTRACTOR shall carry on the Work and maintain the progress schedule during the dispute resolution proceedings, unless otherwise agreed by CONTRACTOR and OWNER in writing.”

#### **SC-17.02**

Add a new paragraph immediately after Paragraph 17.01 of the General Conditions which is to read as follows:

“17.02 Venue

Any legal action relating to this Contract shall be filed in the Superior Court for the County in the Commonwealth of Massachusetts in which the Project is located, unless otherwise agreed by CONTRACTOR and OWNER in writing.”

### **ARTICLE 18. MISCELLANEOUS**

#### **SC-18.08**

18.08 Headings:

Delete paragraph 18.08.A and replace with the following paragraph:

“18.08.A The headings or titles of any article, paragraph, subparagraph, section, subsection, or part of the Contract Documents shall not be deemed to limit or restrict the article, paragraph, section, or part.”

#### **SC-18.09**

18.09 Legal Address of Contractor

Add the following paragraph immediately after section 18.08:

“18.09.A CONTRACTOR'S business address and his office at or near the site of the Work are both hereby designated as places to which communications shall be delivered. The depositing of any letter, notice, or other communication in a postpaid wrapper directed to the CONTRACTOR'S business address in a post office box regularly maintained by the Post Office Department or the delivery at either designated address of any letter, notice, or other communication by mail or otherwise shall be deemed sufficient service thereof upon CONTRACTOR, and the date of such service shall be the date of receipt. The first-named address may be changed at any time by an instrument in writing, executed and acknowledged by CONTRACTOR and delivered to ENGINEER. Service of any notice, letter, or other communication upon the CONTRACTOR personally shall likewise be deemed sufficient service.”

#### **SC-18.10**

Insert the following new paragraph:

“SC-18.10 Wage Rates

“A. The requirements and provisions of all applicable laws and any amendments thereof or additions thereto as to employment of labor, and to the schedule of minimum wage rates established in compliance with laws shall be a part of the Contract Documents. If after the Notice of Award, it becomes necessary to employ any person in a trade or occupation not classified in the wage determinations, such person shall be paid at not less than such rates as shall be determined by the officials administering the laws mentioned above.

“B. The schedule of wages referred to above is minimum rates only, and OWNER will not consider any claims for additional compensation made by CONTRACTOR because of payment by CONTRACTOR of any wage in excess of the applicable, required rates.”

END OF SECTION 00800

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DIVISION 1 – GENERAL REQUIREMENTS

01010 ..... Summary of Work  
01024 ..... Measurement and Payment  
01040 ..... Project Coordination  
01045 ..... Cutting, Coring, and Patching  
01046 ..... Control of Work  
01050 ..... Field Engineering  
01063 ..... Miscellaneous Requirements  
01095 ..... Reference Standards and Definitions  
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01400 ..... Quality Assurance  
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01600 ..... Control of Materials  
01610 ..... Delivery, Storage, and Handling  
01620 ..... Identification Systems (Project Signs)  
01650 ..... Facility Start-Up/Commissioning  
01700 ..... Contract Closeout  
01710 ..... Cleaning Up  
01730 ..... Operation and Maintenance Data  
01740 ..... Warranties and Bonds  
01850 ..... Traffic Management  
01900 ..... Selective Demolition

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## SECTION 01010

### SUMMARY OF WORK

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 LOCATION OF WORK

- A. The work of this Contract is located in the Town of Sharon, Massachusetts, at the following locations:
  - 1. Water Treatment Plant and Well Station 4: 15 Tree Lane. The Town maintains an access drive to the project site from Tree Lane near the intersection with Depot Street.
  - 2. Well Station 2: 0 Moose Hill Parkway. The Town maintains an access drive to the project site from Moose Hill Parkway across from the residence at 85 Moose Hill Parkway.
  - 3. Well Station 3: 12-17 Farnham Road. The Town maintains an access drive to the project site from Farnham Road near the intersection with Sandy Ridge Circle.
  - 4. Well Station 1: 0 Upland Road. Access to the project site is via the MBTA parking lot.

##### 1.3 SUMMARY OF WORK

- A. In general and without limitation, the work to be done under this contract consists of the construction of the Wells 2, 3, and 4 Water Treatment Plant and modifications to existing Well Stations 2, 3, and 4.
- B. The work to be performed shall include the work shown on the Contract Drawings, as specified herein, and as indicated below.
- C. All construction activities must also be completed while meeting the requirements of the Appendices of the specifications.
- D. The project shall include furnishing all plant, labor, services, equipment, materials, devices, facilities, and appurtenances for the installation of new and salvaged materials, equipment, and facilities for the proposed water treatment plant (WTP) and existing well stations. A general description of the work to be performed under this contract (Wells 2, 3, and 4 WTP) shall include, but will not be limited to, the construction operations described herein.

- E. Standby generator installation in accordance with all applicable federal, state and local regulations. The work includes start-up, check-out, field testing, and O&M training of the equipment. Completion of Massachusetts Department of Environmental Protection (MassDEP) Installation Compliance Certification for New Emergency Engines and Emergency Turbines for each new standby generator. Refer to Appendix H.

#### 1.4 SCOPE OF WORK

- A. A general description of the work to be performed under this contract shall include, but will not be limited to, the following construction operations:
  - 1. Coordination of all construction activities with the appropriate Local and State Authorities, utilities, trades, and subcontractors.
  - 2. Attending the Pre-construction conference, Pre-demolition conference, and the required job progress meetings.
  - 3. Submission of a construction schedule, sequence of construction (as described herein), list of subcontractors, and proposed source locations for off-site materials, including, but not limited to: vegetative layer and additive(s), structural fill, sand and gravel, crushed stone, stone, processed gravel, concrete, and asphalt pavement.
  - 4. Submission of a schedule of values for all lump sum work in accordance with Section 01370 of the Contract Documents. Schedule of values must be approved prior to payment requisitions.
  - 5. Submission of all required shop, working, interference, and record drawings, in a timely manner, to the Engineer, for review. Submission of operation and maintenance manuals, warranties, bonds, and field test reports. Submission of Stormwater Pollution Prevention Plan (SWPPP). Submission of health and safety plan. Submission of demolition plans. Submission of facility start-up, testing, and check-out plans. Submission of drone site photographs.
  - 6. Perform all field engineering associated with the project work including, but not limited to: pre- and post-construction record of condition surveys; construction layout and elevations and preparation of an as-built CADD and PDF site plan at the completion of the project.
  - 7. Mobilization to the Site and Demobilization from the Site.
  - 8. Traffic management, including submission of a traffic management plan to the Engineer/Owner for review.
  - 9. Providing temporary facilities, including a field office.
  - 10. Select demolition, refer to Section 01900, including: Site/Civil; Painting; Process Mechanical; Heating, Ventilation, and Air Conditioning (HVAC); Electrical; and Instrumentation and Controls/SCADA.



11. Hazardous waste abatement and hazardous waste disposal at each of the well stations, as needed, refer to Appendix K – Well Stations Hazardous Waste Building Materials Survey Report. The General Contractor shall be solely responsible for all hazardous waste abatement. The General Contractor shall be solely responsible for proper disposal of all hazardous waste. The General Contractor shall coordinate all work with filed sub bidders.
12. Providing site security, temporary fencing, and other construction site control measures, as needed.
13. Protection of existing on-site structures and coordination with on-going Owner operations.
14. On-site and laboratory testing, as specified.
15. Recondition production wells, as specified.
16. Civil/site construction including, but not limited to: sediment and erosion control; site preparation; grubbing; grading; excavation; earthwork; temporary excavation support systems; dewatering; paving; utilities including water, sanitary waste, sample sink waste, electric, internet, and gas; fiber optic trenching and backfilling; concrete equipment pads; yard piping and valves; hydrants; thrust blocks; catch basins; manholes; hydrodynamic separators; plantings and landscaping; infiltration basins; retaining walls; loam and seed; gravel areas; chain link fencing; guardrail; and disinfection of water systems.
17. Architectural and structural construction of water treatment plant. Work includes cast-in-place concrete; precast concrete planks; concrete faced insulated panels; masonry; metal building system; metals; woodwork and carpentry; windows; roofing; fiberglass grating, stairs, and railings; aluminum stairs, guardrails, and grating; damproofing; waterproofing; air/vapor barrier and insulation; steel and fiberglass doors; overhead coiling door; louvers; finishes; lifting beam and hoist trolley; and signage.
18. Process mechanical construction of mechanical process equipment and appurtenances including but not limited to: pumps; chemical storage tanks and chemical feed systems; iron and manganese filtration system; bag filter system; PFAS filtration system; gates; control valves; air scour blower; sample sink drain and sample sink fixtures; and various associated process piping, valves, and appurtenances. The work includes coordination, start-up, check-out, field testing, and O&M training of the mechanical process equipment.
19. HVAC construction including but not limited to: unit heaters; heat pump; thermostats; air separator; dampers; air handling units; dehumidifier; condensing units; fume hood; ductwork; insulation; fans; louvers; HVAC instrumentation and controls; and HVAC systems testing, adjusting, and balancing. HVAC coordination drawings shall be provided for final coordination of installation and maintenance clearances of all systems and equipment with Architectural,

Structural, Mechanical, Plumbing, Fire Protection, Electrical and other work.  
Select demolition at Well Stations 3 and 4.

20. Plumbing construction including but not limited to: emergency shower/eye wash stations; plumbing for water, gas, and sanitary waste; plumbing fixtures and equipment; drains; insulation; water heaters; pumps; backflow preventers; hose bibbs; wall hydrant; sink; and toilet. Select demolition at Well Station 4.
21. Fire protection system including but not limited to: automatic wet pipe fire suppression sprinkler system. Coordination with Town of Sharon Fire Department including the submission of the NFPA 241 plan.
22. Electrical construction including but not limited to: lighting; communications including fiber optic; fire alarm system; chemical alarm system; security system; motor control center; panel boards; power panels; variable frequency drives; transformer; stand-by generator; automatic transfer switch; motor starters; grounding; lightning protection systems; electric vehicle charging station; interior and exterior conduit and wiring; and testing. Select demolition at Well Stations 2, 3, and 4.
23. Hoisting equipment including, but not limited to: portable gantry crane, scissor lift, and finished water pump hoist and trolley.
24. Perform PFAS removal media pilot at Well Station 4.
25. Coordination with water, gas, electric, and internet utilities. Coordination with work completed by Town.
26. Instrumentation and controls construction including but not limited to: instrumentation and controls hardware and products such as flow instruments, pressure instruments, level instruments, pH instruments, chlorine instruments and temperature instruments; control panels; and SCADA system. The work includes coordination meetings, start-up, check-out, field testing, and O&M training of the instrumentation and controls systems. Coordination with work completed by Application Engineer. Select demolition at Well Stations 2, 3, and 4.
27. Obtaining necessary permits and licenses, complying with and maintaining all items required by applicable permits, and payment of fees.
  - i. Obtaining necessary permits and licenses include but are not limited to: Building, Fire Protection, Trench Opening, Construction General Permit, and Generator Certification (Appendix H), and all other permits and licenses necessary to complete the work.
  - ii. Complying with all previously obtained permits included in the specification appendices.
28. Complying with the requirements of the Massachusetts State Revolving Loan Fund Program (SRF).

- 29. Providing technical service representatives from equipment manufacturers for performance inspections, start-up services, performance testing, acceptance testing, and training.
  - 30. Providing a Licensed Facility Operator for facility start-up, testing, and check-out.
- B. The work shall also conform to such additional Drawings and addenda to these Specifications and Drawings as may be published or exhibited prior to the opening of bid proposals and to such drawings in explanation of details, or as may be furnished by the Engineer from time to time during the construction.
  - C. Work and materials which are necessary in the construction but which are not specifically referred to in the Specification, or shown on the Drawings, but implied by the Contract shall be furnished by the Contractor at his/her own cost and expense and shall be such as will correspond with the general character of the work as may be determined by the Engineer, whose decisions as to the necessity for and character of such work and materials shall be final and conclusive. It is the intent of these Specifications to produce a complete, finished job whether shown in every detail or not.

#### 1.5 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall limit the use of the premises for his/her Work and for storage to allow for:
  - 1. Owner occupancy.
- B. Coordinate use of premises with Engineer and the Owner.
- C. Contractor shall assume full responsibility for security of all his/her and his/her subcontractors' materials and equipment stored on the site.
- D. If directed by the Owner, the Contractor shall move any stored items which interfere with operations of the Town or other contractors.
- E. Contractor will have access to Town water for construction purposes and operation of hydrants and wells shall be authorized by and coordinated with the Sharon DPW.

#### 1.6 OWNER OCCUPANCY

- A. Owner will occupy premises during performance of the work for the conduct of his/her normal operations. Coordinate all construction operations with Owner to minimize conflict and to facilitate Owner usage.

#### 1.7 WORK SEQUENCE

- A. The Contractor shall submit a sequence of construction for the overall project for the Engineer's review and approval. The sequence of work must recognize all Contract requirements including the Work Sequence in the Contract Drawings.

- B. The Contractor shall submit a sequence of work for the Engineer's review and approval for any proposed water system shutdowns. Proposed shutdowns shall be limited to a maximum of 8 continuous hours. Shutdowns may be required to be performed at night (4 P.M. to 7 A.M.). A minimum 24-hour period is required between shutdowns. Requests by the Contractor for any and every proposed shutdown shall be provided a minimum of seven (7) days in advance of the requested date. The Engineer/Owner shall have the final authority for granting a proposed shutdown.
- C. The Contractor shall notify the Owner a minimum of seven (7) days in advance of any work which may affect or disrupt the operations of the existing well stations. The Engineer/Owner shall have the final authority for granting a proposed shut-down.
- D. Any work that requires the mechanical, instrumentation or electrical isolation of an existing piece of equipment, process or system shall be coordinated with the Engineer and Owner two (2) weeks prior.
- E. All work associated with the gas service must start after the gas main and meter are installed by Eversource Gas of Massachusetts. The General Contractor is responsible for coordinating work with Eversource Gas of Massachusetts.
- F. Refer to the Contract Drawings for additional requirements.

#### 1.8 SUBMITTALS

- A. The Contractor shall submit a sequence of work meeting the requirements of Paragraph 1.7 and the Contract Drawings for the overall project for the Engineer's review and approval.

#### PART 2 – PRODUCTS (NOT USED)

#### PART 3 – EXECUTION (NOT USED)

END OF SECTION 01010

## SECTION 01024

### MEASUREMENT AND PAYMENT

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Under the price specified to be paid for each item, the Contractor shall furnish all materials and equipment, furnish all labor and plant, and do all operations necessary to complete all work specified or shown. All supervision, overhead items, protection, and precautions, permit fees, bonds, insurance fees, and all other costs incidental to the construction work including training, start-up, testing, and calibration services, complete, and as specified, are included.
- B. A complete, finished, working job, as intended by the general nature of these Specifications, shall be produced whether or not any particular wording or direction is omitted or inadvertently not clearly stated.
- C. Measurement for payment shall be by the Engineer, except where noted elsewhere in this Specification. Measurement for payment for lump sum items shall be on the basis of percentage of work complete and in place.
- D. Each unit or lump sum price stated in the bid shall constitute full compensation as herein specified for each item of work completed in accordance with the Drawings and Specifications.
- E. The prices for those items which involve excavation shall include compensation for disposal of surplus excavated material and handling water.
- F. Submit a schedule of values for all lump sum work in accordance with Section 01370 of the Contract Documents.

##### 1.3 ITEM DESCRIPTIONS

- A. Part 1 - Item 1: Mobilization and Demobilization
  - 1. Under the lump sum for Item 1, the Contractor shall mobilize and demobilize to and from the site all labor, materials and equipment to complete all work associated with the Wells 2, 3, and 4 Water Treatment Plant project. Demobilization from the Site includes, but is not limited to, removal of all equipment and final cleanup to the satisfaction of the Owner and Engineer. The Site is defined as the WTP, Well Station 4, Well Station 3, Well Station 2, and Well Station 1 sites and Tree Lane.

2. Payment for Mobilization and Demobilization shall be by lump sum. Fifty percent of the lump sum price shall be paid to the Contractor upon completing mobilization activities and the remaining fifty percent shall be paid upon demobilization from the site.
3. The total lump sum for mobilization/demobilization may not exceed 5 percent of the total of all bid items, excluding this item.

B. Part 1 - Item 2: Wells 2, 3, and 4 Water Treatment Plant and Appurtenant Work

1. The lump sum for this item shall constitute full compensation for furnishing all labor, materials, tools, devices, and equipment necessary for constructing the water treatment plant (15 Tree Lane), associated yard piping and utilities, modifying Well Station 4 (15 Tree Lane), and appurtenant work, which is not included in Bid Items 1 and 3 through 8, complete as indicated on the Contract Drawings and as specified.
2. The Payment limit for Item 2 shall be the entirety of the proposed work at 15 Tree Lane, 0 Upland Road, and within the Tree Lane right-of-way.
3. Under the lump sum price bid for this item, the Contractor shall complete all the remaining work shown on the Contract Drawings and specified in the Specifications, not included in Bid Items 1 and 3 through 8, to provide a fully functioning water treatment plant. Work generally includes, but is not limited to: all labor, equipment, materials, and services; coordination with subcontractors and filed sub-bidders; hazardous waste abatement; field engineering; temporary facilities; storage areas; snow removal as required for Work completion and dealing with adverse weather conditions; obtaining electrical power for dewatering or other construction operations; maintaining all items required by applicable permits; obtaining necessary permits and licenses; payment of fees; federal protection; sampling and testing materials; providing required insurance; cleaning up; providing shop, working, interference, coordination, and record drawings; operation and maintenance manuals; certificates and schedules; providing health and safety plan and health and safety equipment; loam and seed all disturbed areas as a result of construction activities; sampling; laboratory analyses; any costs incurred by the Contractor for usage of the public water supply; erosion controls and maintaining in accordance with the Order of Conditions; site preparation; test pits; excavation, backfill, and dewatering; site grading; earthwork; retaining walls; foundation drains; drainage work; infiltration basins; landscaping, planting, and restoration; fencing; paving; gravel areas; riprap areas; cement; yard piping and valves; tight tank and appurtenances; water systems and appurtenances; utilities including electric, gas, fire protection, and fiber optic; coordination and scheduling with utility companies including electric and gas companies; duct bank trenching and backfill; natural gas service trenching and backfill; coordination of MassDEP standby generator installation compliance permit (see Appendix H); trench boxes, trench shields, excavation support; demolition of select paved areas, fencing, existing structures, yard piping, gas service, process equipment, electrical equipment, HVAC equipment, and appurtenances; placing of all concrete and steel; architectural and building construction including pre-engineered metal building, laboratory cabinets, window treatments, furniture, appliances, stair systems, and

guardrails; signage; select demolition; removal and disposal of up to 500 gallons of 45% potassium hydroxide (KOH); furnishing, anchoring, and installing mechanical process piping, valves, pipe supports, hoist trolley, and equipment including pumps, blower, chemical storage tanks, chemical feed systems, and control valves; furnishing and installing PFAS removal system; furnishing and installing iron and manganese removal system; hydrostatic testing; start-up, check-out, field testing, certified operation, and O&M training of the mechanical process equipment; instrumentation and controls construction; furnishing scissor lift and portable gantry crane; coordination with Application Engineer; coordination with Water Main Contractor; pressure and leakage testing; disinfection; dechlorination; laboratory equipment; and all other work necessary for a complete installation in accordance with the Contract Drawings and Specifications.

4. All hazardous waste abatement shall be the responsibility of the General Contractor. The General Contractor is responsible for all hazardous waste disposal in accordance with local, state, and federal regulations. The General Contractor shall coordinate all remediation work with filed sub bidders.
5. Payment for Item 2 shall be made based on the percentage of the work completed, as determined by the Engineer.

C. Part 1 - Item 3: Well Station 2 and Appurtenant Work (SRF Ineligible Item)

1. The lump sum for this item shall constitute full compensation for furnishing all labor, materials, tools, devices, and equipment necessary for modifying Well Station 2 (0 Moose Hill Parkway), associated utilities, and appurtenant work, which is not included in Bid Items 1, 2, and 4 through 8, complete as indicated on the Contract Drawings and as specified.
2. The Payment limit for Item 3 shall be the entirety of the proposed work at 0 Moose Hill Parkway.
3. Under the lump sum price bid for this item, the Contractor shall complete all the remaining work shown on the Contract Drawings and specified in the Specifications, not included in Bid Items 1, 2, and 4 through 8, to modify Well Station 2. Work generally includes, but is not limited to: all labor, equipment, materials, and services; coordination with subcontractors and filed sub-bidders; hazardous waste abatement; field engineering; temporary facilities; storage areas; snow removal as required for Work completion and dealing with adverse weather conditions; obtaining electrical power for dewatering or other construction operations; maintaining all items required by applicable permits; obtaining necessary permits and licenses; payment of fees; sampling and testing materials; providing required insurance; cleaning up; providing shop, working, interference, coordination and record drawings; operation and maintenance manuals; certificates and schedules; providing health and safety plan and health and safety equipment; loam and seed all disturbed areas as a result of construction activities; erosion controls and maintaining in accordance with the Order of Conditions; sampling; laboratory analyses; any costs incurred by the Contractor for usage of the public water supply; site preparation; earthwork; electric utilities; coordination and

scheduling with utility companies including electric company; duct bank trenching and backfill; trench boxes and trench shields; well disinfection and reconditioning; select demolition; removal and disposal of up to 3,000 gallons of 45% potassium hydroxide (KOH); furnishing, anchoring, and installing mechanical process piping, valves, pipe supports, and equipment including raw water pumps and vacuum priming system; hydrostatic testing; start-up, check-out, field testing, and O&M training of the mechanical process equipment; instrumentation and controls demolition and construction; coordination with Application Engineer; pressure and leakage testing; disinfection; dechlorination; and all other work necessary for a complete installation in accordance with the Contract Drawings and Specifications.

4. All hazardous waste abatement shall be the responsibility of the General Contractor. The General Contractor is responsible for all hazardous waste disposal in accordance with local, state, and federal regulations. The General Contractor shall coordinate all remediation work with filed sub bidders.
5. Payment for Item 3 shall be made based on the percentage of the work completed, as determined by the Engineer.

D. Part 1 - Item 4: Well Station 3 and Appurtenant Work (SRF Ineligible Item)

1. The lump sum for this item shall constitute full compensation for furnishing all labor, materials, tools, devices, and equipment necessary for modifying Well Station 3 (12-17 Farnham Road), associated yard piping and utilities, and appurtenant work, which is not included in Bid Items 1 through 3 and 5 through 8, complete as indicated on the Contract Drawings and as specified.
2. The Payment limit for Item 4 shall be the entirety of the proposed work at 12-17 Farnham Road.
3. Under the lump sum price bid for this item, the Contractor shall complete all the remaining work shown on the Contract Drawings and specified in the Specifications, not included in Bid Items 1 through 3 and 5 through 8, to modify Well Station 3. Work generally includes, but is not limited to: all labor, equipment, materials, and services; coordination with subcontractors and filed sub-bidders; hazardous waste abatement; removal and legal disposal of asbestos-cement pipe; field engineering; temporary facilities; storage areas; snow removal as required for Work completion and dealing with adverse weather conditions; obtaining electrical power for dewatering or other construction operations; maintaining all items required by applicable permits; obtaining necessary permits and licenses; payment of fees; sampling and testing materials; providing required insurance; cleaning up; providing shop, working, interference, coordination and record drawings; operation and maintenance manuals; certificates and schedules; providing health and safety plan and health and safety equipment; loam and seed all disturbed areas as a result of construction activities; erosion controls and maintaining in accordance with the Conservation Commission Order of Conditions; sampling; laboratory analyses; any costs incurred by the Contractor for usage of the public water supply; excavation, backfill, and dewatering; site preparation; cutting and capping yard piping; paving; electric utilities; coordination and scheduling with



utility companies including electric company; duct bank trenching and backfill; trench boxes and trench shields; well disinfection and reconditioning; select demolition; removal and disposal of up to 500 gallons of 45% potassium hydroxide (KOH); furnishing, anchoring, and installing mechanical process piping, valves, pipe supports, and equipment including the well pump; hydrostatic testing; start-up, check-out, field testing, and O&M training of the mechanical process equipment; instrumentation and controls demolition and construction; coordination with Application Engineer; pressure and leakage testing; disinfection; dechlorination; and all other work necessary for a complete installation in accordance with the Contract Drawings and Specifications.

4. All hazardous waste abatement shall be the responsibility of the General Contractor. The General Contractor is responsible for all hazardous waste disposal in accordance with local, state, and federal regulations. The General Contractor shall coordinate all remediation work with filed sub bidders. The General Contractor is responsible for removal and legal disposal of asbestos-cement pipe as outlined in the Appendix P. The Asbestos notification form shall be completed and submitted to the appropriate agency under this item.
5. Payment for Item 4 shall be made based on the percentage of the work completed, as determined by the Engineer.

E. Part 1 - Item 5: Rock Excavation

1. Under the unit price bid for Item 5, the Contractor shall excavate, remove, and dispose of ledge and rock from trenches and excavated areas. Included in the price bid per cubic yard shall be related costs such as drilling, permitting, blasting, and replacement with suitable gravel borrow material, removal, and disposal of excavated material.
2. Measurement for payment will be on the basis of cubic yards of ledge or rock excavated as measured and approved by the Engineer.
3. Rock in pipe trenches shall be measured from its surface to 6-inches below the outside of the pipe and with a width of two (2) feet greater than the inside diameter of the pipe but not less than 3 feet minimum trench width. Any rock excavated to a depth or width greater than the above shall be removed and backfilled with common fill at the Contractor's expense.

F. Part 1 - Item 6: Exploratory Excavation

1. Under the unit price bid for Item 6, the Contractor shall excavate and refill, only as directed and approved by the Engineer, such materials as are necessary to locate pipe, utilities, and possible obstructions. Included under the unit price is payment for excavation; dewatering; backfill; compaction; surface restoration; landscaping; all labor, services and equipment necessary for exploratory excavations in the locations of this Contract. Measurement for payment will be on the basis of cubic yards of exploratory excavation as measured and approved by the Engineer.

Paving shall be included for payment as specified under Items 2, 3 or 4 depending on the location of the exploratory excavation.

G. Part 1 - Item 7: Owner's Electric Utility Contingency Allowance

1. The not-to-exceed price for Item 7 is an Owner's contingency allowance for the new electrical services, utility pole demolition, and overhead wire demolition as shown on the Contract Drawings. Contractor agrees that Owner's contingency allowance, if any, is for the sole use of Owner to cover estimated anticipated costs for Electric Utility charges. The General Contractor shall coordinate the work of this allowance, including scheduling as specified under Items 2, 3, or 4 depending on the location of the work.
2. If the Electric Utility's charge, when final, is more or less than the stated allowance, the contract sum shall be adjusted accordingly by change order. A copy of the utility company's invoice(s) describing the work performed shall be submitted to the Engineer/Owner for approval. Payment for this lump sum Item shall be made based on the submitted invoice/costs from the Electric Utility. No markups of Electric Utility invoices shall be allowed.

H. Part 1 - Item 8: Owner's Natural Gas Utility Contingency Allowance

1. The not-to-exceed price for Item 8 is an Owner's contingency allowance for the disconnection of the existing natural gas service for Well Station 4 and the connection of a new natural gas service to the water treatment plant and Well Station 4 as shown on the Contract Drawings. The Natural Gas Utility shall disconnect the existing Well Station 4 service and shall perform all trenching and backfilling on the existing Tree Lane for the new service; the Contractor shall perform all trenching and backfilling for the natural gas service installation from the existing Tree Lane to the WTP and Well Station 4. Contractor agrees that Owner's contingency allowance, if any, is for the sole use of Owner to cover estimated anticipated costs for Natural Gas Utility charges. The General Contractor shall coordinate the work of this allowance, including scheduling as specified under Item 2.
2. If the Natural Gas Utility's charge, when final, is more or less than the stated allowance, the contract sum shall be adjusted accordingly by change order. A copy of the utility company's invoice(s) describing the work performed shall be submitted to the Engineer/Owner for approval. Payment for this lump sum Item shall be made based on the submitted invoice/costs from the Natural Gas Utility. No markups of Natural Gas Utility invoices shall be allowed.

I. Part 2: Filed Sub-Bids

1. Under the lump sum price filed sub-bids for Part 2 – Items 9 through 17, the Contractor's sub-contractors shall furnish all labor, materials, tools, devices, and equipment necessary for selective demolition and constructing their respective work as indicated on the Contract Drawings, Specifications, and as noted. Sub-bid work shall be coordinated by the General Contractor.

2. The lump sum price filed sub-bid Item 15A shall include costs for HVAC coordination drawings for Wells 2, 3, and 4 Water Treatment Plant, Well Station 2, Well Station 3, and Well Station 4, for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Plumbing, Fire Protection, Electrical, and other work.
3. Payment for Part 2 shall be made based on the percentage of the work completed, as determined by the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01024

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## SECTION 01040

### PROJECT COORDINATION

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
  - 1. Coordination.
  - 2. Administrative and supervisory personnel.
  - 3. General installation provisions.
  - 4. Cleaning and protection.
- B. Progress meetings and preconstruction conferences are included in Section 01200 – Project Meetings.
- C. Requirements for the Contractor's Construction Schedule are included in Section 01300 - Submittals and Section 01311 – Construction Progress Schedules.

#### PART 1 - PRODUCTS (NOT USED)

#### PART 2 - EXECUTION

##### 3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Inspect the conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner, and at no additional cost to the Owner.
- B. Manufacturer's Written Instructions: Comply with manufacturer's written installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items, and at no additional cost to the Owner.

- D. Provide attachment and connection devices and methods for securing work. Secure work true to line and level. Allow for expansion and utility movement.
- E. Recheck measurements and dimensions before starting installation or erection.
- F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material to prevent deterioration.
- G. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

### 3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Install protective covering to ensure protection from damage or deterioration.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period.
- C. Contractor shall be required to sweep public and private roadways to remove all materials related to project activities. The frequency of sweeping shall be based on the condition of the affected roadway.
- D. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.
  - 2. Excessive internal or external pressures.
  - 3. Excessively high or low temperatures.
  - 4. Air contamination or pollution.
  - 5. Water or ice.
  - 6. Solvents.
  - 7. Chemicals.
  - 8. Misalignment.
  - 9. Unprotected storage.
  - 10. Improper shipping or handling.

11. Theft.

12. Vandalism.

3.3 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 01040

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## SECTION 01045

### CUTTING, CORING, AND PATCHING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section specifies administrative and procedural requirements for any cutting, coring, rough and finish, and patching as necessary.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.
- C. Painting of materials impacted by cutting and patching activities is included in Division 9 of these specifications.
- D. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 2 – Site Work
  - 4. Division 3 – Concrete
  - 5. Division 4 – Masonry
  - 6. Division 7 – Thermal and Moisture Protection
  - 7. Division 9 – Finishes

##### 1.3 SUBMITTALS

- A. Cutting, Coring, and Patching Proposal: Proposed procedures for cutting and patching must be submitted well in advance of the time cutting and patching will be performed. Include the following information as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components, as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Review by the Engineer prior to proceeding with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.
8. Refer to Paragraph 1.4 - Quality Assurance and submit the information specified.

#### 1.4 QUALITY ASSURANCE

- A. No structural members shall be cut without the approval of the Engineer. No holes shall be drilled in beams or other structural members without the approval of the Engineer.
  1. Submit for review the cutting and patching proposal before cutting and patching the following structural elements:
    - i. Foundation construction.
    - ii. Bearing and retaining walls.
    - iii. Structural concrete.
    - iv. Structural steel.
    - v. Lintels.
    - vi. Structural decking.
    - vii. Miscellaneous structural metals.
    - viii. Equipment supports.
    - ix. Piping, ductwork, vessels, and equipment.
- B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- C. Operational and Safety Limitations: Do not cut and patch operating elements or safety-related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance or decreased operational life or safety.

1. Submit for review the cutting and patching proposal before cutting and patching the following operating elements or safety-related systems:
  - i. Shoring, bracing, and sheeting.
  - ii. Primary operational systems and equipment.
  - iii. Water, moisture, or vapor barriers.
  - iv. Membranes and flashings.
  - v. Control systems.
  - vi. Communication systems.
  - vii. Electrical wiring systems.
  
- D. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
  1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - i. Unit masonry.
    - ii. Stucco and plaster.
    - iii. Aggregate wall coating.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available, or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.
  
- B. Concrete and grout for rough patching shall be as specified in Divisions 3.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched, and conditions under which cutting and patching is to be performed. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered.
  1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving the building, but scheduled to be removed or relocated, until provisions have been made to bypass them.
- E. Check area during sawing operations for partial cracking and provide additional support and bracing to prevent a partial release of cut area during sawing operations.
- F. Provide equipment of adequate size to remove cut panels.

### 3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  - 1. Cut existing construction to provide for installation of other components or performance of other construction activities, and the subsequent fitting and patching required to restore surfaces to their original condition.
  - 2. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.
  - 1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or diamond core drill.
  - 4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

5. Bypass utility services, such as pipe or conduit, before cutting where services are shown or required to be removed, relocated, or abandoned. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.
6. Provide full control of slurry generated by sawing operations on both sides of wall.
7. When cutting a reinforced concrete wall, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in the structure. Cut shall be made so that steel neither protrudes nor is recessed from face of the cut.

C. Coring:

1. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise approved.
2. If holes are cored through floor slabs, they shall be drilled from below.
3. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.
4. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeve, equipment or mechanical seals to be installed.
5. All equipment shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.
6. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.
7. Slurry or tailings resulting from coring operations shall be vacuumed or otherwise removed from the area following drilling.

D. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of

uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

4. Where patching occurs in a painted surface, extend final paint coat over unbroken area containing the patch after the patched area has received primer and second coat.
5. Finish patching shall be the responsibility of the Contractor and shall be performed by the trade associated with the application of the particular finish.

### 3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty, and items of similar nature. Thoroughly clean piping, conduit, and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01045

SECTION 01046

CONTROL OF WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

1.2 EQUIPMENT

- A. Furnish equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such equipment appears to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he/she may order the Contractor to increase the efficiency, change the character or increase the plant equipment and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his/her obligations to secure the quality of the work and rate of progress required.

1.3 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of easements, except by permission of the land owner or the Owner.

1.4 HAULING, HANDLING, AND STORAGE OF MATERIALS

- A. The Contractor shall, at his own expense, handle and haul all materials furnished by him and shall remove any and all of his surplus materials at the completion of the work. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by him that are liable to injury, and shall be responsible for any loss or damage to any equipment or materials by theft, breakage, or otherwise. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance, even though partial payments have been made under the Contract.

1.5 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, fences, guardrails, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. The Contractor is required to comply with all provisions of General Laws Chapter 353, entitled "Excavations-Public Ways-Notice

Requirements", otherwise known as DigSafe. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

- B. Assistance will be given to the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including, but not limited to existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures, as described in this Section, shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the Contract.
- D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the Town is required, which is not shown on the Plans or the Specifications, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for as extra work under Articles of the General Conditions. If relocation of a privately-owned utility is required, the Town will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Town and utility, and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies, in writing, at least 72 hours (excluding Saturdays, Sundays, and legal holidays) before excavating in any public way.

#### 1.6 WATER SYSTEM INTERRUPTION

- A. The Contractor shall disrupt the normal functioning of the water distribution system as little as possible.

#### 1.7 PIPE LOCATIONS

- A. Pipelines shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him/her from laying and jointing different or additional items where required.

#### 1.8 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his/her own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures



such as limiting the length of the open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

#### 1.9 MAINTENANCE OF TRAFFIC

- A. Unless permission to close a street is received in writing from the proper authority, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he/she shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.
- B. When, in the opinion of the Police Department, public safety requires the services of police, the Safety Officer may direct the Contractor to provide manpower to direct traffic within the location of work under this Contract.
- C. Under normal circumstances the Contractor shall coordinate the scheduling of all police activities, however, when so directed, the Contractor shall make all arrangements in obtaining the manpower and all invoices for policing.
- D. The intent is to insure public safety by police direction of traffic. Police are not to serve as watchmen to protect the Contractor's equipment and materials, or to warn pedestrians of such hazards as open trenches.
- E. Nothing contained herein shall be construed as relieving the Contractor of any of his/her responsibilities for protection of persons and property under the terms of the Contract.
- F. It is the intent of this contract that traffic is maintained at all times in the areas of construction. The contractor may be required to halt operations and/or transport material to areas beyond immediate work locations in order to allow minimum traffic disruptions. Access to the site by emergency vehicles, school buses and residents shall be maintained at all times.
- G. The contractor shall be responsible for providing property owners with written notification of proposed construction which may require detours or road closures.

#### 1.10 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly-constructed work shall be carefully protected from injury in any way. No placing of heavy loads on it shall be allowed, and all portions injured shall be reconstructed by the Contractor at its own expense.
- B. All structures shall be protected in a manner approved by the Engineer. All such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense, and to the satisfaction of the Engineer.

- C. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship, without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction, and other work undertaken herein, for at least the guarantee period described in the Contract Documents.
- D. The Contractor shall take all necessary precautions to prevent damage to any work during and after construction, and until such work is accepted and taken over by the Owner.

#### 1.11 CARE AND PROTECTION OF PROPERTY AND SURVEY MONUMENTS

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property, by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Engineer.
- B. Along the location of this work, all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated on the Drawings as soon as conditions permit. All grass areas beyond the limits of construction, which have been damaged by the Contractor, shall be graded and seeded.
- C. Trees close to the work shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any trees be cut or removed without prior notification of the Town or other person in charge. All injuries to bark, trunk, limbs, and roots of trees shall be repaired by dressing, cutting, and painting according to approved methods using only approved tools and materials.
- D. The protection, removal, and replacement of existing physical features along the limit of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the Total Bid Price. The Contractor is responsible for protecting and, if required, re-setting survey monuments (bounds). If a bound is in the way of required excavation, the Contractor will notify the Engineer/Inspector and/or the town Engineering Division with as much notice as possible prior to performing excavation near the bound.

#### 1.12 REJECTED MATERIALS AND DEFECTIVE WORK

- A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the Specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work. Any errors, defects, or omissions in the execution of the work or in the materials furnished

by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor, and in a manner satisfactory to the Engineer. The Contractor shall reimburse the Owner for any expenses, losses, or damages incurred in consequence of any defect, error, omission, or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

### 1.13 COORDINATION WITH LOCAL AGENCIES

- A. The Contractor shall attend a Pre-Construction Meeting to be held approximately one week prior to start of work. Municipal departments who will also be invited to this meeting include Police, Fire, School, Standing Building Committee, and Conservation. Electric, gas, and phone utility companies will also be invited. The contractor will provide the proposed schedule at that time (see Submittals, Section 01300). Any proposed detours will be reviewed with all potentially affected parties at the Pre-Construction Meeting. If any additional detours are considered after the Pre-Construction Meeting, the Contractor must first get approval from the Engineer.
- B. The Contractor will immediately notify the utility owner of any utility main breaks. The emergency contact number for the Sharon Department of Public Works during business hours is 781-784-1525. Additional emergency contact information will be exchanged during the pre-construction meeting.
- C. The Contractor will be required to reimburse the Owner for the actual cost of the services of the Sharon Department of Public Works Personnel required during other than regular working hours. This includes the cost of the Engineer/ Site Inspectors when inspection is required outside the normal business hours. This cost shall be at the rate of time and one-half of the Inspector's pay rate, to be paid to the Town by the Contractor.
- D. The Contractor shall notify the Sharon Department of Public Works at least 72 hours prior to the construction of any public improvement so that the Town can have an inspector present if work requires inspection.
- E. The Contractor shall notify the Sharon Board of Health at least 72 hours prior to backfilling the tight tank and prior to testing tight tank alarms so that the Town can have an inspector present if work requires inspection.
- F. The Engineer will have the authority to reject any work or materials that do not constitute approval by the Town and shall not relieve the Contractor of his obligations to perform the work in accordance with the Plans and Specifications.
- G. The Contractor shall maintain pavement as specified and shall provide the Sharon Department of Public Works with contact information at which he/she can be contacted when he/she is not at the site. Upon notification by the Owner or the Engineer the Contractor shall promptly make repairs to the construction site as may be necessary.

- H. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, curbing, electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him/her at his/her expense.
- I. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- J. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Price Bid in the Bid Form.
- K. If, in the opinion of the Engineer, permanent relocation of a utility owned by the Town is required, he/she may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for as extra work under Article 11 of the Supplementary Conditions. If relocation of a privately owned utility is required, the Sharon Department of Public Works will notify the Utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Sharon Department of Public Works and the Utility and shall have no claim for delay due to such relocation. The Contractor shall notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays and Legal holidays) before excavating in any public way. Contractor shall also notify Massachusetts Dig Safe, telephone 1-888-344-7233 at least 72 hours prior to start of work.

The following is a partial list of Owners of Utilities:

**Water:**

Sharon Department of Public Works  
217R South Main Street  
Sharon, MA 02067  
Telephone: 1 (781) 784-1525 ext. 2315

**Gas:**

Eversource Gas of Massachusetts  
Telephone: 1 (800) 592-2000

**Electric:**

Eversource  
Telephone: 1 (800)-592-2000

**Telephone & Internet:**

Verizon  
Telephone: 1 (877) 728-6101

**DIGSAFE:**  
Telephone: 1 (888) 344-7233

#### 1.14 WATER FOR CONSTRUCTION PURPOSES

- A. The express approval of the Owner shall be obtained before Town water is used. Any Contractor proposing to use town water must meet all requirements of the Town of Sharon, including cross connection protection, before using any town water. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.
- B. Hydrants shall only be operated under the supervision of the Owner's personnel.
- C. The Contractor shall furnish all water required for and in connection with work to be done under this Contract including but not limited to: water for cleaning and testing all pipelines, manholes, and structures; temporary potable water; sanitation and toilet facilities; facility start-up/commissioning of all equipment; and as required to complete the Work.
- D. No direct cross connections will be permitted between the public water supply and the new work, or any other point where the possibility of backflow of contaminated water exists. All connections to points where there is the possibility of backflow shall be arranged to prevent backflow and shall be approved by the Owner before they are put into operation.
- E. All water for construction purposes shall be metered, in cubic feet, as specified by the Town. Where metering is not possible (i.e. in the case of filling pipes and tanks), water volume can be calculated. The volume of all water used by the Contractor is to be determined and provided to the Owner.
- F. The Contractor must supply their own backflow prevention device and flow meter. The backflow prevention device and flow meter must be tested and certified by the Town of Sharon Water Division.
- G. No separate measurement and payment shall be made for temporary water and all costs shall be incidental to and included with each applicable item.
- H. Performance testing of pumps shall be completed with Town provided water from on-site hydrant. Contractor shall provide all hoses, cross-contamination protection, and additional appurtenances as described above.

#### 1.15 MAINTENANCE OF FLOW

- A. The Contractor shall maintain the flow in all watercourses, whether open channels or in pipes, in all sewers and other pipes interfered with in the line of work and convey the flow to a suitable point of discharge so as not to flow upon the work or create a

nuisance. In the discharge of water removed from the excavations by pumping or by gravity similar precautions shall be observed.

#### 1.16 COOPERATION WITHIN THIS CONTRACT

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his/her Subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

#### 1.17 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, the Contractor shall keep the site of his/her operations in as clean and neat a condition as is possible. He/She shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he/she shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his/her subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.
- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his/her own expense and restore the area impacted.
- D. Outdoor burning of rubbish and waste material on the site will not be permitted.
- E. Disposal of volatile fluid wastes (such as mineral spirits, oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.
- F. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as

promptly as practicable as work progresses and shall not be left until the end of the contract period.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01046

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## SECTION 01050

### FIELD ENGINEERING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Examination of site and conditions of construction.
2. Establishment of lines, grades, and easements.
3. Connections to existing facilities.
4. Restoration and protection of public and private property.

##### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - Submittals:

1. A pre- and post-construction record of condition survey shall be provided by the Contractor and performed by an independent Professional Engineer registered in the State of Massachusetts. Provide written documentation and photographs of the condition identified, or a good quality videotape survey with appropriate audio description of conditions and defects.
  - i. Prior to the start of the work, one copy of the Contractor's pre-construction record of condition survey shall be submitted to the Engineer for information and retention.
  - ii. Following substantial completion, one copy of the Contractor's post-construction record of condition survey shall be submitted to the Engineer for information and retention.
2. A post construction topographic survey shall be provided by the Contractor and shall be stamped by a Registered Land Surveyor (RLS).
  - i. Topographic Survey: After completion of construction activities, a topographic survey shall be conducted by an RLS and a record drawing shall be prepared signed and sealed by the RLS, which includes the following information:
    - (a) Locating the construction control points, including establishing and maintaining permanent bench marks.
    - (b) Location of all property lines within 200 feet of the work area.

- (c) The topographic survey work shall extend to the limit of work shown on the Drawings and includes, but is not limited to, access drive, Well Stations 2, 3 and 4, water treatment plant, and all new utilities. Provide topographic survey with 1-ft contours and spot elevations.
  - (d) Location of all permanent utilities, buildings, edge of pavement, and drainage structures within the work area.
  - (e) The invert elevations of all drainage structures and gravity pipe inlets and outlets.
  - (f) The information obtained from this survey shall be professionally drafted on 22" x 34" sheets, using a scale of 1"=40' and shall be based on the NAVD 1988 vertical datum, and using the Massachusetts Coordinate System Horizontal Datum.
- ii. The Contractor shall submit the record drawing in hard copy form as specified above, and as an AutoCAD drawing file, meeting the Town of Sharon's AutoCAD specifications (version 2021 Civil 3D compatible, or more recent). A PDF version of the hard copy shall also be provided.

#### 1.4 PROJECT/SITE CONDITIONS

##### A. Environmental Requirements:

###### 1. Unfavorable Construction Conditions:

- i. During unfavorable weather, wet grounds, or other unsuitable construction conditions, confine operations to work which will not be affected adversely by such conditions.
- ii. No portion of Work shall be constructed under conditions which adversely affect quality or efficiency thereof, unless special means or precautions are taken to perform Work in manner acceptable to the Engineer.

##### B. Field Measurements:

###### 1. Lines and Grades:

- i. All Work shall be done to lines, grades, and elevations indicated on drawings or specified herein.
- ii. Elevations on the construction plans are in the NAVD 1988 vertical datum and any plans required by this section are to be done in the NAVD 1988 vertical datum. Datum of well station drawings provided in Appendix L of the Specifications are as noted. Contractor shall be responsible for maintaining or subsequently replacing these controls to the satisfaction of the Engineer if these controls are disturbed. The Contractor shall be responsible for verifying all vertical control information that is used.
  - (a) Points shall be used as datum for work.
  - (b) Contractor shall be responsible for transferring all lines and grades from basic survey control points.
- iii. Contractor to perform all additional survey, layout, and measurement work.
  - (a) The Contractor shall provide survey work by a firm having successfully completed at least two projects of similar size and complexity within the

last five years, and who shall employ experienced personnel and provide adequate supervision to satisfaction of the Engineer at all times when operations are in progress.

(b) Surveyor shall be a registered land surveyor (RLS) in the State of Massachusetts.

- iv. Keep the Engineer informed, in writing, two weeks in advance, of times and places at which work is to be performed, so that horizontal and vertical control points may be established and any checking deemed necessary by the Engineer may be performed.
- v. Remove and reconstruct Work which is improperly located as determined by the Engineer and at no additional cost to the Owner.

2. Easements and Rights-of-Way:

- i. Easements and rights-of-way for utilities, if required, will be provided by the Owner.
- ii. Confine construction operations within limits indicated on drawings and/or within limits of easements or public ways.
- iii. Place construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause least possible damage to property and interference with traffic.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Use new materials in restoration of existing facilities except where soil materials and plants may be reused as appropriate, and as approved by the Engineer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examination of Site and Verification of Conditions:

- 1. Before starting operations, examine site to become acquainted with conditions to be encountered.
- 2. Verify exact locations of sewers, water mains, gas mains, above or below ground electrical wires, other utilities, conduits and structures which may interfere with work.
- 3. Verify and stake-out exact locations of the proposed work.

### 3.2 APPLICATION

- A. Site Layout: Prior to any construction activities at the site, the Contractor shall establish control points and coordinate this work with the Engineer. The Contractor shall use the information on the Drawings, where available, and shall supplement this with any necessary file searches to provide the necessary information to perform a complete line

survey around the entire limits of the work area. The Contractor shall also establish permanent vertical benchmarks within the limit of work in locations approved by the Engineer.

B. Record of Condition Survey

1. Pre-construction record of condition survey: Prior to the start of earth work, the Contractor shall engage an independent Professional Engineer registered in the State of Massachusetts, to conduct a pre-construction condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site including the following properties: 6 Tree Lane, 23 Pine Grove Avenue, and 26 Pine Grove Avenue. This survey shall extend to such structures or conditions as may be affected by the contractor's construction operations.
2. Following substantial completion, the Contractor shall make an examination similar to the pre-construction record of condition survey of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed and give notice to all interested parties so that they may be present during the final examination. Record of the final examination shall be distributed the same as the original preconstruction survey.
3. The Contractor shall also:
  - i. Coordinate activities, issue notices, obtain clearance and provide whatever photographic and secretarial assistance is necessary to accomplish the survey.
  - ii. Give seven days notice in writing, to the owner of the property concerned, and tenants of the property. Advise in notice the dates on which surveys are to be made so that they may have representatives present during the examination. Provide copies of all notices to the Engineer.
  - iii. The survey shall consist of a description of the interior and exterior conditions of the various structures examined. Descriptions shall locate any cracks, damage, or other defects existing and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks, damage, or other defects exist, or for defects too complicated to describe in words, photographs, shall be taken and made part of the record.
  - iv. The Contractor's record of the pre-construction survey shall consist of written documentation and photographs of the condition identified, or a good quality videotape survey with appropriate audio description of conditions and defects. Prior to the start of the work, one copy of the Contractor's record of condition survey shall be submitted to the Engineer for information and retention.
  - v. Any damage noted prior to substantial completion which cannot be determined from the pre-construction survey to be a pre-existing condition shall be presumed to have been caused by construction operations. Such damage shall

be repaired promptly and completely to the property owner's satisfaction to restore the condition of the property to that existing prior to blasting.

- vi. Pre-construction survey records shall be maintained for a period of not less than three years following final completion and acceptance of the Work.

C. Connections to Existing Facilities:

1. Make connections to existing facilities as indicated on drawings or as specified.
2. Obtain permission from specific utility owners in writing prior to undertaking connections.
  - i. Protect facilities against deleterious substances and damage.
3. Plan in advance all connections to existing facilities which are in service.
  - i. All equipment, materials, and labor shall be on hand at time of undertaking connections to existing facilities in service.
  - ii. Work shall proceed continuously if necessary to complete connections within the time designated by the Engineer.
  - iii. Existing water distribution systems to be connected to shall not be taken out of service during periods of high demand; coordinate any disruptions to service with the Owner.
  - iv. Refer to Section 01010 – Summary of Work and Contract Drawings for additional work sequence requirements.

D. Restoration and Protection of Public and Private Property:

1. Protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by construction operations.
2. Restore all public and private property including pavement, surfacing, curbs, walks, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all loam and seed and landscaping to their original condition or better, whether within or outside easements.

3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01050

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## SECTION 01063

### MISCELLANEOUS REQUIREMENTS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The Contractor shall conform to all miscellaneous requirements as herein specified.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 3 – Concrete

##### 1.3 TRAFFIC CONTROL

- A. For control of moderate traffic, the Contractor shall provide an adequate number of traffic control devices employed at his own expense.
- B. Whenever and wherever traffic is sufficiently congested, public safety is endangered, or as required by authorities having jurisdiction, furnish uniformed police officers to direct traffic and to keep traffic off the area affected by construction operations. Such officers shall be in addition to the traffic control requirements specified in other provisions of the contract.
- C. The employment or presence of traffic flagmen, special officers, or police shall in no way relieve the Contractor of any responsibility or liability which is his under the terms of the contract.
- D. Contractor is responsible for scheduling of all uniformed police details. The Police Department will invoice the Owner directly for accepted Police Details.
- E. It is the Contractor's responsibility to cancel Police Details a minimum of four hours in advance of the start of the shift if conditions so warrant. The Contractor will be responsible to reimburse the Police when the cancellation notice is not given by the Contractor in a timely fashion. Lateness or failure to show on the part of the Contractor or inclement weather shall not excuse the Contractor from the obligation to give adequate notice to the Police Department. Payment for Police Details not cancelled as required will be the responsibility of the Contractor.

- F. Road closures shall not be allowed without prior permission of the Owner, Police Department, and Fire Department.

#### 1.4 INTERFERENCE WITH EXISTING WORKS

- A. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing works. The Contractor shall develop a program, in cooperation with the Engineer and Owner, which shall provide for the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted. All work of connecting with, cutting into, and reconstructing existing pipes or structures shall be planned to interfere with the operation of the existing facilities for the shortest possible time when the demands on the facilities best permit such interference, even though it may be necessary to work outside of normal working hours to meet these requirements. Before starting work which will interfere with the operation of existing facilities, the Contractor shall do all possible preparatory work and shall see that all tools, materials, and equipment are made ready and at hand. The Contractor shall make such minor modifications in the work relating to existing structures as may be necessary, without additional compensation.
- B. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting his operations to the need for continuous operations of Well Station 2, 3, and/or 4 as required in the Sequence of Work described in Section 01010 and Contract Drawings.

#### 1.5 PRELOADING AND LEAKAGE TESTING OF TANKS

- A. No backfilling, floor finish, concrete or mortar fill, wall insulation, gasproofing or protective coatings, or permanent pipe connections shall be applied to the backwash waste tank and finished water wet well until they have been subjected to loading for settlement and tested for leakage. Testing shall not be done until the concrete has reached its 28 day design strength.
- B. During the test period, the excavation around the structure shall be kept dewatered by the Contractor. The Contractor shall close temporarily all bottom openings and wall openings below maximum water level in the structures; furnish and fill the structures to the design maximum water level with clean water and let it stand for 24-hours before testing. The Contractor shall make their own arrangements for handling the water for testing and its transfer from one structure to another and its final disposal. After 24-hours, the Contractor shall take all necessary elevations and measurements prior to testing of the structures.
- C. For the Preloading Test the Contractor shall maintain the liquid level in the structures at the design maximum water level for 72-hours. If the characteristics of settlement of the structure so require, the loading shall continue for a longer period to permit the necessary consolidation of the foundation material, in which case the Contractor shall be entitled to no extra compensation, but a commensurate extension of time for completion of the whole work under this contract shall be allowed.



D. Test for Water Tightness:

1. All concrete tanks shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer.
  2. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.
  3. Water tightness testing of tanks shall be conducted when all structural components of the tank are in place, including its walls, top slab, and all piping as applicable. Testing of the tank without the top slab shall be allowed only with approval from the Engineer.
  4. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24-hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Engineer. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.
  5. For structures designed to hold water, 0.25 inch of leakage will be allowed during a 72-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.
  6. The Contractor shall pay all costs (including water) incurred in the testing for water tightness.
  7. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.
- E. If, in the opinion of the Engineer, during the course of the test weather conditions are such that it becomes difficult to accurately monitor the water level in the tank, the test shall be stopped, and started over again when weather permits.
- F. On conclusion of the test, the Contractor shall pump or drain the water from the structure and dispose of it without injury to structures or surfaces.

1.6 HYDRAULIC UPLIFT OF STRUCTURES

- A. The Contractor shall be responsible for the protection of all structures against hydraulic uplift until such structures have been accepted finally by the Owner.
- B. In this regard, the Contractor is advised that the water treatment plant (WTP) when completed is designed to resist hydraulic uplift from groundwater up to the estimated

seasonal high groundwater level as noted on the Drawings. Higher groundwater levels may necessitate flooding of the tanks to resist uplift. The reinforced- concrete slab bottoms shall be placed in the dry, with the use of wellpoints or other dewatering means to keep the water elevation sufficiently low to carry on the work.

#### 1.7 PRECAUTIONS AGAINST HYDROSTATIC UPLIFT DURING CONSTRUCTION

- A. The Contractor shall maintain a low groundwater elevation in the vicinity of the WTP until the pre-engineered metal building and below grade structures have been installed. In case of extremely high water during construction of the WTP, it may be necessary to flood the facility to maintain a stable condition. The WTP has been designed for high water at the estimated seasonal high groundwater level as noted on the Drawings when complete.

#### 1.8 PROTECTION AGAINST ELECTROLYSIS

- A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

#### 1.9 WATERTIGHTNESS

- A. All structures, pipes, and equipment which are to contain water shall be watertight under all operating conditions for which they are intended. The Contractor shall furnish all labor, materials and equipment and do all work required by the Engineer to make all such parts of the work watertight, or to replace them if in the opinion of the Engineer any leakage is excessive. All such parts of the work filled with water for testing water tightness shall be left filled as ordered by the Engineer.

#### 1.10 MAINTAINING FIRE HYDRANTS

- A. Fire hydrants on or adjacent to the work shall be kept operational and accessible to fire-fighting equipment at all times.

#### 1.11 DRONE SITE PHOTOGRAPHY

- A. Provide digital construction photographs pertinent to the Contract work during the Contract period as specified and as directed by the Engineer. Photographs shall be taken prior to the start of construction and monthly throughout the contract duration.
- B. Photographs shall be taken by a licensed drone photographer and in accordance with FAA, state, and local regulations. Proposed photographer shall be approved by the Engineer and shall have not less than 2 accumulated years of experience with similar construction photography.
- C. Photographer shall coordinate with Engineer on views to be taken. In general views from locations to adequately illustrate state of project and condition of construction. Over-all site photography to have at least 4 different views unless otherwise approved

by Engineer. Succeeding photography from the same view points as preceding photographic sessions.

#### 1.12 ELECTRONIC FILE EXCHANGE CLOUD SOFTWARE

- A. Contractor shall be responsible for hosting an electronic, cloud-based software for file processing and exchange. Software shall be hosted throughout the duration of the Contract and shall include unlimited document storage. Software shall be by Procore or Engineer Approved Equal. Software shall be suitable for processing and exchanging all construction period documentation including but not limited to submittals, requests for information, change order proposals, etc.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION (NOT USED)

END OF SECTION 01063

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## SECTION 01095

### REFERENCE STANDARDS AND DEFINITIONS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Engineer, requested by the Engineer, and similar phrases.
- D. Approve: The term approved, when used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulation: The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work.
- F. Furnish: The term furnish means supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install describes operations at the project site, including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. Replace: The term replace means dismantle, remove, and dispose of existing equipment and materials and furnish and install new specified item.
- I. Provide: The term provide means to furnish and install, complete and ready for the intended use.
  - 1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this project, being

familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

2. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such a carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
- J. Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the project is to be built.
- K. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the Engineer for a decision before proceeding.
  1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on the project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed, but not assured, to be accurate and up-to-date as of date of Contract Documents.

ACI American Concrete Institute

P.O. Box 19150

Detroit, Michigan 48219-0150

Telephone: (313) 532-2600

Asphalt Institute

Research Park Drive

P.O. Box 14052

Lexington, Kentucky 40512-4052

Telephone: (606) 288-4960

ANSI American National Standards Institute

11 West 42nd Street

13th Floor

New York, New York 10036

Telephone: (212) 642-3300

ASTM American Society for Testing and Materials

1916 Race Street

Philadelphia, Pennsylvania 19103

Telephone: (215) 299-5400

AWWA American Water Works Association

6666 West Quincy Avenue

Denver, Colorado 80235

Telephone: (303) 794-7711

- UL Industrial Control Panels  
85 John Road  
Canton, Massachusetts 02021  
Telephone: (781) 821 2200
- MSS Manufacturers Standardization Society of  
the Valve and Fittings Industry  
127 Park Street, N.E.  
Vienna, Virginia 22180  
Telephone: (703) 281-6613
- NAPA National Asphalt Pavement Association  
6811 Kenilworth Avenue  
Calvert Building  
Suite 620  
Riverdale, Maryland 20737  
Telephone: (301) 779-4880
- NFPA National Fire Protection Association  
One Batterymarch Park  
Quincy, MA 02169  
Telephone: (617)- 770-3000
- WSC Water Systems Council  
600 South Federal Street  
Suite 400  
Chicago, Illinois 60605  
Telephone: (312) 922-6222

F. Federal Government Agencies: Names and titles of Federal Government standard- or specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard- or



specification-producing agencies of the Federal Government. Names and addresses are subject to change and are believed, but not assured, to be accurate and up-to-date as of the date of the Contract Documents.

CFR Code of Federal Regulations

(available from the Government Printing Office)

North Capitol Street between G and H Streets, N.W.

Washington, D.C. 20402

Telephone: (202) 783-3238

(Material is usually first published in the "Federal Register)

EPA Environmental Protection Agency

401 M Street, S.W.

Washington, D.C. 20460

Telephone: (202) 382-2090

NIST National Institute of Standards and Technology

(U.S. Department of Commerce)

Gaithersburg, Maryland 20899

Telephone: (301) 975-2000

OSHA Occupational Safety and Health Administration

(U.S. Department of Labor)

Government Printing Office

Washington, D.C. 20402

Telephone: (202) 523-6091

#### 1.4 GOVERNING REGULATIONS AND AUTHORITIES

- A. The Engineer has contacted authorities having jurisdiction where necessary to obtain information to prepare Contract Documents. Contact authorities having jurisdiction directly for information and decisions regarding the work.

Town of Sharon Department of Public Works, Water Division

Telephone: (781) 784-1525

1.5 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, warranties, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01095

## SECTION 01110

### ENVIRONMENTAL PROTECTION PROCEDURES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.
- C. MEPA Certificate issued by the Secretary of Energy and Environmental Affairs, provided in Appendix R of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered by this section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environmental for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the generation of windblown dust and erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, filter sock, seeding, mulching, or other special surface treatments as are required to prevent silting and muddying of the drainage systems, wetlands, streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area.
- D. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. Schedule and conduct all work in a manner that will minimize the level of noise escaping the site, especially at night and on weekends.

- F. Contractor shall be responsible for maintenance of the erosion control structures and devices, and replacing as needed to maintain the required protection and performance.
- G. Contractor shall be responsible for complying with the mitigation measures and draft Section 61 Findings in accordance with the MEPA Certificate issued by the Secretary of Energy and Environmental Affairs, provided in Appendix R of these Specifications.
- H. Related sections include the following:
  - 1. Section 02020 – Erosion and Sediment Control
  - 2. Section 02050 – Tree Protection and Trimming
  - 3. Section 02920 – Topsoil
  - 4. Section 02945 – Turf
  - 5. Appendix F – Order of Conditions
  - 6. Appendix R – MEPA Certificate

### 1.3 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement. Work shall be completed in accordance with the Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, included in these Specifications under Appendix F.

### 1.4 NOTIFICATIONS

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

- B. If oil and/or hazardous material are found during construction, the Contractor shall notify MassDEP, the Engineer, and the Owner in accordance with the Massachusetts Contingency Plan (310 CMR 40.00).

## 1.5 IMPLEMENTATION

- A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the project at the earliest practicable time.

## 1.6 SUBMITTALS

- A. Submit a Stormwater Pollution Prevention Plan (SWPPP) under the NPDES Construction General Permit and in accordance with the Standard 8 of the Massachusetts Stormwater Handbook for review and approval by the Engineer and Town of Sharon Conservation Commission.
- B. Submit a NPDES General Permit for Dewatering Activity Discharges for review and approval by the Engineer.
- C. Submit in accordance with Section 01300 – Submittals.

## PART 2 – PRODUCTS

### 2.1 EROSION CONTROLS

- A. Filter sock with orange construction fencing as shown on the Contract Drawings and as specified in Section 02020 – Erosion and Sediment Control.

## PART 3 - EXECUTION

### 3.1 EROSION CONTROL

- A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures such as siltation basins, check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Offsite surface water shall be diverted around the site to a downstream channel ahead of siltation barriers. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition.

### 3.2 PROTECTION OF STREAMS, WETLANDS, AND SURFACE WATER

- A. Care shall be taken to prevent or reduce to a minimum any damage to any wetland, stream, drainage ditch, surface water body, storm drain or sewer from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the receiving body shall not be directly returned to the surface water body. Such water will be diverted through a settling basin or filter before being directed into the surface water body.
- B. The Contractor shall not discharge water from dewatering or water treatment plant (WTP) commissioning operations directly into any live or intermittent stream, channel, wetland, surface water, storm sewer, or within 50-feet of any resource area. Water from dewatering or WTP commissioning operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action drawing or plan approved by the Massachusetts Department of Environmental Protection. Contractor shall submit two copies (2) of approved contingency drawings or plans to the Engineer.

### 3.3 PROTECTION OF LAND RESOURCES

- A. Land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. Work shall be completed in accordance with Section 02050 – Tree Protection and Trimming and as specified herein. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment, dumping or other operations, protect such trees by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original

condition. The Engineer will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.

- E. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in. in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
- F. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer shall be immediately removed and replaced.
- G. The locations of the Contractor's storage, staging and other construction building, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and shall require written approval of the Engineer and shall not be within wetlands or floodplains. No materials shall be stored within 100 feet of the wetland boundary. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of the work. Drawings showing storage facilities and staging shall be submitted for approval by the Engineer.
- H. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as described in Section 02920 and 02945, or as approved by the Engineer.
- I. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

### 3.4 PROTECTION OF AIR QUALITY

- A. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Dust Control. The Contractor will be required to maintain all excavations, embankments, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded, and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust.
- D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient,

competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer. This is especially important during the period when areas are being grubbed.

- E. Minimize air emissions by using an emission control device such as a diesel oxidation catalyst or diesel particulate filter on each piece of diesel construction equipment, using ultra-low sulfur diesel (ULSD) fuel, prohibiting motor vehicle engines from idling more than five minutes, and require that diesel equipment meet EPA's Tier 4 Emissions Standards.

### 3.5 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this Contract, maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

### 3.6 NOISE CONTROL

- A. The Contractor shall make every effort to minimize noises caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal (OSHA) regulations. The operation of equipment shall not be allowed on Saturdays, Sundays, legal holidays, religious holidays, or between the hours of 4:00 p.m. and 7:00 a.m.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01110



## SECTION 01170

### SPECIAL PROVISIONS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section specifies the general requirements for the special provisions required in the construction of the work. Specific requirements, if any, are specified with the related item.

##### 1.3 SUBMITTALS

- A. Provide shop, working, interference, and record drawings as necessary in accordance with Section 01300 - Submittals.

##### 1.4 GENERAL OBLIGATIONS OF THE CONTRACTOR

- A. General obligations of the Contractor shall be as set forth in the Contract Documents. Unless special payment is specifically provided in the payment paragraphs of the specifications, all incidental work and expense in connection with the completion of work under the Contract will be considered a subsidiary obligation of the Contractor and all such costs shall be included in the appropriate items in the Bid Form in connection with which the costs are incurred.

##### 1.5 SITE INVESTIGATION

- A. The Contractor shall satisfy himself/herself as to the conditions existing within the project area, the type of equipment required to perform the work, the character, quality and quantity of the subsurface materials to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the Drawings and Specifications. Any failure of the Contractor to acquaint himself/herself with the available information will not relieve him/her from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor on the basis of the information made available by the Owner.

##### 1.6 CONTRACTOR'S EMERGENCY CONTACT AND RESPONSE REQUIREMENT

- A. The Contractor will be required to designate a contact person as well as an emergency response crew who can be notified by the Owner and the Engineer during Contract

related emergencies, 7 days a week, 24 hours a day throughout the length of this Contract.

- B. The name of the designated person, a daytime contact telephone number, an evening contact telephone number, and a cellular telephone number must be furnished to the Engineer/Owner at the pre-construction meeting. The Contractor must also provide a cellular telephone that will remain at the construction site during the hours of construction.
- C. The contact person shall be required to respond to any Owner notification in this regard within one hour of such notice, contact phone numbers shall be provided at the pre-construction meeting. Upon being advised by the Owner of the location and nature of the emergency, the Contractor will be required to provide an emergency coordinator or contact at the site within one hour of the initial notification and to mobilize the necessary response crew(s) and have them at the site of the emergency within two hours of the initial notification.
- D. The Contractor's failure to comply with the above notification and response requirements shall result in a one thousand dollar (\$1,000.00) fine for each failure to respond as indicted in 1.6.C. In addition, the Contractor shall be liable for any and all damages, liabilities and costs which result from his/her failure to respond to any emergency within the designated time periods. The Owner assumes no responsibility or costs for the Contractor's negligence in complying with these requirements. If the subject fine or other liabilities are not paid by the Contractor upon request, it shall be deducted from any payment(s) which may be due the Contractor by the Owner, solely at the discretion of the Owner.
- E. The Contractor shall not use any Owner or municipal personnel to fulfill these requirements.
- F. This requirement shall be considered an incidental part of the Contract, no matter how many times the Contractor is alerted during this Contract, and no payment will be made for any costs incurred or associated with the emergency contact and response requirements.

## 1.7 PUBLIC UTILITIES

- A. The Contractor shall comply with the requirements of the Commonwealth of Massachusetts Statute - Chapter 82A, for excavations in public and private property. Compliance shall include the following:
  - 1. The Contractor shall notify public utility companies in writing at least 72 hours (excluding Saturdays, Sundays and legal holidays) but not more than 30 days before excavating in areas where underground utility plant (pipes, cables, manholes, etc) exist.
  - 2. The Contractor shall be responsible for providing the Utility Companies with a schedule of his/her activities in areas where the utilities exist.

3. The Contractor shall immediately notify utility companies of any damage to their utilities resulting from construction operations.
  4. The express approval of the Owner shall be obtained before public water is used. Hydrants shall only be operated under the supervision of the Owner's personnel. The water is to be metered. A meter must be attained from the Town of Sharon. The Contractor will be responsible for all associated fees and charges for water use.
- B. The Contractor shall notify DIGSAFE at 1-888-344-7233 at least 72 hours before digging, trenching, blasting, demolishing, boring, backfilling, grading, landscaping or other earth moving operations in any public ways, rights of way and easements.

## 1.8 PERMITS

- A. The Contractor shall be required to obtain all necessary permits for proper execution of certain phases of the project. The Contractor shall fill out all forms and furnish all drawings required to obtain the permits. A copy of the approved permit shall be submitted to the Engineer. All fees associated with these permits shall be paid by the Contractor as part of the project. Work shall not commence on any phase of the work requiring a permit until the permit is obtained.
- B. All construction activities must be completed while meeting the requirements of previously obtained permits; refer to the Appendices of the specifications for permit approvals.

## 1.9 COORDINATION

- A. Drawings are diagrammatic. They indicate general arrangements of work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate between trades.
- B. Work shall be performed in cooperation between trades on the project and so scheduled to allow speedy and efficient completion of the work.
- C. Furnish to trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work, and also furnish information necessary to permit trades affected by the work to install same properly and without delay.
- D. The work of the various trades shall be coordinated to avoid interference and to secure maximum head room. Particular attention is drawn to congested spaces inside and outside of the structures. If, in the interest of coordination and expediency, it becomes necessary to develop "interference drawings" (defined as drawings embodying the work of trades involved, illustrating details or construction proposed by the contractor and arrangement of actual equipment and apparatus purchased), such drawings shall be prepared by the Contractor and shall be coordinated with other trades at no additional expense to the Owner.

- E. If work has been installed before coordination with other trades so as to cause interference with the work of other trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the Owner.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.
- G. Protect all materials and work of trades from damage which may be caused by other trade work, and repair all damages without extra cost to the Owner.

#### 1.10 MAINTAINING EXISTING WORKS

- A. The Contractor shall maintain the existing works to the maximum extent possible for the duration of construction.

#### 1.11 MINIMIZING INTERFERENCE

- A. The Contractor shall have all materials and equipment on-site, and shall receive the Engineer/Owner's approval prior to initiating Work which requires any part of the water distribution system or Well Stations 2, 3, and/or 4 to be offline. The downtime for any process or piece of equipment shall be limited to the maximum extent possible.
- B. The Contractor shall conduct his/her operations so as to interfere as little as possible with the existing operations.
- C. The existing water system is active. Portions of the water system shall be taken off-line for construction activities as noted on the Contract Drawings and in accordance with Section 01010 – Summary of Work.
- D. The Contractor shall submit a detailed schedule for the work at each site, including work to be completed by sub-contractors, for Engineer review. During an emergency condition, the Owner reserves the right to bring a facility on-line with 24 hour notice to the Contractor.
- E. The Owner must have access to Well Stations 2, 3, and 4 at all times during construction, including regularly scheduled operation activities and chemical deliveries.
- F. The Contractor shall have all materials and equipment on-site when connecting with, cutting into, or reconstructing existing pipes and/or structures.
- G. The Contractor shall provide, maintain and operate all temporary facilities.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION (NOT USED)

END OF SECTION 01170

## SECTION 01200

### PROJECT MEETINGS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 PRE-BID CONFERENCE

- A. Prior to the opening of the bids, a site conference shall be held with prospective bidders. All Contractors are urged to attend. All Contractors who have requested bid documents shall be furnished with the date, time and place of the meeting, refer to Invitation to Bid.

##### 1.3 PRE-AWARD MEETING

- A. Prior to award of contract, a pre-award meeting shall be scheduled with the prospective General Contractor who has been deemed the lowest responsive, qualified bidder. The time and place shall be arranged by the Engineer.

##### 1.4 PRECONSTRUCTION CONFERENCE

- A. A preconstruction conference will be held between the Contractor, the Engineer, the Owner, and applicable agency representatives to review the Contractor's proposed methods of complying with the requirements of the Contract Documents.
- B. Contractor will be notified of the time, date, and place where the preconstruction conference will be held.

##### 1.5 PROGRESS MEETINGS WITH ENGINEER

- A. In addition to other regular project meetings for other purposes (as indicated elsewhere in the Contract Documents), hold general progress teleconference meetings every week and hold on-site progress meetings every month with times and place coordinated between Contractor and Engineer. The Contractor shall provide the teleconference calling platform and phone system for the field office. The on-site progress meetings shall have the option for the Owner/Engineer to call in via teleconference. Meeting dates shall be established by the Engineer. Require every entity then involved in the planning, coordination or performance of work to be properly represented at each meeting. Include (when applicable) consultants, separate contractors (if any), principal subcontractors, suppliers/manufacturers/fabricators, governing authorities, insurers, special supervisory personnel and others with an interest or expertise in the progress of the work. Review each entity's present and future needs including interface requirements, time, sequence, deliveries, access, site utilization, temporary facilities and services, hours

of work, hazards and risks, housekeeping, submittals, change orders, and documentation of information for payment requests. Discuss whether each element of current work is ahead of schedule. Determine how behind-time work will be expedited and secure commitments from the entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work and subsequent work will be completed within the Contract Time. Review everything of significance which could affect the progress of the work.

- B. Within seven days after each progress meeting date, the Engineer will forward copies of the minutes-of-the-meeting, to the Contractor.
- C. Immediately following each on-site progress meeting (held every 6 weeks) where revisions to the Progress Schedule/Critical Path Schedule have been made or recognized (regardless of whether agreed to by each entity represented), revise the Schedule. Reissue revised Schedule within 10 days after meeting. At intervals matching the preparation of payment requests, revise and reissue the Schedule to show actual progress of the work in relation to the latest revision of the Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01200

## SECTION 01300

### SUBMITTALS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This section specifies the general methods and requirements of submissions applicable to the following work-related submittals.
  - 1. Shop Drawings.
  - 2. Product Data.
  - 3. Samples.
  - 4. Mock Ups.
  - 5. Operation and Maintenance Manuals.
  - 6. Construction Photographs.
  - 7. Construction or Submittal Schedules.
  - 8. Or Equal submittals.
  - 9. As-Built Surveys.
- B. Additional general submission requirements are contained in the General Conditions.
- C. Detailed submittal requirements will be specified in the technical specifications section.
- D. Refer to Section 01063 Miscellaneous Requirements for electronic file exchange cloud software requirements.

##### 1.3 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

- A. Shop Drawings:
  - 1. Shop drawings, as defined in the General Conditions, and as specified in individual work sections include, but are not necessarily limited to: custom-prepared data such as fabrication and erection/installation (working) drawings of

concrete reinforcement, structural details and piping layout, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, interference drawings, individual system or equipment inspection and test reports including performance curves and certifications as applicable to the work.

2. All shop and working drawings shall be prepared on standard size, 22-in. by 34-in. sheets, except those which are made by changing existing standard shop or working drawings.
3. All shop drawings shall be submitted using a transmittal form approved by the Engineer. Submittal form shall include identification of transmittal number and specification section number.
4. All shop drawings submitted by subcontractors for review shall be sent directly to the Contractor for approval. The Contractor shall be responsible for their submission to the Engineer at the proper time so as to prevent delays in delivery of materials.
5. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof to the Engineer.
6. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.
7. If requested by the Engineer, submittals for equipment specified under Divisions 11, 13, 15, and 16 shall include a listing of all installations where identical or similar equipment has been installed and been in operation for a period of at least one year.
8. Submittals for equipment furnished under Divisions 11, 13, 15, and 16 shall include maintenance and lubrication schedules for each piece of equipment. Schedules shall be similar to the following sample schedules:

SAMPLE MAINTENANCE SCHEDULE

ITEM	ACTION	FREQUENCY	REMARKS
Sedimentation Equipment	Check removal of scum washdown; if required, remove any debris, etc. Sludge Collector Drive Unit	Daily Six Months Daily	Remove shear pin, clean off rust, grease and replace Check serviceability



	Overflow weir		
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### SAMPLE LUBCRICATION SCHEDULE

ITEM	MANUFACTURER'S RECOMMENDATIONS	LUBRICANT TYPE	FREQUENCY
Spur and Worm Gearing	Check Oil Level Change Oil	See below; same as for oil change 75-80 NSMP (Winter) 80-90 NSMP Gem Oil (Summer)	Weekly Six Months

**B. Product Data:**

1. Product data as specified in individual sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

**C. Samples:**

1. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

#### 1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:
  1. Field measurements.
  2. Field construction criteria.
  3. Catalog numbers and similar data.
  4. Conformance with the Specifications.

- B. Each shop drawing, sample, and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in. X 17-in. and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Engineer a copy of each submittal transmittal form for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the Engineer.
1. Submittals received "WITHOUT" Certification Statement shall not be reviewed.
- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Engineer and provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefore.
- E. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
1. Manufacturer's printed installation instructions; a part of product data submitted to the Engineer will not be reviewed and are for informational purposes only.

#### 1.5 "OR EQUAL"

- A. Should the Contractor seek approval of a product other than the brand or brands named in these specifications, it shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards the Contractor shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature.

- B. Manufacturers' standard data and catalog cut sheets will not be considered sufficient in themselves, and the Engineer will not be responsible for seeking further data from the manufacturer, or for otherwise researching the product. Failure to provide complete data will be cause for rejection of the product.
- C. The Contractor shall be responsible for all additional costs including license fees, structural/foundation, piping, instrumentation, and electrical work necessary to accommodate the proposed "or equal" equipment. Items which result in a cost reduction shall be presented and a change order reflecting 65% of the cost savings will be prepared and the contract price modified.

## 1.6 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.
- B. All complete submittals shall be submitted sufficiently in advance of construction requirements to provide no less than fifteen (15) days, excluding Saturdays, Sundays and legal holidays for review from the time received at the Engineer's reviewing office. For submittals of major equipment, that require more than fifteen (15) days to review, due to its sheer complexity and amount of detail and also requiring review by more than one engineering discipline, a letter will be sent by the Engineer or his/her designee to the Contractor informing him/her of the circumstances and the date it is expected the submittal will be returned to the Contractor.
- C. Number of submittals required:
  - 1. Shop Drawings: Unless otherwise stated in the respective Specifications Sections, submit a searchable and indexed PDF (on CD or via electronic file transfer service).
  - 2. Product Data: Unless otherwise stated in the respective Specifications submit a searchable and indexed PDF (on CD or via electronic file transfer service).
  - 3. Samples: Submit the number stated in the respective Specification Sections.
- D. Submittals shall contain:
  - 1. The date of submission and the dates of any previous submissions.
  - 2. The Project title and number.
  - 3. Contractor identification.
  - 4. The names of:
    - i. Contractor
    - ii. Supplier
    - iii. Manufacturer

5. Identification of the product, with the specification section number, page and paragraph(s).
  6. Field dimensions, clearly identified as such.
  7. Relation to adjacent or critical features of the Work or materials.
  8. Applicable standards, such as ASTM, MassDOT, or Federal Specification numbers.
  9. Identification of deviations from Contract Documents.
  10. Identification of revisions on resubmittals.
  11. An 8-in. X 3-in. blank space for Contractor and Engineer stamps.
- E. Each shipment of drawings shall be accompanied by a transmittal form furnished by the Engineer giving a list of the drawing numbers and the names mentioned above.

1.7 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract plans and specifications or from departures there from. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
  1. as permitting any departure from the Contract requirements;
  2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
  3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. A digital copy of shop drawings or product data will be returned to the Contractor. Samples will not be returned.

- E. Submittals will be returned to the Contractor under one of the following codes.

Code 1 “NO EXCEPTION TAKEN” is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 “MAKE CORRECTIONS AS NOTED” is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 “SUBMIT SPECIFIED ITEM” is assigned when a confirmation of the notations and comments IS required by the Contractor. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 10 calendar days of the date of the Engineer’s transmittal requiring the confirmation.

Code 4 “REVISE AND RESUBMIT” is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 10 calendar days of the date of the Engineer’s transmittal requiring the resubmittal.

Code 5 “REJECTED” is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

- F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
- G. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered “Rejected” until resubmitted. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
- H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.

- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

## 1.8 GENERAL PROCEDURES FOR SUBMITTALS

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval resubmittal (if required), coordination with other submittals, inspection, testing (off-site and on-site), purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

## 1.9 CERTIFICATION FORMS

- A. If specifically specified in other sections and appendices of these Specifications, the Contractor shall submit the applicable certification form(s) for each item required, and if applicable, the form attached to this section, completely filled in and stamped.

## 1.10 CERTIFICATES OF COMPLIANCE

- A. Certificates of Compliance specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, compliance reporting forms, certified copies, letters of certification and certificate of materials.
- B. The Contractor shall be responsible for providing Certificates of Compliance requested and specified in Division 0, Division 1, and the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in 6 hard copies as well as a searchable and indexed PDF (on CD or via electronic file transfer service) unless otherwise specified/approved. Each certificate shall be signed by an official authorized to certify on behalf of the Contractor, Sub-contractor, or manufacturing company (as appropriate), and shall contain the individual's name and title, address of the Supplier, the project name and location, and if applicable, the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor, Sub-contractor, or Supplier from providing additional means of verification or from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of \_\_\_\_\_ and that he/she has been employed by (Name of Contractor) \_\_\_\_\_ to design \_\_\_\_\_ in accordance with Specification Section \_\_\_\_\_ for the Sharon Wells 2, 3, and 4 Water Treatment Plant. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the \_\_\_\_\_, that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and Professional Engineer (P.E.) stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance with limits of \$1,000,000.00 and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the Town of Sharon or the Owner's representative within seven (7) days following written request by the Owner.

\_\_\_\_\_  
P.E. Name

\_\_\_\_\_  
Contractor's Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

\_\_\_\_\_  
Address

\_\_\_\_\_  
Address

CERTIFICATE OF UNIT RESPONSIBILITY  
For Specification Section \_\_\_\_\_

\_\_\_\_\_  
(Section title)

In accordance with Section 01300, paragraph 1.11 of the contract documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section \_\_\_\_\_ and the requirements specified in Section \_\_\_\_\_. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified and indicated performance and design requirements.

\_\_\_\_\_  
Notary Public

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
Commission Expiration Date

\_\_\_\_\_  
Address

Seal: By:

\_\_\_\_\_  
Duly Authorized Official

\_\_\_\_\_  
Legal Title of Official

Date: \_\_\_\_\_

END OF SECTION 01300



## SECTION 01311

### CONSTRUCTION PROGRESS SCHEDULES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. Prepare and submit to Engineer for review projected construction schedules. Update and revise schedules periodically to reflect progress of work.
- B. Prepare and electronically submit to Engineer for review weekly look ahead schedule.

##### 1.3 FORM OF SCHEDULES

- A. Prepare in form of network analysis system using the Critical Path Method.
- B. Perform data preparation, analysis, charting and updating in accordance with pertinent recommendations contained in current edition of "CPM in Construction" manual of the Associated General Contractors.
- C. The network analysis system shall consist of a detailed network, mathematical analysis and a network diagram.
  - 1. The network diagram shall show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.
  - 2. Detailed network activities shown on the network diagram shall include, in addition to construction activities, the submittal for approval of samples and shop drawings, the procurement of critical materials and equipment and their installation and testing.
  - 3. Related activities shall be grouped on the network. The activities on the critical paths shall be highlighted. The network shall be time scaled using units of approximately one-half inch equals one week or other suitable scale approved by the Engineer. Weekends and holidays shall be indicated. Where slack exists, the activities shall be shown at the earliest time they are scheduled to be accomplished. Sheet size shall be 30" x 60" minimum.

4. The mathematical analysis of the network diagram shall include a tabulation of each activity shown on the detailed network diagram. The following information shall be furnished as a minimum for each activity.
  - i. Preceding and following event numbers.
  - ii. Activity description.
  - iii. Estimated duration of activities in units of working days (being the best estimate available at time of computation).
  - iv. Earliest start date (by calendar date).
  - v. Earliest finish date (by calendar date).
  - vi. Scheduled or actual start date (by calendar date).
  - vii. Scheduled or actual finish date (by calendar date).
  - viii. Latest start date (by calendar date).
  - ix. Latest finish date (by calendar date).
  - x. Slack or Float.
  - xi. Monetary value of activity.
  - xii. Responsibility for activity (Prime Contractor, subcontractors, suppliers).
  - xiii. Manpower required by trade and by total. Graphic representatives will be allowed.
  - xiv. Equipment required.
  
5. The mathematical analysis shall list the activities in sorts or groups as follows:
  - i. By the preceding event number from lowest to highest and then in the order of the following event number.
  - ii. By the amount of slack, then in order of activity number.
  - iii. By responsibility in order of earliest start date.

#### 1.4 REVIEW OF SYSTEM

- A. Participate in a review and evaluation of the proposed network diagrams and analysis by the Engineer. Revisions necessary as a result of this review shall be resubmitted to the Engineer within 10 days after the conference. Twenty days will be allowed for checking and further action by the Engineer. Progress payments will be withheld pending attainment of a mutually acceptable schedule. The mutually acceptable schedule shall then be the schedule to be used by the Contractor for planning, organizing, directing and executing the Work and for reporting progress. If the Contractor thereafter desires to make changes in his method of operating and scheduling he shall notify the Engineer in writing stating the reasons for the change. If the Engineer considers these changes to be of a major nature he may require the Contractor to revise and submit, without additional cost to the Owner, all of the affected portion of the network diagram and mathematical analysis to show the effect on the entire project. A change may be considered of a major nature if the time estimated to be required or actually used for an activity or the logic of sequence of activities is varied from the original plan to a degree that there is reasonable doubt as to the effect on the Contract completion date or dates. Changes which effect activities with adequate slack time shall be considered as minor changes, except that an accumulation of minor changes may be considered as a major change when their cumulative effect might affect the Contract completion date.

## 1.5 UPDATES

- A. Submit at intervals of 30 days a report of the actual construction progress by updating the mathematical analysis. All contract changes, including pending and approved change orders and field orders shall be included in the update schedule. Revisions causing changes in the detailed network shall be noted on the network or a revised issue of the affected portions of the detailed network furnished. The network shall be revised as necessary for the sake of clarity.
- B. The report shall show the activities or portions of activities completed during the reporting period and their total value as basis for the Contractor's periodic request for payment. Coordinate with the schedule of breakdown of lump sum items. The report shall state the percentage of the Work actually completed and schedule as of the report date and the progress along the critical path in terms of days ahead or behind the allowable dates. If the project is behind schedule, progress along other paths with negative slack shall be reported. Percentage of work actually completed will be reviewed by the Engineer. If the Contractor fails to submit the required monthly reports and updates within the time prescribed, the Engineer may withhold approval of progress payment estimates until such time as the Contractor submits the required reports and updates. Three copies of the report shall be submitted for each update.
- C. Simultaneously submit a narrative report with the updated analysis which shall include but not be limited to a description of the problem areas, current and anticipated delaying factors, their impact, and an explanation of corrective actions taken or proposed.

## 1.6 SUBMITTALS

- A. Within 15 days after execution of the AGREEMENT, submit 3 copies of a preliminary schedule indicating planned operations during first 60 days. Include cost of activities expected to be completed before submission and approval of the complete schedule.
- B. Within 30 days after execution of the AGREEMENT, submit 3 copies of the complete network analysis system. After review, submit 3 copies of the mutually acceptable system.
- C. Submit 3 copies of monthly reports and updates by the tenth day of the month.
- D. Submit an electronic copy of weekly look ahead schedule to the Engineer by 9:00 am every Friday.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION (NOT USED)

END OF SECTION 01311

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## SECTION 01350

### HEALTH AND SAFETY PLAN

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. The Contractor shall, prior to the start of work on the site, prepare and submit for review, a site-specific health and safety plan. Work may not proceed at the project site until the Owner and/or Engineer have reviewed and approved the Contractor's health and safety plan. Any delays incurred by the Contractor relating to reviews of the health and safety plan shall be the responsibility of the Contractor and constitute no additional costs or claims to the Owner. The Contractor is responsible for all safety precautions and maintaining a safe work site.
- B. Individuals involved in the work shall be properly informed and trained in the recognition, response, and handling of hazardous materials identified in the Hazardous Building Materials Survey Report included in Appendix I. Contractor shall be aware of site-specific work conditions including hazards posed by chemical stored on site, including but not limited to, sodium fluoride, granular activated carbon, potassium hydroxide, and sodium hypochlorite. The Contractor shall provide appropriate equipment (e.g., gloves, face shields, blowers, etc.) in working around hazards present.
- C. The Excavation of contaminated soils areas is not anticipated. However, the Contractor shall provide appropriate equipment (e.g., temporary fencing, drums) in the event hazardous materials are spilled or encountered.
- D. Individuals involved in the excavation of potentially impacted soils shall be properly informed and trained in the recognition and response strategies involved with the hazards posed by these contaminants.
- E. The Contractor shall be cognizant of the minimum standards set forth in OSHA 29 CFR 1910.120. The health and safety plan shall include, but not be limited to the following:
  - 1. Identification of Contractor's Site Safety Officer.
  - 2. Identification of Contractor's Designated Field Personnel.
  - 3. Type of Medical Surveillance Program.
  - 4. Identification of Hazard and Risks Associated with Project.

5. Contractor's Standard Operating Procedures including Personnel Training and Field Orientation; Personal Hygiene Requirements & Guidelines; Field Monitoring Requirements of Site Contaminants; Respiratory Protection Training & Requirements; Levels of Protection and Selection of Equipment Procedures; Zone Delineation of the Project Site; Site Security and Entry Control Procedures; Contingency and Emergency Procedures; and Listing of Emergency Contacts.
  6. Contractor's air monitoring plan (if required) immediately adjacent to the work area, and at the fence line.
  7. Contractor's dust suppression plan. If air monitoring indicates a higher level of protection than modified Level D, work will stop at no cost to Owner until proper engineering controls/dust suppression sufficiently address the elevated air monitoring results. Modified Level D protection for all onsite personnel is the minimum project requirement.
  8. The Contractor must be aware of site-specific requirements such as site security during non-working hours, limited work space, and minimizing the effects of demolition to adjacent structures.
  9. The Contractor shall make available complete sets of personal protective equipment and clothing to the Owner and Engineer for use during site inspections by the Owner and Engineer. These shall be supplied and maintained at no cost to the Owner, and shall be returned to the Contractor upon completion of the Work, except for expendable disposal protective clothing. Contractor shall provide a repository for collection of disposable health and safety materials. Collection and disposal of contaminated expendable supplies shall be at cost to the Contractor.
- F. The Contractor shall comply with all federal, state, and local regulations in regards to demolition/transportation/disposal of asbestos containing materials, lead paint, and other hazardous materials.
1. At least 10 working days prior to initiating work, the Contractor is required to submit to MassDEP an Asbestos Removal Notification (Form AQ04(ANF-001)) for any asbestos abatement, removal, or disposal and a Construction/Demolition Notification (Form BWP AQ 06) for demolition work.
  2. If any asbestos-containing materials will be abated through non-traditional abatement methods, the Contractor must apply for and obtain approval from MassDEP, through Application BWP AQ36 – Application for Non-Traditional Asbestos Abatement Work Practice Approval.
  3. MassDEP Asbestos, Construction and Demolition Notifications can be found at: <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>
- G. The Contractor shall incorporate all COVID-19 protection guidance and requirements in accordance with the guidelines from the State of Massachusetts and the Town of Sharon. State COVID-19 guidelines for construction sites is located in Appendix H.

1. The General Contractor shall update the COVID-19 policy within the Health and Safety Plan as state and local COVID-19 guidance changes.
2. The General Contractor shall be solely responsible for maintaining a site access log of all personnel on-site for contract tracing.
3. Contract extensions shall not be granted to the General Contractor for COVID-19 impacts if state or local COVID-19 guidelines are not followed. Liquidated damages may apply if the construction schedule is impacted due to Contractor negligence regarding the implementation and enforcement of the COVID-19 policy.
4. The General Contractor shall provide, at no cost to the Owner, all PPE (gloves, masks, etc.) and supplies (water for handwashing, hand sanitizer, etc.) pertaining to the approved COVID-19 policy within the Health and Safety Plan.

### 1.3 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 - Submittals:

1. Health and Safety Plan – Prior to the start of work on the site, prepare and submit for review, a site-specific health and safety plan. Work may not proceed at the project site until the Owner and/or Engineer have reviewed and approved the Contractor's health and safety plan.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION (NOT USED)

END OF SECTION 01350

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## SECTION 01370

### SCHEDULE OF VALUES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section includes the following:

- 1. Provide schedule of values covering each lump sum bid item.

##### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - Submittals:

- 1. Schedule of values.

- i. Revise and resubmit schedule until acceptable to the Engineer and Owner.

- 2. Itemize separate line item cost for work involving each lump sum item, including each filed sub-bid.

- i. Ensure that the sum of the items listed in the schedule of values for each lump sum item equals the bid price for the respective lump sum item.
- ii. For "Mobilization and Demobilization", items such as Bond premium and temporary construction facilities may be listed separately in the schedule, provided amounts can be substantiated.

- 3. Breakdown installed costs into:

- i. Delivered cost of product, material, equipment.
- ii. Total installed cost with overhead and profit.
  - (a) Do not list overhead and profit as separate items.
  - (b) An unbalanced schedule of values providing for overpayment on items of work performed first will not be accepted.
- iii. For underground utilities, include a breakdown for testing, chlorinating (water only), and putting into service
- iv. For Division 11, 13, 15, and 16 equipment, include a breakdown for start-up, testing, and training.

#### 1.4 SEQUENCING AND SCHEDULING

- A. Prepare schedule of values covering each lump sum item after review of tentative schedule at pre-construction conference, but before submission of first application for payment.
- B. Before submitting any application for payment, obtain the Engineer's approval of the Schedule of Values.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01370

## SECTION 01400

### QUALITY ASSURANCE

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This section covers Quality Assurance and Control requirements for this contract.
- B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, filed sub-bidders, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.
- C. Related Sections include the following:
  - 1. Division 1 – General Requirements
  - 2. Division 2 – Site Work
  - 3. Division 3 – Concrete
  - 4. Division 4 – Masonry
  - 5. Division 5 – Metals
  - 6. Division 6 – Wood and Plastics
  - 7. Division 7 – Thermal and Moisture Protection
  - 8. Division 8 – Doors and Windows
  - 9. Division 9 – Finishes
  - 10. Division 10 – Specialties
  - 11. Division 11 – Equipment
  - 12. Division 12 – Furnishings
  - 13. Division 13 – Special Construction
  - 14. Division 15 – Mechanical
  - 15. Division 16 – Electrical

### 1.3 TESTING LABORATORY SERVICES

- A. All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory acceptable to the Engineer. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: Unless otherwise specified, the Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural fills, embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. Quality Control Testing Services: Perform all quality control tests in the field or in the laboratory on asphalt mixtures, moisture-density (Proctor) and gradation tests on structural and embankment fills, and backfill materials, in-place field density tests on structural and embankment fills, and other materials and equipment, during and after their incorporation in the Work. The Contractor shall pay all costs for services. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.
- D. Arrangements for delivery of samples and test specimens to the testing laboratory will be made by the Contractor. The laboratory tests shall be performed within a reasonable time consistent with the specified standards. Furnish a written report of each test to the Engineer.
- E. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary. When sampling or testing activities are performed in the field, the Contractor shall furnish personnel and facilities to assist in the activities.
- F. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- G. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

- H. The testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel in the field or laboratory to the Contractor. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor within three days after each test is completed.

#### 1.4 QUALITY ASSURANCE

- A. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer.
- B. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. Material and equipment shall not be used by the Contractor for any purpose other than that intended or specified unless such use is authorized by the Engineer.
- C. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

#### 1.5 OFFSITE INSPECTION

- A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by an independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.
- B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.
- C. The inspection organization shall submit a written report to the Contractor who shall provide copies to the Engineer.

#### 1.6 MATERIALS AND EQUIPMENT

- A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.
- B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more

stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

#### 1.7 SHOP AND FIELD TESTING

- A. The Contractor is also responsible for providing the shop and field testing specified in the technical specification sections.
- B. The Contractor and its Subcontractor shall perform inspections, tests, and other services as required by the Contract Documents.
- C. Contractor shall provide twenty one days notice (or as required by Section 01650 – Facility Start-up/Commissioning, whichever is longer) to the Engineer so that the Engineer may witness Contractor and/or Subcontractors off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

#### 1.8 MANUFACTURER'S FIELD SERVICES

- A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from manufacturer's of respective equipment, items or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.
- B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall revisit the jobsite as often as necessary until all problems are corrected and the equipment installation and operation are satisfactory to the Engineer.

#### 1.9 CERTIFICATION FORMS AND CERTIFICATES

- A. The Contractor shall be responsible for submitting the certification forms and certificates in conformance with the requirements specified in Section 01300 - Submittals.

### PART 2 - PRODUCTS (NOT USED)

## PART 3 – EXECUTION

### 3.1 QUALITY CONTROL

- A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.
- B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office, available for inspection by the Engineer. Copies will be made available to the Engineer upon request.
- C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer or Owner to supersede or void that responsibility.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01400

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## SECTION 01500

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 CODES AND AUTHORITIES HAVING JURISDICTION FOR TEMPORARY FACILITIES AND UTILITIES

- A. Codes and Authorities Having Jurisdiction for Temporary Facilities and Utilities: Comply with all requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to the following:
  - 1. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
    - i. Submit NFPA 241 Compliance Plan to the Town of Sharon Fire Department.
  - 2. ANSI-A 10 Series, Safety Requirements for Construction and Demolition.
  - 3. NECA National Joint Guideline NJG-6, Temporary Job Utilities and Services.
  - 4. Electrical Service: NEMA, NECA, and UL.

##### 1.3 PLANT AND HOURS OF CONSTRUCTION

- A. Furnish plant and equipment which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such plant appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the plant equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.
- B. Normal construction activity shall take place between the hours of 7 a.m. to 4 p.m., excluding Saturdays, Sundays, legal holidays, and religious holidays.
- C. Coordinate with Owner continuing occupation of portions of existing buildings and facilities.

- D. Work in streets, roadways and areas adjacent to them shall cease at noon on days before legal or religious holidays, and at noon on Fridays prior to Monday holidays.
- E. Contractor shall coordinate with the Engineer/Owner and the Sharon Police Department, and coordinate construction activities and operations throughout construction.

#### 1.4 OCCUPYING PRIVATE LAND

- A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment any land outside the rights of way or property of the Owner. A copy of the written consent shall be given to the Engineer, prior to entering or occupying private property.

#### 1.5 PIPE LOCATIONS

- A. Pipelines will be located as indicated on the Drawings, but the right is reserved to the Owner, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.
- B. Small interior piping is indicated diagrammatically on the Drawings, and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access ways, and, in general, without diagonal runs. Additional requirements are described within the Drawings and Specifications.

#### 1.6 DIMENSION OF EXISTING STRUCTURES

- A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

#### 1.7 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, and requiring that the trench shall not remain open overnight.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.
- C. Open trenches must be backfilled at the end of the workday or covered with steel plates.
- D. Contractor is responsible for obtaining all local trench permits pursuant to M.G.L. c. 82A §1 and 520 CMR 7.00 and any additional Town requirements.

#### 1.8 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor in areas where the Contractor deems it necessary to obtain subsurface information. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

#### 1.9 INTERFERENCE WITH AND PROTECTION OF STREETS

- A. Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefore from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.
- B. Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefore.
- C. The Contractor shall, at least 24 hours in advance, notify the DPW, Police, Fire and School Departments in writing, with a copy to the Engineer, if the closure of a street or road is necessary. He shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lit, in order to minimize confusion.

#### 1.10 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

#### 1.11 INSPECTION OF WORK AWAY FROM THE SITE

- A. If work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

#### 1.12 COOPERATION WITHIN THIS CONTRACT

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

#### 1.13 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and as neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this section and elsewhere in the Specifications.
- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

#### 1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at its own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and

made good by the Contractor at his own expense and to the satisfaction of the Engineer.

- C. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the Contract Documents.
- D. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

#### 1.15 INSTALLATION OF EQUIPMENT

- A. Special care shall be taken to ensure proper alignment to all equipment with particular reference to the pumps and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved by the Engineer, the bed plates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations, and after confirmation of all alignments, the sole plates shall be firmly grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed.
- B. All wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

#### 1.16 TEMPORARY UTILITIES

- A. Temporary Light and Power: The Contractor shall at his own expense, provide his own temporary light and power as required for the prosecution and completion of work. Usage of facility power for tools and temporary lights at the well stations shall be provided upon approval by Engineer/Owner but is not guaranteed.
- B. Temporary Heat: The Contractor shall, at his own expense, provide sufficient temporary heat to maintain a minimum temperature of 50 degrees F at all times for the prosecution and completion of work.
- C. Temporary Telephone: The Contractor shall provide at his own expense a job telephone for his use and for communication to the Engineer. The Contractor shall pay all phone charges.

- D. Temporary Water: Water for drinking purposes and other usage will be provided by the Contractor at his own expense.
- E. Sanitary Provisions: The Contractor shall provide and maintain separate sanitary accommodations for the use of his employees and the Engineer, as may be necessary to comply with the requirements and regulations of the local and state departments of health. Use of existing Town sanitary facilities are not allowed.
- F. Maintaining Operation of the Existing Facilities:
  - 1. The Contractor shall be responsible for careful consideration of the construction scheduling and anticipation of potential interference with existing utilities, operations, and structures. The Contractor shall maintain close communications with the Engineer and provide the Engineer with a detailed description of each proposed activity sufficiently in advance of its commencement for review and comments to be made.
  - 2. Temporary facilities which may be required include, but are not limited to, electrical power; lighting; heating; cooling; ventilating; telephone; potable water; fire protection; drainage; sanitary facilities; trench covers; protection of existing utilities; structures; streams; trees and shrubs; access roads; sewage conveyance; piping; pumping and sludge disposal.

#### 1.17 WATER FOR CONSTRUCTION PURPOSES

- A. The approval of the Owner shall be obtained before town water is used. Any Contractor proposing to use town water must meet all requirements of the Town of Sharon, including cross connection protection, before using any town water. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.
- B. Hydrants shall only be operated by, or under the supervision of, the Owner's personnel.
- C. No direct cross connections will be permitted between the public water supply and the new work, or any other point where the possibility of backflow of contaminated water exists. All connections to points where there is the possibility of backflow shall be arranged to prevent backflow and shall be approved by the Owner before they are put into operation.
- D. All water for construction purposes shall be metered, in cubic feet, as specified by the Town. Where metering is not possible (i.e. in the case of filling piping and tanks), water volume can be calculated. The volume of all water used by the Contractor is to be determined and provided to the Owner.
- E. The Contractor must supply their own backflow prevention device and flow meter. The backflow prevention device and flow meter must be tested and certified by the Town of Sharon Water Division.

- F. No separate measurement and payment shall be made for temporary water and all costs shall be incidental to and included with each applicable item.

#### 1.18 ACCESS TO THE WORK

- A. The Contractor shall provide sufficient and proper facilities at all times for inspection of all work under this project in preparation or in progress, by the Owner, the agents and employees of the Owner, by authorized representatives of the State of Massachusetts and the Federal Government and by the Engineers.
- B. The Contractor shall furnish the Engineer or his authorized representative and other personnel mentioned above with such facilities and assistance as are necessary to ascertain performance of the work in accordance with the plans and specifications.

#### 1.19 DUST CONTROL

- A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as to minimize the creation and dispersion of dust.

#### 1.20 POLLUTION CONTROL

- A. The Contractor shall conduct clean-up and disposal operations, as necessary, to comply with state and local ordinances and anti-pollution laws.
- B. Outdoor burning of rubbish and waste material on the site will not be permitted.
- C. Disposal of volatile fluid wastes (such as mineral spirits, oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.

#### 1.21 PRECAUTIONS DURING ADVERSE WEATHER

- A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

#### 1.22 FIELD OFFICE

- A. The Contractor shall provide and maintain at an approved location for the duration of the contract, a separate office building or trailer, minimum interior dimensions of 10 feet x 36 feet for the exclusive use of the Engineer. The plans and construction of the office shall be approved by the Engineer. The Contractor shall have the field office operational within 30 days of the Notice to Proceed.
- B. The office shall be equipped with electric lights, heating facilities, air conditioner, water, and internet service. Doors and windows shall be equipped with locks and the windows shall have security screens and horizontal blinds. Trailer shall have an insulated skirt installed around the lower perimeter. The office shall be equipped with the following furniture and accessories:
1. (1) Flat top desk with drawers.
  2. (1) Table at least 2 feet 8-inches wide and 6 feet long.
  3. (1) Drafting table with lamp.
  4. (1) Desk chair.
  5. (8) Folding chairs.
  6. (1) 4-section lockable, fireproof file case.
  7. (2) 5000 BTU air conditioners.
  8. (1) 5-pound fire extinguisher.
  9. (1) Industrial type first aid kit.
  10. (1) K-cup style coffee maker.
  11. (1) Microwave/refrigerator combo.
  12. (1) Water cooler/dispenser and five gallon water bottles for the duration of the contract.
  13. (1) Photocopy/scanner capable of enlarging and reproductions of both 8.5"x11" and 11"x17" paper sizes, similar to model HP LaserJet Enterprise MFP M725 or approved equal, with ink cartridges/toner for the duration of the contract.
  14. Five-500 sheet reams of 8.5" x 11" copy paper.
  15. Five-500 sheet reams of 11" x 17" copy paper.
  16. Additional items listed in paragraph C below.
  17. General Field Office Computer Equipment:



- i. High speed internet connection via cable modem or DSL, in that order of preference. Provide the high speed internet connection via a private, secure, password-protected Wi-Fi network (IEEE 802.11ac, or more recent, standard) within the entire field office.
- ii. All cables, routers, network connections, manuals, and associated equipment.

18. Conference calling system (including speaker phone and microphone).

C. The Contractor shall maintain the office during construction and remove it upon approved substantial completion. The cost for operation of the Engineer's field office shall be the responsibility of the Contractor and included into his Bid price. Operation and maintenance shall be construed at a minimum, to include: supplying paper towels, liquid hand sanitizing gel, copying paper, bottled water, coffee, paper cups, monthly utility costs, heating and cooling costs, restocking of the first aid kits, cleaning of the copier on a monthly basis and cleaning/house-keeping of the inside of the trailer on a weekly basis.

D. Contractor shall pay for all associated costs related to high-speed internet connection.

### 1.23 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals:

1. Laydown Area and Temporary Facilities Plan – Prior to the start of work on the site, prepare and submit for review, a site-specific laydown area and temporary facilities plan for approval by Owner and Engineer.
2. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations Plan – Prior to the start of work on the site, prepare and submit for review, a site-specific NFPA 241 Compliance Plan for approval by Owner and Engineer. Following approval by the Engineer/Owner, the Contractor shall submit the NFPA 241 Compliance Plan to the Town of Sharon Fire Department.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01500

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## SECTION 01600

### CONTROL OF MATERIALS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 APPROVAL OF MATERIALS

- A. Unless otherwise specified, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.
- B. As specified in Section 01300, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.
- C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- D. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner or the Engineer.
- E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- F. The materials and equipment used on the work shall correspond to the approved samples or other data.

##### 1.3 BOLTS, ANCHOR BOLTS AND NUTS

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

- B. All anchor bolts, nuts, washers, plates, and bolt sleeves shall be galvanized unless otherwise indicated or specified.
- C. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.
- D. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to AN Standard B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form).
- E. Bolts, anchor bolts, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.
- F. Bolts, anchor bolts, nuts, and washers specified to be stainless steel shall be Type 316 stainless steel. All anchor bolts, nuts, washers, plates and bolt sleeves to be submerged in a liquid shall also be Type 316 stainless steel.
- G. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

#### 1.4 GREASE FITTINGS

- A. Provide extension fittings and tubing on all grease fittings that are installed in an inaccessible location. The extension is to be located so that equipment can be lubricated from the operating level without the use of ladders, staging or shutting down the equipment. Tubing: 316 stainless steel.

#### 1.5 CONCRETE INSERTS

- A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

## 1.6 SLEEVES AND OPENINGS

- A. The Contractor shall provide all openings, channels, chases, and install anchor bolts and other items to be imbedded in concrete, as required to complete the work under this Contract, together with those required by subcontractors, and shall do all cutting and patching excepting cutting and patching of materials of a specific trade and as stated otherwise in the following paragraph.
- B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, required for the execution of their work. It shall be their responsibility before the work of the Contractor is begun to furnish him with the above items and with templates, drawings or written information covering chases, openings, etc., which they require, and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. Failing to do this, they shall be responsible for the cost of any corrective measures which may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Engineer.
- C. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 4 in. (min) above the finished floor surface. Threaded nipples shall not be used as sleeves. Refer to Contract Drawings for additional details.
- D. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-in. annular fin of 1/8-in. plate welded with a continuous weld completely around the sleeve at about mid-length to serve as a water stop and anchor collar. Sleeves shall be galvanized after the fins are attached. Refer to Contract Drawings for additional details.
- E. All sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

## 1.7 EQUIPMENT DRIVE GUARDS

- A. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

## 1.8 GREASE, OIL AND FUEL

- A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, 13, 15 and 16 unless stated otherwise in these specifications.

## 1.9 CLEANING AND REPLACEMENT OF GLASS

- A. All glass shall be thoroughly cleaned and polished by qualified window cleaners just prior to acceptance of the work at the expense of the Contractor.
- B. All broken glass not required to be replaced under Division 8 shall be replaced by the Contractor at no additional expense to the Owner.

## 1.10 ARCHITECTURAL COATINGS

- A. Maintain coordination among all sections (windows, window walls, louvers, doors and frames, etc.) requiring special coatings. All coatings shall match to the satisfaction of the Engineer with regard to color and texture. Items rejected by the Engineer shall promptly be removed from the job site.

## 1.11 REJECTED MATERIALS AND DEFECTIVE WORK

- A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer. The Contractor shall reimburse the Owner for any expenses, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION (NOT USED)

END OF SECTION 01600

## SECTION 01610

### DELIVERY, STORAGE, AND HANDLING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

##### 1.3 TRANSPORTATION AND DELIVERY

- A. Transport and handle items in accordance with manufacturer's printed instructions.
- B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Provide on-site storage plan. Under no circumstances shall equipment be delivered to the site more than one week prior to installation without written authorization from the Engineer.
- C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- F. Provide equipment and personnel to unload all items delivered to the site.
- G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

##### 1.4 STORAGE AND PROTECTION

- A. Store and protect products in accordance with the manufacturer's printed instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer by him. Instructions shall be carefully

followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.

- B. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter.
- C. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in manner to reduce breakage, cracking and spalling to a minimum.
- D. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere (even though covered by canvas) shall be stored in a weathertight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be provided with ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
  - 1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.
  - 2. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
  - 3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
  - 4. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.
  - 5. No stainless steel components shall come in contact with carbon steel products, in order to prevent contamination by rust.



PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01610

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## SECTION 01620

### IDENTIFICATION SYSTEMS (PROJECT SIGNS)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.
- C. Guidelines for Implementing the Bipartisan Infrastructure Law Signage Term and Condition for the State Revolving Fund Programs, provided in Appendix I of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Furnish, install, and maintain project signs.
  - 2. Furnish, install, and maintain DEP project file number signs.
  - 3. Furnish and install Bipartisan Infrastructure Law (BIL) project sign.
  - 4. Furnish and install dedication plaque.
  - 5. Remove sign on completion of construction.
  - 6. Allow no other signs to be displayed.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

##### 1.3 SYSTEM DESCRIPTION

- A. Project Signs:
  - 1. Painted signs with painted lettering, or standard products:

- i. Size of signs and lettering: As required by regulatory agencies, and/or as specified herein or as appropriate to usage.
  - ii. Colors: As required by regulatory agencies, otherwise uniform colors throughout Project.
  - iii. Furnish, erect, and maintain job instruction signs, such as "DANGER," "KEEP OFF," "NO PARKING," etc., as may be required to conduct the Work safely. Such signs shall be neat in appearance, maintained in good condition, and promptly removed when they have served their purpose.
2. Erect at appropriate locations to provide required information.
  3. A 4 ft. by 8 ft. project sign shall be displayed at the construction site. The sign shall have a white background with blue lettering. The sign shall indicate the following:

Owner's Name: Town of Sharon, MA  
Town Seal

Project Title: Wells 2, 3, and 4 Water Treatment Plant  
DWSRF Project #12443  
EPA DWSRF Seal

Engineer: Environmental Partners Group, LLC, Quincy,  
Massachusetts  
Company logo

Sub-Consultants: CGKV Architects, Cambridge, Massachusetts  
Odeh Engineers, North Providence, Rhode Island  
SAR Engineering, Inc., Braintree, Massachusetts

Contractor: Name and Address

For more information contact: Department of Public Works Department –  
Town of Sharon, MA (781) 784-1525

Uppercase lettering shall be 2.5" high by 1.5" wide. Lowercase lettering shall be 2.0" high by 1.5" wide.

Environmental Partners Group, LLC logo shall be located beneath Engineer's name.

4. Signs as specified in this section shall be prepared and installed. The signs shall be in accordance with municipal ordinances.
5. Contractor shall apply for all required permits to allow installation of project signs.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Submit manufacturer's product information in accordance with Section 01300 – Submittals.

#### 1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400.
- B. Finishes, Painting: Project sign shall resist weathering and fading for the duration of the construction period.

#### 1.6 MAINTENANCE

- A. Maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Wood Exterior Paint
  - 1. Tnemec Company, Inc., North Kansas, Missouri
  - 2. The Glidden Co., Cleveland, Ohio
  - 3. PPG Industries Inc., Pittsburgh, Pennsylvania
  - 4. or Engineer approved equal.

#### 2.2 MATERIALS

- A. Project Sign Materials
  - 1. Structure and Framing: May be new or used, wood in sound condition, structurally adequate to work, and suitable for specified finish.
  - 2. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints:
    - i. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.
  - 3. Wrought Hardware: Galvanized.
  - 4. Alkyd Gloss Paint System:
    - i. Give priming coat (2.5 mil thick) to entire woodwork of sign.

ii. Give two (2) (1.5 mil) coats of white exterior Alkyd Gloss paint to sign including framework.

5. Sign shall be a minimum size of 48 - inches by 96 - inches.

B. DEP Project File Number Signs

1. The signs shall be professionally prepared. Each sign shall be constructed of 3/4-inch minimum thickness exterior plywood (A-B) or APA high density overlay plywood (HDO).
2. All fasteners used in the sign construction shall be galvanized or stainless steel. All fasteners shall be rustproof.
3. The sign face backgrounds shall consist of at least three (3) coats of white outdoor enamel paint. The rear side to be painted with one (1) coat of white outdoor enamel paint. All lettering shall be black.
4. The Conservation Commission project file number signs shall be not less than 2-foot square or more than 3-foot square in area. The signs shall bear the words "MassDEP File #: SE 280-0653".

C. Signs shall be weather resistant material.

2.3 DEDICATION PLAQUE

- A. The plaque shall be cast bronze, Oshalloy C83450 by Matthews and Co., Pittsburgh, PA; Steel Art Boston, MA, Seaboard Graphic Inc, Woodmere, NY, or equal. The size shall be 36-inches (H) by 24-inches (W) with Matthews Single Line Border Style, BS-1 Mounting System (four bronze studs drilled and tapped into cast bosses in back) Helvetica Medium Letters and pebbled texture background. Border face and letters shall be light oxidized bronze with medium oxidized bronze background all as approved.
- B. Text shall include full names of the Owner, Department of Public Works Director and Water Superintendent, and appropriate personnel, Project name, names of Engineer and General Contractor and Date completed. For bidding purposes, allow for a total of 550 letters and numerals and the Town Seal. Final text and composition shall be furnished by the Engineer during construction.
- C. The entire plaque shall receive two shop coats of protective lacquer after fabrication and finishing.
- D. Dedication plaque shall be installed into holes drilled in masonry with waterproof cement in accordance with approved shop drawings. Installed location of plaque to be directed by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Project Sign

1. Wood surface shall be clean and dry. Paint exposed surface of supports, framing, and surface material; one coat of primer and two coats of exterior paint as indicated herein.
2. Paint graphics in styles, sizes, and colors selected.
3. Sign layout as approved by Engineer and Owner.

3.2 ERECTION

A. Project Sign:

1. Erect project signs at location selected by Engineer.
2. Maintain in good condition until completion of project.
3. Remove signs, framing, supports, and foundations at completion of project.

B. DEP Project File Number Signs

1. Mount sign adjacent to the work site. For projects with multiple sites, mount sign at construction trailer location. Post at the entrance of the site within clear view from the public way.

3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01620

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## SECTION 01650

### FACILITY START-UP/COMMISSIONING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this section of the Specifications includes providing a technical service representative from the equipment manufacturers furnished under Divisions 11, 13, 15, and 16. The technical service representative shall oversee/provide performance inspections, start-up services, performance testing, acceptance testing, and training.

- B. Work included:

1. The Contractor shall be responsible for the following:
  - i. Furnishing all plant, labor, equipment, supplies, consumables, chemicals, fees, utilities, appliances, and materials;
  - ii. Performing all operations in connection with start-up, testing, inspection, and commissioning of all mechanical and process-related equipment, including:
    - (a) Coordination of all functional tests, performance tests, demonstration tests, and all activities and responsibilities related to this section.
    - (b) Furnishing operating instructions for all equipment as required in the Contract Documents, prior to final acceptance.
2. The Engineer shall be responsible for reviewing and approving the Contractor's testing plan and schedule; witnessing all inspections, start-up tests, functional and performance tests; and assisting with the coordination of operations, testing, and training with the Owner.
3. The Owner shall be responsible for coordinating the operation of existing facilities, systems, and equipment to facilitate the Contractor's start-up requirements for the new facilities.
4. Refer to Section 13320 – Instrumentation and Controls for additional start-up, testing, and commissioning requirements and division of labor for the instrumentation and controls systems.

- C. Related Sections include the following:

1. Division 11 – EQUIPMENT

2. Division 13 – SPECIAL CONSTRUCTION
3. Division 15 – MECHANICAL
4. Division 16 – ELECTRICAL

### 1.3 SUBMITTALS

#### A. Submit the following in accordance with Section 01300 – Submittals:

1. A detailed plan and schedule for completing all required inspection, start-up, and performance tests as specified herein. The plan and schedule shall be approved by the Engineer. The Contractor is required to submit to the Engineer all equipment O&M manuals specified in the Contract Documents at least twenty-eight days (28) days prior to any scheduled equipment inspections or proposed test dates – **no exceptions**.
2. Qualifications for the Licensed Treatment Facility Operator to be responsible for assisting with the commissioning tests and overseeing the full system tests. Qualifications shall include but not be limited to: Grade II-T license, certified by the Massachusetts Board of Certification of Operators of Drinking Water Supply Facilities, and a minimum of 3 years of experience in the operation of a facility similar to the one specified. Submit a qualifications summary and resume at least twenty-eight days (28) days prior to any proposed test dates – **no exceptions**.
3. Detailed test procedures shall be submitted at least fourteen (14) days prior to the Contractor's proposed final inspection, start-up, and performance testing dates– **no exceptions**. This submittal shall include the proposed testing dates for each piece of equipment, the names of all technical representatives who will perform equipment tests, a testing record form supplied by the manufacturer to collect appropriate test data, a list of any/all laboratory testing required, the specific responsibilities of the Contractor and technical service representative to prepare for and execute the test, all electrical, chemical, water and waste disposal requirements for the tests, and a description of all activities which require coordination or assistance from the Owner.
4. An inspection report prepared by the manufacturer's technical service representative summarizing the results of the final inspection and start-up testing prior to performance testing shall be submitted. The report shall include certification that the equipment is properly installed and ready for operation and results of the test and adjustments performed.
5. Start-up and performance test reports shall be submitted within fourteen (14) days of completion of the tests. The reports shall include all information and results indicated in the detailed test procedures and any supplemental information from laboratory analysis, specified performance compared to actual performance test results, and if performance of equipment is not acceptable, a description of the actions to be taken prior to re-testing the equipment.

#### 1.4 LICENSED TREATMENT FACILITY OPERATOR

- A. The Contractor shall provide the service of a Licensed Treatment Facility Operator to be responsible for assisting with the commissioning tests and overseeing the full system tests. The water treatment facility operator shall have a Grade II-T license, certified by the Massachusetts Board of Certification of Operators of Drinking Water Supply Facilities. The operator shall have a minimum of 3 years of experience in the operation of a facility similar to the one specified. Contractor's personnel shall not be substituted for the licensed water treatment facility operator requirements.
- B. The following companies provide operations services:
1. WhiteWater, Inc.  
253B Worcester Road  
Charlton, MA 01507  
888-377-7678
  2. Veolia  
111 Fisher St  
Westborough, MA 01581  
508-836-3672
  3. Weston and Sampson  
221 Crowell Road  
Chatham, MA 02633  
508-954-5150
- C. Personnel-day requirements for the Licensed Treatment Facility Operator are listed exclusive of travel time, and do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.
1. Instruction and training on entire treatment plant: Sufficient time for classroom and field operation and maintenance instruction, but not less than:
    - i. 4 days
    - ii. Instruction shall be scheduled separately from other start-up and testing activities, unless approved by the Engineer.
  2. Full System Performance Testing: Sufficient time for field performance testing, but not less than:
    - i. 4 days
  3. Full System Demonstration Testing: Sufficient time for field performance testing, but not less than:
    - i. 8 days
  4. Post-Commissioning Operations Assistance: Full-time operations assistance following WTP commissioning:

- i. 5 days

## 1.5 COMMISSIONING REQUIREMENTS

### A. General

1. The Contractor shall be responsible for furnishing and installing all of the several kinds and types of equipment required in the facilities, for starting-up and testing each individual piece of equipment, all combinations of equipment as they may operate one in conjunction with another, and the complete system, such that each component and the entire facility operates as a fully functioning system that is acceptable to the Engineer, the Owner, and to any other municipal, State or Federal authorities within whose jurisdiction the operation of the facility may be a concern.
2. Equipment shall be inspected, started-up, and tested for proper operation (rotation, alignment, mechanical and electrical connections, performance) in the presence of the Engineer, and at no additional cost to the Owner.
3. At no time during the commissioning of the facilities shall any equipment or system be operated under a more severe condition than the maximum design condition for which the equipment is rated.
4. All treated water commissioning waste shall be treated in accordance with the requirements of the Contract Drawings and Specification Section 01110 – Environmental Protection Measures prior to discharge. Backwash waste from iron and manganese removal filters and PFAS removal filters shall not be discharged to the environment under any circumstances.
5. All spare parts, tools, lubricants shall be delivered to the Owner prior to performance testing.
6. All start-up and testing activities shall be completed in accordance with the requirements of the Sequence of Work on Sheet G-2.
7. The following representatives, at a minimum, shall be present simultaneously for the start-up and full system performance testing dates:
  - i. General Contractor.
  - ii. Electrical Subcontractor.
  - iii. HVAC Subcontractor.
  - iv. Plumbing Subcontractor.
  - v. Manufacturer's Technical Service Representatives.
  - vi. Instrumentation and Control System Integrator/Supplier.
  - vii. Licensed Treatment Facility Operator.
  - viii. Engineer.
  - ix. Application Engineer.
  - x. Owner and Owner's Representatives.

### B. Start-up Activities

1. All mechanical and electrical equipment shall be checked to verify it is properly connected. Preliminary run-ins of mechanical equipment shall be done to verify that it is operating properly. All systems and related work areas shall be cleaned of all debris and build-up.
2. All safety equipment shall be installed and operating properly prior to any equipment operation or performance testing.
3. Alarm and access control systems shall be tested to show they are capable of transmitting, annunciating, and controlling all specified alarm conditions and security features.
4. Instruments: Contractor shall furnish standards, calibrated meters, and necessary instruments, labor, and equipment to test installed instruments under the direction of the Engineer. Units will be tested to determine their accuracy, precision, and efficiency.

#### C. Functional Testing and Inspection of Equipment

1. After the installation of all permanent equipment is complete, and deemed ready for operation by the equipment manufacturer(s), the manufacturer's technical service representative and Contractor shall clean, inspect, start-up, test, calibrate, balance, align, and adjust as necessary all equipment to meet the manufacturer's requirements and all other requirements of the Contract Documents. The inspection and determination of required adjustments shall consider the completeness and integrity of the installed systems including proper electrical, process, and mechanical connections, alignment, clearances, proper rotation, noise, vibration, torque, speed, thrust restraint, and complete initial servicing including required sealing, lubricants, lubrication, and packing. All adjustments necessary to maintain the equipment warranty shall be made.
2. Conduct functional tests as described above on all individual equipment components until each individual component has achieved one (1) continuous hour of satisfactory operation.
3. The technical service representative shall submit the results of the inspection and functional testing including certification that the equipment was properly installed, is operating as specified, and documentation of all adjustments made.
4. Performance testing on equipment shall not be scheduled or commence until the equipment and systems have passed the functional testing and inspection requirements to the satisfaction of the manufacturer and Engineer.
  - i. Functional testing for the Well Station 4 equipment shall be completed following receipt of the MassDEP approval to operate the WTP with Well Stations 2 and 3.

#### D. Performance Testing

1. General Requirements

- i. Performance tests on all items and systems shall be made at the facility only after all inspections, start-up activities, and functional tests have been satisfactorily conducted by the Contractor, and the Contractor and Engineer are satisfied that the equipment is operating as specified.
- ii. Prior to performance testing of equipment all pipelines and appurtenances shall be inspected, pressure tested and found to be acceptable.
- iii. If equipment is unable to operate, initial calibration and/or additional adjustments are required, or representatives are absent, the performance test shall be canceled at that time and full re-scheduling will be required. Damages shall be assessed to the Contractor for Owner's, Owner's Representative, and Manufacturer's Representative time and expenses wasted on scheduling, coordinating and attending the failed performance test.
- iv. The performance tests are meant to verify and check the complete performance of the equipment for a fully functioning system, and are not a time for contractors' or manufacturers' representatives to begin or complete major calibrating, testing, and adjusting of their equipment to ensure it works or performs as required.
- v. All related costs and fees associated with completing the performance testing requirements shall be fully paid by the Contractor at no additional cost to the Owner.
- vi. Once all facilities are fully tested, operational, calibrated, and capable of operating in harmony with all new and existing systems, and performing as specified and approved by the Massachusetts Department of Environmental Protection, the Owner shall take occupancy of the equipment.

## 2. Performance Tests:

- i. All training as specified in Divisions 11, 13, 15, and 16 by manufacturer's technical service representatives shall be completed prior to the full system performance test.
- ii. Full System Performance Test: The successful performance of all systems, equipment and components shall be demonstrated to the satisfaction of the Engineer through the completion of a full system performance test. The performance test will consist of operating each system at design capacity for a period of 2 continuous hours without interruption. Where redundant or multiple systems, process trains, and pumping systems exist, each train shall be operated at design capacity and/or design loading rates separately. Downstream systems and process trains shall be completed simultaneously to simulate treated water flow. Failure of equipment to operate as specified will require the test to be repeated for another 2 hour period.
  - (a) Following performance testing and prior to the start of the Full System Demonstration test, the Contractor must complete all alarm and interlock testing to the satisfaction of the Engineer. Refer to Section 13320 – Instrumentation & Controls for additional information.
  - (b) Phase 2 Performance Testing: For Well Stations 2 and 3 and the WTP, full system performance testing shall use raw water from Well Stations 2 and 3. Well Station 4 shall continue to pump into the distribution system uninterrupted and shall not be available for full system performance testing.

- (i) Iron and manganese removal system full system performance testing shall be completed prior to PFAS system media commissioning and performance testing. This shall include pre-filtration chemical feed, recycle pumps, iron and manganese removal optimization, and backwash operations optimization.
- (ii) PFAS system media commissioning shall only commence once iron and manganese treatment full system performance testing has been completed in accordance with the requirements of this section.
- (c) Phase 3 Performance Testing: For Well Station 4 modifications, full system performance testing shall be required. Raw water from the Well Stations may be pumped into the WTP for treatment during testing.
  - (i) Performance testing for the Well Station 4 equipment shall be completed following receipt of the MassDEP approval to operate the WTP with Well Stations 2 and 3.
  - (ii) During Phase 3 Performance testing, the WTP shall run to waste. Performance testing shall occur between 9 PM and 5 AM and with permission from the Engineer/Owner. The Owner/Engineer maintain the right to cancel performance testing after it begins in the event of an emergency or due to higher-than-expected distribution system demands.

#### E. Full System Demonstration Testing

1. Full System Demonstration Test: After the successful completion of the Full System Performance Test, the Contractor shall conduct a Full System Demonstration Test. The Demonstration Test will consist of operating the water treatment plant and associated well facilities for (a) an uninterrupted 2 day period (48 hour period at 500 gpm with a backwash of each iron and manganese removal filter). Failure of equipment to operate as specified will require the entire test to be repeated until the fully required period of continuous operations is achieved.
  - i. For Well Stations 2 and 3 and the WTP, full system demonstration testing shall use raw water from Well Station 2 and 3. Well Station 4 shall remain in service and shall not be available for full system performance testing.
  - ii. For Well Station 4 modifications, full system demonstration testing shall not be required.
2. Substantial completion and facility acceptance will not be issued until the Full System Demonstration Test is successfully completed. Satisfactory performance shall be considered achieved once the facility equipment and systems, including the related electrical and instrumentation systems, have been operated and meet all performance criteria for the specified time periods.
3. Equipment to Meet Requirements: In the event of a failure to demonstrate satisfactory facility performance on the first or any subsequent attempt, it shall be the responsibility of the Contractor to make all the necessary and required changes, replacements, and tests to make the units meet the specified operating and efficiency requirements at no additional cost to the Owner.

4. The Contractor shall be fully responsible for the operation and maintenance of the new equipment and systems until the performance test has been completed and substantial completion has been issued.

## 1.6 GUARANTEE

- A. The Contractor shall guarantee the materials and equipment furnished and the performance thereof to be in accordance with the requirements of the Contract Documents and agrees upon written notice to make promptly and without charge, all necessary changes, corrections, and replacements (including installation of replacement parts) required to make good all defects developing in the material or equipment, under ordinary use and proper care, within a period of twelve months after final acceptance or substantial completion of the facilities.
- B. The manufacturer's technical service representative shall be experienced in the installation, operation and testing of the equipment and/or system they shall be responsible for inspecting, starting up and testing. The manufacturer's sales representative shall not be provided as the technical service representative.

## 1.7 OPERATION AND MAINTENANCE MANUALS

- A. Provide in accordance with Section 01730 and as specified.
- B. PDF versions of the Operation and Maintenance Manuals shall be submitted prior to start-up and final testing of equipment.
- C. The Contractor shall be responsible for any malfunction of, or damage to the equipment or system resulting from incomplete or incorrect instructions in the manual for the guarantee period specified elsewhere in this Specification.

## 1.8 TREATMENT EQUIPMENT USAGE

- A. Any partial or full usage of the proposed equipment by the Owner, and/or their employees or agents, prior to acceptance shall be the responsibility of the Contractor.

## 1.9 OPERATIONAL EXPENSES

- A. During the construction testing and start-up period, before the facilities are turned over to the Owner, the Contractor shall bear all expenditures and operational expenses of all systems included in the project, including electrical power, chemicals, maintenance, and fuel. After completion of the Full System Demonstration Test, the Contractor shall fill each chemical bulk tank 50% full of product.
- B. The Contractor shall be responsible for the proper handling, sampling, lab testing and analysis, and disposal of all water and wastes generated from the testing and start-up of the facility.

## PART 2 - PRODUCTS (NOT USED)



PART 3 – EXECUTION (NOT USED)

END OF SECTION 01650

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## SECTION 01700

### CONTRACT CLOSEOUT

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Closeout procedures.
  - 2. Final cleaning.
  - 3. Adjusting.
  - 4. Record Documents.
- B. Related Sections include the following:
  - 1. Cleaning up requirements are included in Section 01710.
  - 2. Warranties and Bonds are included in Section 01740.

##### 1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payment, and sum remaining due.
- D. Submit all warranties.
- E. Submit written notice that all subcontractors and suppliers have been paid in full.
- F. Submit written notice showing the disposition of all insurance filings and claims.
- G. Copy of "Statement of Compliance" filed with the Division of Labor and Workforce Development, as required under the State Wage Rate Provisions.

## 1.4 RECORD DOCUMENTS

- A. Maintain on site, one set of the following documents; actual revisions to the Work shall be recorded in these documents:
  - 1. Contract Drawings
  - 2. Specifications
  - 3. Addenda
  - 4. Change orders and other Modifications to the Contract
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Written interpretations and clarifications.
  - 7. Field orders.
  - 8. Field test reports properly verified.
- B. Store As-built Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
  - 1. Manufacturer's name, address, telephone number, and website and product model and serial number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and Modifications.
- E. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured horizontal and vertical location of excavation limits referenced to permanent surface bounds.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension of detail.
  - 5. Details not on original Contract Drawings.

## 1.5 FINAL CLEANING

- A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
1. Remove labels that are not permanent labels.
  2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
  3. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition and empty the tight tank. Clean light fixtures and lamps.
  4. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Clean the drainage system; remove sediment from catch basins, drain manholes, and hydrodynamic separators; remove silt sacks. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

## 1.6 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01700

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## SECTION 01710

### CLEANING UP

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. During its progress, the work and the adjacent areas affected thereby shall be cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.
- B. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.
- C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.
- D. The Contractor shall thoroughly clean all materials and equipment installed by him and his sub-contractors, and on completion of the work shall deliver it undamaged and in fresh and new-appearing condition. All mechanical equipment shall be left fully charged with lubricant and ready for operation.
- E. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01710



## SECTION 01730

### OPERATION AND MAINTENANCE DATA

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 2 – Site Work
  - 4. Division 3 – Concrete
  - 5. Division 4 – Masonry
  - 6. Division 5 – Metals
  - 7. Division 6 – Wood and Plastics
  - 8. Division 7 – Thermal and Moisture Protection
  - 9. Division 8 – Doors and Windows
  - 10. Division 9 – Finishes
  - 11. Division 10 – Specialties
  - 12. Division 11 – Equipment
  - 13. Division 12 – Furnishings
  - 14. Division 13 – Special Construction
  - 15. Division 15 – Mechanical
  - 16. Division 16 – Electrical

### 1.3 OPERATING AND MAINTENANCE INSTRUCTIONS AND PARTS LISTS

A. Where reference is made in the Detailed Technical Specifications to operating and maintenance and spare parts lists, the Contractor shall furnish for each piece of equipment two (2) complete sets giving the information listed below. In addition to providing hard copies, the Contractor shall furnish an electronic version of all documents in indexed and searchable PDF-format (on CD).

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

i. Contents:

- (a) Table of contents and index;
- (b) Brief description of each system and components;
- (c) Starting and stopping procedures;
- (d) Special operating instructions;
- (e) Routine maintenance procedures;
- (f) Clean and concise manufacturer's printed operating and maintenance instructions, adjustment, lubrication and other maintenance of equipment including: parts list, illustrations, and diagrams;
- (g) One copy of each wiring diagram;
- (h) One copy of each approved shop drawing and each Contractor's coordination and layout drawing;
- (i) List of spare parts, manufacturer's price, and recommended quantity; and
- (j) Name, address, and telephone numbers of local service representatives.

ii. Material:

- (a) Loose leaf on 60-pound, punched paper;
- (b) Holes reinforced with plastic cloth or metal;
- (c) Page size, 8-1/2-in. by 11-in.;
- (d) Diagrams, illustrations, and attached foldouts as required of original quality, reproduced by dry copy method; and
- (e) Covers: oil, moisture, and wear resistant 9 X 12 size.

B. Such instructions and parts lists shall be completely and neatly annotated so that only the specific equipment and features furnished are clearly indicated. References to other sizes and types or models of similar equipment shall be deleted or neatly lined out.

C. Such instructions and parts lists shall be delivered to the Engineer at the same time that the equipment to which they pertain is delivered to the site. Each submittal shall be accompanied by a transmittal form identifying the information included. Each submittal shall be reviewed by the Engineer for compliance with the above requirements.

### 1.4 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of Project, names, postal and email addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of

responsible parties; schedule of products and systems, indexed to content of the volume.

- B. For Each Product or System: List names, postal and email addresses, and telephone number of Subcontractors and suppliers; including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. A list of all parts for the equipment with each part identified by a functional name, the part manufacturer's name and a unique part number, (normally the part manufacturer's alpha-numeric designation). A list of parts keyed by non-unique item numbers to a sectional drawing will not be adequate to fulfill this requirement.
- E. All components of each system, e.g., pump motor, coupling, and drive, shall be combined in a single submittal with the above data provided for each component.
- F. Drawings: Supplement product data to illustrate relations of component parts, and data applicable to installation. Delete inapplicable information.
- G. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's printed instructions specified.
- H. Warranties and Bonds are as specified in Section 01740 - Warranties and Bonds.

#### 1.5 MANUAL FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's printed recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing, applicable reference standards, chemical composition, and details of installation. Provide printed recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specification sections.
- E. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

#### 1.6 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. For each Item of Equipment and Each System provide the following:

1. Description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include certified performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  2. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color coded wiring diagrams as installed.
  3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down, and emergency instructions; and summer, winter, and any special operating instructions.
  4. Maintenance Requirements:
    - i. Route procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
    - ii. Servicing and lubrication schedule, with list of lubricant type, frequency and method of lubrication. Any components which do not require lubrication or any expendable components which are not normally serviced shall be clearly noted as such.
    - iii. Manufacturer's printed operation and maintenance instructions.
    - iv. Sequence of operation by controls manufacturer.
    - v. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
    - vi. Lubrication and maintenance schedules shall be similar to that specified in Section 01300 - Submittals.
  5. Control diagrams by controls manufacturer as installed.
  6. Contractor's coordination drawings, with color coded piping diagrams as installed.
  7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  8. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
  9. Test and balancing reports as specified.
  10. Additional Requirements: As specified in individual product specification section.
- B. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

## 1.7 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. All Division 11, 13, 15, and 16 specifications shall have instructions/trainings recorded while they are being given to Owner's personnel. Recording shall be performed by a person or organization experienced in the production of recording and shall include the entire instruction session(s) and all questions and answers. Provide recording on one (1) CD-Rom and one (1) USB drive. Recordings shall become the property of the Owner.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in Operations and Maintenance Manual when need for such data becomes apparent during instruction.
- D. Provide a completed and filled-out Equipment Manufacturer's Certificate of Installation, Testing and Instruction form attached to the end of this section.
- E. Training/Instruction shall be scheduled separately from installation checkout and testing, unless approved by the Engineer.

## 1.8 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall arrange for a qualified service representative from each company manufacturing or supplying the equipment specified in the Detailed Technical Specification Sections.
- B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include but shall not be limited to, the following points as applicable:
  - 1. Soundness (without cracked or otherwise damaged parts).
  - 2. Completeness in all details, as specified.
  - 3. Correctness of setting, alignment, and relative arrangement of various parts.
  - 4. Adequacy and correctness of packing, sealing, and lubricants.
- C. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
- D. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results

obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a Certificate of Compliance stating that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

- E. After the Engineer has reviewed the reports from the manufacturers' representatives, the Contractor shall make arrangements to have the manufacturers' representatives present when the field functional and performance tests are made.
- F. Refer and conform to the additional requirements specified in Section 01400 - Quality Assurance and Section 01650 – Facility Start-up/Commissioning.

#### 1.9 NAMEPLATES

- A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.
- B. This requirement shall not apply to standard, manually operated hydrants.
- C. Each process valve shall be provided with a substantial tag of non-corrodible metal securely fastened in place and inscribed with an identification number in conformance with the drawings or furnished later by the Engineer.

#### 1.10 LUBRICANTS

- A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this contract.

#### 1.11 SPECIAL TOOLS

- A. For each type of equipment furnished by him, the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.
- B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
- C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

### PART 2 - PRODUCTS - (NOT USED)

### PART 3 - EXECUTION - (NOT USED)

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION,  
TESTING AND INSTRUCTION

Owner: Town of Sharon, MA

Project: Wells 2, 3, and 4 Water Treatment Plant

EP Project No.: 245-2103

EQUIPMENT SPECIFICATION SECTION \_\_\_\_\_

EQUIPMENT DESCRIPTION \_\_\_\_\_

I \_\_\_\_\_, Authorized representative of  
(Print Name)

\_\_\_\_\_  
(Print Manufacturer's Name)

hereby CERTIFY that \_\_\_\_\_  
(Print equipment name and model with serial No.)

installed for the subject project (has) (have) been installed in a satisfactory manner, (has) (have) been satisfactorily tested, (is) (are) ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit(s) on

Date: \_\_\_\_\_ Time: \_\_\_\_\_

CERTIFIED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
(Signature of Manufacturer's Representative)

WITNESSED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
(Signature of Owner's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

(I) (We) the undersigned, authorized representatives of the \_\_\_\_\_  
and/or Plant Operating Personnel have received classroom and hands-on instruction on the operation,  
lubrication, and maintenance of the subject equipment and (am) (are) prepared to assume normal  
operational responsibility for the equipment:

\_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_ Date: \_\_\_\_\_

END OF SECTION 01730



## SECTION 01740

### WARRANTIES AND BONDS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

##### 1.3 RELATED WORK

- A. Refer to General Conditions of the Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01700 - Contract Closeout.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be under warranty are included in the individual Sections of Division 2 through 16.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

##### 1.4 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
- B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.

- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- E. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the "Warranties and Bonds" binder.
- F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the "Warranties and Bonds" binder, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.
- H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
- I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
- J. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- K. In addition to providing hard copies, the Contractor shall furnish an electronic version of all documents in indexed and searchable PDF-format (on CD).

## 1.5 WARRANTY REQUIREMENT

- A. Related Damages and Losses: When correcting Work under warranty that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of Work under warranty.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding; reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.
- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

## 1.6 DEFINITION

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

### PART 2 - PRODUCTS - (NOT USED)

### PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01740

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## SECTION 01850

### TRAFFIC MANAGEMENT

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. The Massachusetts Department of Transportation Construction Standards, most recent version, shall apply to all materials furnished under this section. When conflicts arise between this specification and the Construction Standards, the Contractor shall coordinate with the Owner and/or Engineer for a final decision.

##### 1.2 SUMMARY OF WORK

- A. This section includes the following:
  - 1. Pedestrian, vehicular traffic and other safety control devices, construction signs, requirements, and management for the protection of the traveling public and working personnel during construction and related operations.
  - 2. Establishing, maintaining, and removing detour routes as shown on the Plans or as directed by the Owner and/or Engineer in order to perform the proposed construction.
  - 3. The design, application, and installation of all devices required by this section shall conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) latest edition, Part VI, published by the Federal Highway Administration (FHWA), the Massachusetts Amendments to the MUTCD latest edition, MassDOT Work Zone Safety Guidelines for Massachusetts Municipalities and Contractors, MassDOT Construction and Traffic Standard Details (1996), Americans with Disabilities Act (ADA), and the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges with all subsequent Special Provisions and Supplemental Specifications, hereinafter referred to as the "MassDOT Standard Specifications", Section 850, and MassDOT "Standard Details and Drawings for the Development of Temporary Traffic Control Plans", except as modified herein.

4. Traffic management during construction and maintenance operations includes installing and maintaining temporary vehicular, pedestrian and construction facilities, furnishing, installing, inspecting, positioning, repositioning, and removing channelization devices necessary to maintain pedestrian and vehicular traffic during construction and fencing of excavations as required for the protection of the public and all project personnel.
5. All construction vehicles not protected by any form of traffic control device on a project which is open to traffic shall have an amber flashing light mounted on the cab roof or on the highest practical point of the machinery. The light shall be in operation whenever the equipment is working on the highway or travelway. Amber flashers must be a minimum of 40 candelas and have a flashing frequency of 50 to 60 times per minute. Either rotating beacons or strobe lights meeting these requirements are acceptable.
6. All materials provided by the Contractor under the items of this section shall remain the property of the Contractor upon completion of the project, unless otherwise specified below.
7. Any traffic management and traffic detours proposed by the Contractor shall be subject to approval by the Owner and/or the Engineer. The Contractor shall provide detailed Traffic Management Plans and detour maps indicating the proposed detour routes, all proposed signs, the proposed hours of operation, the proposed locations of police detail officers and barricades for each phase of construction two weeks before the intended implementation date for approval by the Owner and/or the Engineer. Work shall not proceed without specific notice to and approval of the Owner and/or the Engineer. Any detours or changes in normal traffic patterns or road closures shall be coordinated by the Contractor with the Owner and/or Engineer, local Police Department, and Fire Department.
8. "Approved by the Owner" throughout this Section shall mean the approval of the Town of Sharon.

### 1.3 HOURS OF OPERATION

- A. Daily restricted hours of operation shall be between 7:00 am and 5:00 pm Monday through Friday on Local roads. Construction shall be coordinated around other nearby construction projects, and heavy seasonal traffic which may further prohibit construction in the streets during certain periods to retain adequate circulation.
- B. The Contractor can request permission for construction on Saturdays. Such work cannot be performed without permission from the Owner and/or the Engineer.

## 1.4 SUBMITTALS

- A. Shop Drawings: Contractor shall submit the following in accordance with Section 01300 – SUBMITTAL PROCEDURES:
1. Traffic Management Plans: Where designs for pedestrian and traffic control devices are not specifically indicated on the Contract Drawings or for any variations from the Traffic Management Plans on the Contract Drawings, the Contractor shall prepare and submit to the Owner and/or Engineer for approval, a traffic management plan, complete with details of the proposed methods, including materials for approval two weeks before implementation. This includes but is not limited to road closures and detour routes for each phase of construction including time periods of work, temporary pedestrian and construction facilities, locations of signage, portable changeable message signs, police and other traffic control devices to maintain traffic and access to abutting properties.
  2. Shop Drawings
    - a. Submit complete shop drawings for traffic management plans, including temporary pedestrian sidewalks and driveways, as needed, certified by a Professional Engineer registered in the Commonwealth of Massachusetts.
    - b. Show on the shop drawings all materials, including traffic control devices, signs and methods of installation.
    - c. Include with the shop drawings alignment tapers, lane widths, police detail locations, temporary pavement markings, barriers and traffic control device spacing.
    - d. The Contractor shall submit in writing proposed road closures and anticipated detour routes and signage based on the provided information for approval two weeks prior to implementation.
  3. Safety Signing for Construction Operations. Where not indicated on the Contract Drawings, the Contractor shall submit temporary traffic management plans and sign placement and size sketches showing the proposed sign setups he intends to use to provide the necessary traffic control and protection during the progress of the work, plus the sign and legend size and layout. These sketches shall also be submitted to the Owner and/or Engineer for review and approval two weeks before work begins. Particular care shall be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety. Traffic control devices required only during

working hour operations shall be removed and the appropriate signs shall be covered at the end of each working day.

4. The Contractor shall submit to the Owner and/or Engineer the information required by this section a minimum of two weeks prior to the start of construction and prior to the start of construction at any new location throughout the duration of work under this contract for approval. Work shall not proceed without specific notice to and approval of the Owner and/or Engineer.

#### 1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 and as specified.
- B. No material shall be stored within the work area or on adjacent roadways or residential streets except which is needed for work being performed for that day.

#### 1.7 TRAFFIC CONTROL REQUIREMENTS

- A. The Contractor shall meet the following conditions, unless otherwise specifically approved by the Owner and/or Engineer:
  1. All work shall be prosecuted with proper regard for the convenience of the public and in a manner to permit unimpeded traffic flow whenever possible. The interruption of traffic will not be permitted unless specifically allowed by the Owner and in accordance with the requirements of the Owner and/or Engineer and in conformance with MUTCD requirements.
  2. Traffic control devices and signs shall be removed, demounted or properly covered for those periods of the day not in use or not applicable.
  3. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefore from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he/she shall make such repairs or provide such temporary ways or guards without delay that are acceptable to the Owner and/or Engineer.
  4. Streets, roads, private ways, and walks under construction and not closed shall be maintained passable and safe at all times by the Contractor, who shall assume and have full responsibility for the



adequacy and safety of provisions made therefore.

5. The Owner and/or Engineer shall be notified of any re-routing of traffic two weeks in advance. Approval must be obtained from the Owner and/or Engineer prior to any rerouting of traffic (except emergencies). Following receiving approval from the Owner and/or Engineer, it will be the Contractors responsibility to coordinate with other agencies or departments including Police and Fire Department in writing a minimum of 72 hours prior to road closures. This will include providing the Police Department, Fire Department and Department of Public Works with the following information:
  - a. A list of streets and intersections where work will be in progress to be supplied at intervals as required by the Owner and/or Engineer.
  - b. Immediate notification of any utility breaks.
6. The Contractor is responsible for notifying abutters of anticipated construction adjacent to their property and the anticipated temporary alterations in circulation through distribution of written notices 72 hours in advance.
7. No operations shall be conducted, including the loading or unloading of vehicles, on or near the traveled lanes or road shoulders without first erecting warning signs and channelizing devices as directed. These precautions shall be maintained at all times while work is in progress.
8. Construction signs and channelizing devices shall be used to separate traffic from the work areas and for traffic control. Placement, other than as shown in the Contract Drawings or the MUTCD, will require prior approval from the Owner and/or Engineer.
9. Temporary signs and channelizing devices shall not be set up until there is adequate visibility or appropriate construction lighting. The Contractor shall schedule his work so that temporary signs and channelizing devices are removed and traffic is returned to its normal pattern before the end of the work period.
9. Work operations shall not be performed on the roadway in such a manner that traffic is obstructed or endangered from either side of the roadway.
10. The Contractor shall keep all roadway areas open to traffic as clear as possible at all times. Materials shall not be stored on any roadway area or within 10 ft. of the traveled way. Material shall be delivered to the installation areas as they are needed to provide a continuous

installation. Location of storage areas shall be subject to approval.

11. The Contractor shall remove all equipment and construction vehicles from the traveled way and shoulders open to traffic during non-work hours. Vehicles shall be parked no closer than 10 feet from the traveled way in pre-approved areas unless specifically permitted.
12. Temporary signs and channelizing devices shall not be set up in inclement weather.
13. The Contractor shall provide necessary, unimpeded access for fire apparatus and other emergency vehicles through the work zones to abutting properties at all times.
14. Sweeping and cleaning of surfaces beyond the limits of the project required cleaning up material caused by spillage or vehicular tracking during the various phases of the work shall be considered as incidental to the work being performed under the Contract and there will be no additional compensation. Sweeping and cleaning shall be done daily.

## 1.8 EXCAVATIONS

- A. The Contractor shall excavate for the amount of work to be completed and subsequently backfilled that same day (except for drilling, jacking and receiving pits). Open excavations shall not remain open through non-work hours, unless prior approval is obtained from the Owner and/or Engineer (except for drilling, jacking and receiving pits).
- B. All open excavations shall be adequately safe guarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Owner and/or Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, special construction procedures shall be taken, such as limiting the length of open trench.
- C. The Contractor shall not enter upon or occupy with men, tools, equipment or materials any property outside the rights-of-way or property of the Owner, except after the written consent of the Owner and/or Engineer.
- D. The Contractor shall erect substantial barriers at the ends of open ditches; stockpiled construction materials or other obstructions and shall erect warning signs and provide adequate lights or flares to guard the barriers, trenches, and excavation.
- E. At the end of each work day the Contractor shall fill in or cover with steel plates of adequate strength to carry traffic all open trenches, test pits or other excavations. The roadway shall be free of construction debris and excavated

material and shall be relatively smooth to provide safe passage.

- F. At the end of each work week, backfilled excavations shall be paved with hot mix asphalt in accordance with the Drawings and Section 02576 of these specifications. Temporary paint pavement markings that match the existing markings disturbed by the excavation shall be applied to the new pavement in accordance with the MassDOT Standard Specifications and MUTCD.

## 1.9 COORDINATION OF WORK AREAS

- A. The Contractor shall be responsible for the coordination of his/her work with all utility or roadway work being performed by the Town and/or utility owners in relation to this project or projects near this project in order to retain adequate circulation throughout the area. The Contractor shall phase all work in a manner that will provide positive and safe through movement of traffic passing the construction site.

## 1.10 ACCESS TO PROPERTIES

- A. At least one serviceable driveway access to all residences and businesses within the project shall be maintained at all times.
- B. The Contractor shall coordinate the work with the schedules of delivery trucks to the adjacent stores and property owners so as not to impede their access.

## 1.11 HAULING

- A. The Contractor is advised that all roads and bridges within or adjacent to the project shall be subject to legal loads and vehicles.
- B. The Contractor is advised that no agreements have been made by the Town of Sharon or MassDOT with surrounding cities or towns to relieve the Contractor of liability for damage to local roads and bridges caused by the Contractor's operation. The Contractor shall contact appropriate officials of the surrounding cities or towns concerning hauling over city or town roads and bridges.
- C. The Contractor shall furnish 60" x 30" approved signs reading "CONSTRUCTION VEHICLE - DO NOT FOLLOW" to be used on trucks hauling to the project, when such signs are deemed necessary by the Engineer. The color, type of sheeting and size of lettering shall conform to that of the permanent construction signs.
- D. Each driver of any vehicle used on this contract shall have furnished written instructions concerning the manner of operation for that vehicle. Specifically, these instructions shall warn against stopping on the traveled portions of the roadway, against passing other vehicles, and against traveling in close

proximity to other vehicles. A copy of these instructions shall be given to the Engineer.

#### 1.12 DETOUR ROUTE

- A. The Traffic Management Plan identifies roadways that may be considered for temporary detour routes. Once specific staged work zones have been established by the Contractor, the Contractor shall submit detour routes and Traffic Management Plans to the Owner and/or Engineer for approval a minimum of two weeks prior to anticipated implementation.
- B. The Contractor shall coordinate and time construction with other construction projects nearby to maintain adequate circulation.
- C. The Contractor is permitted to install construction signage and other traffic control devices prior to opening the detour. Temporary traffic control devices installed prior to the detour shall be covered or rendered inoperative until the detour begins. Temporary traffic control devices no longer needed after the last day of the detour shall be covered until they are removed.
- D. Portable Changeable Message Signs (PCMS) will be in place and operational one week prior to anticipated construction to warn drivers of altered circulation patterns. Locations and messages for PCMS's will be shown on the Contractor's submitted Traffic Management Plans and as approved by the Owner and/or Engineer.
- E. The Contractor shall cover all existing traffic signs that are in conflict with the detour route. Existing pavement markings that conflict with detour traffic shall be removed in accordance with the MassDOT Standard Specifications, Section 850.
- F. Upon completion of the detour, the Contractor shall restore all pavement markings to the existing conditions and uncover existing traffic signs.

#### 1.13 PEDESTRIAN TRAFFIC

- A. Sidewalks shall be maintained at all times throughout the construction period. Temporary sidewalks, pedestrian detours, and pedestrian and construction facilities shall be constructed as needed to maintain pedestrian traffic and business access, as shown on the Plans or as directed by the Owner and/or Engineer. Walkways of 5 feet minimum width (not including curb width) will be provided at all times unless otherwise approved by the Owner and/or Engineer. All permanent and temporary sidewalk construction shall be in accordance with ADA requirements including clearance around obstructions, slopes, and alignments.
- B. Pedestrian access will be provided to abutting land uses such as residences and businesses at all times, as approved by the Owner and/or Engineer and in

accordance with ADA requirements.

- C. Temporary pedestrian walkways shall be separated from roadway and constructed areas by barricades as approved by the Owner and/or Engineer.

#### 1.14 CONSTRUCTION AND ADVANCE WARNING SIGNS

- A. Construction and advance warning signs shall be in accordance with the MUTCD, MassDOT Standard Specifications, Section 850 – Traffic Controls for Construction and Maintenance Operations and the provisions of this Section.
- B. Construction and advance warning signs shall be replaced, covered, uncovered, furnished, positioned, repositioned, inspected, maintained, and removed as often as necessary and or directed by the Owner and/or Engineer, including regulatory, warning, and guide signs and temporary bus stop signs and taxi stop signs and their supports.
- C. All signs which are damaged or are missing from their location will be replaced by the Contractor without additional compensation.
- D. All signs will be maintained by the Contractor in a satisfactory manner including the removal of dirt or road film that causes a reduction in sign retroreflectivity.
- E. Special construction signs will be furnished and installed by the Contractor during the work to improve traffic flow or safety, as directed by the Owner and/or Engineer.

#### 1.15 PORTABLE CHANGEABLE MESSAGE SIGN

- A. Portable Changeable Message Signs shall be in accordance with the MassDOT Standard Specifications, Section 850 and the provisions of this Section.
- B. All messages signs location and displayed shall be submitted by the Contractor to the Owner and/or Engineer two weeks prior to construction for approval.
- C. Message signs shall be installed one week prior to detours being in place to warn drivers and shall be kept fully operational by the Contractor throughout the duration of the work.
- D. The Contractor shall be responsible for positioning, repositioning, operating, maintaining, revising messages, and removing the message signs as needed or as directed by the Owner and/or Engineer.

## 1.16 TRAFFIC CONTROL DEVICES

- A. Install, inspect, maintain, reposition and remove all temporary traffic control devices and construction elements as often as necessary and as directed by the Owner and/or Engineer in accordance with an approved construction staging sequence and traffic management plan.
- B. Materials required for the work of this Section need not be new, but must be in first-class condition and acceptable to the Owner and/or Engineer and meeting requirements set for the MUTCD and MassDOT standards. Any materials, that in the judgment of the Owner and/or Engineer, are unsatisfactory in appearance or performance shall be removed and immediately replaced by the Contractor with acceptable units.
- C. All traffic control devices shall be in accordance with MassDOT Standard Specifications, Section 850 and the provisions of this Section.
- D. Temporary Safety Signing
  - 1. Safety Signing shall consist of furnishing, positioning, repositioning, covering and uncovering, maintaining and removing, as needed and/or as directed: regulatory, warning, and guide signs together with their supports. If additional supports are needed due to site conditions they will be considered incidental to the work.
  - 2. Any temporary safety sign no longer applicable shall either be removed or covered as soon as possible.
  - 3. No temporary safety sign shall be visible to traffic that may conflict with actual roadway conditions.
  - 4. Signs over 50 square feet will require approval of design calculations and shop drawings of the breakaway support system if the signs are installed at an unprotected location.
  - 5. Site conditions including signage will be returned to pre-construction conditions at the completion of that phase of construction.
- E. Sign Covers
  - 1. Cover any existing regulatory and warning signs as necessary and as directed by the Owner and/or Engineer.
  - 2. Use a cover approved by the Owner, which shall be securely fastened to the existing sign and shall completely cover the legend of the existing sign. The cover shall remain in place as long as necessary at which time it shall be promptly removed.

3. Signs shall be covered without causing any damage to the existing sign. Damaged signs will be replaced by Contractor at no additional cost to the Owner.
- F. Temporary Pavement Markings
1. Temporary Pavement Markings shall consist of furnishing, applying, maintaining and removing temporary white and yellow reflectorized pavement markings during construction and maintenance operations.
  2. Temporary markings shall be effective for a period of 90 days. Re-application or replacement within the 90 day period shall be done at no additional cost to the Owner.
- G. Pavement Marking Removal
1. Pavement Marking Removal shall consist of removing existing pavement markings no longer applicable as required to support the Traffic Management Plan through the approved techniques outlined, or as directed by the Owner and/or Engineer.
- H. Arrow Board
1. Arrow Board shall consists of providing, operating, positioning, repositioning, maintaining and removing a portable truck-mounted or trailer-mounted flashing arrow unit on the project at designated locations as shown on the approved traffic management plans or as directed.
- I. Reflectorized Drums
1. Reflectorized Drums consists of furnishing, positioning, repositioning, maintaining, and removing reflectorized plastic drums and necessary ballast, as needed and/or as directed by the Engineer including locations of lane closures, shifting traffic, road closures, channelizing or otherwise re-directed traffic. The use of cones will not be permitted.
  2. Traffic Drums shall conform to Drawing No. TR.7.1 of the MassDOT Construction and Traffic Standard Details, 1996 edition and MUTCD.
- J. Pavement Marking Removal
1. Pavement Marking Removal shall consist of removing existing pavement markings as required to support the Traffic Management Plan or as directed through the approved techniques, outlined.

K. Temporary Barrier

1. Temporary Barrier shall consist of furnishing, installing, maintaining and final removal of temporary barriers, including delineation, for traffic control or work zone protection in construction zones. This barrier shall be continuous as a unit across bridges and other limited construction areas unless designated on the plans as "Temporary Restrained Barrier."
2. Vehicular traffic within 30 feet of the travelled way shall not be exposed to blunt ends of barrier without acceptable impact attenuators with delineation.
3. Temporary Barrier shall be removed, transported and reset from the alignments established along the roadway to new alignments as required by the construction and staged construction operations for the control of traffic or work zone protection.
4. Temporary Barrier shall be installed where required by the Owner to protect the work zones and excavations, which cannot be completed and backfilled within a daily work period. Barriers shall be removed when no longer required.
5. Temporary barrier for use for temporary pedestrian and construction facilities shall have three (3) sleeves cast in each section of barrier to receive a post for panel and fence installations.
6. Temporary barrier shall conform to Drawing Nos. E403.1.0 to E403.7.0 of the MassDOT Construction Standard Details dated June 2014 with the latest revision.

L. Temporary Restrained Barrier

1. Temporary Restrained Barrier shall consist of furnishing, installing, removing, transporting, resetting, maintaining and final removal of temporary restrained barriers on bridge decks and other locations including delineation, in accordance with details as shown on the traffic management plans and/or bridge plans and as directed by the Owner and/or Engineer.
2. The work shall also include furnishing and installing all hardware and associated materials necessary to restrain the barriers in position, or attach the barriers to the roadway or the bridge deck.
3. Only barrier systems that have been crash tested and approved by FHWA are acceptable for the intended use.

M. Portable Breakaway Barricades Type III



1. Portable Breakaway Barricades Type III shall consist of furnishing, positioning, transporting, repositioning, maintaining, and final removal of portable barricades as shown on the approved traffic management plan or as directed by the Owner and/or Engineer.
2. Barricades shall be maintained in good and serviceable condition throughout the duration of the Contract.

N. Temporary Impact Attenuators

1. Temporary Impact Attenuators shall consist of furnishing, installing, removing, relocating, reinstalling, maintaining, and final removal of temporary impact attenuators in conformance with the specifications of the manufacturer and MassDOT.

O. Truck Mounted Attenuator

1. Truck Mounted Attenuator shall consist of furnishing a moveable impact attenuator equipped with a flashing arrow board. The impact attenuator can be either a truck-mounted or a tow-behind unit and shall conform with the specifications of the manufacturer and MassDOT.

P. Temporary Fence

1. Temporary fence shall consist of furnishing and installing, removing and resetting and the dismantling of 6-foot high temporary fence to separate construction activities from public access and as determined and required by the Owner and/or Engineer.
2. The temporary fence shall be constructed at locations as directed by the Owner and/or Engineer. The Contractor shall install and maintain temporary construction fences around the construction site, stockpile areas, and any and all exposed excavations located outside the defined roadway area, accessible to the public until such time it is no longer necessary as determined by the Owner and/or Engineer. Carefully protect all areas of the site from intrusion and trespass. Protect Public Health Safety and Welfare at all times.
3. The Contractor is responsible for relocating the fence as many times as required to properly protect construction activities.

## 1.17 POLICE DETAILS

- A. The Contractor shall coordinate with the Owner, Police Department, and Engineer to determine daily uniformed police detail requirements for the control of pedestrians and vehicular traffic within the project area for each

stage of construction.

- B. The decision to use a police detail at a specific project location shall be shown on the Traffic Management Plans approved by the Owner and/or Engineer or as directed by the Owner and/or Engineer.
- C. Contractor is responsible for scheduling of all uniformed police details. The Police Department will invoice the Owner directly for accepted Police Details.
- D. It is the Contractor's responsibility to cancel Police Details a minimum of four hours in advance of the start of the shift if conditions so warrant. The Contractor will be responsible for reimbursing the Police when the cancellation notice is not given by the Contractor in a timely fashion. Lateness or failure to show on the part of the Contractor or inclement weather shall not excuse the Contractor from the obligation to give adequate notice to the Police Department. Payment for Police Details not cancelled as required will be the responsibility of the Contractor.
- E. Road closures shall not be allowed without prior permission of the Owner, Police Department, and Fire Department.

#### 1.18 PERMITS

- A. The Contractor shall be responsible for obtaining any permits to perform the work.

### PART 2 - PRODUCTS

#### 2.1. GENERAL

- A. Devices required under this Section need not be new but must be in first class condition and acceptable to the Owner and/or Engineer. The condition of the work zone traffic control devices shall meet the quality standards set forth in the Quality Standards for Work Zone Traffic Control Devices compiled by the American Traffic Safety Services Association (ATSSA). Any devices that, in the judgment of the Owner, are unsatisfactory in appearance and/or performance shall be removed and immediately replaced by the Contractor with acceptable devices.

#### 2.2. PORTABLE CHANGEABLE MESSAGE SIGN

- A. The Portable Changeable Message Sign shall be capable of performing all functions at ambient temperatures ranging from -31° to 165 ° F (-35 ° to 74 ° C). There shall be no degradation of operation due to fog, rain or snow. A radar detector activator meeting the requirements shall be considered part of this item.
- B. Maintenance shall include periodic cleaning. When not being used the sign

shall be stored in a secure area approved by the Owner and/or Engineer.

C. The Portable Changeable Message Sign shall consist of the following major components:

1. Message Sign:

- a. Type – The technology can be LED or a combination of both Flip Disk and LED (Hybrid).
- b. Matrix Displays – Shall be character, line or full matrix.
- c. Size – The message sign shall have a minimum height of 6 feet, maximum height of 6.5 feet and a minimum width of 8 feet, maximum width of 12 feet.
- d. Colors – The display shall be either fluorescent yellow or ITE amber.
- e. Lines – The message sign shall have the capability of displaying at least three lines of 18 inch characters with a minimum of 8 characters per line.
- f. The sign shall be illuminated for nighttime visibility.

2. Operator Interface: A means of creating and controlling the display message(s) on-site and remotely through an NTCIP compatible IP addressable modem, shall be provided with each sign. The operator interface shall contain as a minimum the following:

- a. Display terminal with keyboard to allow previewing the message content and format before it is sent to the sign panel. The keyboard shall be of a standard design.
- b. Controller (CPU).
- c. Lockable weatherproof enclosure for interface components.

3. Controller: The Controller shall possess, at a minimum, the following features:

- a. Full 32K user memory with the option for additional archive memory.
- b. Capacity to store a minimum of 50 messages.
- c. Changeable message flash rate capability.

- d. A minimum of 24 hour battery back-up.
  - e. Password activation shall be software available.
4. Power Supply: The sign shall be capable of operation from a diesel powered generator, a battery or solar power. The power supply shall be protected from the weather and be locked for security.
  5. Trailer: The trailer shall have at least the following features:
    - a. A current Registry of Motor Vehicles registration.
    - b. Swivel jacks capable of leveling the trailer on a 1:6 (1 vertical to 6 horizontal) slope and capable of stabilizing the trailer in winds of up to 80 miles per hour.
    - c. The sign shall be capable of being locked in a stowed position while being towed.
    - d. A lift mechanism shall be provided to elevate the sign to its operating position.
    - e. The capability to lock the sign panel in several off-angle positions with respect to the trailer axis.

### 2.3. TRAFFIC CONTROL DEVICES

#### A. Temporary Safety Signing

1. Rigid signs shall be fabricated from plywood, aluminum or approved alternate substrate material.
2. Plywood sign material shall be 5/8 inch Exterior MDO – General (one sided).
3. Aluminum sign material shall be Type A, 0.08 inches thick as specified in MassDOT Standard Specification Subsection 828.42.
4. Route marker overlay on directional sign panels shall be fabricated from Aluminum Alloy 5052-H38 0.08 inches thick.
5. The entire sign face shall be retro-reflectorized. Reflective sheeting shall meet the requirements of ASTM D4956 and AASHTO M268, and as Flexible High Intensity Prismatic (HIP) Sheeting to ASTM Type VII or better.
6. Rollup signs shall be fabricated from vinyl microprismatic retroreflective material.

7. Background sheeting for all construction warning signs shall be of a fluorescent orange color. The minimum spectral radiance factor, in accordance with Section 5.1 of ASTM E991, for the fluorescence shall be as follows:

New	110% minimum
Weathered	60% minimum

B. Temporary Pavement Markings

1. Glass beads, tapes and paints used for temporary pavement markings shall be lead free, conform to MassDOT Standard Specification, Subsections M7.01.07, M7.01.16, M7.01.23 and M7.01.24, and meet the retroreflectivity requirements of the MUTCD for a period of 90 days. Final determination as to pavement marking quality shall be made by the Engineer. The Contractor shall supply a retroreflectometer for this purpose.
2. The colors of the marking materials shall be the standard highway colors of white or yellow and as outlined in the MUTCD.

C. Arrow Board

1. The unit shall consist of a black background panel meeting the requirements of MUTCD Type C and shall contain at least 15 amber lamps of approximately 8,000 initial maximum candelas each.
2. Panels shall have the capability of the following mode selections: (1) left or right flashing or sequential arrows; (2) left or right sequential chevrons; (3) flashing double arrow; (4) flashing caution and (5) alternating diamond caution.
3. Panels shall automatically provide for a minimum of 50 percent dimming from their rated lamp voltage at night. The flashing rate of the lamps shall not be less than 25 or more than 40 flashes per minute.
4. Minimum mounting height should be 7 feet above the roadway to the bottom of the panel, except on vehicle-mounted panels, which should be as high as practicable.
5. The arrow board shall include a radar detector activator meeting its requirements.

D. Reflectorized Drums

1. Reflectorized drums shall be plastic and shall meet the applicable requirements of the MUTCD.

2. Reflective sheeting for drums shall meet the requirements of ASTM D4956 and AASHTO M268, and the Flexible High Intensity (H/I) Sheeting for ASTM Type VI and shall be six inches wide.
  3. Reflectorized drums are listed on the MassDOT Qualified Construction Materials list.
  4. The first five drums used for any taper or as designated on the Traffic Management Plan shall be equipped with flashing lights, or as directed by the Owner and/or Engineer.
- E. Temporary Barrier
1. Temporary barriers shall be precast and manufactured in accordance with the plans and Section 629 of the MassDOT Standard Specifications.
  2. The Contractor shall supply a barrier and anchorage system that was crash tested in accordance with NCHRP 350, TL-3 or MASH, TL-3 and accepted by FHWA.
- F. Temporary Restrained Barrier
1. Temporary restrained barriers for use on roadways or on bridges shall be restrained by blocking or other system, affixed to the roadway by pinning, set into the roadway surface or other tested system or bolted down to the bridge deck, and shall be manufactured in accordance with the plans and Section 629 of the MassDOT Standard Specifications.
  2. The Contractor shall supply a barrier and anchorage system that was crash tested in accordance with NCHRP 350, TL-3 or MASH, TL-3 and accepted by FHWA. The Contractor shall provide evidence of FHWA acceptance.
- G. Portable Breakaway Barricades Type III
1. Portable Breakaway Barricades shall conform to the plans and the following requirements:
    - a. Portable breakaway barricades shall comply with the latest version of the MUTCD.
    - b. Reflectorized sheeting conforming to M9.30.0. Type VI. Pipe shall be Polyvinyl Chloride (PVC) pressure rated SDR 21 or SDR 26 ASTM D2241. Fittings may be PVC ASTM D2665 or Acrylonitrile Butadiene Styrene (ABS) ASTM D2661

(Drainage Waste and Vent).

- c. The alternating 6 inch wide reflectorized diagonal stripe shall be orange and white and shall slope downward at 45° toward the end by which the traffic is to pass. Barricades that block the passage of traffic or designate the end of the traveled way shall have alternating vertical orange and white stripes on the rails.

#### H. Temporary Impact Attenuators

1. Only those Temporary Impact Attenuators previously approved for the purpose intended and listed on the Qualified Construction Materials List may be used.
2. The temporary impact attenuator shall be designed to fit within reasonably close tolerance of the dimensions given on the plans or in the special provisions for a given location.
3. The Contractor shall provide a design for temporary impact attenuator at the design speed shown on the plans or other speed designated by the Engineer.

#### I. Truck-Mounted Attenuator

1. Only those truck mounted attenuators previously approved for the purpose intended and listed on the Qualified Construction Materials List may be used. Since most approvals are conditional, any associated issues including but not limited to anticipated conditions, model, variations, modifications, proper installation of truck-mounted units and tow-vehicle specifications shall be resolved to the satisfaction of the Engineer before use in the field. The submitted information shall include estimated displacement characteristics for a variety of impacts (assumptions regarding both impacting vehicle weight and speed) so that appropriate temporary traffic control set-ups can be undertaken in the field.
2. The flashing arrow board shall conform to the requirements of Section 2.4, Subsection D.

#### J. Temporary Fence

1. The type of temporary Chain link fence shall be the Contractor's option with approval from the Owner.
2. The Contractor shall submit the type of temporary chain link fence to the Owner for approval prior to placing at the construction area. Following types are acceptable:
  - a. New materials or previously used salvaged chain link fencing

in good condition.

- b. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with steel base plates, or inserting in precast concrete blocks.
  - c. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.
  - d. Gates:
    - i. Provide personnel and vehicle gates of the quantity and size required for functional access to site.
    - ii. Fabricate of same material as used for fencing.
3. Fence fabric shall be fastened to posts by means of No. 6 gauge zinc coated wire clips. No post tops are required.

### PART 3 - EXECUTION

#### 3.1. PORTABLE CHANGEABLE MESSAGE SIGN

- A. The changeable message units shall be available for use one week prior to and throughout the duration of the project and be positioned in accordance with the Traffic Management Plans approved by the Owner and/or Engineer for each phase of construction and/or at the direction of the Owner and/or Engineer. The signs shall be visible from a minimum distance of 900 feet with a viewing angle of no less than 30 degrees. The Contractor shall take appropriate measures as needed within the roadway layout to provide the required minimum sight distance. The Contractor shall be responsible for the maintenance of each device and appurtenance. If the unit is found to be defective in any way it shall be replaced immediately at the Contractor's expense.

#### 3.2. TRAFFIC CONTROL DEVICES

- A. Temporary Safety Signing
  1. Signs which are damaged or are missing from their locations shall be replaced by the Contractor without additional compensation.
  2. All signs shall be maintained in a satisfactory manner including the removal of dirt or road film that causes a reduction in sign retroreflectivity.
  3. All signs shall be mounted in compliance with the requirements of



the MUTCD.

4. All signs not consistent with the use of the roadway shall be removed, completely covered, or turned away from traffic each day. In no case shall signs or their portable supports be left in the traveled way when the traffic management set-up has been removed.
5. Rollup signs shall only be used for single work shift setups.

B. Temporary Pavement Markings

1. The Contractor shall install all necessary temporary pavement markings prior to opening the roadway to traffic following the completion of each day's operations. The Contractor shall make all necessary arrangements for this work beforehand so that it may be properly coordinated with construction operations. Temporary pavement markers shall be installed in accordance with the requirements of the MUTCD.

C. Arrow Board

1. The arrow board shall be deployed as shown on the approved Traffic Management Plan or as directed. The unit shall be properly maintained throughout its use on the project.

D. Reflectorized Drums

1. Reflectorized drums are to be used as channeling devices in roadway work zones. The first five drums used for any taper or as designated on the Traffic Management Plan shall be equipped with flashing lights.

E. Temporary Barrier

1. The Temporary Barrier shall be installed where needed to provide protection of work zone and as directed by the Owner and/or Engineer in accordance with these provisions.
2. Each run of temporary barrier units shall be fastened together to form a continuous chain.
3. Temporary impact attenuators with delineation shall be installed at ends of barriers within 30 feet of the travelled way. The Contractor shall not leave a barrier leading-end unprotected.
4. Delineators shall be installed in conformance with manufacturer's recommendations on the barriers at their termini; at 20-foot intervals on tangent sections; and 10 foot intervals on curved sections

depending on radius as determined by the Owner and/or Engineer.

5. Delineators mounted on top of barriers separating opposing traffic shall have two sided amber reflectors delineating the left edge. Side mounted delineators shall have amber delineating the left edge, white delineating the right edge and have red as the back color. If mounted on the sides they shall be 6 inches below the top and on the side of traffic. Delineators shall be mounted at angles that provide maximum reflectorization.
6. Temporary Barriers shall be removed from existing locations, transported, and reset as needed in accordance with above requirements, as directed by the Owner and/or Engineer.

F. Temporary Restrained Barrier

1. The Contractor shall ensure that where the restrained barrier is to be pinned to the roadway, the pin holes are filled with a sand mortar mix upon removal of the barrier. If the barrier is to be restrained by setting it into the roadway in a planned slot, the roadway surface shall be restored by appropriate full depth HMA or Cement Concrete roadway reconstruction.
2. The Contractor shall ensure that the restrained barrier is required or directed by the Owner and/or Engineer to be bolted to the bridge deck, the deck reinforcement will not be damaged during the installation of the proposed barrier anchor bolts. Any damage to the deck reinforcement, which occurs during the course of the Contractor's operations, shall be repaired to the satisfaction of the Engineer at the Contractor's expense.
3. Impact or percussion drills are allowed if no distress occurs to the existing concrete. Their use is subject to the approval of the Owner and/or Engineer.
4. If core drilling, the holes may be cored using either a carbide or diamond bit. The diameter of the cored holes shall be in accordance with the recommendations of the resin manufacturer. If a diamond bit is used to core the holes in the proposed deck, a sandblast, high-pressure water blast, or other mechanical means must be used to properly roughen the inner surface of the holes. The type of abrasive surface roughening used shall be approved by the Owner and/or Engineer.
5. On the concrete deck all holes shall be blown clear of any debris prior to placement of resin. The Contractor shall have the approval of the Engineer signifying that the holes are clean prior to placing the resin adhesive. The Contractor shall strictly follow the recommendations of

the manufacturer for mixing and placing the adhesive material prior to the placement of the bolts. The Contractor shall not place adhesive material when the existing concrete temperature is below 40°F. Any excessive resin adhesive around the hole after placement of the bolt shall be struck off smooth while the resin adhesive is still workable.

6. The anchor bolt holes shall be repaired as needed by methods acceptable to the Engineer at no additional cost to Owner. Damage to the concrete-to-remain shall be repaired to a condition equal to or better than that prior to the beginning of these operations, at no additional cost to the Owner.
7. High strength bolts shall be installed through pockets formed in the barriers and bonded in holes drilled in either the existing or proposed concrete deck. The bolts shall be suitably coated to facilitate removal from the mating threads of the cured resin adhesive once the barriers are no longer needed. The process of removing the bolts shall cause no distress to the proposed deck concrete.
8. The bolt embedment length and resin adhesive shall be adequate to develop a minimum of 36 Kips of tension in the bolts. The embedment length shall not be less than 6½" in concrete and shall not extend below the bottom of the proposed deck.
9. Where the condition of the existing deck is unsuitable due to deterioration or insufficient embedment depth, bolts extending through the deck and fastened to an appropriately sized steel member which will provide the required pull strength may be used.
10. The details of the proposed bolted anchorage system and all installation and removal procedures shall be in accordance with the recommendations of the manufacturer, and shall be submitted to the Engineer for approval.
11. Field tests shall be performed to verify the effectiveness of the anchorage detail including the drilled hole diameter, embedment length, and the resin adhesive capacity. Two test bolts in both the existing concrete and the new concrete shall be installed and tested by the Contractor for pullout as required by the system manufacturer. If the desired strength is not achieved, the Contractor shall adjust the hole size, embedment length, bolt size, and/or adhesive material to meet this test requirement. Retesting as required by the Engineer shall be performed by the Contractor, at no additional cost to the Owner.
12. All testing shall be performed by the Contractor and is incidental to the work under this item. The method of applying the tension test load to the bolts shall be in accordance with ASTM E488. The testing equipment used and the locations and details of the test bolts shall be

submitted to the Engineer for approval. The Contractor shall perform this test as soon as possible in order to eliminate delays in construction due to the approval process. Bolts shall not be ordered until the embedment lengths have been approved.

13. The delineators shall be single units, with yellow or white lenses on both sides, placed 6" below the top and on the traffic side of the median barrier at 20' on center. The delineators shall be the type designed expressly for this type of attachment and may be made entirely of plastic.
14. Temporary impact attenuators with delineation shall be installed at ends of barriers within 30 feet of approaching traffic. The Contractor shall not leave a barrier leading end unprotected.
15. Temporary Barriers on Bridge shall be removed from existing locations and reset in accordance with above requirements, as directed by the Engineer.

G. Portable Breakaway Barricades Type III

1. The Contractor shall furnish, set up, move and remove Portable Breakaway Barricades Type III as required or directed by the Engineer. Portable Breakaway Barricades Type III shall be maintained in a good and serviceable condition throughout the project and shall be moved from place to place as required during construction and as directed by the Owner and/or Engineer.

H. Temporary Impact Attenuators

1. Excavation for temporary attenuator foundations and anchorage shall be made to the required depth and to a width that will permit the installation and bracing of forms where necessary. All soft and unsuitable material shall be replaced with compacted gravel borrow.
2. The temporary impact attenuator shall be installed in accordance with the manufacturers' specifications and recommendations. Copies of these specifications and recommendations shall be provided to the Owner and/or Engineer.
3. Temporary Impact Attenuators damaged by traffic shall be replaced by the Contractor within 24 hours or as directed by the Owner and/or Engineer.
4. Temporary Impact Attenuators Removed and Reset consists of removing temporary impact attenuators furnished above, relocating and re-installing it at new locations in accordance with the specifications and recommendations of the manufacturer.

I. Truck-Mounted Attenuator

1. The truck-mounted attenuator shall be utilized as shown on the plans or as directed by the Owner and/or Engineer, at the proper orientation and height above the paved surface.
2. A damaged truck-mounted attenuator shall not be used. Any repairs to the attenuator shall be accompanied by a statement from the product manufacturer certifying the repairs that were performed. Any work that becomes delayed due to the lack of a properly functioning truck-mounted attenuator will not constitute justification for an extension of time.

J. Pavement Marking Removal

1. The existing pavement markings shall be removed to the fullest extent possible by an approved method. Pavement marking removal methods shall not cause damage to the pavement or cause drastic change in texture, which could be construed as delineation at night, and shall be approved by the Engineer. It is not permissible to paint over existing markings with black paint in lieu of removal. Approved methods include but are not limited to:
  - a. High pressure air.
  - b. High pressure water (cold weather use not permitted)
  - c. Sand blasting,
  - d. Mechanical devices such as grinders, sanders, scrapers, scarifiers and wire brushes.
2. Painting over a pavement marking line by use of asphaltic liquids or paints will not be permitted.
3. Conflicting pavement markings shall be removed before any change is made in the traffic pattern.
4. Material deposited on the pavement as a result of removing markings shall be removed as the work progresses. Accumulations of sand or other material, which might interfere with drainage or could constitute a hazard to traffic, will not be permitted.
5. Any damage to the pavement or surfacing caused by pavement marking removal shall be satisfactorily repaired by the Contractor at no additional cost to the Owner.

6. Where the removal operation is being performed near a lane occupied by traffic, a vacuum attachment operating concurrently with the removal operation must be in use. All residue shall be removed immediately from the surface being treated.
7. Existing raised pavement markers shall be removed by a method approved by the Engineer. Any damage to the pavement or surfacing caused by pavement marking removal shall be repaired at no additional cost by methods acceptable to the Engineer. Voids in the pavement shall be filled with like materials with adhesive bonding to the substrate.
8. Following completion of construction, permanent pavement markings shall be installed to replace pre-construction markings to comply with MUTCD.

K. Temporary Fence

1. The Contractor shall install and maintain temporary construction fences at the location as directed by the Owner and/or Engineer.
2. Gates shall be fabricated using welded construction or heavy pressed steel or malleable corner fitting securely riveted. Gates shall be properly braced and diagonally trussed to eliminate any possible sagging. Hinges shall be of sufficient strength and design to permit easy and trouble free operation. All single swing gates shall be equipped with two H.O. hinges and one yoke latch per gate. All double swing gates shall be equipped with a positive type latching device with padlock fitting.
3. Installation of temporary fencing shall not deter or hinder access to existing or proposed fire hydrants. Maintain 3 feet diameter clear space around fire hydrants. Where fire hydrant is blocked by fencing, provide access gate markings with black paint in lieu of removal.
4. The Contractor shall replace fence due to construction accidents, vandalism and/or any other manner by the Contractor at no additional cost to the Owner.

END OF SECTION 01850

## SECTION 01900

### SELECTIVE DEMOLITION

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Work to include demolition of existing pavement areas; fencing; utilities; concrete; structures; architectural components; equipment; process mechanical, HVAC, plumbing, electrical, and instrumentation systems; piping and valves; and amenities as indicated on the Drawings, Specifications, or otherwise noted. Work shall also include power-washing.
- C. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's or applicable Filed Sub-Bid Contractor's property and shall be removed from the site in full compliance with all applicable disposal regulations.

##### 1.2 SUMMARY OF WORK

- A. This Section requires the selective removal of equipment and materials, necessary to complete the project. Removal and protection of existing materials and equipment items indicated for "salvage" are to be turned over to the Owner or re-installed as indicated on the Drawings. In some cases, the removed equipment or materials may be delivered offsite by the General Contractor. The General and Filed-Sub Bid Contractors shall verify with the Owner or Engineer prior to disposing any equipment or materials offsite.
- B. Related sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 2 – Site Work
  - 4. Division 3 – Concrete
  - 5. Division 4 – Masonry
  - 6. Division 5 – Metals
  - 7. Division 7 – Thermal and Moisture Protection
  - 8. Division 8 – Doors and Windows

9. Division 9 – Finishes
10. Division 11 – Equipment
11. Division 13 – Special Construction
12. Division 15 – Mechanical
13. Division 16 – Electrical

C. Work included:

1. The equipment and materials covered by this section shall include, but are not limited to the following:
  - a. Civil/Site work including pavement, fencing, concrete equipment pads, underground utilities, temporary PFAS treatment system and related appurtenances, buildings, sheds, and related appurtenances as indicated on the Drawings.
  - b. Painting components including scraping and wire brushing.
  - c. Process mechanical equipment including: chemical feed system tanks, piping, metering pumps, and secondary containment; process mechanical piping, fittings, valves, and appurtenances; vacuum priming system; well pumps; supports; masonry containment walls; sample lines; equipment pads; and related appurtenances as indicated on the Drawings. Salvage process mechanical equipment as indicated on the Drawings.
  - d. Heating, Ventilation, and Air Conditioning (HVAC) components including unit heaters, and related appurtenances as indicated on the Drawings.
  - e. Plumbing components including gas piping and related appurtenances as indicated on the Drawings.
  - f. Electrical components including: utility poles, generator, lights, right angle drive, disconnect switches, motor control centers, utility meters, equipment control wiring and conduit, conduit, wiring, starters, cabinets, panelboards, mounting systems, and related appurtenances as indicated on the Drawings.
  - g. Instrumentation and controls and SCADA equipment including analyzers, chart recorders, control panels, OITs, appurtenances, mounting systems, and related wiring, conduit, and appurtenances as indicated on the Drawings. Salvage Instrumentation and controls and SCADA equipment as indicated on the Drawings.
  - h. Up to 4,000 gallons of 45% potassium hydroxide (KOH).
  - i. Power-washing of surfaces as indicated in the Contract Documents.
2. Demolition of materials shall be completed by the respective Filed Sub Bid Contractor and coordinated by the General Contractor. All disposal of demolished materials shall be the responsibility of the General Contractor including hazardous materials. All equipment pads shall be demolished by the General Contractor.



### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Submit schedule indicating proposed sequence of operations for selective demolition work to the Engineer for review prior to start of work. Include details for dust and noise control protection.
  - 1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations, unless otherwise approved by the Owner.
  - 2. Coordinate with Owner continuing occupation of portions of existing building and facilities. Refer to Contract Drawings for Work Sequence.
  - 3. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
  - 4. Means of protection for items to remain and items in path of waste removal from building and structures.
- C. Pre-construction survey photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with the Engineer prior to start of work.
- D. Landfill Records: Indicate receipt and acceptance of hazardous wastes, such as asbestos-containing material, by a landfill facility licensed to accept hazardous wastes.
- E. Qualification Data: Provide certificate that Contractor is licensed to perform asbestos abatement.
- F. All Filed Sub-Bid Contractors shall submit demolition plans in accordance with this Section.

### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Demolish and remove existing construction, utilities, equipment, and appurtenances without damaging integrity of existing structures, equipment, and appurtenances that are to remain.
- C. Store equipment to be salvaged for relocation where directed by Engineer, and if necessary, protect from damage during work.
- D. Repair or remove items that are damaged. Repair and install damaged items at no additional compensation and to condition at least equal to that which existed prior to start of work.

- E. Exercise all precautions for fire prevention. Do not burn demolition debris on or near site.
- F. Maintain circulation of traffic within area at all times during demolition operations.
- G. Obtain permission from Engineer before abandoning or removing any existing structures, materials, equipment and appurtenances.
- H. Make arrangements with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.

#### 1.5 DEFINITIONS:

- A. Demolish: Demolish and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Salvage and Protect: Items indicated to be salvaged remain the Owner's property. Remove, clean, and store items to protect against damage. Stockpile in Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, repair, and otherwise prepare them for reuse; store and protect against damage. Make available for Engineer's inspection. Reinstall items in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Engineer, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

#### 1.6 JOB CONDITIONS

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he/she finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
  - 1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur prior to start of selective demolition work.
- C. Occupancy: Conduct selective demolition work in manner that will minimize the need for disruption of Owners normal operations. Provide minimum of 72 hours advance

notice to Owner of demolition activities that will affect Owners normal operations. Demolition activities shall be coordinated with Owner to minimize disruption.

1. Refer to Contract Drawings for Work Sequence.
- D. Partial Demolition and Removal: Items indicated to be removed, but of salvageable value to Contractor, may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
1. Storage or sale of removed items on-site will not be permitted.
- E. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
1. Provide protective measures as required to provide free and safe passage of Owner's personnel to occupied portions of building.
  2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
  3. Protect floors with suitable coverings when necessary.
  4. Remove protections at completion of work.
- F. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
- G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
- H. Utility Services: Maintain existing utilities which are to remain in service and protect them against damage during demolition operations.
1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
- I. Environmental Controls: Use temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
- J. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

## 1.7 REGULATORY REQUIREMENTS

- A. Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having

jurisdiction. Comply with all federal, state, and local regulations in regards to demolition/transportation/disposal of asbestos containing materials, lead paint, and other hazardous materials.

1. At least 10 working days prior to initiating work, the Contractor is required to submit to MassDEP an Asbestos Removal Notification (Form AQ04(ANF-001)) for any asbestos abatement, removal, or disposal and a Construction/Demolition Notification (Form BWP AQ 06) for demolition work.
2. If any asbestos-containing materials will be abated through non-traditional abatement methods, the Contractor must apply for and obtain approval from MassDEP, through Application BWP AQ36 – Application for Non-Traditional Asbestos Abatement Work Practice Approval.
3. MassDEP Asbestos, Construction and Demolition Notifications can be found at: <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>

## 1.8 PRE-DEMOLITION CONFERENCE

- A. Conduct conference at Project site with Engineer to comply with requirements in Division 1. Review methods and procedures related to selective demolition including, but not limited to, the following:
  1. Inspect and discuss condition of construction to be selectively demolished.
  2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  3. Review areas where existing construction is to remain and requires protection.
  4. Review areas where hazardous materials are known to be present and call for special demolition and disposal requirements.
- B. Conference shall be coordinated by General Contractor with all Filed Sub-Bid Contractors.
- C. Conference shall be held prior to the start of any demolition activities, no exception.

## PART 2 – PRODUCTS (NOT USED)

### 2.1 TEMPORARY PROTECTION MATERIALS

- A. Expanded Polystyrene (EPS) Insulation: ASTM C 578.
- B. Plywood: DOC PS1, Grade CD Exposure 1.
- C. OSB: DOC PS2, Exposure 1.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. General: Examine all interior and exterior conditions. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain. Have sufficient and suitable materials on site to facilitate rapid installation of temporary protection as needed.
1. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
  2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
  3. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
    - a. Provide weatherproof closures for exterior openings resulting from demolition work.
    - b. Extra protective measures shall be provided for all electrical and instrumentation panels and systems to remain.
  4. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
    - a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner.

### 3.2 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each level or tier before disturbing supporting members on the next lower level.
  2. Demolish concrete in small sections. Cut concrete at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
  3. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
  4. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

- B. If unanticipated mechanical, plumbing, HVAC, instrumentation, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the Engineer in written, accurate detail. Pending receipt of directive from the Engineer, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
- C. Use diamond tipped rotary saws or wires for all concrete cutting associated with demolition work.
- D. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that process mechanical, plumbing, HVAC, and electrical services to the particular area have been made inactive. Coordinate with Plumbing, HVAC, and Electrical Contractors, as necessary. Only licensed tradesmen of that particular trade shall disconnect existing Plumbing, HVAC, and Electrical items that are to be removed, abandoned and/or relocated.

### 3.3 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
  - 1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
  - 2. Burning of removed materials is not permitted on project site.

### 3.4 REMOVED AND REINSTALLED MATERIALS

- A. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
- B. Pack or crate items after cleaning and repairing. Identify contents of containers.
- C. Protect items from damage during transport and storage.
- D. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Items for Re-use and Preservation of Existing Surfaces to Remain:
  - 1. The Contractor shall inspect closely each item specifically designated to be relocated, reused, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Engineer. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Engineer, to the satisfaction of the Owner.

2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

### 3.5 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, lead paint or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Engineer of such discovery. Do not proceed with work in such areas until instructions are issued by the Engineer. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Engineer of such discovery. Do not proceed with work in such areas until instructions are issued by the Engineer. Take immediate precautions to prohibit endangering the container's integrity. Continue work in other areas.
- C. The General Contractor is responsible for demolition of hazardous materials detailed in the Hazardous Building Materials Survey Report included in Appendix K. The General Contractor is responsible for disposal of all hazardous materials detailed in the Hazardous Building Materials Survey Report included in Appendix K.
- D. Coordinate with the requirements of Section 01350 – Health and Safety Plan for demolition of asbestos containing materials, lead paint, or other hazardous materials. Refer to <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications> for Asbestos Removal Forms and Regulations.

### 3.6 CLEAN-UP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
  1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

### 3.7 POWER-WASHING

- A. Provide power-washing plan prior to start of Work for Engineer/Owner approval. Power-washing shall conform to ASTM E1575 and ASTM D4258 Paragraph 6.4 (Water Cleaning) and Paragraph 6.5 (Detergent Water Cleaning) requirements and standards.
- B. Disposal of solids and power-washing discharge shall be the responsibility of the Contractor. On-site disposal is not allowed.

3.8 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 01900



DIVISION 2 – SITE WORK

02020	.....Erosion and Sediment Control
02050	..... Tree Protection and Trimming
02060	..... Site Clearing
02080	..... Waste Material Abatement
02140	..... Dewatering and Discharge
02160	..... Temporary Excavation Support Systems
02200	..... Earthwork
02273	..... Geotextile Fabric
02444	..... Chain-Link Fence
02513	..... Bituminous Concrete Pavement
02532	..... Asphalt Emulsion Tack Coat
02550	..... Signage
02570	..... Precast Manholes, Tight Tanks, Hydrodynamic Separators, Gravity Piping, and Appurtenances
02615	..... Ductile-Iron Pipe and Fittings
02640	..... Fire Hydrants, Valves, and Appurtenances
02673	..... Well Reconditioning
02700	.....Asbestos-Cement Pipe Removal and Disposal
02725	..... Water Service Connections
02830	..... Guard Rail
02832	..... Segmental Retaining Walls
02901	.....Miscellaneous Work and Cleanup
02920	..... Topsoil
02945	.....Lawns and Seeding
02950	..... Planting

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## SECTION 02020

### EROSION AND SEDIMENT CONTROL

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section specifies equipment and materials for an erosion and sediment control program for minimizing erosion and siltation during the construction phase of the project. The erosion and sediment control provisions detailed on the Drawings and specified herein are the minimum requirements for erosion controls. The Contractor shall provide additional erosion and sediment control materials and methods as required to affect the erosion and siltation control principles specified herein.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02060 – Site Clearing
  - 4. Section 02140 – Dewatering and Discharge
  - 5. Section 02273 – Geotextile Fabric

##### 1.3 SUBMITTALS

- A. Proposed methods, materials to be employed, and schedule for effecting erosion and siltation control and preventing erosion damage shall be submitted for approval. Submittals shall include:
  - 1. List of proposed materials including manufacturer's product data.
  - 2. Perimeter (Limit of Work) Erosion Controls damaged during construction shall be replaced immediately if damaged or operating improperly and installed per the Details. Schedule of any additional erosion control program indicating specific dates for implementing programs in each major area of work, including dewatering sedimentation basin(s) shall be submitted prior to installation.

## B. Samples

The following samples shall be submitted:

<u>Sample</u>	<u>Size</u>
Filter Fabric	12 X 12 in.
(Woven and Non-woven)	

## 1.4 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
1. Massachusetts Department of Public Works, and The Commonwealth of Massachusetts Department of Public Works; Construction Standards.
  2. Massachusetts Department of Environmental Protection.
  3. Order of Conditions as issued by the Town of Sharon Conservation Commission (Appendix F).

## 1.5 EROSION CONTROL PRINCIPLES

- A. The following erosion control principles shall apply to the land grading and construction phases:
1. Stripping of vegetation, grading, or other soil disturbance shall be done in a manner which will minimize soil erosion.
  2. Whenever feasible, natural vegetation shall be retained and protected.
  3. Extent of area which is exposed and free of vegetation and duration of its exposure shall be kept within practical limits.
  4. Temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed critical areas during prolonged construction or other land disturbance. Prolonged exposure of unstabilized soil shall not exceed 60 days.
  5. Drainage provisions shall accommodate increased runoff resulting from modifications of soil and surface conditions during and after development or disturbance. Such provisions shall be in addition to existing requirements.
  6. Sediment shall be retained on-site.
  7. Dewatering systems, if used, shall be installed prior to dewatering operations. Dewatering systems shall not be installed in accordance with Section 02140.

- B. Erosion Protection: Cut and fill slopes and stockpiled materials shall be protected to prevent erosion. Slopes shall be protected with permanent erosion protection when erosion exposure period is expected to be greater than or equal to two months, and temporary erosion protection when erosion exposure period is expected to be less than two months.
  - 1. Permanent erosion protection shall be accomplished by seeding with grass and covering with an erosion protection material, as appropriate for prevailing conditions.
  - 2. Temporary erosion protection shall be accomplished by covering with an erosion protection material, as appropriate for prevailing conditions.
  - 3. Except where specified slope is indicated on Drawings, fill slopes shall be limited to a grade of 3:1 (horizontal: vertical) cut slopes shall be limited to a grade of 2:1.

**PART 2 - PRODUCTS**

**2.1 FILTER SOCK**

- A. Filter sock for construction of erosion control devices shall be blown or placed media (mulch or compost) in twelve-inch diameter natural, 100% biodegradable filter sock. Photodegradable, UV degradable, or Oxo-(bio)degradable plastics are not allowed.
- B. Wooden stakes (2-in. by 2-in. by 36-in.) shall be placed 10 foot on center, driven a minimum of 12 inches into the ground.

**2.2 SILT SACKS**

- A. Silt sacks or approved equal shall be placed in all catch basins or drop inlets as indicated on the Drawings. Silt sacks for catch basin inlet protection shall be ACF Environmental High Flow or equal. Minimum physical properties of the geosynthetic shall be as follows:

Property	Test Method	Units	Test Results
Trapezoid Tear	ASTM D-4533	lbs.	90x71
UV Resistance	ASTM D-4355	%	99.4
AOS	ASTM D-4751	US Sieve	20
Flow Rate	ASTM D-4491	gal/min/sf	100.6
Permittivity	ASTM D-4491	sec-1	4.81

**2.3 SILT FENCE**

- A. Silt fence, if required, shall consist of woven filter fabric as defined in Section 02273 – Geotextile Fabric.
- B. Wooden stakes (2-in. by 2-in. by 48-in.) shall be placed 10 foot on center, driven a minimum of 12 inches into the ground. Stakes shall be placed on the downstream side of the fabric.

2.4 HAY BALES

- A. Hay bales for construction of erosion control devices shall be new, firm, bound salt marsh hay, bound with biodegradable twine.

2.5 DEWATERING (SILT) BAGS

- A. Silt bags shall be utilized for trench dewatering activities. The silt bags shall be in accordance with the construction details on the Drawings.

2.6 TEMPORARY SEED COVER

- A. If required, seed mixture for temporary cover by hydroseeding application shall conform to the following:

<u>Quantity per 1000 sq. ft. Coverage</u>	<u>Material</u>
27-1/2 lb.	Wood Fiber Mulch
4 lb.	Seed
1/2 lb.	Annual Ryegrass
22 lb.	10-6-4 Fertilizer
69 gal.	Water

- B. Hydroseeding Equipment: Hydroseeding equipment may be either portable or truck mounted, with dual agitation, a minimum working volume of 1000 gallons and a minimum spray range of 80 ft.

1. Hydroseeding equipment must be capable of uniformly applying the slurry mix including wood fiber mulch if required, at the specified rate, and at the required locations.
2. Hydromulching equipment, either trailer or truck mounted, must be capable of uniformly applying straw or hay mulch at a minimum mulching rate of 8 tons per hour, at a distance of not less than 80 ft.

2.7 EROSION CONTROL BLANKET

- A. All loam and seeded slopes 3:1 or steeper shall have a fully biodegradable straw or fiber erosion control blanket installed.

1. Erosion control blanket shall be RollMax BioNet S150BN as manufactured by North American Green, ADS Geosynthetics 00S2AN by Advanced Drainage Systems, Inc., or Curlex NetFree by American Excelsior, Inc., or engineer approved equal.

B. All erosion control reinforcement areas shall have a fully biodegradable straw or fiber erosion control blanket installed.

1. Erosion control blanket shall be RollMax BioNet C700BN as manufactured by North American Green, ECC-2B by East Coast Erosion Control, or SC32 BD by ECBVerdyol, or engineer approved equal.

### PART 3 - EXECUTION

#### 3.1 HAY BALE DIKE

A. Bales shall be constructed and installed as indicated on the Drawings or as necessary to control run-off during contractors' site work operations. Bales shall be placed in a double row with ends tightly abutting the adjacent bales. Each bale shall be embedded in the soil a minimum of 6 in. Bales shall be securely anchored in place by wooden stakes driven through the bales. The first stake in each bale shall be angled toward the previously laid bale to force the bales together. Stakes shall be embedded into the ground no less than 1 ½ to 2 feet.

#### 3.2 HAY BALE CHECK DAM

A. Check dams shall be constructed and installed as necessary to control site runoff from stormwater or dewatering operations.

#### 3.3 HYDROSEEDING

A. If required for long-term disturbance greater than 60 days, seed for temporary cover shall be spread by the hydroseeding method, utilizing power equipment commonly used for that purpose. Seed, fertilizer, mulch and water shall be mixed and applied to achieve application quantities specified. Material shall be applied in 2 equal applications, with the equipment during the second pass moving perpendicular to direction employed during the first pass. Hydroseeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.

B. If the results of hydroseeding application are unsatisfactory, the mixture and/or application rate and methods shall be modified to achieve the required results.

C. After the grass has appeared, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas seeded repeatedly until all areas are covered with a satisfactory growth of grass.

#### 3.4 MAINTENANCE AND REMOVAL OF EROSION CONTROL DEVICES

A. Wetland area, water courses, and drainage swales adjacent to construction activities shall be monitored continuously for evidence of silt intrusion and other adverse environmental impacts, which shall be corrected immediately upon discovery.

- B. Limits of Bordering Vegetated Wetlands shall be marked by flagging and maintained until receipt of Certification of Completion from the Sharon Conservation Commission.
- C. Culverts and drainage ditches shall be kept clean and clear of obstructions during construction period.
- D. Erosion Control Devices
  - 1. Sediment behind the erosion control device shall be checked twice each month and after heavy rain. Silt shall be removed if greater than 6 in. deep.
  - 2. Condition of erosion control devices shall be checked twice each month or more frequently as required. Damaged and/or deteriorated items shall be replaced. Erosion control devices shall be maintained in place and in effective condition.
  - 3. Filter sock shall be inspected frequently and maintained or replaced as required to maintain both their effectiveness and essentially their original condition. Underside of filter sock shall be kept in close contact with the earth below at all times, as required to prevent water from washing beneath.
  - 4. Sediment deposits shall be properly disposed of, in a location and manner which will not cause sediment nuisance elsewhere.
- E. Removal of Sediment and Erosion Control Devices
  - 1. Sediment and erosion control devices shall be maintained until all disturbed earth has been paved or vegetated, at which time they shall be removed. After removal, areas disturbed by these devices shall be regraded and seeded.
  - 2. Sediment and erosion protection material shall be kept securely anchored until acceptance of the entire Project and receipt of Certification of Completion from the Sharon Conservation Commission.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02020



## SECTION 02050

### TREE PROTECTION AND TRIMMING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction. It also covers tree pruning when necessary in the vicinity of the site Work.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02020 – Erosion and Sediment Control
  - 4. Section 02060 – Site Clearing
  - 5. Section 02200 – Earthwork
  - 6. Section 02273 – Geotextile Fabric
  - 7. Section 02920 – Topsoil

##### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
- C. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

## 1.4 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm to be consulted as necessary.
- B. Arborist Qualifications: An arborist certified by the International Society of Arboricultural or licensed in the jurisdiction where Project is located, to be consulted as necessary.
- C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.
- D. Pre-installation Conference: Conduct conference at Project site prior to start of work.
  - 1. Before starting tree pruning protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Engineer, consultants, and other concerned entities. Review tree pruning protection and trimming procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Drainage Fill: Refer to Section 02200 – Earthwork. Selected 2 1/2 inch crushed stone, and with not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Refer to Section 02920 – Topsoil. Obtain topsoil only from well-drained sites where soil occurs in depth of 6 inches or more; do not obtain from bogs or marshes.
- C. Filter Fabric: shall consist of nonwoven, pervious geotextile filter fabric as defined in Section 02273 – Geotextile Fabric.

## PART 3 – EXECUTION

### 3.1 PREPARATION

- A. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- B. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.
- C. Do not allow fires under or adjacent to remaining trees or other plants.

### 3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
  - 1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
  - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

### 3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.
  - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6 inches, but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  - 1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
  - 2. Place filter fabric with edges overlapping 6 inches minimum.
  - 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

### 3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction as indicated on the plans or as directed by Engineer.
- B. Prune remaining trees, if any, to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- C. Pruning Standards: Prune trees according to ANSI A300.
- D. Cut branches with sharp pruning instruments; do not break or chop.

### 3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
  - 1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified.
  - 2. Provide new trees of 6-inch caliper size and of a species selected by Engineer when trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches (on center). Backfill holes with an equal mix of augered soil and sand.

### 3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, roots, stumps and excess chips from Owner's property.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02050

## SECTION 02060

### SITE CLEARING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions and Special Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Limits of clearing and grubbing are as indicated on the Drawings. Miscellaneous trash and debris shall be removed and disposed of legally off site. The work covered under this Section of the Specifications includes the following:
  - 1. Removing stumps and roots
  - 2. Topsoil stripping and stockpiling.
  - 3. Protecting existing trees and vegetation to remain.
  - 4. Establishing the limit of work.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 01110 – Environmental Protection Procedures
  - 4. Section 02020 – Erosion and Sediment Control
  - 5. Section 02050 – Tree Protection and Trimming
  - 6. Section 02211 – Rough Grading
- C. Work included:
  - 1. The Contractor shall be responsible for clearing and removing trees and limbs, stump removal, grubbing, filling depressions left by grubbing, stripping and stockpiling topsoil, protecting existing trees and vegetation to remain, and disposal.

### 1.3 SUBMITTALS

- A. Shop Drawings: Submit in accordance with the Conditions of Contract and Division 1 Specifications Sections.

### 1.4 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and other deleterious materials.

### 1.5 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled, managed and reused, or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

### 1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site prior to commencement of tree removal and grading operations.
- B. Comply with governing Massachusetts Department of Environmental Protection (MassDEP) and Environmental Protection Agency (EPA) notification regulations before starting site tree removal and grading. Comply with hauling and disposal regulations of authorities having jurisdiction.

### 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, and walkways during site-clearing operations.
  - 1. Do not close or obstruct streets and walkways without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Approval for performing indicated removal and alteration work on property adjoining Owner's property (if any) will be obtained by Owner before award of Contract.
- C. Notify utility locator service for area where Project is located before operations begin.

### 1.8 SITE CONDITIONS

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon

transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, groundwater table or similar physical conditions at the site, the conformation of subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with all available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work.

## PART 2 - PRODUCTS

### 2.1 CONSTRUCTION FENCING

Construction fencing shall be 6-foot high post-driven, temporary chain link fencing with privacy screen. Fencing shall be galvanized steel with a corrosion resistant coating in accordance with ASTM A392-06. Line posts shall be 1-5/8" diameter. Posts shall be driven into the ground a minimum of 2 feet.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction. Prior to construction activities, the limit of work shall be staked in the field by a Registered Land Surveyor. The limit of work shall be marked with the placement of construction fencing and maintained throughout the project. No disturbance is allowed beyond the limit of work line.
- B. Prior to construction provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated as approved by the Engineer.
- D. Locations of existing utilities were taken from the best available information and are approximate only. Contractor shall field locate and verify all utilities and improvements prior to commencement of work under this section. Contractor shall notify "Dig Safe" (1-888-344-7233) and the Town of Easton Department of Public Works to verify the location, depth, and size of the existing site utilities and utility structures prior to the commencement of work under this section.
- E. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 24 inches below exposed subgrade, unless otherwise indicated on the Contract Drawings.
  - 4. Use only hand methods for grubbing within drip line of remaining trees.
  - 5. All debris to be removed from site and properly disposed of.
- B. Fill depressions caused by stump removal and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding 8-inches loose depth, and compact each layer to a density equal to adjacent original ground.

### 3.3 DISPOSAL

- A. Disposal: Remove obstructions, demolished vegetation materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.
- B. Invasive plant disposal shall be undertaken in accordance with the 2014 "Guidelines for Disposal of Terrestrial Invasive Plants" produced by the Connecticut Department of Energy and Environmental Protection and the University of Connecticut.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02060



## SECTION 02080

### WASTE MATERIAL ABATEMENT

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Refer to Appendix P – Asbestos Regulations and Removal Forms for additional information and requirements.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this section includes furnishing all plant, labor, equipment, appliances, and materials, and performing all operations in connection with the handling, disposal, and/or stockpiling of waste material, including solid waste, excavated unsuitable soils, excess fill and topsoil screening spoils, resulting from the construction operations as specified herein, and as directed.
- B. All excavation, handling and disposal of waste materials will conform to the minimum requirements of the applicable federal, state, and local agencies.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. 02700 – Asbestos-Cement Pipe Removal and Disposal

##### 1.3 SUBMITTALS

- A. Submittals shall conform to the conditions of the Contract and Division 1 Specification Sections.
- B. The work covered under this section shall be performed in accordance with the Health and Safety Plan (Section 01350), which includes the submittal of a site-specific Health and Safety Plan.
- C. The Contractor shall submit to the Engineer for approval, at least ten (10) calendar days prior to the start of work, a detailed plan for shoring, excavating, segregating, handling, stockpiling, and placement of waste materials excavated at the site. The plan will be as detailed as necessary to evaluate the means, methods, and scheduling of work.

#### 1.4 EXCAVATED MATERIAL

- A. All excavations shall only be performed in the presence of the Engineer, where excavated materials can be visually screened and any solid waste identified. All excavations shall be performed in accordance with the Contractor's site-specific Health and Safety Plan.
- B. Solid waste material encountered during excavations, as identified by the Engineer, shall be initially stockpiled separately by the Contractor and temporarily stored in a location as directed and approved by the Engineer, prior to being disposed of.
- C. Non-solid waste material that is determined unsuitable for backfill by the Engineer shall be transferred to the Owner for their use. All excavations shall be backfilled with suitable material in accordance with the specifications.

#### 1.5 OFF-SITE DISPOSAL OF WASTE MATERIALS

- A. Contractor shall provide for the proper collection, handling, and disposal of decontamination materials and liquids resulting from construction operations at the site. Disposal shall be in conformance with federal, state, and local regulations, and shall be paid for under the Contractor's bid price.
- B. It is the responsibility of the Contractor to determine current waste handling, transportation, and disposal regulations and or requirements for each waste stream generated at this site by this work and for each waste disposal facility. The landfill destination must be approved by the Owner. The Contractor must comply fully with these specifications and all U.S. Department of Transportation and EPA requirements as well as the requirements of all states through which the waste is transported and all requirements of the state where disposal occurs.
- C. Since individual disposal facilities have different permit conditions and specific characterization data requirements, the Contractor is responsible for final characterization prior to transport and disposal. The Contractor is hereby made aware that for the purposes of disposal, final waste characterization is the responsibility of the Contractor, and costs for characterization shall be incorporated into the Contractor's bid price for construction.
- D. Manage wrapped asbestos cement pipe, polyethylene sheeting and any other material contaminated with visible asbestos debris as asbestos waste in accordance with 310 CMR 7.15 and 310 CMR 19.061.
- E. All asbestos wastes must be handled, packaged, stored, transported, and disposed of as in compliance with all Federal, State, and local regulations and codes.
- F. If waste containers are not already so preprinted, warning labels having waterproof print and permanent adhesive shall be affixed to the lid and/or sides of the containers, whether or not these containers are further packaged. Warning labels shall be conspicuous and legible, and conform to the latest OSHA, EPA, DOT asbestos regulatory labeling requirements.

- G. Include owner's name and address on all waste containers.
- H. All waste shall be thoroughly wetted when packaged. When a waste bag is full, it shall be securely sealed with tape, and then placed in the designated temporary storage area inside of the work area.
- I. All Asbestos Cement (AC) pipe shall be double wrapped in 6-mil polyethylene sheeting and labeled as Asbestos-Containing Materials (ACM) prior to transport.
- J. Properly wrapped and labeled asbestos pipe, as well as all other containerized debris, must be placed in a roll-off container(s), or covered trucks, trailers or vans that are lined with 2 layers of 6 mil polyethylene sheeting. The container should be an enclosed leak-tight container and locked having proper labels and DOT placards as required. All Asbestos Containing Materials (ACM) must be properly sealed, labeled and secured inside a locked fenced area to prevent access by unauthorized personnel and covered to prevent water accumulation.
- K. Contractor shall insure that transport vehicles do not leak water or other material while being loaded, being transported or while on site partially loaded. If water is observed leaking from any transport or storage container, contractor shall immediately stop work, unload the container (including dumpsters and semi-trailers) find and correct the source of the leak, and place waste material back into the container. This process will be repeated each time any water is observed leaking from a storage or transport vehicle that contains asbestos waste. Contractor shall also take all steps necessary to decontaminate the ground or other surfaces that became wet due to water leaking from a container that holds asbestos waste.
- L. To comply with the requirement that waste disposal to a permitted landfill be documented, remove waste containers from work areas only under the direction of Owner's representative, and complete appropriate documentation for each load of waste removed from the site. ACM waste shall not be transported until the owner has inspected said waste, transport vehicle, placarding and signed off on Asbestos Waste Shipment Record (WSR).
- M. Accurately measure and record the volume of each container or load of waste removed from the site.
- N. Provide legal transportation of the waste to the disposal landfill, and complete or obtain all required licenses, manifests, dump slips, or other forms. Copies of all forms or licenses, and the signed original of the WSR for each waste load, shall be given to Owner's Representative.
- O. Subject to approval by the Owner's representative, waste may be transported to and temporarily stored at an off-site storage area owned by Asbestos Contractor, but it must ultimately be disposed of at the specified landfill before final payments are approved.
- P. The Contractor will document actual disposal of the waste at the designated landfill by completing a WSR and forwarding the original along with the Bill of Lading to

the Owner within the time limits specified by EPA NESHAP regulations. Investigate, correct and notify owner immediately in writing if executed WSR is not received from disposal facility within 30 days. A properly executed WSR is required for final payment of work.

- Q. Complete WSR must be retained for two years by the owner, municipality and contractor. Indefinite retainage of WSR is recommended to address any long term disposal site issues.

#### 1.6 EQUIPMENT DECONTAMINATION

- A. An equipment decontamination area conforming to the Contractor's Health and Safety Plan shall be constructed in such a manner as to protect existing site surfaces, materials, and structures. The area shall be sized adequately to provide for the decontamination of the largest piece of equipment to be decontaminated, as appropriate.

#### 1.7 EXISTING UTILITIES

- A. Existing utilities to be abandoned, and those that are required to be removed to facilitate construction shall be removed from the site and legally disposed of by the Contractor, at no additional cost to the Owner, unless otherwise directed by the Engineer.

#### PART 2 – PRODUCTS (NOT USED)

#### PART 3 – EXECUTION (NOT USED)

END OF SECTION 02080

## SECTION 02140

### DEWATERING AND DISCHARGE

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Order of Conditions issued by the Town of Sharon Conservation Commission, provided in Appendix F of these Specifications apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This work covered under this Section of the Specifications includes the following:
  1. Design, furnish, operate, maintain, and remove temporary dewatering systems to control groundwater and surface water to maintain stable, undisturbed subgrades, and permit work to be performed under dry and stable conditions. Work to be done as part of dewatering includes, but is not limited to:
    - i. Lower the groundwater level.
    - ii. Lower hydrostatic pressure.
    - iii. Prevent surface water from entering the excavation during construction.
    - iv. Implement erosion control measures for disposing of discharge water.
    - v. Provide groundwater recharging systems as specified and as indicated.
    - vi. Provide and monitor observation wells and geotechnical instrumentation as specified and indicated.
  2. Groundwater within the excavation area shall be lowered to at least 2 feet below the lowest excavation levels as specified and as indicated. Direct discharge into the wetland resource area will not be allowed.
  3. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points, or any combinations thereof.
- B. Related sections include the following:
  1. Division 0 – Bidding and Contract Requirements
  2. Division 1 – General Requirements
  3. Section 02020 – Erosion and Sediment Controls
  4. Section 02160 – Temporary Excavation Support Systems
  5. Section 02200 – Earthwork

## 6. Section 02273 – Geotextile Fabric

### 1.3 SUBMITTALS

A. Shop Drawing: Submit the following in accordance with Section 01300 - Submittals:

1. Qualification of the Contractor's dewatering specialist's or firm's qualifications a minimum of four (4) weeks prior to execution of any dewatering. The submittal shall include, but not be limited to:
  - i. Qualifications of specialist's or firm's Registered Professional Engineer as specified in Paragraph 1.4 B.
  - ii. Qualifications of specialist's or firm's field representative, as specified in paragraph 1.4 B, who shall oversee the installation, operation and maintenance of the dewatering system.
2. Submit a dewatering and discharge plan at least two weeks prior to start of any dewatering operation. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
  - i. Dewatering plan and details stamped and signed by a Massachusetts Registered Professional Engineer.
  - ii. Certificate of Design: Refer to Section 01300 for form.
  - iii. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.
  - iv. Detailed description of dewatering, discharge, maintenance, and system removal procedures.
  - v. Monitoring plan and details, including, but not limited to, locations of observation wells, and geotechnical instruments such as settlement markers (reference points on structures) and piezometers, and frequency of reading the monitoring devices, as needed.
  - vi. Erosion/sedimentation control measures, and methods of disposal of pumped water.
  - vii. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.
3. Measurement records consisting of observation well groundwater records and the geotechnical instrumentation readings within one day of monitoring.
4. A modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.

### 1.4 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

- B. Employ the services of a dewatering specialist or firm having the following qualifications:
  - 1. Have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years.
  - 2. Retain the services of a Registered Professional Engineer (in the state where the project is located) having a minimum of five (5) years experience in the design of well points, deep wells, recharge systems, or equal systems.
  - 3. Retain the services of a field representative having a minimum of 5 years experience in installation of well points, deep wells, recharge systems, or equal systems.
- C. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner.
- D. Notify the Engineer immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.
- E. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer and Massachusetts Department of Environmental Protection (MassDEP) in accordance with the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000).

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 and as specified.

#### 1.6 PROJECT/SITE CONDITIONS

- A. Subsurface Conditions: Refer to Appendix C of the Contract Documents for available information.

#### 1.7 PERMITS

- A. Contractor shall be responsible for the preparation, submittal and approval of all required stormwater, drainage, and groundwater discharge or construction permits and plans, such as the development of site specific Stormwater Pollution Prevention Plan (SWPPP).

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Provide settlement markers, piezometers and/or any other geotechnical instruments in accordance with the submitted dewatering plan or as specified.
- B. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.
- C. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.
- D. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.
- E. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.
- F. Provide and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.
- G. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.
- H. Provide cement grout having a water cement ratio of 1 to 1 by volume.

## PART 3 - EXECUTION

### 3.1 EXECUTION

- A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed and the geotechnical instrumentation has been installed.
- B. All foundations and excavations shall occur in "the dry". Groundwater shall be lowered by a minimum of 2-feet below the base of the excavation. During any dewatering, the Contractor shall use temporary stone around the suction and discharge ends to minimize transport of trench materials. The discharged water shall pass through filter fabric, silt bags, frac tanks or a combination of all.
- C. Furnish, install and maintain dewatering system in accordance with the dewatering plan.
- D. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.



- E. Do not excavate until the dewatering system is operational.
- F. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below groundwater level have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.
- G. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit to the Engineer at no additional cost to the Owner.
- H. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with Section 02200 at no additional cost to the Owner.
- I. Dewatering Discharge:
  - 1. Install and monitor recharge systems when specified and/or indicated and in accordance with the submitted dewatering plan.
  - 2. Install sand and gravel filters in conjunction with well points and deep wells to prevent the migration of fines from the existing soil during the dewatering operation.
  - 3. Transport pumped or drained water to discharge location without interference to other work, damage to pavement, other surfaces, or property.
  - 4. Provide separately controllable pumping lines.
  - 5. The Engineer reserves the right to sample discharge water at any time. If discharge water quality is poor, the Engineer may request additional measures to improve water quality.
  - 6. The Contractor shall not discharge silty water in the wetland resource area; and discharges shall meet the Order of Conditions requirements.
  - 7. Immediately notify the Engineer if suspected contaminated groundwater is encountered. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.
- J. Monitoring Devices and Records:
  - 1. Install, maintain, monitor and take readings from the observation wells and geotechnical instruments in accordance with the dewatering plan.
  - 2. Install settlement markers on structures within a distance equal to twice the depth of the excavation, from the closest edge of the excavation. Conduct and report settlement surveys to 0.001 ft.

K. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.

L. Removal:

1. Do not remove dewatering system without written approval from the Engineer.
2. Backfill and compact sumps or ditches with screened gravel or crushed stone wrapped with geotextile fabric in accordance with Section 02200 and Section 02273.
3. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

### 3.2 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02140

## SECTION 02160

### TEMPORARY EXCAVATION SUPPORT SYSTEMS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section includes the following:

1. Design, furnish and install temporary excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits and protect from damage existing and proposed improvements including, but not limited to, pipelines, utilities, structures, roadways, and other facilities.
2. Common types of excavation support system include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheetpile wall, timber sheetpile wall, trench box, or combinations thereof. Trench box temporary excavation support system is only acceptable for pipe or utility trench excavations. Temporary unsupported open cut excavation with stable sloping sides is allowed where applicable.
3. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall be in reference to any type of excavation support system specified except trench box.
4. Construction of the temporary excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired by the Contractor at no additional cost to the Owner.
5. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 02140 – Dewatering and Discharge

4. Section 02200 – Earthwork
5. Section 03300 – Cast-In-Place Concrete

### 1.3 SUBMITTALS

#### A. Shop Drawing: Submit the following in accordance with Section 01300 – Submittals:

1. Submit the following qualifications four (4) weeks prior to the construction:
  - i. Qualifications of Contractor's temporary excavation support system designer as specified in Paragraph 1.4 D.
  - ii. Qualifications of Contractor's temporary excavation support system installer as specified in Paragraph 1.4 E.
  - iii. Qualifications of Contractor's independent tieback testing laboratory as specified in Paragraph 1.4 F, if a tieback system is utilized.
  - iv. Qualifications of Contractor's temporary excavation support system installation supervisor as specified in Paragraph 1.4 G.
2. Submit a temporary excavation support plan stamped and signed by a Massachusetts Registered Professional Engineer at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
  - i. Proposed temporary excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.
  - ii. Certificate of Design: Refer to Section 01300 for form.
  - iii. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.
  - iv. Requirements of dewatering during the construction, per Section 02140.
  - v. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
  - vi. List of equipment used for installing the excavation support systems.
  - vii. A plan to monitor movements of the ground adjacent to excavation support systems and adjacent structures. The plan shall include, but not be limited to locations, details and monitoring schedule of geotechnical instruments such as survey markers (reference points on structures).
3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.

4. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
  - i. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.
  - ii. Type of the temporary excavation support system.
  - iii. Elevations of top and bottom of the excavation support systems left in place.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.
- C. All welding shall be performed in accordance with AWS D1.1.
- D. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in Massachusetts and having the following qualifications:
  1. Not less than ten (10) years experience in the design of specific temporary excavation support systems to be used.
  2. Completed not less than five (5) successful temporary excavation support system projects of equal type, size, and complexity within the last five (5) years.
- E. Temporary Excavation Support System Installer's Qualifications:
  1. Not less than three (3) years experience in the installation of similar types and equal complexity as the proposed system.
  2. Completed not less than three (3) successful excavation support systems of similar type and equal complexity as the proposed system.
- F. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:
  1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.
  2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.
  3. Have not less than five (5) years experience in testing of tieback systems of similar type and equal complexity as the proposed system.

4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.
- G. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:
1. Not less than five (5) years experience in installation of systems of similar type and equal complexity as the proposed system.
  2. Completed at least five (5) successful temporary excavation support systems of similar type and equal complexity as the proposed system.

## 1.5 DESIGN CRITERIA

- A. Design of temporary excavation support systems shall meet the following minimum requirements:
1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, and other surcharge loads.
  2. Design a bracing system to provide sufficient reaction to maintain stability.
  3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
  4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet below the bottom of the excavation.
  5. Design temporary excavation support systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
  6. Maximum width of pipe trench excavation shall be as indicated on the drawings.
  7. Do not cast permanent structure walls directly against excavation support walls.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

## 1.7 PROJECT/SITE CONDITIONS

- A. Subsurface Conditions: Refer to Appendix D of the Specifications.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
- B. Steel Sheet Piling: ASTM A328, continuous interlocking Z-type. Steel sheet shall be ASTM A572 Grade 60.
- C. Timber Sheeting shall be composed of a 3 layer laminated timber with tongue and groove connecting edges. The toe of the sheeting shall be cut on a diagonal so that, in driving, the pile will be continuously wedged back against the previously driven pile. Timber sheet piling shall conform to the requirements of AASHTO M. 09.01-1.
- D. Timber Lagging Left in Place: Pressured treated per appropriate AWWA standards.
- E. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- F. Raker Ties: ASTM A615 Grade 60.
- G. Cement Grout Materials and Admixtures for Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.
- H. Concrete: Refer to Section 03300.
- I. Tamping tools adapted for backfilling voids after removal of the excavation support system.
- J. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the temporary excavation support plan.
- C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present will not be accepted. Repeat testing in the Engineer's presence at no additional cost to the Owner.

- D. Do not drive sheeting within 100 feet of concrete less than seven (7) days old.
- E. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.
- F. Perform preparatory Work to discover, protect, maintain and restore, or remove utilities, foundations or other facilities located in close proximity of the proposed excavation lateral support system.
- G. Conduct pre-excavation as necessary to remove obstructions and identify existing utilities along the alignment of the excavation lateral support system which will interfere with installation in accordance with Section 02200.
- H. The Contractor shall provide fully equipped rig(s) and appropriate tools in full-time operation at the Site during the Work, and shall mobilize additional equipment, if necessary, to complete the Work on schedule.
- I. Excavation shall not proceed more than two (2) feet below the bracing level, anywhere within the excavation support limits, until the entire level of bracing is completely installed, including prestressing.
- J. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.
- K. Install and survey geotechnical instrumentation in accordance with the temporary excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at no additional cost to the Owner.
- L. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In event of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities or other measures (Construction Contingency Plan) as required.
- M. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owners permission or have the utility owner make the modifications at no additional cost to Owner.

### 3.2 GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS

- A. Criteria for “threshold” and “limiting” movements of wall elements of excavation support system have been established as follows:
  - 1. “Threshold” Horizontal Movement:

Dx = No greater than 1.0 inch where no buildings are present within 25 feet of support system



Dx = No greater than 0.5 inch where buildings are present within 25 feet of support system.

Where

Dx = measured horizontal wall movement at any level.

2. "Limiting" Horizontal Movement:

Dx = No greater than 2.0 inches where no buildings are present within 25 feet of support system

Dx = No greater than 0.75 inch where buildings are present within 25 feet of support system.

- B. The Contractor shall notify the Engineer and shall take immediate steps to control further movement by revising his procedures, providing supplemental bracing or other measures (working 24 hours per day or temporarily terminating Work in the area of movement if necessary) as required if any of the following occur:
1. Field measurements indicate that any of the "threshold" movement criteria are reached or exceeded.
  2. Field measurements or observations indicate that significant or sustained wall movements are occurring (total movement may be less than the "Limiting" movement criteria).
  3. Movements of adjacent structures, utilities or other facilities are detected.
- C. If "Limiting" movements are being approached or reached, the Engineer, based on his judgment and review of the movement monitoring data, may require the Contractor to temporarily terminate the Work in the area where such movement is occurring and implement all necessary mitigation measures which are satisfactory to the Engineer, to arrest the movements, at no cost to the Town.
- D. Horizontal or vertical movement of any point on adjacent structures shall not exceed 0.5 inches. The Contractor shall establish and monitor survey points on the adjacent structures. The Contractor shall take all necessary measures to prevent greater settlements, at no additional cost to the Town.
- E. These criteria are intended to establish a minimum basis for the Contractor's design and procedures and in no way relieve the Contractor of his sole responsibility for preventing detrimental movements and damage to adjacent structures, utilities or other Work.
- F. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.

- G. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.
- H. Implement Construction Contingency Plan under direction of the temporary excavation support system designer, installation supervisor and the Engineer.

### 3.3 REMOVAL OF EARTH RETENTION SYSTEM

- A. Sheet piling shall not be left in place unless otherwise indicated or approved in writing by the Engineer.
- B. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.
- C. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.
- D. The excavation support system left-in-place shall be cut-off a minimum of 2 feet below the bottom of the next higher foundation level or a minimum of 5 feet below finished grade.
- E. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.
- F. Submit as-built information, prior to backfilling.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02160

## SECTION 02200

### EARTHWORK

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section includes excavations of normal depth in earth for trenches and structures; backfilling such excavations to the extent required; filling; rough grading; cofferdamming; constructing embankments; miscellaneous earth excavation; temporary excavation support; the removal, hauling and stockpiling of suitable excavated material for subsequent use in the work; all rehandling, hauling and placing of stockpiled materials for use in refilling, filling, backfilling, grading and such other operations; the removal and satisfactory disposal off the site of unsuitable and/or surplus material; compaction; and appurtenant work, complete, in accordance with the Drawings and Specifications, and as directed.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02140 – Dewatering and Discharge.
  - 4. Section 02160 – Temporary Excavation Support Systems

##### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Backfill Materials: If requested by the Engineer, submit a grain size analysis and curve performed in accordance with ASTM D422 for each proposed source of backfill for review by the Engineer. The grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.
- C. If requested by the Engineer, submit a grain size analysis and a constant head permeability result in accordance with ASTM D422 and ASTM D2434 respectively for each proposed source of the drainage sand for review by the Engineer.
- D. If requested by the Engineer, submit a controlled density fill (CDF) mix design showing the proportions and gradations of all materials.

- E. If requested by the Engineer, submit a modified proctor curve indicating the maximum dry-density and optimum moisture content as determined by ASTM D1557 for each proposed source of backfill for review by the Engineer.
- F. Submit the qualifications of the independent geotechnical testing laboratory performing soil testing and inspection services during earthwork operations. The geotechnical testing laboratory must demonstrate to the Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to ASTM D3740, that it has the experience and capability to conduct required field and laboratory geotechnical testing. In addition, the laboratory shall be supervised by a Registered Professional Engineer in the State of Massachusetts.
- G. Submit an excavation, backfilling, and filling plan at least one week prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include, but not be limited to the following items:
  - 1. Detailed sequence of work.
  - 2. General description of construction methods.
  - 3. Numbers, types, and sizes of equipment proposed to perform excavation and compaction.
  - 4. Details of dust control measures.
  - 5. Proposed locations of stockpiled excavation and/or backfill materials.
  - 6. Proposed surplus excavated material off-site disposal areas and required permits.

#### 1.4 EXCAVATION CLASSIFICATIONS

- A. Earth Excavation or "Excavation" consists of removal of materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for exploratory excavation, unauthorized excavation, additional excavation, or rock excavation.
- B. Exploratory Excavation, also referred to as test pits, shall consist of the removal of materials for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work. Exploratory excavation shall be performed as shown on the plans and as directed by the Engineer. Exploratory excavation not directed or approved by the Engineer shall be at the Contractor's expense.
- C. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized

excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.

1. Under footings, foundation bases, concrete slabs, retaining walls or other structures, fill unauthorized excavations to the proper elevations with lean concrete or compacted structural fill as approved by the Engineer. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise directed by the Engineer.

D. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Engineer who will review subgrade conditions.
2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.
3. Removal of unsuitable material and its replacement as directed in Paragraph 1.4, D, 2 will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for this classification.

E. Rock Excavation:

1. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10 feet 0-inches in width and pits in excess of 30 feet 0-inches in either length or width are classified as open excavation.
2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).
3. Determination of rock excavation classification will be made by the Engineer. Typical of materials classified as rock are boulders 1.0 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by Engineer. If the area to be excavated is preblasted prior to the excavation of overburden soils, the Engineer shall be notified at least two days in advance to allow observation of the preblast drilling

by the Engineer in order to classify the excavation. Visual observation of the completed excavation may be made by the Engineer to modify the excavation classifications. Removal of rock excavation prior to classification by the Engineer shall be considered as earth excavation unless accepted by the Engineer in writing. Such excavation will be paid on the basis of contract unit rates for this classification.

4. Rock payment lines are limited to the following:
  - i. Two feet outside of concrete work for which forms are required, except footings.
  - ii. One foot outside perimeter of footings.
  - iii. In pipe trenches, depth limits shall be 6-inches below bottom of pipe with a minimum payment depth of 3 feet of rock excavated with blasting and a minimum payment depth of 6-inches of rock excavated with power tools or by mechanical means. Width payments limits shall be according to the following table:

Depth From Ground <u>Surface to Invert of Pipe</u>	Pay Width (Pipe I.D.)	
	0 - 24"	over 24"
0 to 12'	5'- 0"	Pipe I.D. +3'-0"
12' to 20'	7'- 0"	Pipe I.D. +5'-0"
Over 20'	9'- 0"	Pipe I.D. +7'-0"

- iv. Rock sloping across the width of trench shall have the top of rock established at the rock elevation over the centerline of the pipe.
- v. Rock excavation within the limits of tunneling or which are included under other items of work will not be considered as rock excavation.

## 1.5 EXCAVATION

- A. The Contractor shall perform all excavations of every description and of whatever substances encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access to the Engineer for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the required work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work; work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.
- B. All excavations made in open cut will be controlled by the conditions existing at the various locations and shall always be confined to the limits as designated by the Engineer. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth faced bucket or by hand if directed by the Engineer.

- C. The Contractor shall satisfy all dewatering requirements specified in Section 02140 – Dewatering and Discharge before performing trench excavations.

## 1.6 TEMPORARY EARTH SUPPORT

- A. In accordance with specification Section 02160 – Temporary Excavation Support Systems, the Contractor shall furnish, place and maintain such sheeting, shoring, and bracing at locations necessary to support the sides of excavations and to prevent danger to persons or damage to pavements, facilities, utilities, or structures, and to prevent injurious caving or erosion or the loss of ground, and to maintain pedestrian and vehicular traffic as directed and required.
- B. In all sheeting, shoring, and bracing operations, care shall be taken to prevent injury to persons or damage to structures, facilities, utilities and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing or other construction operations of the Contractor shall be satisfactorily repaired or made good by the Contractor, at no additional expense to the Owner.
- C. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with selected fill, thoroughly compacted.
- D. The Contractor shall leave in place all sheeting and bracing at the locations and within the limits ordered by the Engineer in writing. The Contractor shall cut off the sheeting at elevations to be determined by the Engineer.
- E. Conform to the requirements of the OSHA Standards and Interpretations: “Part 1926 Subpart P-Excavation, Trenching, and Shoring”.
- F. The Contractor shall comply with all federal, state, and local safety regulations and requirements.

## 1.7 GROUNDWATER CONTROL

- A. In accordance with specification Section 02140 – Dewatering and Discharge, the Contractor shall provide, at his own expense, adequate pumping and drainage facilities to maintain the excavated area(s) sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The drainage of all water resulting from pumping shall be managed so as not to cause damage to adjacent down gradient property or resource areas.
- B. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, as directed by the Engineer, at no additional expense to the Owner. The Contractor’s pumping and

dewatering operations shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from these operations. Precautions shall be taken to protect new work from flooding during storms or from other causes. Pumping shall be continuous where directed by the Engineer to protect the work and/or maintain satisfactory progress.

- C. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected. Water from the trenches, excavations, and drainage operations shall be disposed of in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or resource areas, or damage to the work completed or in progress.
- D. The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided for drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

**PART 2 – PRODUCTS**

**2.1 BACKFILL MATERIALS**

- A. Gravel Borrow/Common Fill: Common fill shall be soil containing no stone greater than 2/3 loose lift thickness. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. Common fill shall not contain more than 35 percent by weight of silt and clay. It shall be of such a nature and character that it can be compacted to the specified densities in a reasonable length of time. Topsoil and subsoil shall not be considered common fill.
- B. Structural Fill: Structural fill shall consist of gravel and sand consisting of hard durable particles, and free from trash, ice and snow, tree stumps, roots and other deleterious or organic matter, silt or clay. Structural fill shall conform to the following gradation requirements.

SIEVE DESIGNATION	NOMINAL PERCENT PASSING BY WEIGHT
8-inch	100 (1)
3-inch	70-100
1-inch	45-90
No. 4	20-70
No. 10	15-60
No. 40	10-40
No. 200	0-10
Notes: (1) Two-inch maximum particle size within 12 inches of slab, footing or pavement grade.	



- C. Sand and Gravel: Sand and gravel fill shall consist of hard, durable sand and gravel, and shall be free from ice and snow, roots, sod, rubbish, and other deleterious or organic matter. It shall conform to the following gradation requirements as designated by Massachusetts Department of Transportation (MassDOT) Standard Specification M1.03.0.

SIEVE DESIGNATION	NOMINAL PERCENT PASSING BY WEIGHT
(a)	100
No. 4	40-75
No. 50	8-28
No. 200	0-10
Notes: (a)Maximum grain size shall be four (4)-inches where placed as base below slab and pavement; Type A (maximum grain size 6-inches) or Type C (maximum grain size 2-inches) as specified in the Contract Drawings; elsewhere 2/3 of the loose lift thickness.	

- D. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following gradation requirements as designated by MassDOT Standard Specification M2.01.0.

SIEVE DESIGNATION	NOMINAL PERCENT PASSING BY WEIGHT		
Sieve Size	1 1/2-inch Stone	3/4-inch Stone*	1/2-inch Stone
2-inch	100	---	---
1 1/2-inch	95-100	---	---
1-inch	35-70	100	---
3/4-inch	0-25	90-100	---
5/8-inch	---	---	100
1/2-inch	---	10-50	85-100
3/8-inch	---	0-20	15-45
No. 4	---	0-5	0-15
No. 8	---	---	0-5

\*Stone shall be washed

- E. Crushed Stone for Drainage Fill: Crushed stone for drainage fill shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. Drainage fill shall consist of 2 1/2" crushed stone with not more than 10 percent passing the 3/4-inch sieve.
- F. Processed Gravel for Subbase: Processed gravel for subbase shall be used where specified and shall consist of inert material that is hard, durable stone and coarse sand

free from frost, frozen lumps, loam and clay, surface coatings, and deleterious materials.

Gradation requirements for processed gravel for subbase shall be as designated by MassDOT Standard Specification M1.03.1 and shall conform to the following:

<b>SIEVE DESIGNATION</b>	<b>NOMINAL PERCENT PASSING BY WEIGHT</b>
3 inch	100
1 ½"	70-100
¾"	50-85
No. 4	30-60
No. 200	0-10

G. Controlled Density Fill (CDF): CDF shall meet the requirements of MassDOT Standard Specification M4.08.0, and be suitable for the application.

H. Drainage Sand: Drainage sand shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings or other deleterious material. Drainage sand shall have an internal friction angle of 30 degrees. Drainage sand shall conform to the following gradation requirements as designated by MassDOT Standard Specification M1.04.1:

<b>SIEVE DESIGNATION</b>	<b>NOMINAL PERCENT PASSING BY WEIGHT</b>
1/2-inch	100 (1)
3/8-inch	85-100
No. 4	60-100
No. 16	35-80
No. 50	10-55
No. 100	2-10
No. 200	0-10
Notes:	
(1) Maximum grain size shall be 1/4-inches	

Drainage sand shall be free of all angular materials and shall have a minimum permeability of  $1.0 \times 10^{-3}$  cm/sec at the thickness shown on the Drawings.

I. Rip-Rap Stone (Modified Rockfill):

1. All stone riprap for overflow weirs and pipe outlet protection shall be sound, durable rock angular in shape, and resistant to abrasion and freeze-thaw deterioration. No boulders or rounded stones will be accepted for this work.
2. All stone riprap shall have at least three (3) flat faces to enable the stones to be properly locked together to form a compact mass. Unacceptable rock includes mica schist, slate, micaceous or thinly-bedded sandstone, shale, coarse limestone,

gypsiferous rock, poorly cemented sandstone and conglomerate or soft or closely jointed rock of any sort. The rock shall have the physical properties required by ASTM C33 for quarry rock suitable for producing coarse aggregate for concrete, in accordance with ASTM C88 and C131, respectively. The requirements of the Los Angeles Abrasion Test for all rock shall be a maximum loss of 30 percent. All stone shall not weigh less than 155 pounds or more than 175 pounds per cubic foot, as determined by the standard test for apparent specific gravity (ASTM C127), using representative chips about one inch in size taken from the stone as furnished. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified.

3. The stone riprap to be used will be accepted only after its suitability has been established to the satisfaction of the Engineer. Samples of the proposed stone riprap shall be submitted as directed by the Engineer, as well as the name and location of proposed quarry for approval prior to shipment of any stone riprap. The Engineer will approve proposed procedures for delivery of stone riprap, prior to shipment of any materials.
4. Approval of samples submitted, or of the quarries, shall not be construed as a waiver by the Engineer of the right to reject any stone riprap which does not comply with the requirements noted hereinafter.
5. Rip-Rap Overflow Weir and Riprap at Pipe Ends (3" to 6" Rip-Rap): Stone riprap shall conform to MassDOT Standard Specification M2.02.4 and the following gradation requirements:

SIZE OF STONE (IN)	NOMINAL PERCENT PASSING BY WEIGHT
12	100
8	95-100
4	0-25
2 1/2	0-5

- J. Dense Graded Crushed Stone: Dense graded crushed stone shall consist of durable crushed rock or durable crushed gravel stone and fine aggregates of natural sand or stone screenings uniformly mixed, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following gradation requirements as designated by MassDOT Standard Specification M2.01.7.

SIEVE DESIGNATION	NOMINAL PERCENT PASSING BY WEIGHT
2-inch	100
1 1/2-inch	70-100
3/4-inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-10

- K. Loam Borrow: Loam borrow shall consist of fertile, friable, natural topsoil, having similar properties to the existing topsoil in the area. It shall be a mixture of sand, silt, and clay and be free from ice and snow, roots, weeds, heavy or stiff clay, stones larger than 1 inch diameter, or other deleterious material.

SIEVE DESIGNATION	NOMINAL PERCENT PASSING BY WEIGHT
No. 10	85-100
No. 40	35-85
No. 200	10-35
<20µm	0-5

- L. Topsoil/Planting Soil Mix: Topsoil as specified in Section 02920.
- M. Wood Mulch: Wood mulch shall meet the requirements of MassDOT Standard Specification for Wood Chip Mulch M6.04.3 or Aged Pine Bark Mulch M6.04.5, and be suitable for the application.

## 2.2 DUST CONTROL

- A. Calcium chloride application will not be permitted unless it is approved by the Engineer.
- B. Water application shall be the only means for dust control.

## PART 3 – EXECUTION

### 3.1 FILLING AND BACKFILLING

- A. Subgrade Preparation: After the subgrade has been shaped to line, grade, and cross-section, it shall be thoroughly compacted. This operation shall include any required reshaping and wetting to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material from excavation or borrow. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted.
- B. Backfill Material Selection: Unless otherwise specified or directed, material used for filling and backfilling shall meet the requirements specified under Materials (Part 2). In general, the material used for backfilling utility trench excavations shall be material removed from the excavations provided that the reuse of these materials result in the required trench compaction and meets the requirements specified. All backfill placed within the building limits shall be structural fill unless otherwise specified. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, the first lift of backfill shall be 12-inches of compacted sand and gravel to provide a working mat and drainage layer.

1. Place backfill to a maximum loose lift thickness of 12 inches. Maintain backfill material with uniform moisture content, with no visible wet or dry streaking, between plus 2 percent and minus 3 percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

C. Trench Backfill:

1. The trenches shall be backfilled as soon as practicable with suitable material. All trench backfilling shall be done with special care, in the following manner and as directed by the Engineer.
2. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the springline of the pipe. The selected backfill material shall be placed by hand shovels, in layers not more than 4-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids.
3. The balance of backfill shall be spread in layers not exceeding 12-inches in loose depth. Each layer shall be thoroughly compacted by mechanical methods and shall contain no rock, stones or boulders larger than 4-inches in their greatest dimension.
4. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time; if necessary, a timber grillage or other suitable method shall be used to break the fall of material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.
5. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density at least equal to that of the surrounding undisturbed earth, and in such a manner as to permit the rolling and compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value, so that paving of the excavated and disturbed areas, where required, can proceed immediately after backfilling is completed.
6. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
7. During filling and backfilling operations, pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any other

defects they shall be remedied in a manner satisfactory to the Engineer at no additional cost to the Owner.

D. Backfilling Against Structures:

1. Backfilling against masonry or concrete shall not be done until permitted by the Engineer. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed including waterproofing, special leakage tests of the structures shall be made by the Contractor, as required by the Contract Drawings and/or the Engineer. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures including waterproofing, the backfilling around the structures shall proceed using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2 feet of the structure; the backfill material within 2 feet of the structure shall not contain silt or clay. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.
    - i. The material used for backfilling within 2 feet of structures with sheet waterproofing shall be drainage sand.
  2. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12-inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
  3. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures, waterproofing, and appurtenances due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.
- E. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.
- F. The finished subgrade of the fills and filled excavations upon which topsoil is to be placed, or pavements are to be constructed, shall not be disturbed by traffic of other

operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

- G. Uniformly smooth grading of all areas to be graded, as indicated and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations, shall be accomplished. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

### 3.2 COMPACTION

- A. Compaction Requirements: The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. The compaction requirements are as follows:

AREA	ASTM DENSITY DEGREE OF COMPACTION
Below footings	95%
Below slabs	95%
Against concrete structures	95%
Below retaining walls	95%
Pavement base course	95%
Pavement subbase	95%
General fill below pavement subbase	95%
Trench backfill - below pavements	95%
- below landscaped areas	92%
- below structures	95%
Stormwater Infiltration Systems	None/Minimal Minimal/By Hand
Other areas	90%

- B. Moisture Control:

1. Fill that is too wet for proper compaction shall be disced, harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

- C. Unfavorable Conditions:

1. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is

interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.

**D. Compaction Control:**

1. In-place density tests shall be made in accordance with ASTM D1556, D2922 or D2167 as the work progresses, to determine the degree of compaction being attained by the Contractor. Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner. In-place density tests will be made at the Contractor's expense by the geotechnical testing laboratory.
2. The Engineer's duties do not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing performed by him shall excuse the Contractor from defects discovered in his work at that time or subsequent to the testing.
3. In-place density tests shall be performed as a minimum according to the following:
  - i. One test per lift under spread footings.
  - ii. One test per lift for every 100' length, or portion thereof, of strip footings.
  - iii. One test for every 100' length, or portion thereof, of retaining walls.
  - iv. A minimum of every 50 cubic yards of backfill in trenches or around structures.
  - v. One test every 500 cubic yards of material placed for embankment construction.
4. Minimum testing requirements for granular drainage and cover material are as follows:

TYPE OF TEST	FREQUENCY	TESTING METHOD(S)
Grain Size Analysis (to the No. 200 Sieve)	1 test/1500 cy	ASTM D-422
Proctor Compaction Test	As determined by Engineer	ASTM D-1557

**E. Placement:**

1. All fill shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein.



Each layer of fill should be benched into the existing slope in order to avoid the formation of a shear plane.

### 3.3 FINE GRADING

- A. Before surface or subbase is spread, the subgrade shall be shaped to a true surface conforming to the Drawings. All depressions and high spots shall be filled with suitable material or removed and such areas again compacted until the surface is smooth and properly compacted. A tolerance of 1/2-inch above or below the finished subgrade will be allowed provided that this 1/2-inch above or below grade is not maintained for a distance longer than 50 feet and that the required crown is maintained in the subgrade. Any portion which is not accessible to a roller shall be thoroughly compacted by other mechanical methods.

### 3.4 STOCKPILING AND USE OF SURPLUS EXCAVATED MATERIALS

- A. The Contractor shall strip and stockpile excavated materials. Any bushes that are removed shall be protected and replanted in the same location. Removed curbing shall be stockpiled in a safe manner. Where grassed areas are disturbed by stockpiled materials, the Contractor shall rake out the area and loam and re-seed at his expense.
- B. Stockpiling of materials shall be included in the pay items for excavating and no allowances shall be made for any stripping and stockpiling requirements.
- C. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored at a location provided by the Contractor. When required, it shall be re-handled and used in backfilling the trench.
- D. Use of surplus excavated materials (not including pavement or asphaltic concrete) as back-fill material is permitted if surplus material meets requirements of backfill materials as specified above. All other surplus material shall be taken off-site and disposed of legally at the Contractor's expense.
- E. Testing of surplus excavated materials shall be provided as described in Paragraph 1.3. to confirm compliance with specifications. Submit test results to Engineer one week prior to backfill operations.

### 3.5 EXCAVATION SUPPORT SYSTEM

- A. Furnish, put in place and maintain sheeting and bracing required by Federal, State or local safety requirements to support the sides of the excavation and prevent loss of ground which could endanger personnel, damage or delay the work or endanger adjacent structures. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he/she may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

- B. When moveable trench bracing such as trench boxes, manhole boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the screened gravel backfill.
- C. When installing pipe; trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, screened gravel shall be placed to fill any voids created and the screened gravel and backfill shall be recompacted to provide uniform side support for the pipe.
- D. The Contractor will be permitted to use steel sheeting in lieu of wood sheeting for the entire job wherever the use of sheeting is necessary. The cost for use of sheeting will be included in the bid items for pipe and shall include full compensation for driving, bracing and later removal of sheeting.
- E. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction of other structures, utilities, or property, whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as directed.
- F. The Contractor shall receive no payment, for sheeting, bracing, etc., during the progress of the work. The Contractor shall receive no payment for sheeting which has actually been left in place for the convenience of the Contractor.
- G. Sheetting driven below mid-diameter of any pipe shall remain in place from the driven elevation to at least 1-ft above the top of the pipe.

### 3.6 DUST CONTROL

- A. Calcium chloride application will not be permitted unless it is approved by the Engineer.
- B. Water application shall be the only method used for dust control. Application shall be by means of a water truck or other approved method. The number and frequency of applications shall be determined by the Engineer.

### 3.7 PLACING TOPSOIL

- A. Scarify compacted subgrade to a 2-inch depth to bond topsoil to subsoil. Place topsoil to a minimum depth of six (6) inches for areas disturbed by Contractor's construction operations and as shown on the Drawings. Spread evenly and grade to elevations and slopes shown. Hand rake areas inaccessible to machine grading.

### 3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02200

## SECTION 02273

### GEOTEXTILE FABRIC

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Providing geotextile fabric in foundation preparation for separation of existing soil from screened gravel or crushed stone beneath structures.
2. Providing geotextile fabric for separation of existing soil from crushed stone for gravel driveways, gravel shoulders, and temporary construction exits.
3. Placing the geotextile fabric for separation of soil from riprap at pipe outlets, overflow weirs, and as otherwise indicated or specified.
4. Providing geotextile fabric for silt fence as indicated or specified.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 02020 – Erosion and Sediment Control
4. Section 02140 – Dewatering and Discharge
5. Section 02200 – Earthwork

##### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – Submittals:

1. At least two weeks prior to shipment, submit manufacturer's certificate of compliance and physical property data sheet indicating that requirements for materials and manufacture are in conformance as specified.
2. For informational purposes only, submit manufacturer's printed installation instructions.

## 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 - Quality Assurance and as specified.
- B. General:
  - 1. Producer of geotextile fabric to maintain competent laboratory at point of manufacture to insure quality control in accordance with ASTM testing procedures. Laboratory to maintain records of quality control results.
  - 2. Do not expose geotextile fabric, except the geotextile fabric for silt fence, to ultraviolet radiation (sunlight) for more than 14 days total in period of time following manufacture until geotextile fabric is installed and covered with fill or backfill material.
  - 3. Take all precautions to protect geotextile fabric from damage resulting from any cause. Either repair or replace geotextile fabric to Engineer's satisfaction at no additional cost to the Owner.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 - Delivery, Storage, and Handling and as specified herein.
- B. Provide in accordance with manufacturer's recommendations.
- C. Provide geotextile fabric in rolls wrapped with protective covering to protect geotextile fabric from mud, dirt, dust, and debris. Label each roll of geotextile fabric with number or symbol to identify production run.
- D. Protect geotextile fabric from sunlight during transportation and storage. Do not leave geotextile fabric exposed to sunlight for more than two weeks during installation operations.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Provide nonwoven, 4.5 ounce per square yard, geotextile fabric, having an apparent opening size equivalent to US Sieve 70, and a tensile strength of 120 pounds for the precast concrete tight tank; catch basin, drain manhole, and hydrodynamic separator structures; retaining wall; foundation drain; gravel driveway; gravel shoulder area; construction exit; overflow weir; pipe ends; and, as directed by the Engineer:
  - 1. US 120NW as manufactured by US Fabrics.
  - 2. Mirafi 140N as manufactured by TenCate Geosynthetics Americas.
  - 3. ACF NO45 as manufactured by ACF Environmental.

4. Or Engineer approved equal.
- B. Provide the following woven geotextile fabric having an apparent opening size equivalent to US Sieve 50, and a minimum tensile strength of 320x320 pounds for the silt fence (if required), overflow weir filter fabric, and as directed by the Engineer:
1. US 350 as manufactured by US Fabrics.
  2. Mirafi FW500 as manufactured by TenCate Geosynthetics Americas.
  3. ACF HSP2 as manufactured by ACF Environmental.
  4. Or Engineer approved equal.

## 2.2 MATERIAL

- A. Geotextile fabric shall conform to test requirements for minimum average roll value (weakest principle direction) for strength properties of any individual roll tested from manufacturing lot or lots of particular shipment in excess of minimum average roll value (weakest principle direction) as specified hereafter:
- B. Physical Properties of Minimum Average Roll of the 4.5-ounce per square yard nonwoven geotextile fabric shall be:

Property	ASTM Test Method	Units	Value
Tensile Strength	D4632	lbs	120
Elongation at Break	D4632	%	50
Trapezoidal Tear Strength	D4533	lbs	50
Puncture Strength	D4833	lbs	65
Permittivity	D4491	Sec <sup>-1</sup>	1.5
Apparent Opening Size	D4751	Sieve #	70
Mullen Burst Strength	D3786	Psi	225
UV Resistance %Retained	D4355	%	70
Flow Rate	D4491	Gal/mins/sf	120

- C. Physical Properties of Minimum Average Roll of the woven geotextile fabric for the shall be:

Property	ASTM Test Method	Units	Value
Grab Strength	D4632	lbs	320
Permittivity	D4491	sec - 1	0.20
Apparent Opening Size	D4751	Sieve #	50
Ultraviolet Stability	D4355	%	70

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install geotextile fabric in accordance with manufacturer's printed instructions.
- B. Place geotextile fabric on the foundation subgrade prior to placing the screened gravel or crushed stone.
- C. Overlap geotextile fabric 18 inches minimum for unsewn lap joint.
- D. Do not permit traffic or construction equipment to travel directly on geotextile fabric.
- E. Place geotextile fabric in relatively smooth condition to prevent tearing or puncturing. Lay geotextile fabric loosely but without wrinkles or creases so that placement of the backfill materials will not stretch or tear geotextile fabric. Leave sufficient slack in geotextile fabric around irregularities to allow for readjustments.
- F. Patch all tears in geotextile fabric by placing additional section of geotextile fabric over tear with a minimum of 3 feet overlay.
- G. Extend the geotextile fabric and wrap around the screened gravel or crushed stone along the perimeter of the foundation.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02273

SECTION 02444  
CHAIN-LINK FENCE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Providing chain-link fence, double-leaf entrance gate, single leaf pedestrian gates, and accessories as indicated and specified.
- 2. Design Criteria
  - i. Fence heights as indicated on Contract Drawings with top rail and bottom tension wire.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 02200 – Earthwork
- 4. Section 03300 – Cast-in-Place Concrete

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – Submittals:

- 1. Submit manufacturer's specifications, drawings, details, and fence layout with appurtenances.
- 2. Submit two samples of fencing materials. Mark or tag each sample and submit 30 days prior to erection of fence.
- 3. Submit certified test reports with results of tests for fence finish.
- 4. Submit shop drawings, samples and certificates simultaneously as one complete package.

## 1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage and Handling.

## PART 2 - PRODUCTS

### 2.1 GENERAL

#### A. Galvanized Steel

1. Conform to ASTM Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric. (Designation A392-71a)
  2. Class II zinc coating (minimum of 2.0 oz. of zinc per sq. ft. of uncoated wire surface)
- B. Steel pipe dimensions and weights: ASTM A53, Schedule 40. Dimensions specified are nominal pipe sizes.
  - C. Dimensions and weight tolerances: Plus or minus five percent.
  - D. Provide posts with tops of same material, and designed to fit securely over post and carry top rail. Carry apron around outside of post at base of top fitting.
  - E. Ferrous metal fittings, posts, fence, gate framework, and accessories galvanized with heavy coating of 2.0 oz. pure zinc spelter per sq. ft. or surface area to be coated. Use hot-dip process. Thinner zinc coatings, electro-galvanizing, zinc paint or cold galvanizing compounds not used as substitute for hot-dipped galvanized finish not acceptable.
  - F. Fabricate and weld before hot-dip galvanizing. Weld conforming to American Welding Society standards.
  - G. Hot-dip galvanized gate frame, after welding, if bolted or riveted corner fittings not used.
  - H. Single and double leaf swing gates with center bolt, center stop, and automatic backstops process.

### 2.2 FENCE FABRIC

- A. Galvanized steel chain-link fabric conforming to ASTM A392, with Class 2 zinc coating (2.0 oz. of zinc per sq. ft. of uncoated wire surface); Fabric woven No.9 gage wire in a 6 ft. height Top selvage to be barbed, bottom selvage to be knuckled.

### 2.3 TENSION WIRE

- A. No. 7-gage coil spring steel wire with galvanized finish having minimum of 0.80 oz. of zinc coating per sq. ft. of uncoated wire surface.



## 2.4 TIE WIRES

- A. Tie wires, for fastening fence fabric to line posts and rails, not less than No. 6 gage aluminum wire.
- B. Tie wires, for fastening fence fabric to line posts and rails, not less than 9 gage (outside diameter) galvanized steel wire.

## 2.5 LINE POSTS

- A. 2-3/8 in. outside diameter steel pipe weighing not less than 3.65 lb. per ft., or 1-7/8 in. high carbon steel H-beams weighing not less than 2.70 lb. per ft.

## 2.6 END, CORNER, AND PULL POSTS

- A. 2-7/8 in. outside diameter steel pipe weighing not less than 5.79 lb. per ft., or 2-1/2 in. square steel tube weighing not less than 5.14 lb. per ft., or 3-1/2 in. by 3-1/2 in. roll-formed, steel corner section weighing not less than 5.14 lb. per ft.

## 2.7 GATE POSTS

- A. 2-7/8 in. outside diameter steel pipe and gate posts, for gate leaves up to and including 6 ft. wide, weighing not less than 5.79 lb. per ft., or 2-1/2 in. square steel tube weighing not less than 5.14 lb. per ft., or 3-1/2 in. by 3-1/2 in. roll-formed, steel corner section weighing not less than 5.14 lb. per ft.
- B. 4 in. outside diameter steel pipe, gate posts for gate leaves over 6 ft. wide and up to and including 13 ft. wide and weighing not less than 9.10 lb. per ft.
- C. 6-5/8 in. outside diameter steel pipe, gate posts for gate leaves over 13 ft. wide and up to and including 18 ft. weighing not less than 18.97 lb. per ft.

## 2.8 RAILINGS

- A. 1-5/8 in. outside diameter steel pipe with minimum weight of 2.27 lb. per ft. or 1-5/8 in. by 1-1/4 in., 14-gage roll-form section, for top railing and railings for top middle and bottom braces between terminal posts and adjacent line posts.

## 2.9 TRUSS

- A. 2-3/8 in. diameter steel rod diagonal truss braces between terminal and adjacent line posts and for gate framework.

## 2.10 FITTINGS

- A. Heavy-duty malleable iron or pressed steel fittings of suitable size to produce strong construction.

2.11 STRETCHER BARS

- A. Flat bars with minimum cross section dimensions of 1/4 in. by 3/4 in, full height of fabric, secured with bar bands of minimum 11-gage sheet steel, spaced approximately 15 in. on centers and bolted with 3/8 in. diameter bolts, for attaching fabric to terminal posts.

2.12 GATE LEAF FRAMEWORK

- A. 1-7/8 in. outside diameter steel pipe weighing 2.72 lb. per ft, minimum.

2.13 DROP ROD

- A. 1-3/8 in. outside diameter steel pipe weighing not less than 1.68 lb. per ft.

2.14 GATE HINGES

- A. Heavy pattern of adequate strength for gate size, with large bearing surfaces for clamping or bolting in position.

2.15 LATCH

- A. Gates with suitable latch, accessible from both sides and with provision for padlocking.

2.16 GATE PADLOCKS

- A. Manufacturers:

1. Yale, Berlin, CT;
2. Corbin Russwin, Inc., Berlin, CT;
3. Best Universal Lock Co., Inc., Indianapolis, IN;
4. Or acceptable equivalent product.

- B. Solid brass cases, hardened steel shackles, removable core cylinders, and galvanized steel chains attached to shackle by clevis.

- C. Provide padlocks for each gate.

- D. Key padlocks to the Town of Sharon's keying system. Coordinate with Owner/Engineer.

2.17 CONCRETE FOOTINGS

- A. Concrete shall conform to Section 03300 – Cast-In-Place Concrete.

## 2.18 GROUT

- A. One part Portland cement and three parts of clean, sharp, well-graded sand with minimum water for proper workability for posts set in solid rock.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Examine conditions under which fence and gates are to be installed. Notify Engineer, in writing, of improper conditions of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Verify measurements at site.
- D. Check location of underground work to make sure fence footings clear utilities and drainage work.
- E. Do not install fence until final grading is complete and finish elevations are established.
- F. Do not drive equipment on areas to be landscaped, except as approved by ENGINEER. Areas not accessible from roads shall be protected with heavy wood planking. Remove barricades and protection at completion of project. Repair damaged landscape surfaces.

### 3.2 INSTALLATION

#### A. Footings:

1. Vertical sides to minimize up-lift. Dispose of excavated material in accordance with Section 02200 – Earthwork.
2. Rod and compact concrete around posts. Slope top of footings above level of adjacent grade, and trowel finish.
3. Size:
  - i. 6 in. minimum dia, plus outside dimension of post.
  - ii. Set corner, end, pull, and gate posts 42 in. into concrete.
  - iii. Set line posts 36 in. into concrete.
  - iv. Total depth of concrete 6 in. greater than required for post embedment.
4. Time of Set: 48-hrs before rails are erected or before fabric is applied or stretched.

#### B. Framing:

1. Install line posts not more than 10 ft. apart.

2. Install pull posts not more than 600 ft. apart where a straight run of fence exceeds 600 ft. and where fence line changes direction by more than 15° but less than 30°.
3. Install corner posts where the fence line changes direction by more than 30°.
4. Set posts in concrete footings, plumb and true to line.
5. Brace and truss end, pull, corner, and gate posts to adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to adjacent line post. Truss diagonally with 3/8 in. dia tension rod with turnbuckle.
6. Fasten top rail to end, pull, gate, and corner posts. Pass top rail through fittings of line posts.
7. Provide expansion and contraction joints in top rail for each 100 linear ft. of fence.
8. Fasten bottom tension wire to end, pull, gate, corner, and line posts.
9. Maximum area of unbraced fence shall not exceed 1,500 square feet.
10. Use galvanized sleeve and grout posts or install with suitable galvanized flange casings and galvanized anchor bolts as directed by Engineer.
11. When rock is encountered, set posts into rock a minimum depth of 12 in. for line posts and 18 in. for terminal posts. If solid ledge is encountered without overburden of soil, provide post holes at least 1 in. greater in diameter than post, fill post holes with concrete, work post into hole taking care not to cause voids, remove excess concrete and crown remainder at top to shed water. Where solid rock is covered by overburden, do not exceed total setting depth required for setting in earth, grout posts into rock as described.

C. Fabric:

1. Place fabric on outside of posts and stretch to avoid bulging or buckling.
2. Fasten at line posts, top rail, and bottom tension wire with aluminum or zinc coated ties. Space ties not more than 15 in. apart on line posts and not more than 24 in. apart on rail and tension wire.
3. Fasten at terminal posts at intervals not exceeding 15 in. using flat or beveled galvanized steel bands with 5/16 in. x 1-1/4 in. galvanized carriage bolts and nuts.
4. Make tie connections on interior side of fence.

- D. Provide steel angle metal closures where finished ground surface is more than two inches below bottom tension wire. Bolt steel angle to fence posts, and install reinforcing rods and bracing members as approved. Install rods of accepted length

vertically where drainage ditches cross fence line, provide concrete ditch lining and steel reinforcing bar grill.

- E. Install gates plumb, level, and secure for full width of opening and hardware adjusted for smooth operation.
- F. Electrical Ground where a power line carrying more than 600 volts passes over fence, install ground rod at nearest point directly below each point of crossing.

### 3.3 TOUCH-UP AND REPAIR WORK

- A. Remove and replace fencing which is improperly located or is not true to line, grade and plumb within tolerances as indicated.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02444

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## SECTION 02513

### BITUMINOUS CONCRETE PAVEMENT

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Work under this section includes the installation of bituminous concrete pavement to a total compacted thickness of 4” for the existing roadway within Tree Lane, the WTP access driveway, and Well 4 driveway. Work also includes trench pavement and temporary pavement, as required. All existing pavement damaged or displaced as a result of the construction operations shall be restored in accordance with the requirements for this Section.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 02200 – Earthwork

##### 1.3 SUBMITTALS

- A. Refer to Section 01300 – Submittals. Include data showing gradation and composition of materials proposed. Product pavement slips to include all material by percentage and weight.
- B. Design Data: Submit design mix for bituminous binder and top (wearing) course.

##### 1.4 QUALITY CONTROL

- A. All work specified in this Section shall conform to Commonwealth of Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges (2023 Edition, or latest edition), including latest supplements, hereinafter called the "MassDOT Standard Specifications".
- B. Thickness: Test in-place asphalt concrete courses for compliance with requirements for thickness. Repair or remove and replace unacceptable paving as directed by Engineer. In-place compacted thickness will not be accepted if exceeding the following allowable variation from required thickness:
  1. Binder Course: ¼-inch, plus no minus

2. Top Course: ¼-inch, plus no minus

PART 2 – PRODUCTS

2.1 BANK OR CRUSHED GRAVEL

- A. Conform to MassDOT Standard Specifications, M1.03.1 for processed gravel for subbase and M2.01.7 for dense-graded crushed stone for subbase.

2.2 COARSE MINERAL AGGREGATE

- A. Conform to subsection M3.06.2 of the MassDOT Standard Specifications.

2.3 BITUMINOUS MATERIALS

- A. Bituminous material shall conform to M3.06.00 of the MassDOT Standard Specifications.
- B. Proportioning of Bituminous Concrete Mixture: The bituminous concrete mixture shall contain from 5.0 to 6.0 percent by weight of bitumen and from 94.0 to 95.0 percent by weight of mineral aggregates. The percentage of bitumen used shall be as directed within the limits specified.

2.4 BITUMINOUS CONCRETE BINDER COURSE

- A. MassDOT Standard Specifications subsection M3.06.00.

2.5 ASPHALT EMULSION TACK COAT

- A. MassDOT Standard Specifications subsection M3.03.0

2.6 BITUMINOUS CONCRETE TOP COURSE

- A. MassDOT Standard Specifications subsection M3.06.00.

2.7 PAVEMENT MARKINGS

- A. Pavement markings shall conform to the MassDOT Standard Specifications, Section M7.01.3 –for white and yellow Thermoplastic ReflectORIZED Pavement Markings.

PART 3 – EXECUTION

3.1 GENERAL

- A. Pavement depths shall be as shown on Drawings or as specified herein. All thicknesses are measured after rolling. The bituminous concrete mixture shall be evenly spread and rolled with a power roller having a minimum weight of 5-tons.
- B. Place bituminous concrete mixture on prepared surface, spread, and strike-off. Mixture temperature shall conform to the MassDOT Standard Specifications, Section 460.61.



Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Protect all adjacent construction from staining with mix or damage by mechanical equipment. Clean, repair, or replace any construction stained or damaged at no additional cost to the Owner.

### 3.2 PROTECTION OF EXISTING ROADWAYS

- A. Saw cut existing pavement to required width and depth to avoid damage to adjacent pavement, curbs, gutters, or other structures and as indicated on the drawings.

### 3.3 TEMPORARY PAVEMENT AND TRENCH PAVEMENT

- A. The pavement sub-base shall be excavated, graded, and compacted to a depth of 2-inches below the existing pavement.
- B. The initial pavement layer shall be a hot mixed binder course placed and compacted to a thickness of 2-inches by steel-wheeled rollers of sufficient weight to thoroughly compact the bituminous concrete without damaging the existing pavement. The new pavement shall be rolled smooth and even with the existing pavement.
- C. Temporary pavement and trench pavement shall be maintained in a condition suitable for traffic until final pavement. Defects shall be repaired within 24 hours of notification of such defects.

### 3.4 SUB-GRADE PREPARATION

- A. Subgrade preparation is in accordance with Section 02200 – Earthwork.

### 3.5 GRAVEL SUB-BASE PLACEMENT

- A. Gravel sub-base placement in accordance with Section 02200 and Pavement Details shown on the Drawings.

### 3.6 BITUMINOUS CONCRETE BINDER COURSE

- A. On the approved subbase course shall be placed a plant mixed bituminous concrete binder course Class I-1 (Hot-Mix) in compacted thickness of 2 1/2 inches. The bituminous concrete binder course shall be provided in accordance with the applicable requirements of MassDOT Standard Specifications Subsection 460.30 and Section M3.06.0 for "Materials", and Subsection 460.4 for "Construction Methods". Surface of the binder course as thus compacted shall not vary more than one-quarter inch (1/4") in ten feet (10') measured in any direction.
- B. Environmental Requirements:
  - 1. Do not place materials when underlying surface is muddy, frozen, or has frost, snow, or water thereon.
  - 2. Do not place when air temperature at time of placement, or anticipated temperature for following 24 hours, is lower than 40°F or higher than 90°F.

3. Apply prime and tack coats when ambient temperature is above 50°F and when temperature has not been below 35°F for 12 hours immediately prior to application.
4. Binder Course may be placed when air temperature is above 30°F and rising.
5. Grade Control: Establish and maintain required lines and elevations.

### 3.7 BITUMINOUS CONCRETE TOP COURSE

- A. Place bituminous concrete top course Class I-1 (Hot-Mix) pavement in one course to a compacted thickness of 1.5 inches. The finished pavement surface shall conform to meet the existing slope and shall not vary more than one-eighth inch (1/8) in ten feet (10') measured in any direction.
- B. The permanent bituminous concrete pavement top course shall be provided in accordance with details and the applicable requirements of MassDOT Standard Specifications Subsection 460.30 and Section M3.06.0 for "Materials", and Subsection 460.4 for "Construction Methods". The surface shall be rolled free of any roller marks, ridges, and voids, and shall be repaired as directed.

### 3.8 MILL AND PERMANENT PAVEMENT OVERLAY

- A. Preparation for permanent pavement overlay shall include milling, sweeping the existing and temporary pavement, from road edge to road edge. Areas of milling and overlay will be determined by the Engineer prior to placement.
- B. All pavement edges shall be square and straight. Irregular, jagged edges will not be allowed.
- C. Tack coat shall be applied immediately prior to placement of pavement.
- D. Permanent pavement overlay shall consist of two courses as shown on the Drawings.
- E. The permanent surface course shall be keyed to the existing pavement at ends of pavement repair sections, including driveways. Keys shall be cut to full pavement depth and be a minimum width of 24-inches. All joints between the existing and new pavements shall be keyed on an angle, or as approved by the Engineer, and shall be sealed with bitumen RS-1 and sanded.

### 3.9 RAISING BOXES AND CASTINGS

- A. Prior to placing pavement, the Contractor shall raise all castings, gate boxes, utility castings, as required, to proper grade.
- B. Contractor shall coordinate with all utility companies to obtain their requirements on castings.

### 3.10 SIDEWALKS

A. Cement concrete sidewalks:

1. Construct in accordance with MassDOT Standard Specifications Subsection 701, Sidewalks, Pedestrian Curb Ramps and Driveways.
2. Use 6x6, W2.9xW2.9 welded wire reinforcement.
3. Concrete sidewalks shall be 4-inches thick.
4. The subgrade for the walk or driveway shall be shaped to a true surface conforming to the proposed slope of the walk, thoroughly rolled at optimum moisture content, and tamped with a power roller weighing not less than one ton and not more than 5 tons. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard.
5. After the subgrade has been prepared, a sub-base of gravel at optimum moisture content shall be placed, thoroughly rolled by a power roller, and tamped. The gravel shall be a minimum of 8 inches in thickness.
6. The forms shall be smooth, free from warp, strong enough to resist springing out of shape, and deep enough to conform to the thickness of the proposed walk or driveway. All mortar or dirt shall be completely removed from forms that have been previously used. The forms shall be well staked, thoroughly braced, and set to the established lines with their upper edge conforming to the grade of the finished walk or driveway.
7. The finished surface shall have sufficient pitch from the outside edge to provide for surface drainage. This pitch shall be 1/4 of an inch per foot unless otherwise directed by the Engineer. Before the concrete is placed, the sub-base for sidewalks shall be thoroughly dampened until it is moist throughout but without puddles of water.

3.11 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02513

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## SECTION 02532

### ASPHALT EMULSION TACK COAT

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. An asphalt emulsion tack coat shall be placed on all surfaces to receive a new asphalt bituminous top course in accordance with these plans and specifications, and Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges (2023 Edition, or latest edition), Subsection 452.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 02513 – Bituminous Concrete Pavement

##### 1.3 SUBMITTALS

- A. Samples of the asphalt emulsion material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the asphalt emulsion material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.
- B. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of asphalt emulsion material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the asphalt emulsion material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

PART 2 - PRODUCTS

2.1 ASPHALT EMULSION MATERIALS

- A. The asphalt emulsion material should be cutback asphalt and shall conform to the requirements of Table A:

TABLE A  
ASPHALT EMULSION MATERIAL

<u>Type/Grade</u>	<u>Specification</u>	<u>Application Temperature</u>	
		<u>Deg. F.</u>	<u>Deg. C.</u>
Cutback Asphalt/RC-70	ASTM D 2028	120-160	50-70

The materials used for the work specified herein shall also meet the following requirements:

- ASTM D 1250                      Petroleum Measurement Tables
- ASTM D 2028                     Liquid Asphalt (Rapid-Curing Type)

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. The tack coat shall be applied only when the existing surface is clear and dry and the atmospheric temperature is above 60°F (15°C). The temperature requirements may be waived, at the direction of the Engineer.

3.2 EQUIPMENT

- A. The Contractor shall provide equipment for heating and applying the asphalt emulsion material.
- B. The distributor shall be designed, equipped, maintained, and operated so that asphalt emulsion material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gauges, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperature of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.
- C. A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

### 3.3 APPLICATION OF ASPHALT EMULSION MATERIAL

- A. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or air blast to remove all loose dirt and other objectionable material.
- B. The asphalt emulsion material shall be uniformly applied with a distributor at the rate of 0.1 gallons per square yard.
- C. Following the application, the surface shall be allowed to cure without being disturbed for such periods of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02532

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## SECTION 02550

### SIGNAGE

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Provide all labor, materials, equipment and supervision necessary to complete the work specified in this Section and shown on the Contract Drawings.

##### 1.3 RELATED SECTIONS

- A. Drawings and general provisions of the Contract and:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02640 – Fire Hydrants, Valves, and Appurtenances
  - 4. Section 03300 – Cast-in-Place Concrete

##### 1.4 SUBMITTALS

- A. Shop Drawings: Submit manufacturer's product information in accordance with Section 01300 – Submittals.

##### 1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400.

##### 1.6 REFERENCES

- A. Commonwealth of Massachusetts Department of Transportation (MassDOT Standard Specifications for Highways and Bridges (2021 Edition, or latest edition) with all supplemental specifications.
- B. FHA – Manual on Uniform Traffic Control Devices (MUTCD).
- C. American Association of State Highway and Transportation Officials (AASHTO).

## PART 2 – PRODUCTS

### 2.1 SIGNS

- A. All signs shall be in compliance with the latest revision of the MassDOT specifications.
- B. Each hydrant connected to non-potable water (e.g. raw water and flow to waste) shall be provided with a weather resistant metallic sign that reads “NON POTABLE – NOT FOR FIRE PROTECTION”
- C. The entrance gate of the Access driveway shall be provided with a weather resistant metallic sign that reads “DAVID M. MASCIARELLI WATER TREATMENT PLANT”.

### 2.2 CONCRETE

- A. All concrete must be 3,000 psi concrete, provide in accordance with Section 03300.

### 2.3 SIGN POSTS

- A. All sign posts shall be “breakaway” type and must conform to the latest revision of the MassDOT specifications.

## PART 3 – EXECUTION

### 3.1 SITE SIGNAGE

- A. The Contractor shall coordinate the final location with the Owner/Engineer.
- B. The Contractor shall furnish signs as indicated on the Drawings and install in accordance with manufacturers recommendations and these Specifications.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 02550

## SECTION 02570

### PRECAST MANHOLES, TIGHT TANKS, HYDRODYNAMIC SEPARATORS, GRAVITY PIPING, AND APPURTENANCES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. The work covered under this Section of the Specifications includes the following:
  - 1. The work includes furnishing and installing waste pipes, drainage pipes, manholes, catch basins, fittings, tight tanks, hydrodynamic separators, and other structures and appurtenances required and in accordance with the Contract Drawings and Specifications.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02200 – Earthwork
  - 4. Section 02140 – Dewatering and Discharge
  - 5. Section 02160 – Temporary Excavation Support
  - 6. Section 02615 – Ductile-Iron Pipe and Fittings

##### 1.3 SUBMITTALS

- A. List of materials proposed and manufacturers' specifications and installation instructions.
- B. Shop drawings for all material and structures prior to ordering materials, including pipe materials, connections, fittings and valves, and component construction, features, configuration, and dimensions.
- C. Manufacturer's certifications, warranties, and operation and maintenance manuals.
- D. Submit in accordance with Section 01300 – Submittals.

## 1.4 INSPECTION

- A. The supplier is responsible for the provisions and all test requirements. Pipe may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid for by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections.
- B. Inspection of the pipe may also be made after delivery. The Contractor shall furnish all labor to assist the Engineer in inspecting the pipe. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipe samples may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once.
- C. Imperfections in materials may be repaired, subject to approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval.

## 1.5 DELIVERY, STORAGE & HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein.
- B. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.
- C. All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Engineer to be unrepairable, shall be replaced at no cost to the Owner.
- D. Storage and handling of pipes, precast structures, and other system appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Engineer.
- E. Only nylon-protected slings shall be used for handling the pipe. No hooks or bare cables will be permitted.
- F. Pipe shall be stored above ground at a height no greater than 5 feet, and with even support for the pipe barrel.

## PART 2 - PRODUCTS

### 2.1 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. Storm Drain Pipe: Pipe shall be smooth interior wall and corrugated exterior wall.
  - 1. Pipes shall comply with the requirements for test methods, dimensions, and markings found in AASHTO Designation M294, Type S for 12-inch through 60-inch diameters.

2. Pipe joints shall be water tight according to the requirements of ASTM D3212, and gaskets shall meet the requirements of ASTM F477.
  3. Pipe and fittings shall be HDPE conforming to the minimum requirements of cell classification 435400C for 12-inch through 60-inch diameters in accordance with ASTM D3350.
  4. Pipe and fittings shall be ADS N-12 WT pipe or approved equal.
- B. Foundation Drain Pipe: Pipe shall be smooth interior wall and corrugated exterior wall.
1. Pipes shall comply with the requirements for test methods, dimensions, and markings found in AASHTO Designation M252, Type S or SP for 4-inch through 10-inch diameters.
  2. Pipe joints shall be soil tight according to the requirements of ASTM F2306.
  3. Pipe and fittings shall be HDPE conforming to the minimum requirements of cell classification 435420C for 4-inch through 10-inch diameters in accordance with ASTM D3350.
  4. Pipe shall be perforated by manufacturer for applications as indicated in the contract drawings.
  5. Pipe and fittings shall be ADS N-12 ST IB pipe or approved equal.
- C. Flared End Sections: Flared ends shall be corrugated HDPE.
1. Flared end section dimensions, materials, and fabrication shall be in accordance with AASHTO M294.
  2. Flared end sections shall be by the same manufacturer as HDPE Storm Drain Pipe.

## 2.2 POLYVINYLCHLORIDE (PVC) PIPE

- A. PVC pipe shall be certified by the National Sanitation Foundation (NSF).
- B. Vent Pipe and Fittings: PVC Vent Pipe shall be Schedule 80 CPVC with UV stabilizer with rubber rings and shall meet the requirements of ASTM D3034.
- C. Joints: Rubber rings shall conform to ASTM F477 and joints shall be design tested to the requirements of ASTM D3139. Rubber rings capable of withstanding a pH of 9.5, and shall be petroleum resistant. Rubber rings shall provide a tight seal that protects the line from shock and vibration, and compensates for expansion and contraction of pipe lengths.
- D. Gasketed joints shall meet the requirements of ASTM D3212.
- E. PVC Vent Odor Control: A passive odor control vent shall be supplied using a top mounted carbon canister unit with rain shield. The canister housing shall be aluminum

with mounting flange, rain shield, with powder coat finish. The replaceable canister shall contain a minimum of 12 pounds of activated carbon, and shall be safe for recyclable disposal.

- F. Insulation: Extruded closed-cell rigid formed polystyrene, equal to "Styrofoam: HI-60" by Dow Chemical. Size is 2-inch thick by 4 feet wide.

### 2.3 CAST IRON PIPE

- A. Sanitary Waste and Sample Sink Waste Pipe and Fittings: Cast iron pipe and fittings shall meet the requirements of the editions of ASTM A74 or CISPI 301 currently in effect. Cast iron pipe and fittings shall be service weight coated with tar or asphaltum with resilient gasket joints.

### 2.4 DUCTILE IRON PIPE

- A. Provided in accordance with Section 02615 Ductile-Iron Pipe and Fittings.

### 2.5 GATE VALVES AND BOXES

- A. Sample Sink Waste Valves: Resilient wedge gate valves shall be iron body, resilient seated type meeting the latest edition of AWWA C509 or AWWA C515 with mechanical joint ends. Valves shall have corrosion resistant fusion - bonded interior and exterior coatings. Valves shall be as manufactured by Mueller Company, American Flow Control, Kennedy Valve Manufacturer Company or Engineer approved equal. For standardization, valves and accessories shall be from the same manufacturer. Gate valves shall be NSF61 Standard Certified. Gate are to have O-ring seals and a non-rising stem. Valves shall have a 2-inch operating nut, and be Open Left (counterclockwise to open).
- B. Valve boxes shall be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "sewer" cast on the top. A minimum 6-inch overlap is required between sliding sections. The inside diameter of the bottom section shall be at least 5-1/4-inches and shall have a belled base. The top section shall be at least 6-1/8-inches and have top flanges. The bottom section shall be at least 36-inches in length. The top section shall be at least 26-inches in length and have a plain bottom. No three piece combinations shall be acceptable. Valve boxes shall be manufactured in North America only.

### 2.6 MANHOLES AND CATCH BASINS

- A. Precast Units:

- 1. Structure: Four foot minimum inside diameter precast unit for manholes and catch basins (4,000 psi minimum compressive strength) with standard precast concentric cone section or flat top section (as required) including a twenty-four inch (24") diameter (minimum) opening, and one pour monolithic base section conforming to ASTM C478. All units shall be designed for HS20-44 loading. Structure wall thickness shall be 5 inches, minimum.

2. Precast Unit Joint Seals: Preformed bitumastic sealant conforming to ASTM C990. Joint seal shall fill 75% of the joint cavity.
3. The date of manufacture, trademark and name of the manufacturer shall be clearly marked on the inside of each precast section.

B. Masonry:

1. Brick for minor grade adjustments shall be Grade SS conforming to ASTM C32. Grade MS shall be used for manhole structures and applications other than inverts and shelves.
  2. Mortar shall be composed of one part Type II Portland cement (ASTM C150), two parts sand (ASTM C144), well graded with no grain larger than will pass a Number 8 sieve, and 20 percent hydrated lime conforming to ASTM C207 Type S.
  3. Cement shall be Type I or II Portland cement conforming to ASTM C150, Standard Specification for Portland cement. Where masonry is exposed to salt water, Type II shall be used.
  4. Hydrated lime shall be Type S conforming to ASTM D207.
  5. Sand for masonry mortar shall conform to the gradation requirements of ASTM C144.
- C. Frame and Cover: Provide heavy duty cast iron frame and cover, with the word "DRAIN" embossed on cover. Letter size shall be 3 inches. Frame shall have a clear opening dimension of 24 inches and the frame depth shall be determined by the Contractor and a minimum of 4 inches deep. Frame and Cover shall be North American made, no exceptions.
- D. Frame and Grate: Provide 24 inch square cast iron catch basin grate. The frame depth shall be determined by the Contractor and a minimum of 4 inches deep. Frame and grate shall be North American made, no exceptions.
- E. Pipe Connections: Flexible sleeve or rubber gaskets shall be fastened with stainless steel clamps and shall be Lock-Joint, Kor-N-Seal, Press-Seal, or approved equal.
- F. Dampproofing Bitumastic Coating: The entire exterior surface of all manholes shall be coated with two coats of an approved bitumastic material using cutback asphalt, AASHTO M81 or M82, Asphalt emulsion AASHTO M140 or approved equal, at 5 gallons per 100 square feet minimum per coat to produce a dry film thickness of 0.07 inches (7 mils) per coat. Touch up in the field prior to backfilling as required by Engineer.

## 2.7 TIGHT TANK

A. Precast Units:

1. Structure: Precast concrete unit (5,000 psi minimum compressive strength) capable of holding 3,500 gallons below pipe inlet. Tank shall be two piece construction, one pour monolithic top and bottom section conforming to ASTM C150 / C150M-21. Top section shall include three twenty-four inch (24") diameter (minimum) openings. Reinforcement per ASTM C1227. All units shall be designed for HS20-44 loading.
  2. Investigate buoyancy and soil bearing considerations for groundwater elevation shown. The groundwater shall be assumed to be at the ground surface, unless otherwise noted on the drawings. If the design of the tight tank requires a concrete pad to prevent flotation, the cost of designing, furnishing, and installing a reinforced concrete pad shall be included in the price for the tight tank. Details of the design of the concrete pad (if required) shall be submitted to the Engineer for review.
  3. Precast Unit Joint Seals: Preformed bitumastic sealant conforming to ASTM C990. Joint seal shall fill 75% of the joint cavity.
  4. The date of manufacture, trademark and name of the manufacturer shall be clearly marked on the inside of each precast section.
  5. Contractor to coordinate all tank penetrations with field conditions and other disciplines, as required and shown on the Contract Drawings.
- B. Manhole Frame and Cover: Provide heavy duty cast iron frame and cover, with the word "SEWER" embossed on cover. Letter size shall be three inches. Frame shall have a clear opening dimension of 24 inches and the frame depth shall be determined by the Contractor and a minimum of 4 inches deep. Frame and Cover shall be North American made, no exceptions.
- C. Pipe Connections: The annular space between the concrete and the pipe shall be positively sealed with "Model 'C' Link Seal" as manufactured by GPT (formerly Thunderline) or approved equal. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the annular space, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall opening. Bolts and nuts shall be constructed of steel with a corrosion inhibiting coating. The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members. Grout penetrations after installation.
- D. Waterproofing: Units shall have 2 coats of factory applied bitumastic waterproofing coating on the exterior surface. Touch up in the field, by General Contractor, prior to backfilling as required by Engineer. Tight tank shall be waterproof and water tight.
- E. Instrumentation and Controls/Electrical: As specified under Division 13 and Division 16.



## 2.8 HYDRODYNAMIC SEPARATOR

### A. General:

1. The manufacturer of the hydrodynamic separator shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer.
2. All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.
3. The manufacturer shall guarantee the hydrodynamic separator components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation.
4. Submit a “Manufacturer’s Performance Certification” certifying that each hydrodynamic separator is capable of achieving the specified removal efficiencies listed in these specifications.
5. Submit project specific operations and maintenance manuals in accordance with Section 01730.

### B. Precast Units:

1. The hydrodynamic separators shall be as shown on the Contract Drawings and shall have a sediment storage capacity of at least 46 cubic feet; a MassDEP water quality flow rate of at least 0.40 cfs; and a peak conveyance flow rate of at least 2.9 cfs.
2. Manufacturers:
  - i. Contech Engineered Solutions LLC
  - ii. StormTrap, LLC
  - iii. Hydro International UK Ltd.
  - iv. Or Engineer approved equal.
  - v. The basis of design on the Contract Drawings for hydrodynamic separators is Stormceptor STC 450i.
3. Structure: Housing unit of stormwater treatment device shall be constructed of pre-cast concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:
  - i. Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);

- ii. Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
  - iii. Cement shall be Type III Portland Cement conforming to ASTM C 150;
  - iv. Aggregates shall conform to ASTM C 33;
  - v. Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
  - vi. Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990. Joint seal shall fill 75% of the joint cavity.
  - vii. Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.
4. Internal Components and appurtenances shall conform to the following:
- i. Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
  - ii. Fiberglass components shall conform to applicable sections of ASTM D-4097;
  - iii. Access system(s) conform to the following: Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30;
  - iv. Ladder rungs to be provided upon request;
  - v. An aluminum safety grate shall be installed within the chamber of the unit.
5. The hydrodynamic separator device shall remove oil and sediment from stormwater during frequent wet weather events and retain these pollutants within the device for later removal.
6. The hydrodynamic separator device shall be sized to remove the specified total suspended sediment load using the particle size distribution (PSD) in Table 1, in addition to adhering to the other sections of this specification. No alternative PSDs or deviations shall be accepted.

Table 1 – Particle Size Distribution		
Particle Size Distribution to be used to size Hydrodynamic Separator		
Particle Diameter (Micron)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

7. The precast concrete unit shall include one twenty-four inch (24") diameter (minimum) opening. The retained sediment shall be accessible for removal during periodic maintenance without requiring entry into the separator.
  8. Investigate buoyancy and soil bearing considerations for groundwater elevation shown. The groundwater shall be assumed to be at the ground surface, unless otherwise noted on the drawings. If the design of the hydrodynamic separator requires a concrete pad to prevent flotation, the cost of designing, furnishing, and installing a reinforced concrete pad shall be included in the price for the unit. Details of the design of the concrete pad (if required) shall be submitted to the Engineer for review.
  9. The date of manufacture, trademark and name of the manufacturer shall be clearly marked on the inside of each precast section.
- C. Manhole Frame and Cover: Provide heavy duty cast iron frame and cover, with the word "DRAIN" embossed on cover. Letter size shall be three inches. Frame shall have a clear opening dimension of 24 inches and the frame depth shall be determined by the Contractor and a minimum of 4 inches deep. Frame and Cover shall be North American made, no exceptions.
- D. Pipe Connections: The annular space between the concrete and the pipe shall be positively sealed with "Model 'C' Link Seal" as manufactured by GPT (formerly Thunderline) or approved equal. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space. Bolts and nuts shall be constructed of steel with a corrosion inhibiting coating. The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members.

## 2.9 INSULATION

- A. Pipe shall be insulated where shown on the Contract Drawings and where directed. Insulation shall be a thermal barrier conduit of nonmetallic, sectional factory fabricated type. It shall be structurally strong, watertight and entirely resistant to corrosive elements. The entire system shall be suitable for outside installation with temperature variations from -40 °F to +120 °F. It shall be closed cell, rigid polyurethane foam pipe insulation of 2-inch minimum thickness, a minimum density of 2.1 pounds per c.f., a maximum "K" factor of 0.14, 90 – 95 percent closed cell quality when cured and a minimum compressive strength of 50 psi. The polyurethane foam pipe insulation shall completely fill the annulus between the carrier pipe and jacketing. The outer casing shall be black high density polyethylene Type 1, Grade 1, Class 12454B in accordance with ASTM Designation D1784. All ends of piping insulation shall be sealed with a factory applied moisture barrier.
- B. Field joints shall be insulated utilizing poured-in-place polyurethane foam, jacketed with the same materials as used on the straight lengths of pipe and sealed with a heat shrinkable end seal.

- C. The piping is to have the encased insulation applied, to the degree practical, at the factory of the insulation and casing fabricator. A representative of the Manufacturer shall be available at the project site for instruction and supervision.
- D. Bedding material for the insulated pipe shall be ½-inch crushed stone.

## 2.10 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

- A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED [WATER, SEWER, DRAIN, ELECTRIC, GAS, ETC.] PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

## PART 3 - EXECUTION

### 3.1 EXCAVATION AND BACKFILLING

- A. The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 02200 – Earthwork, and the details shown on the Drawings.

### 3.2 GRAVITY PIPE INSTALLATION

- A. All waste and drain piping shall be laid accurately to the lines and grades shown in the Contract Drawings and in conformance with pipe manufacturer's recommended procedures.
- B. Laying Pipe: Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells up grade unless otherwise approved by the Engineer.
  - 1. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly lubricated and assembled.
  - 2. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
  - 3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.

- C. Pipe Extension: Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Engineer.
- D. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- E. Pipe Entrances to Structures: All pipes entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics or the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
- F. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment. Vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk and in accordance with all applicable federal, state and local safety regulations.
- G. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary water-tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been properly dewatered and all danger of water entering the pipe eliminated. The Contractor is responsible for proper dewatering to ensure a stable pipe foundation. Proper dewatering to two feet (minimum) below the pipe invert to ensure joining of the pipe in a dry condition.
- H. Water Pipe – Sewer Pipe Separation: When a sewer pipe crosses above or below a water pipe, the following procedures shall be utilized. The Contractor shall comply with these following procedures.
  - 1. Relation to Water Mains
    - i. Horizontal Separation: Whenever possible sewers shall be laid at a minimum at least ten feet (10'), horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet to a water main, the sewer may be laid closer if:
      - (a) It is laid in a separate trench, or if
      - (b) It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if
      - (c) In either case the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
    - ii. Vertical Separation: Whenever sewers must cross under water, sewer is at least eighteen inches (18") below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of ten feet (10') on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

2. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness or both pipes shall be encased in concrete.

### 3.3 PVC PIPE JOINTS

- A. All joints shall be made watertight.
- B. Pipe shall be jointed in strict accordance with the pipe manufacturer's instruction. Jointing of all pipes shall be done entirely in the trench.
- C. PVC Pipe
  1. Lubricant for jointing of PVC pipe shall be applied as specified by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer.
  2. PVC pipe shall be pushed home by hand or with use of a bar and block. The use of power equipment, such as a backhoe bucket, shall only be used at the direction of the manufacturer.
  3. The position of the gasket shall be checked to insure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
  4. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.

### 3.4 CAST IRON PIPE JOINTS

- A. Join cast iron sanitary waste piping according to CISPI 301 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook".

### 3.5 HIGH DENSITY POLYETHYLENE PIPE (HDPE) BELL AND SPIGOT JOINTS

- A. HDPE drainage pipe shall be joined by using a bell and spigot joint meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F203. The joint shall be watertight in accordance with ASTM D3212. Gaskets shall be furnished by the pipe manufacture.

### 3.6 PRECAST TIGHT TANKS, HYDRODYNAMIC SEPARATORS, MANHOLES, AND CATCH BASINS

- A. General Requirements: All tight tanks, hydrodynamic separators, manholes, and catch basins shall be built in accordance with the Details and in the locations shown on the Drawings. Structures shall be constructed of precast concrete as depicted in the drawings. Personnel experienced and skilled in this work shall be provided, and any person not deemed to be such by the Engineer shall be removed and replaced by a person so qualified. The Contractor shall accurately locate each structure and set accurate

templates to conform to the required line and grade. Any structure that is incorrectly located or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at no additional cost to the Owner.

- B. Foundations: The excavation shall be dewatered to provide a dry condition while placing bedding material and setting the base.
- C. Precast Structures: Precast structures shall be installed only after Shop Drawings have been approved. The top grade of the precast concrete flat top section shall be set sufficiently below finished grade to permit a maximum of five and a minimum of two courses of eight inch brick to be used as risers to adjust the grade of the manhole frame. Manhole frames shall be set on a grout pad to make a watertight fit.
- D. The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.
- E. The contractor shall exercise care in the storage and handling of the hydrodynamic separator components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the Contractor.
- F. The hydrodynamic separator shall be installed in accordance with the manufacturer's recommendations and related sections of the Contract Documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours' notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

### 3.7 PIPE CONNECTIONS TO NEW STRUCTURES

- A. Pipe connections for precast structures may be accomplished by the method described below. The Contractor shall make sure that the outside diameter of the pipe is compatible with the particular pipe connection used.
  - 1. Link Seals: Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the annular space, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall opening. Grout penetrations after installation.

### 3.8 PRESSURE TESTING OF GRAVITY MAIN

- A. On completion of a section of gravity main, the Contractor shall install suitable bulkheads as required, dewater and test the gravity main for leakage.

- B. Unless otherwise approved, the section shall be tested using low pressure air test procedures. If circumstances permit, the Engineer may allow testing by infiltration or exfiltration in lieu of air testing.
- C. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psi. The minimum duration permitted for the prescribed low pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. The two tables are reproduced on the following pages.
- D. The pipeline shall be made as nearly watertight as practicable, and leakage tests and measurements shall be made after the pipeline has been backfilled. Where the groundwater level is more than 1 ft. above the top of the pipe at its upper end, the Contractor, with the authorization of the Engineer, conduct either infiltration tests or low pressure air test. Where the groundwater level is less than 1 ft. above the top of the pipe at its upper end, the Contractor, with the authorization of the Engineer, shall conduct either exfiltration tests or low pressure air tests. At the time of the test, the Contractor shall determine the groundwater elevation from observation wells, excavations or other means, all subject to review by the Engineer.
- E. For making the low pressure air tests, the Contractor shall use equipment specifically designed and manufactured for the purpose of testing backwash waste piping, roof leaders, and sewer pipelines using low pressure air. The equipment shall be provided with an air regulatory valve or air safety so set that the internal air pressure in the pipeline cannot exceed 8 psig.
- F. The leakage test using low pressure air shall be made on each structure-to-structure section of pipeline after placement of the backfill. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
- G. All air used shall pass through a single control panel.
- H. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by the groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater is greater than 4 psig, the Contractor shall conduct only an infiltration test. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig. (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

<u>Pipe diameter in inches</u>	<u>Minutes</u>
4	2.5
6	3.0



8	4.0
10	5.0
12	5.5
15	7.5
18	9.0
21	10.0
24	11.5
27	13.0

- I. For making the infiltration and exfiltration tests, the Contractor shall furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests on sections of acceptable length.
- J. For making the infiltration tests, under drains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable.
- K. Upon completion of a section of the gravity pipe, the Contractor shall dewater it and conduct a satisfactory test to measure the infiltration for at least 24 hours. The amount of infiltration, including structures, tees, and connections, shall not exceed 200 gal. per inch diameter per mile of gravity pipe per 24 hours.
- L. For making the exfiltration tests, the gravity pipe shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and structures with clean water to a height of 2 ft. above the top of the gravity pipe at its upper end. The rate of leakage from the gravity pipe shall be determined by measuring the amount of water required to maintain the level 2 ft. above the top of the pipe.
- M. Leakage from the gravity pipe under test shall not exceed the requirements for leakage into gravity pipe as hereinbefore specified. The gravity pipe, including, but not limited to mainlines, cleanouts, and fittings, shall be tested before any connections are made to buildings. The Contractor shall construct weirs or other means of measurements as may be required. Suitable bulkheads shall be installed, as required, to permit the test of the gravity pipe.
- N. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation.
- O. If, in the judgment of the Engineer, it is impracticable to follow the foregoing procedures for any reason, acceptable modifications in the procedures shall be made as required, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

### 3.9 TIGHT TANK LEAKAGE TESTS

- A. During the leakage test period, the excavation around the structure shall be kept dewatered by the Contractor. The Contractor shall close temporarily all bottom openings and wall openings below maximum water level in the structures; furnish and

fill the structures to the design maximum water level with clean water and let it stand for 24-hours before testing. The Contractor shall make his own arrangements for handling the water for testing and its transfer from one structure to another and its final disposal. After 24-hours the Contractor shall take all necessary elevations and measurements prior to testing of the structures.

B. Test for Water Tightness:

1. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer.
  2. Water tightness testing of tanks shall be conducted when all structural components of the tank are in place, including its walls, top slab, and all piping as applicable. Testing of the tank without the top slab shall be allowed only with approval from the Engineer.
  3. The structure shall be filled with water to the maximum tank level, allowed to stand for at least 24-hours, and refilled to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, by measuring the drop in water level or by an equivalent procedure approved by the Engineer. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24 hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.
  4. No leakage (zero leakage) will be permitted during a 72-hour period.
  5. The Contractor shall pay all costs (including water) incurred in the testing for water tightness.
  6. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.
- C. If, in the opinion of the Engineer, during the course of the test weather conditions are such that it becomes difficult to accurately monitor the water level in the tank, the test shall be stopped, and started over again when weather permits.
- D. On conclusion of the test, the Contractor shall pump or drain the water from the structure and dispose of it without injury to structures or surfaces.

3.10 MANHOLE, CATCH BASIN, AND HYDRODYNAMIC SEPARATOR LEAKAGE TESTS

- A. Leakage tests shall be made by the Contractor, and observed by the Engineer on each structure. The test shall be by vacuum or by water exfiltration as described below.
- B. Vacuum Test: The vacuum test shall be conducted in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of

ASTM C1244, the structure will have failed the test. Test times from are shown as follows.

Minimum Test Times for Various Structure Diameters

Depth (Feet)	Diameter (Inches)		
	48	60	72
	<u>Times (Seconds)</u>		
0-12	30	39	49
12-16	40	52	67
16-20	50	65	81
20-24	59	78	97
26-30	74	98	121

If the structure fails the initial test, the Contractor shall locate the leaks and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the structure should again fail the vacuum test, additional repairs shall be made, and the structure water tested as specified below.

- C. Water Exfiltration Test: After the structure has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the structure shall be suitably plugged and the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the structure, it shall be lowered for the duration of the test.
1. The structure shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the structure, the structure may be considered to be satisfactorily water-tight. If the test, as described above, is unsatisfactory as determined by the Engineer or if the structure excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor, so wishes, to allow for absorption by the structure. At the end of this period, the structure shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the structure shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each structure shall not exceed one gallon per vertical foot for a 24-hour period. If the structure fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Engineer to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for rejection of the structure. It shall be the Contractor's responsibility to uncover the rejected structure as necessary and to disassemble, reconstruct or replace it as directed by the Engineer. The structure shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

2. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the structure throughout the test.
3. If the groundwater table is above the highest joint in the structure, and there is no leakage into the structure, as determined by the Engineer, such a test can serve to evaluate water-tightness of the structure. However, if the Engineer is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

### 3.11 CLEANING AND REPAIR

- A. The Contractor shall clean the entire system of all debris and obstructions. This shall include, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sewers, storm drains, or streams. All work of cleaning and repair shall be performed at no additional cost to the Owner.
- B. The Contractor shall empty the tight tanks and hydrodynamic separators at the time of demobilization.

### 3.12 FINAL INSPECTION

- A. Upon Completion of the work, and before final acceptance by the Engineer, the entire system shall be subjected to a final inspection in the presence of the Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and other requirements have been met.

### 3.13 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02570

## SECTION 02615

### DUCTILE-IRON PIPE AND FITTINGS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Providing, installing and testing ductile-iron pipe and fittings, as indicated and specified.

- B. Options:

- 1. For joints in buried exterior pipelines, provide either push-on or mechanical-joint pipe and fittings.
- 2. For piping exposed in buildings and galleries, provide flanged or rigid-joint, grooved-coupled pipe and fittings. Refer to Division 11.

- C. Related Sections includes the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 02200 – Earthwork
- 4. Section 02570 – Precast Manholes, Tight Tanks, Hydrodynamic Separators and Appurtenances
- 5. Section 02640 – Fire Hydrants, Valves, and Appurtenances
- 6. Section 02725 – Water Service Connections
- 7. Section 03300 – Cast-in-Place Concrete
- 8. Section 13201 – Disinfection of Water Systems

##### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – Submittals:

1. Submit shop drawings or descriptive literature, or both, showing dimensions, joint and other details for each type and class of pipe, fitting and restraint system to be furnished for the project. All materials furnished under the Contract shall be manufactured only in accordance with the Specifications. Submittals shall include material information, dimensions, pipe class information, weights, coating and lining system data.
2. Submit manufacturer's Certificates of Compliance with these Specifications and certification that the ductile iron pipe and fittings have been manufactured and tested in accordance with AWWA/ANSI specifications.
3. Submit the vendor's name, address and contact phone number for all materials to be furnished under the contract.
4. Submit a detailed description of proposed testing, flushing and disinfection procedures to be used for this project. The description shall contain the name of the person responsible for the testing, flushing and disinfection work, equipment to be used, chemical to be used, method of measuring flow during flushing procedures and the name of the laboratory to be used for analysis. Review of the description shall not be construed as approval of any methods to be used, the Contractor shall be fully responsible for achieving the specified test results.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Inspect and test at foundry according to applicable standard specifications.
- C. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.
- D. Visually inspect and hammer test before installation.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610.

#### 1.6 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
  1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength.
- B. American Water Works Association (AWWA)
  1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pressure Pipe and Fittings

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
  3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings for Water
  4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  5. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
  6. AWWA C150 - Thickness Design of Ductile-Iron Pipe
  7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
  8. AWWA C153 - Ductile-Iron Compact Fittings, 3-in through 16-in for Water and Other Liquids
  9. AWWA C219 - Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
  10. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
  11. AWWA C651 - Disinfecting Water Mains
- C. American National Standards Institute (ANSI)
1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## PART 2 - PRODUCTS

### 2.1 DUCTILE IRON PIPE

1. Ductile iron pipe shall be that of a North American manufacturer who can demonstrate at least 5 years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push-on type, restrained joint, or mechanical joints, as required.
2. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).
3. The ductile iron pipe shall be Class 52 and furnished in nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, McWane Ductile, American Ductile Iron Pipe, or equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints", latest edition. Push-on joint restraints shall not affect the warranty by the pipe manufacturer.

4. The ductile iron pipe shall be double cement-mortar lined inside coating in accordance with AWWA C104 ANSI A21.4, latest edition. All ductile iron pipe shall have a bituminous outside coating in accordance with AWWA C151, latest edition. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

## 2.2 PIPE FOR USE WITH COUPLINGS

- A. As specified above except ends shall be plain.
- B. With sleeve couplings, ends cast or machined at right angles to axis.
- C. With grooved type coupling:
  1. Ductile-Iron of thickness class specified above.
  2. Grooved End dimensions conforming to AWWA C606 for flexible joints.
  3. Grooved End dimensions conforming to AWWA C606 for flexible or rigid joints to suit joint requirements.

## 2.3 FITTINGS

- A. Fittings shall be compact ductile iron Class 350 Mechanical Joint, conforming to ANSI Specification A21.53 (AWWA C153), latest edition, for pipe sizes 16-inches and smaller, and Class 350 standard Mechanical Joint fittings conforming to AWWA C110/ANSI A21.10, latest edition except as specified, for pipe sizes 16 through 24-inches, unless specifically stated otherwise in the specifications or on the drawings. Fittings shall be suitable for use with restraints as specified hereinafter. Fittings shall be manufactured in North America. Fittings shall be of the same material and have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. Fittings shall be Tyler Union AWWA C153 Compact Fittings, or approved equal.
  1. Hydrant tees shall have a rotatable mechanical joint gland on the 6-inch plain end branch to provide positive valve restraint, unless otherwise allowed by the Engineer.
  2. Caps and plugs installed in all new work as indicated on the drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
- B. Provide all bell push-on or mechanical-joint fittings unless otherwise indicated or specified.
- C. Provide standard base fittings where indicated.



- D. Provide grooved-end fittings ductile-iron conforming to ANSI A21.10 (AWWA C110) for center-to-face dimensions.
  - 1. End preparation for grooved-ends conforming to AWWA C606 for flexible or rigid joints as required by type of joint.
  - 2. Minimum wall thickness of grooved fittings 12 inch and smaller conforming to ANSI A21.53 (AWWA C153).
  - 3. Minimum wall thickness of grooved fittings larger than 12 inch conforming to ANSI A21.10 (AWWA C110).

## 2.4 NONSTANDARD FITTINGS

- A. Acceptable design.
- B. Same diameter and thickness as standard fittings.
- C. Manufactured to meet requirements of same specifications as standard fittings except for laying length and types of ends.

## 2.5 ADAPTERS

- A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.
  - 1. Provide ends conforming to above specifications for appropriate type of joint, to receive adjoining pipe.
  - 2. Joining two classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints sufficient for jointing.

## 2.6 JOINTS

- A. Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.
  - 1. Provide gasket composition suitable for exposure to liquid within pipe.
- B. Restrained joints shall be furnished for thrust restraint for installation on all fittings, sleeves, hydrants, and valves, or where indicated on the drawings, or where required by the Engineer. Restraints for mechanical joints shall be Series 1100 Megalug as manufactured by EBAA Iron, ONE-LOK Series D-Slide Restraints as manufactured by SIGMA Corp., Uni-flanged Series 1400 Mechanical Joint Restraint by Ford Meter Box, or approved equal. Restraints for push-on joints shall be Field Lok gaskets by U.S. Pipe, Sure Stop 350 by McWane Ductile, Series 1390 by Uni-Flange, or approved equal. Push-on joint restraints shall not affect the warranty by the pipe manufacturer.

## 2.7 FLEXIBLE CONNECTIONS

- A. Use as specified or indicated:
  - 1. Sleeve-type couplings
  - 2. Grooved couplings
  - 3. Mechanical-joint pipe and/or fittings
- B. Expansion joints shall be flexible and suitable for connection to ductile iron and/or HDPE pipe. Expansion joints shall be provided with manufacturer's recommended restraints. Expansion joints shall be Flex-Tend by Ebaa Iron, or approved equal.

## 2.8 SLEEVE TYPE COUPLINGS

- A. Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi.
- B. Sleeve type couplings shall be of steel and shall be Style 38 by Dresser Mfg. Div.; Smith-Blair Style 441, Series 3800 Mega Coupling by Ebaa Iron, or approved equal. Couplings shall be furnished with black steel bolts and nuts and with pipe stop removed. Gaskets shall be of a material suitable for exposure to liquid within the pipe.

## 2.9 GROOVED COUPLINGS

- A. Conform to AWWA C606.
- B. Minimum pipe wall thickness specified under "Pipe For Use With Couplings."
- C. Where grooved couplings are indicated to provide for expansion or flexibility, cut pipe grooves to provide necessary expansion or flexibility.
- D. Where grooved couplings are used instead of flanged joints, joint to be of rigid type with pipe grooves cut to bring pipe ends together. Beam strength of joint shall be equal to or greater than that of flanged joint.

## 2.10 FILLING RINGS

- A. Provide where necessary.
- B. Materials, workmanship, facing, and drilling, conforming to 125-lb. ANSI Standard.
- C. Suitable length with nonparallel faces and corresponding drilling, if necessary, for correct assembly of adjoining piping or equipment.

## 2.11 CONNECTIONS - TAPPED

- A. Provide watertight joint with adequate strength against pullout. Use only tapered thread taps.
- B. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in appropriate table of Appendix to ANSI A21.51 based on:
  - 1. 3 full threads for gray iron.
  - 2. 2 full threads for ductile iron.
- C. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, as indicated or permitted.

## 2.12 STANDARD LINING AND COATING

- A. Inside of pipe and fittings: Provide double thickness cement-mortar lining on interior and bituminous seal coat on exterior conforming to AWWA C104 ANSI A21.4.
- B. Outside surfaces of castings to be encased in concrete: Leave bare, do not use coating.
- C. Machined surfaces cleaned and coated with suitable rust-preventative compound at shop.
- D. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate AN Standard.

## 2.13 INSULATION

- A. The pipe shall be insulated where shown on the Contract Drawings and where directed. Insulation shall be a thermal barrier conduit of nonmetallic, sectional factory fabricated type. It shall be structurally strong, watertight and entirely resistant to corrosive elements. The entire system shall be suitable for outside installation with temperature variations from -40 °F to +120 °F. It shall be closed cell, rigid polyurethane foam pipe insulation of two- (2-) inch minimum thickness, a minimum density of 2.1 pounds per c.f., a maximum "K" factor of 0.14, 90 – 95 percent closed cell quality when cured and a minimum compressive strength of 50 psi. The polyurethane foam pipe insulation shall completely fill the annulus between the carrier pipe and jacketing. The outer casing shall be black high density polyethylene Type 1, Grade 1, Class 12454B in accordance with ASTM Designation D1784. All ends of piping insulation shall be sealed with a factory applied moisture barrier.
- B. Field joints shall be insulated utilizing poured-in-place polyurethane foam, jacketed with the same materials as used on the straight lengths of pipe and sealed with a heat shrinkable end seal.

- C. The piping is to have the encased insulation applied, to the degree practical, at the factory of the insulation and casing fabricator. A representative of the Manufacturer shall be available at the project site for instruction and supervision.
- D. Bedding material for the insulated pipe shall be ½-inch crushed stone.
- E. For the underground buried DI water pipes, insulation shall be 2-inch thick polyisocyanurate foam with a density of 2.0 lbs/cf. A 30-mils thick bitumen adhesive shall be used as a vapor and moisture barrier for direct burial applications.

#### 2.14 POLYETHYLENE PIPE ENCASEMENT

- A. Polyethylene pipe encasement shall conform to requirements of AWWA C105, latest edition. Virgin polyethylene shall conform to ANSI/ASTM D1248. Minimum nominal thickness shall be 8 mils.

#### 2.15 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

- A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED [WATER, SEWER, ELECTRIC, GAS, ETC.] PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up below the top surface of earth or the top surface of the subgrade under pavements as shown on the trench details.

### PART 3 - EXECUTION

#### 3.1 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5 feet, and with even support for the pipe barrel.
- C. Only nylon-protected slings shall be used for handling the pipe. No hooks or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

#### 3.2 ALIGNMENT AND PLACEMENT OF PIPE

- A. The Contractor will be responsible for transporting materials to the job site as needed. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, lining or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired by the manufacturer. Handling and laying of pipe and fittings shall be in accordance with the manufacturer's instruction and as specified herein. Any materials damaged during loading, transporting or unloading shall be replaced at the Contractor's expense.
- B. Jointing of ductile iron pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. All pipe and fittings shall be thoroughly cleaned before laying; shall be kept clean until they are used in the work; and when installed, shall conform to the lines and grades required. Special care is required in cleaning the ends of the pipe; wipe the outside of the spigot end with a clean rag prior to applying lubricant; brush clean the inside of the bell end, paying special attention to the rubber joint area, prior to installing the gasket and lubricant; and check inside the pipe for overall cleanliness. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to insure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- C. Installation and jointing of push-on ductile iron pipe shall be in accordance with AWWA C600 Sections 9b and 9c, latest revision, as applicable.
- D. Mechanical joints shall be installed with joint restraints. Restraints shall be installed in full accordance with the manufacturer's instructions. All bolt heads on restraints shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved.
- E. Restrained push on joints shall be installed with specified joint restraints. Restraints shall be installed in full accordance with the manufacturer's instructions.
- F. Ductile iron pipe installed near cathodically protected gas lines or within areas subject to groundwater shall be fully encased with polyethylene material.
- G. A 5-foot minimum cover shall be maintained over the top of the pipe.
- H. Insulated pipe with jacket is to be installed where shown on the drawings and on any pipe having less than 4.5-foot cover.
- I. Sleeve type couplings shall be used to join plain ends on ductile iron pipe.

### 3.3 INSTALLATION

#### A. Piping Support:

1. Furnish and install supports to hold piping at lines and grades indicated or specified.
  2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.
- B. Pipe and Fittings:
1. Remove and replace defective pieces.
  2. Clear of all debris and dirt before installing and keep clean until accepted.
  3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
  4. Provide firm bearing along entire length of buried pipelines.
- C. When pipe cutting is required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be jointed with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall remain undamaged.
- D. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
- E. Socket Pipe Clamps, Tierods, and Bridles: Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure, provide suitable socket pipe clamps, tierods, and bridles. Use bridles and tierod at least 3/4 in. in diameter except where they replace flange bolts of smaller size with nut on each side of flange pairs. Coat clamps and tierods or bridles with two coats of bituminous coating after assembly and allow to dry before backfilling.
- F. Appurtenances: Set valves, fittings and appurtenances as indicated.
- G. The Contractor shall have on hand at the start of the job the following additional bends for each size of pipe to be installed: two 1/32 bends, two 1/16 bends, and two 1/8 bends. These bends shall be replaced each time job conditions require their use.
- H. Coordination with Utilities:
1. To the extent possible, the Contractor shall maintain a minimum 10 ft lateral separation between new water mains and sanitary sewers unless otherwise directed by the Engineer. Refer to Section 02570 for additional requirements.
  2. The Contractor shall maintain a minimum clearance between the new water main and all other existing utilities of at least 12 inches.
  3. Ductile iron pipe installed within 5 feet of gas lines shall be fully encased with polyethylene wrap material.

### 3.4 JOINTS AND COUPLINGS

#### A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

#### B. Bolted Joints:

1. Remove rust-preventive coatings from machined surfaces.
2. Clean pipe ends, sockets, sleeves, housings, and gaskets and smooth all burrs and other defects.
3. Use torque wrench to tighten to correct range of torque not to exceed values specified below:

TORQUE RANGE VALUES

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3	5/8	40-60
4-24, incl.	3/4	75-90
30, 36	1	100-120
42, 48	1-1/4	120-150

#### C. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.
6. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

#### D. Sleeve-Type Coupling:

1. Clean pipe ends for distance of 8 in.
2. Use soapy water as gasket lubricant.

3. Slip follower and gasket over each pipe to a distance of 6 in. from end and place middle ring on pipe end until centered over joint.
4. Insert other pipe end into middle ring and bring to proper position in relation to pipe laid.
5. Press gaskets and followers into middle ring flares.
6. After bolts inserted and nuts made fingertight, tighten diametrically opposite nuts by use of torque wrench of size and torque specified below:

#### TORQUE

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3-24	5/8	75
30-36 (1/2 in. mid ring)	5/8	65
30-36 (3/8 in. mid ring)	5/8	70
30-48	3/4	80
48-72	3/4	70

7. After assembly and inspection and before backfill, coat exterior surfaces of buried couplings with heavy-bodied bituminous mastic.

#### E. Grooved Couplings:

1. Clean grooves and other parts.
2. Coat ends of pipe and outside of gasket with soft soap or silicone and slip gasket over one pipe end.
3. Bring pipes to correct position and center gasket over pipe ends with lips against pipe.
4. Place housing sections, insert bolts and tighten nuts until housing sections in metal-to-metal contact.
5. After assembly and inspection and before backfilling, coat exterior surfaces of buried couplings, including bolts and nuts, with heavy-bodied bituminous mastic.

#### F. Tapped Connection:

1. Drill and tap normal to longitudinal axis.
2. Drilled by skilled mechanics using proper tools.
3. Use only tapered threads.

#### G. Electrical Conductors:



1. Install pipes so terminal strips are aligned.
2. Install jumper strips and tighten bolts.

### 3.5 CONNECTIONS TO WATER MAIN

- A. The Contractor shall make all connections to the existing mains as indicated in the Contract Documents.
- B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing water mains shall be planned so as to interfere with the operation of the existing facilities for the shortest possible time.
- C. The Contractor shall have all preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.
- D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting his operations to the requirements of the Owner.
- E. Under no circumstances shall any customer be without water for a period of more than 4 hours without prior written approval of the Owner. Should it appear that any customer will be without water for more than 4 hours, the Contractor shall install a temporary water service at no additional cost to the Owner.
- F. The Owner does not guarantee a tight shut-off for existing water valves. The Contractor shall not submit a claim for damages due to delays in dewatering pipelines caused by water leaking through an existing closed valve, or having to dewater the excavation while making the connection. It is the Contractor's responsibility to provide the means to dewater the excavation while making the connection.

### 3.6 TESTING AND DISINFECTION

- A. Testing and disinfection shall conform to AWWA C651, latest version, for pipes and pipelines and in accordance with Section 13201 Disinfection of Water Systems.
- B. Prior to pressure and leakage tests, the piping shall be thoroughly flushed clean of all dirt, dust, oil, grease and other foreign materials in accordance with AWWA C651. This work shall be done with care to avoid damage to lining and coatings.
- C. The Contractor shall submit a plan on the method of testing and chlorinating the mains for review to the Engineer. The plan shall include all equipment proposed for use during the work, or the name of the qualified testing company, which will perform the work. Testing of the water main shall not begin until the Engineer has approved the Contractor's plan. All testing shall be done in the presence of the Engineer.
- D. Testing of Water Main:

1. The Contractor, in accordance with ANSI/AWWA C600 specifications or latest revision thereof, will make all pressure and leakage tests to determine that the ductile iron pipe is structurally safe and free of excess leakage. The Contractor shall furnish all the equipment, materials and labor required for testing.
2. The Contractor shall furnish, at his own expense, all the water needed for all water main testing. Water shall be clean, uncontaminated, and potable.
  - i. The Contractor shall coordinate with the Owner before any public water is used. The Contractor will be responsible for all associated fees and charges for water use and compliance with conditions and/or restrictions associated with the use of public water from the Owner. Contractor shall convey in disinfected pipelines or containers to site.
3. Testing shall be done in sections of the main not to exceed a 3,000-foot maximum length. Valves shall be placed in the off position at the ends of the sections to be tested. The Contractor shall provide means to prevent water from entering other parts of the pipeline not subject to testing at all times. Contractor will ensure that air release valves and other venting devices are properly installed and placed in open position when filling pipe with water. Taps shall be installed at high points to release air in the water system.
4. After all entrapped air has been removed from the section; fill the main to the normal static pressure. The Contractor is allowed to let the main rest for up to 48 hours with static pressure. Using a special pressure pump, the Contractor shall raise the pressure to 150 pounds per square inch. The pump will then be shut off and separated from the test section by a globe valve. A fluid filled pressure gage, with a maximum reading of 250 psi, shall have been placed beyond the globe valve. The test section will then be monitored for a 2-hour period.
5. This pressure shall be maintained, within 5 psi, for a minimum of 2 hours during which time the line checked for leaks by the Engineer. Based on an average test pressure of 150 psi, the measured rate of water leakage shall not exceed the following rates in the section under test:

$$L = \frac{12.25SD}{133,200}$$

Where: L = Allowable leakage, gallons per hour

S = Length of pipe section tested, feet

D = Nominal pipe diameter, inches

6. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be flushed and chlorinated when leakage does not exceed above standard. Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water services (to curb box) later within the warranty period.

E. Chlorinating and Flushing:

1. The Contractor, in accordance with the latest edition of ANSI/AWWA 651 Standard for Disinfecting Water Mains, shall chlorinate and flush the new water main. Chlorinated water to be flushed from the pipeline shall be de-chlorinated as shown on drawings or as approved by the Engineer. Chlorinated water shall not be discharged to any natural water body. See the appendix of AWWA C651 for acceptable neutralization methods.
2. Prior to chlorination, the Contractor shall properly flush the water mains. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 3 feet per second, which is approximately 400 GPM in an 8-inch diameter main, 600 GPM in a 10-inch main, 900 GPM in a 12-inch main and 1,600 GPM in a 16-inch main. Flushing of the water main, at the above rates, for approximately 20-minutes per 1,000-foot section, will allow for three volume changes. This is a sufficient period of time for successfully cleaning the water main.
3. The Contractor shall chlorinate the water main until the main contains a solution containing 25 mg/L available chlorine. The valves shall then be closed and the chlorinated water allowed to sit in the mains for 24 hours. The main will then be checked to assure the chlorine residual shall be at least 10 mg/L. If less than 10 mg/L is measured, the Contractor shall flush and re-chlorinate the mains at no cost to the Owner. All valves and hydrants shall be operated to insure their proper disinfection. Valves shall be operated to prevent super chlorinated water from entering the existing distribution system. The Contractor shall then flush the mains until clear, clean water is being discharged.
4. Sixteen hours after the main has been flushed of chlorinated water, bacteriological samples (total coliforms and heterotrophic plate count) shall be taken. Two sample events shall occur. The first sample event from the designated locations shall be taken and the second sample event shall be taken from the same designated locations a minimum of 15 minutes apart. Both sets of samples shall pass. Water samples shall be taken from corporation stops along the length of the water main as designated by the Engineer. A minimum of two (2) samples shall be taken on each street, or two per 3,000 feet of pipe, whichever is greater. Each sample shall be taken in duplicate, in sterile bottles and sent to a State approved private laboratory for analysis. The Contractor shall perform all necessary work including delivery of samples to a certified laboratory, and shall include the cost for sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the Town's system. The failure of any sample to pass the laboratory tests shall require the Contractor to re-flush and re-chlorinate the mains and re-sample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
5. If, during construction, trench water has entered the main, or if in the opinion of the Owner's Engineer, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at 200-foot intervals and shall be

identified as to location. Additional sample taps shall be installed and removed at the Contractor's expense.

6. Contractor shall note that work under this Contract shall not be considered complete until the satisfactory installation and testing of the water mains have been completed.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02615

## SECTION 02640

### FIRE HYDRANTS, VALVES, AND APPURTENANCES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this section includes the furnishing of all plant, labor, equipment, appurtenances and materials, and in performing all operations in connection with installing and testing of the fire hydrants, valves and appurtenances, at the locations indicated and/or as directed, complete in place in accordance with the drawings and specifications.
- B. Where existing gate boxes and hydrants are to be removed the contractor is responsible for disposal.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02140 – Dewatering and Discharge
  - 4. Section 02160 – Temporary Excavation Support System
  - 5. Section 02200 – Earthwork
  - 6. Section 02615 – Ductile-Iron Pipe and Fittings
  - 7. Section 11200 – Interior Process Piping and Valves

##### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - Submittals:
  - 1. Submit shop drawings and descriptive literature, showing hydrant and valve dimensions and other details for each type and class of valve to be furnished.

## 1.4 REFERENCE STANDARDS

- A. American Water Works Association (AWWA)
  - 1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 2. AWWA C500 - Gate Valves for Water and Sewerage System.
  - 3. AWWA C502 - Dry-Barrel Fire Hydrants
  - 4. AWWA C504 - Standard for Rubber-Seated Butterfly Valves.
  - 5. AWWA C509 – Standard for Resilient Seated Gate Valves for Water Supply Service
  - 6. AWWA C515 – Standard for Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service
  - 7. AWWA C517 - Standard for Resilient-Seated Cast-Iron Eccentric Plug Valves
  - 8. AWWA C800 - Underground Service Line Valves and Fittings.
- B. Underwriters Laboratory (UL)
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## PART 2 – PRODUCTS

### 2.1 GATE VALVES AND BOXES

- A. Resilient wedge gate valves shall be iron body, resilient seated type meeting the latest edition of AWWA C509 or AWWA C515 with mechanical joint ends. The valves shall be designed for 200 psi working pressure and 400 psi test pressure. Valves shall have corrosion resistant fusion - bonded interior and exterior coatings.
- B. Tapping valves shall be resilient gate valves as specified above with the following exceptions. Tapping valves shall be full port opening and have flanged by mechanical joint ends.
- C. Tapping sleeves shall be of split mechanical joint design with separate side and end gaskets. The fitting shall be constructed with high strength steel, ASTM 283 Grade C, ASTM 285 Grade C, ASTM A-36, or equal. The mechanical joint end dimensions shall conform to AWWA Standard C-110/C-111. Split coupling designs are not acceptable. Flanges shall conform to AWWA C-207 Class D, ANSI 150 lbs. Bolts shall be corrosion resistant, high strength low alloy. Glands shall be ductile iron and gaskets shall be EPDM. Tapping sleeve shall be finished with a heavy coat of corrosion resistant shop coat primer and bitumastic coal tar. Tapping sleeve shall be NSF61 Standard Certified.

- D. Gate and tapping valves are to have O-ring seals and a non-rising stem. Valves shall have a 2-inch operating nut, and be Open Left (counterclockwise to open).
- E. Valves shall be as manufactured by Mueller Company, American Flow Control, Kennedy Valve Manufacturer Company or Engineer approved equal. For standardization, valves and accessories shall be from the same manufacturer.
- F. Valve boxes shall be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The inside diameter of the bottom section shall be at least 5-1/4-inches and shall have a belled base. The top section shall be at least 6-1/8-inches and have top flanges. The bottom section shall be at least 36-inches in length. The top section shall be at least 26-inches in length and have a plain bottom. No three piece combinations shall be acceptable. Valve boxes shall be manufactured in North America only.
- G. Tapping Sleeves shall be manufactured by Mueller Co., Clow Corporation, or approved equal. Tapping sleeves shall match the requirements of the detail on the construction drawings. Tapping valves shall be manufactured by Mueller Company, Kennedy Valve Manufacturing Company, Ford Meter Box or equal and shall be furnished with one flange end and one mechanical joint end. Valves shall open left. The Contractor shall verify the outside diameter of the pipe to be tapped.

## 2.2 FIRE HYDRANTS

- A. Fire and flushing hydrants (hereinafter referred to as hydrants, unless specifically identified) shall have mechanical joint inlet connections to the main, two 2-1/2-inch hose connections, and one 4-1/2-inch steamer connection with a valve opening 5-1/4-inches in diameter minimum and a standpipe with a 8-1/2-inch minimum diameter. Hydrants shall be traffic model with dual drain ports.
- B. The hydrants shall have an oil reservoir to provide lubrication to all stem threads, bearing surfaces and O-rings each time the hydrant is operated.
- C. The hydrants shall have mechanical joint shoes, 5'-6" bury (street level shoulder areas) or 6'-0" bury (raised sidewalk), 5-1/4-inch valve, and conform to AWWA Specification C-502. Hydrant shall be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant. Hydrants shall Open Right (clockwise to open).
- D. The hydrants are to receive two coats of prime paint before shipment and once installed are to be cleaned and painted by the Painting Filed Sub Bidder. Fire hydrants shall be painted in accordance with the Sharon Water Department requirements: red body with silver bonnet and caps. Flushing hydrants, for raw water and flow to waste, shall be painted green to indicate raw water in accordance with Mass DEP's standard color scheme and as directed by the Engineer.

- E. Hydrants shall be Mueller Co. Centurion Model A-423, American Darling, Model #B62B, or approved equal.
- F. Hydrants shall have hydrant markers with reinforced fiberglass shaft heavy duty spring mounted 4' long x 3/8" diameter. One bolt mounting.

### 2.3 CORPORATION STOPS, SADDLES, AND SERVICE PIPING

- A. All water service plumbing material shall be "lead free" in accordance with Section 1417 of the Safe Drinking Water Act and Section 9 of NSF Standard 61.
- B. The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C800). Corporation stops shall be Mueller 300 Ball Corporation Valve, Model B-25008N, as manufactured by Mueller Company, The Ford Meter Box Company, Red Hed Manufacturing, or approved equal. Corporations larger than one inch shall be installed with saddles.
- C. Service saddles (for services larger than one inch) shall be Smith-Blair 313 Double Strap, by Mueller, Romac Industries or approved equal. Service saddles on ductile-iron water mains (for services larger than one inch) shall have ductile iron body and electrogalvanized carbon steel straps. Units shall be complete with Buna-N gaskets.
- D. Unless otherwise specified, all pipes for services and the 100-foot sample tap shall be copper tubing Type K Annealed and shall conform to provisions of ASTM B-88 (latest edition).

### 2.4 FLAPPER CHECK VALVE

- A. The flap valve shall have a cast iron body and cover.
- B. The seat and disc ring shall be bronze, and the hinge pin and cotter pins shall be stainless steel. (30" and 36" are supplied with Resilient to Bronze seating).
- C. The valve shall be constructed with a 10-degree offset from vertical to ensure positive closure.
- D. The flange shall be drilled using an ANSI 125# template.
- E. All iron parts shall be coated in TNEMEC 2-part epoxy with 3-4 mils dry film thickness to prevent rusting or corrosion.
- F. The valve shall be machined, assembled, and tested in the USA for quality assurance.
- G. The manufacturer shall show proof of ISO 9001 certification.
- H. Valve and accessories shall be manufactured by Troy Valve, Model A2540 or approved equal.



## PART 3 – EXECUTION

### 3.1 INSPECTION AND PREPARATION

- A. All hydrants, valves and appurtenances shall be installed in the location shown on the drawings or where directed by the Engineer. Valves shall be true to alignment and rigidly supported. Any damaged items shall be replaced before they are installed.
- B. During installation of all hydrants, valves and appurtenances, the Contractor shall verify that all the items are clean, free from defects in materials and workmanship and functioning properly. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced.
- C. All valves shall be closed and kept closed until otherwise directed by the Engineer. All hydrants shall be covered with a burlap bag until put into service.
- D. Care shall be taken to avoid freezing of water in valves or hydrants.

### 3.2 FIELD TESTS AND ADJUSTMENTS

- A. Conduct a functional field test of each valve, including actuators and valve control equipment, if any, in the presence of the Engineer to demonstrate that each part and all components together function correctly. The Contractor shall provide all testing equipment.

### 3.3 SHOP PAINTING VALVES AND APPURTENANCES

- A. Interior and exterior surfaces of all valves which are not factory epoxy coated, and not specified elsewhere, shall be given two coats of shop finish of an asphalt varnish conforming to the latest edition of AWWA C504 for Varnish Asphalt. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to application.

### 3.4 INSTALLATION OF HYDRANTS

- A. Furnish all labor, equipment and incidentals required for the installation of hydrants and valves as shown on the Drawings and/or as directed by the Engineer. Hydrants shall be installed as a complete unit, including 6-inch gate valve, as designated by the Contract Drawings with the consent of the Engineer. All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to the curb, with the nozzle facing the curb. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle 18-inches above the ground. The hydrants shall be set upon a slab of concrete not less than 4-inches thick and 15-inches square.
- B. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be 36 square inches. Felt roofing paper shall be placed around the hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.

- C. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. The Contractor shall notify the Town of Sharon Fire Department when a hydrant is taken out of service, for removal or replacement. When hydrants are removed from service, the pipe shall be cut below grade. The old hydrant shall be salvaged and provided to the Town of Sharon. No hydrant shall be left out of service overnight.
- D. When a dry-barrel hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least six (6) inches above the drain port opening in the hydrant and to a distance of one (1) foot around the elbow.
- E. When a dry-barrel hydrant with a drain opening port is set in clay or other impervious soil, a drainage pit, two (2) feet by two (2) feet by two (2) feet, shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under the elbow of the hydrant and to a level of six (6) inches above the drain port. Said installation will be to the detail shown on the Drawings.
- F. Fire hydrants shall be painted in accordance with the Sharon Water Department requirements.

### 3.5 INSTALLATION OF BURIED VALVES AND VALVE BOXES

- A. The Contractor shall furnish all necessary labor and equipment to excavate and expose the water main sufficiently to install valves as required by the Engineer.
- B. Valves shall be cleaned and manually operated before installation. When tapping valves are installed, it is imperative that the shell cutting is removed and discarded. Valves shall be set on a firm foundation and supported by tamping pipe-bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with the finished grade. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. The valve box shall be set so as not to transmit loads to the valve. Refer to the Contract Drawings for additional requirements.
- C. Where ductile iron tapping sleeves are used, the split end flanges shall be rotated off center of the flange body to insure the gasket seams are not aligned.
- D. Tapping valves shall be thoroughly flushed after the tapping operation has been completed.
- E. Before backfilling, all exposed portions of any bolts shall be coated with two coats of bituminous paint.

### 3.6 INSTALLATION OF CORPORATION STOPS, SADDLES, AND SERVICE PIPING

- A. After successful testing and chlorination, water services shall be installed as a “wet” tap as shown on the Drawings, specified, or directed by the Engineer. Exact locations of services shall be located in the field by the Engineer. All services shall be installed

to a minimum depth of 5'-0" unless specifically shown or directed otherwise by the Engineer.

- B. Corporation cocks. The tapping machine shall be rigidly fastened to the pipe. The length of travel of the tap should be so established that when the stop is inserted and tightened with a 14-in wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation cock shall be inserted with the machine while it is still in place. Stops shall be tightened only sufficiently to give watertightness and care must be constantly exercised not to overtighten them.
- C. Saddle taps shall only be used for services larger than one inch or when transite (asbestos cement) pipe, PVC pipe, or HDPE pipe is encountered, or under the direction of the Engineer.
- D. Water service trenches shall be excavated and backfilled in accordance with Section 02200 of this Specification and in conformance to the details. All copper tubing shall be backfilled with sand by hand to 12" above tubing.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02640

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## SECTION 02673

### WELL RECONDITIONING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. The work covered under this section includes the furnishing of all necessary equipment, labor and supplies required to recondition the eight production wells at Well Station 2 and the production well at Well Station 3. Work at the Well Station 2 and Well Station 3 sites includes: video inspection; a step test to determine the specific capacity; redevelopment using chemical and mechanical cleaning and disinfection; and a pre and post well conditions report.
- B. Well lithological logs and well data (depth, drawdown, specific capacity) can be found in the Contract Drawings and provided in Appendix O of these Specifications.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

##### 1.3 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit a Pre and Post cleaning well conditions report. The report shall include the well condition, procedures utilized, and all findings. The report shall include the safety data sheets of any chemicals used.
- B. Submit the video inspection files on a CD.
- C. Water quality results as specified herein.
- D. Submit in accordance with Section 01300 – Submittals.

##### 1.4 CERTIFICATIONS

- A. The Contractor shall provide the service of a Certified Well Driller, approved by the Massachusetts Department of Environmental Protection Well Driller Program in accordance with 310 CMR 46. Contractor's personnel shall not be substituted for the Certified Well Driller requirements.

## PART 2 – PRODUCTS

### 2.1 EQUIPMENT

- A. The Contractor shall furnish, deliver, and erect at the site all necessary rigging and miscellaneous equipment to accomplish the redevelopment. The development rig must include a hydraulically operated surging piston with variable stroke length between 1 and 6-feet to provide a reciprocating surging action in the well automatically. The equipment shall also be capable of a stroke frequency up to 30 strokes per minute.
- B. Any chemicals used shall be NSF61 approved and suitable for potable water applications.

## PART 3 – EXECUTION

### 3.1 PRE-CLEANING VIDEO INSPECTION

- A. A video inspection shall be performed prior to any step testing, cleaning and redeveloping equipment being installed, or any chemicals added. The Contractor shall conduct a closed circuit video inspection of the well to examine the condition of both the well casing and screen. During the inspection the well is to be pumped to waste by the Contractor (with environmental controls as specified in Section 01110) at a rate sufficient to remove any floating debris to allow for the clearest possible view of the well. The equipment shall be capable of viewing the inside of the complete well from top to bottom and transmitting the image to a monitor located at the wellhead. The camera to be used must be portable, full color (black and white will not be acceptable) and capable of including an audio description of the inspection. The Contractor shall notify the Engineer/Owner prior to performing the inspection and a DVD copy of the inspection shall be provided upon its completion. The video inspection shall be performed by the Contractor's personnel and shall not be subcontracted. Equipment primarily designed for sewer or tunnel inspection will not be allowed.
- B. The Contractor shall provide a pre-cleaning written report. The report shall include the current condition of the well and any findings as a result of the pre-cleaning video inspection.

### 3.2 PRE-CLEANING SPECIFIC CAPACITY TESTING

- A. The Contractor shall furnish, deliver, and erect at the site all necessary supervision, labor, rigging and miscellaneous equipment to perform a step test (if necessary) and specific capacity test on the well. The Contractor shall determine the maximum withdrawal rate the well, including a 2-foot buffer above the well screen. The Contractor shall determine if a step test is appropriate for evaluating the well capacity and shall review this recommendation with the Engineer.

Drawdown measurements shall be taken and recorded during the well capacity evaluation and redevelopment.

All pump testing shall be coordinated with the Engineer. Step test and 2-hour specific capacity test results shall be submitted to the Engineer/Owner. Based on the step test and specific capacity test results, the Engineer/Owner shall determine if cleaning and redevelopment is required. If the specific capacity has declined by more than 15%, then cleaning and redevelopment shall take place.

B. Well water quality data shall be obtained upon completion of the initial specific capacity test. One (1) water sample shall be collected from the well and submitted to a Massachusetts State certified laboratory for analyses of the following constituents:

1. Coliform Bacteria
2. pH
3. Conductivity
4. Odor
5. Turbidity
6. Color
7. Nitrates
8. Nitrogen
9. Iron
10. Manganese
11. Total Hardness
12. Chlorine
13. Sodium

### 3.3 WELL CLEANING AND REDEVELOPMENT

A. The Contractor shall redevelop the well by a combination of individual chemical treatments, surging, and high volume backwashing and pumping. The wells shall be cleaned and redeveloped as follows:

1. Cleaning and Redevelopment:
  - a. Furnish all supervision, labor, equipment and materials to provide surging and pumping equipment as necessary to perform mechanical and chemical cleaning of each well. Mechanical cleaning will utilize surge blocks and wire brushing with surging and pumping. The surging and pumping equipment shall be set up in such a way that there is a positive, smooth operation in the vertical motion and there is no undue stress or tension on the well during any part of the surging operation. The contractor shall have the ability to pump at a minimum rate of 200 gpm at the same time that surging is being performed. Pump discharge pressure, static and pumping water levels, drawdown capacity and specific capacity at each stage of redevelopment will be recorded.
  - b. It is the Contractor's sole responsibility to supply on-site temporary power for their pumping equipment, generator, fuel, environmental protection, containment, discharge piping, and erosion protection measures needed throughout the work.

## 2. Chemical Injection:

### a. First Treatment:

- i. The chemicals used shall be injected through a tremie pipe to the screened areas. The tremie shall be raised to assure equal disbursement of the chemical in the screen area. At least 50% of the chemicals used shall be disbursed in the screen area. The remaining 50% shall be injected into the top of the well. Chemicals used shall consist of muriatic acid and shall be set for a minimum of 12 hours.
- ii. The complete chemical treatment shall be agitated and allowed to react for at least a 12-hour period, applied at the end of the work day, before any pumping to waste is performed. At the end of 12 hours, the well must be surged for two hours before any pumping and surging to waste is conducted. The well shall pump sand free.
- iii. For site safety reasons, the field crew for all on-site activities requiring operation of the rig (including pump removal/reinstallation and installation/removal of developing tools) and handling of chemical (including injection/neutralization activities) must consist of a minimum 2-person crew.
- iv. In calculating the amount of chemicals to be required, the screen length plus 5 feet shall be considered as a base. The gravel pack shall be considered to have a porosity of 50% and allowance should be made to fill both the screen and the gravel pack with chemicals.
- v. Once the treatment is complete, the well will be pumped to waste. The discharge water will be pumped into the temporary settling tank provided by the Contractor. After settlement, the acid solution will be neutralized to a pH of at least 6.0 by the addition of soda ash, and then discharged to waste on-site at the location designated by the Owner. A detailed record of the neutralization data shall be maintained and submitted with the final report.

### b. Second Treatment:

- i. After well cleaning described above, a minimum 12% sodium hypochlorite shall be injected into the well as described above. The chemical shall be agitated by the surging equipment for a period of two hours while backflushing with clean water. The well shall be pumped to waste (out of the well as wastewater) until all of the chlorine has been removed.

### c. Additional Treatments:

- i. At the completion of each chemical treatment, a brief 30 minute pumping test shall be conducted to provide an estimate of the specific capacity and development results. Upon completion of each treatment, an analysis of



the development results shall be made with the Engineer. The decision of whether to provide additional chemical treatments will be made at that time.

3. Waste Discharge:

- a. Except as noted otherwise, all water produced as part of the cleaning and redevelopment can be discharged by extending a discharge pipe a minimum of 300 feet from the wellhead and any other public water supply wells, and at a location approved by the Engineer.

3.4 POST-CLEANING SPECIFIC CAPACITY TESTING

- A. Following completion of the reconditioning work, a second specific capacity test will be completed in the same manner and with the same equipment as the pre-cleaning specific capacity test.
- B. Well water quality data shall be obtained upon completion of the initial specific capacity test. One (1) water sample from the well shall be collected and submitted to a to a Massachusetts state certified laboratory for analyses of the following constituents:

1. Coliform Bacteria
2. pH
3. Conductivity
4. Odor
5. Turbidity
6. Color
7. Nitrates
8. Nitrogen
9. Iron
10. Manganese
11. Total Hardness
12. Chlorine
13. Sodium

3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700, Contract Closeout.

END OF SECTION 02673

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## SECTION 02700

### ASBESTOS-CEMENT PIPE REMOVAL AND DISPOSAL

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Refer to Appendix P – Asbestos Regulations and Removal Forms for additional information and requirements.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this section includes furnishing all materials, equipment, labor, and incidentals; provide for the removal and disposal; of all asbestos-cement (AC) water main pipe, as indicated and specified.
- B. Handle, remove, store, transport, and legally dispose of all AC pipe in accordance with all local, state and federal regulations and the reference material in Appendix P.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. 01350 – Health and Safety Plan
  - 4. 02080 – Waste Material Abatement
  - 5. 02200 – Earthwork

##### 1.2 SUBMITTALS

- A. Contractor is required to submit a Health and Safety Plan specific to Asbestos-Pipe removal and disposal in addition to the Health and Safety Plan detailed in Section 01350. The plan shall detail the contractor's removal methods and asbestos handling, management, containment, and transportation procedures necessary to comply with reference standards detailed in section 1.5 below. Initial training certificates and current refresher and accreditation proof must be submitted for each person involved with the Asbestos Pipe removal. At a minimum, this should include the Massachusetts Water Works Association 8 Hour OSHA Class II Asbestos Training: Asbestos – Cement Pipe Worker Safety or equivalent.

- B. Massachusetts DEP Asbestos Notification Form (ANF-001): Submit in accordance with Section 01300 - SUBMITTAL PROCEDURES. Form ANF-001 is included in the appendices. Form shall be submitted to necessary local, state and federal agencies within the required notification period. Contractor is responsible for all fees associated with the form and notification procedures.

### 1.3 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400, and as specified.

### 1.4 STORAGE

- A. Storage of removed asbestos-cement pipe is not permitted without prior MassDEP approval. With prior approval, storage of intact asbestos-cement pipe may be allowed for a limited time provided it is done so in secure, fenced, and locked area. Asbestos-cement pipe that has been properly wetted, sealed, and labeled, is permitted to be stored for up to 30 days at the site with prior approval from MassDEP.

### 1.5 REFERENCE STANDARDS

- A. Massachusetts Division of Occupational Safety (MassDOS)
  - 1. 453 CMR 6.00 – The Removal, Containment, or Encapsulation of Asbestos
- B. Massachusetts Department of Environmental Protection (MassDEP)
  - 1. 310 CMR 7.00 – Asbestos Regulations
  - 2. 310 CMR 19.061 – Asbestos Disposal Regulations
  - 3. 310 CMR 40.0000 – Massachusetts Contingency Plan waste site cleanup regulations
  - 4. 310 CMR 4.00 – Timely Action and Fee Provisions
  - 5. 310 CMR 5.00 – Administrative Penalties Regulations

### 1.6 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling and disposal of asbestos contaminated materials, and protection of workers and visitors to the site, and persons occupying areas adjacent to the site.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. When wrapping asbestos-cement pipe or when protecting soil from contamination, material shall be 6-mil polyethylene sheeting.
- B. Amended water shall be water to which surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate asbestos lined materials.

## PART 3 – EXECUTION

### 3.1 HANDLING AND REMOVAL OF ASBESTOS PIPE

- A. All handling and removal of asbestos pipe shall be conducted in accordance with the above reference standards.
- B. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during uncovering, handling, and removal.
- C. If pipe is intact and not broken, place 6 mil polyethylene sheeting under the asbestos cement pipe to prevent soil contamination.
- D. Adequately wet the pipe with amended water before and during removal to prevent dust.
- E. When pipe is intact, pipe shall be slid apart at the joints as to not cause the pipe to become friable or release asbestos fibers. Saw cutting shall not be permitted.
- F. Pipe shall be wrapped in two (2) layers of 6 mil polyethylene sheeting and sealed with duct tape. Containers shall be labeled appropriately.
- G. If the pipe is damaged or saw cutting is necessary, place 6 mil polyethylene sheeting under the asbestos cement pipe to prevent soil contamination. Saw cutting requires containment unless using HEPA exhausted and shrouded cutting equipment.
- H. Pipe shall be sealed in leak-tight Containers. After the pipe has been properly sealed and labeled as described above, place pipe in lined roll-off containers.
- I. Container shall be enclosed and locked, having proper labels and DOT placards, as required.

### 3.2 TRANSPORT

- A. All transport of asbestos containing waste material shall be conducted in accordance with the above reference standards and local, state, and federal regulations.

- B. Prior to shipment of asbestos containing waste material, Engineer will review/approve vehicle placarding, waste shipment record and applicable transport requirements before transport vehicles will receive approval from Engineer to depart.

### 3.3 DISPOSAL

- A. Disposal of asbestos containing waste material shall be conducted in accordance with the above reference standards and local, state, and federal regulations.
- B. Refer to Section 02080 – Waste Material Abatement for disposal requirements.
- C. All shipments must have complete waste shipment records. Receipt copies of all waste shipment records shall be submitted to Owner from the disposal facility within 30 days of transport off-site.
- D. Dispose of all material at a landfill permitted to accept asbestos-containing waste material.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 02700

## SECTION 02725

### WATER SERVICE CONNECTIONS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specification includes furnishing all plant, labor, equipment and incidentals required in tapping (regardless of size) and performing all operations necessary to provide new water services and 100-foot sample tap from the new water main to the property line or to the location shown, including corporation stops, curb stops and boxes, as shown on the Drawings or as directed by the Engineer. In general, a service shall be brought to each developed parcel of property along the water main route. Trench excavation and backfilling shall be done in accordance with all of the applicable sections of these Specifications.
- B. Corporation cocks shall be installed for connecting all service to the new water mains. The Contractor shall keep a record of the locations of all corporation cocks installed and shall indicate on the record those corporation cocks that have not been connected to service piping. A copy of this record shall be given to the Engineer at the completion of the work. Copper tubing, curb stops and necessary adapters shall be used to make connections between new corporation cocks and new and existing service piping. The Contractor shall be responsible for the removal and/or installation of curb stops in the locations directed by the Engineer.
- C. All existing services shall be maintained until the new service connections have been fully installed, chlorinated and tested to the satisfaction of the Engineer. All service connections shall then be made to the mains as specified below. The Contractor shall connect each existing house service to the new service connections provided after the completed installation has been accepted by the Engineer. All abandoned services shall have ends crimped.
- D. All service fittings, corporations and curb stops shall be provided with no lead meeting the current NSF requirements.
- E. Related Sections includes the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

3. Section 02200 – Earthwork
4. Section 03300 – Cast-in-Place Concrete

### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for materials and products.

### 1.4 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
  1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- B. American Water Works Association (AWWA)
  1. AWWA C800 - Underground Service Line Valves and Fittings.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. All water service plumbing material shall be “lead free” in accordance with Section 1417 of the Safe Drinking Water Act and Section 9 of NSF Standard 61.

### 2.2 SERVICES

- A. Unless otherwise specified, all pipes for services and 2-inch mains shall be copper tubing Type K Annealed and shall conform to the provisions of ASTM B-88 (latest version).

### 2.3 CORPORATIONS, CURB STOPS AND SADDLES

- A. The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C800). Corporation stops shall be Mueller 300 Ball Corporation Valve, Model B-25008N, as manufactured by Mueller Company, The Ford Meter Box Company, Red Hed Manufacturing, or approved equal. Corporations larger than one inch shall be installed with saddles.



- B. The curb stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C800). Curb stops shall be Mueller 300 Ball Curb Valve, Model B-25209N as manufactured by Mueller Company, Ford Meter Box Company, Red Hed Manufacturing, or approved equal. Curb Stops shall open Left.
- C. The curb box shall be of the "Erie" type, cast-iron construction. The curb box shall be tar base enamel coated inside and out and shall be equipped with a stainless steel operating extension rod. The lid shall be of extra heavy cast-iron construction with a brass pentagon plug. Curb stop boxes shall be manufactured in North America only.
- D. Service saddles (for services larger than one inch) shall be Smith-Blair 313 Double Strap, by Mueller, Romac Industries, or approved equal. Bodies shall be ductile iron and straps shall be electrogalvanized carbon steel. Units shall be complete with Buna-N gaskets.

## 2.4 FITTINGS

- A. Unless otherwise approved, only compression type fittings manufactured by Mueller Inc., or equal, shall be used. Fittings shall be no lead brass fittings (NL cast on the fitting body is required).
- B. Adapters required to allow connection to existing services shall be provided.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. After successful testing and chlorination, water services shall be installed as a "wet" tap as shown on the Drawings, specified, or directed by the Engineer. Exact locations of services shall be located in the field by the Engineer. All existing services shall be connected to the curb stop installed under this Contract. All services shall be installed to a minimum depth of 5'-0" unless specifically shown or directed otherwise by the Engineer.
- B. Corporation cocks. The tapping machine shall be rigidly fastened to the pipe. The length of travel of the tap should be so established that when the stop is inserted and tightened with a 14-in wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation cock shall be inserted with the machine while it is still in place. Stops shall be tightened only sufficiently to give watertightness and care must be constantly exercised not to overtighten them.
- C. Saddle taps shall only be used for services larger than one inch or when transite (asbestos cement) pipe, PVC pipe, or HDPE pipe is encountered or under the direction of the Engineer.

- D. Straight couplings. The Contractor shall install straight couplings to existing water mains of the sizes required in the locations designated by the Engineer in the field. The Contractor shall utilize the manufacturers recommended installation procedures while performing the work. Care shall be taken to ensure a watertight connection.
- E. Curb stops will, in most cases, be installed 1.5-ft from the curb line or pavement limit. The Contractor shall install the curb cocks and boxes in a workmanlike manner as described herein and as directed by the Engineer and shall place compacted-screened gravel around and below the cock to permit ready draining of the pipe through the waste opening.
- F. The boxes shall be set in a true vertical position and if they are within the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set about 1/2-in below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground.
- G. Care shall be exercised in the placing and laying of water service tubing to be sure that the pipe does not have kinks or sharp bends and to assure against it being in contact with sharp stones or ledge which would cause damage to the pipe. Service shall be installed with a minimum 6 inches of sand bedding and 12 inches sand cover.
- H. For existing service connections that are less than 1-inch, the change over to the new main shall occur at the new 1-inch tap (1" to 3/4"). If any extensions are required to reach the existing water service, they shall match diameter in kind, except be no less than 1-inch. Water service tubing as specified herein shall be used to make connections between new corporation stops and new curb stops at the property line. If the service connection is greater than 1-inch, the same size water service tubing connection shall be installed. The Contractor shall be responsible for the removal and/or installation of curb stops and boxes in the locations directed by the Engineer.
- I. The transfer of water connections from the old services to the new services shall be performed as quickly as possible in order to minimize the time in which water service is disrupted.
- J. Unless otherwise specified, all pipe for services up to 2-inch diameter shall be copper tubing Type K, conforming to ASTM B88.
- K. Water service trenches shall be excavated and backfilled in accordance with Section 02200 of this Specification and in conformance to the details. Services to be installed beneath paved roadways may be driven beneath the pavement utilizing a pneumatically driven device such as "Hole Hog", or equal. All copper tubing shall be backfilled with sand by hand to 12" above tubing.

3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02725

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## SECTION 02830

### GUARD RAIL

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This section includes furnishing and installing guard rail and accessories per MassDOT standards as shown on the Contract Drawings and as specified herein.
- B. Related Sections Include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements.
  - 3. Section 02200 – Earthwork
  - 4. Section 02513 – Bituminous Concrete Pavement

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – Submittals
  - 1. Submit manufacturer's specifications, drawings, details, rails layout with appurtenances.
  - 2. Submit shop drawings, samples and certificates simultaneously as one complete package.

##### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide in protected and secured area and covered until ready for installation.

#### PART 2 – PRODUCTS

##### 2.1 GUARD RAIL AND CRASH RAIL

- A. Provide rails as shown on the drawings and meeting MassDOT - Highway Standards.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Notify Engineer, in writing, of improper conditions of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Verify measurements at site.
- D. Check location of underground work to make sure the guardrail clears underground utilities and structures.
- E. Do not drive equipment on areas to be landscaped, except as approved by Engineer. Areas not accessible from roads shall be protected with heavy wood planking. Remove barricades and protection at completion of project. Repair damaged landscape surfaces.

### 3.2 INSTALLATION

- A. Guardrail: Install in accordance with MassDOT – Highway Standard Specifications and as shown on the drawings.

### 3.3 TOUCH-UP AND REPAIR WORK

- A. Repair damaged guardrail and components as recommended by manufacturer.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 02830

## SECTION 02832

### SEGMENTAL RETAINING WALLS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Work shall consist of furnishing all materials, labor, equipment, and supervision to install segmental retaining wall (SRW) units in accordance with plans and specifications and to the lines, grades, and dimensions designated on the construction drawings or as directed by the Engineer. Work shall also include furnishing and installing appurtenant materials required for construction of the retaining wall as shown on the Construction Drawings and Details.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02060 – Site Clearing
  - 4. Section 02200 – Earthwork

##### 1.3 SUBMITTALS

- A. Product Data: At least 21 days prior to construction, the General Contractor shall submit the retaining wall submittal package to the Engineer for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:
  - 1. Precast Modular Block System brochure.
  - 2. Precast Modular Block concrete test results that indicate compliance of retaining wall units with requirements based on comprehensive testing of current products. This shall include test data for: 28-day compressive strength, air content, and slump or slump flow (as applicable). This shall also include test data verifying all other properties used as basis of structural design.
  - 3. For installed systems indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

4. Design Calculations and Shop Drawings: Contractor to submit shop drawings and supporting engineering calculations sealed by a registered professional engineer in the State of Massachusetts and schedules for type, location, quantity, and details of components required for the project. Shop Drawings shall also include support base and foundation details based on field verified soil data.
- B. Samples for Verification: Sets for each color, finish, and pattern of unit required. Include 2 or more samples in each set showing the full range of variations expected. Color to be selected by the Owner.
- C. Qualification Data: At least 14 days prior to construction, the General Contractor shall submit the qualifications for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Preconstruction Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Research/Evaluation Reports: Evidence of system's compliance with building code in effect for Project from a model code organization acceptable to authorities having jurisdiction.
- F. Revised design stamped by professional engineer if another product system is to be submitted.

#### 1.4 REFERENCED STANDARDS

- A. Segmental Retaining Wall Units
  1. ACI 201 – Guide to Durable Concrete
  2. ACI 318 – Building Code Requirements for Structural Concrete
  3. ASTM C33 – Standard Specification for Concrete Aggregates
  4. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  5. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
  6. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  7. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
  8. ASTM C150 – Standard Specification for Portland Cement



9. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
10. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
11. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
12. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
13. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
14. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
15. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
16. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
17. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
18. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete
19. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
20. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
21. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
22. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
23. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.
24. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).
25. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).

**B. Soils**

1. ASTM D 1556 Moisture Density Relationship for Soils, Modified Method

2. ASTM D 422 Standard Test Method for Particle-Size Analysis of Soils
3. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
4. ASTM D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
5. ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
6. ASTM D 4972 Standard Test Method for pH of Soils

C. Engineering Design

1. AASHTO LRFD Bridge Design Specifications, 8th and 9th Edition.
2. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-16.
3. International Building Code, 2015 Edition.
4. Design Manual for Segmental Retaining Walls, National Concrete Masonry Association (NCMA), 3<sup>rd</sup> Edition, 2010.
5. Massachusetts State Building Code, latest edition.

D. Where specifications and reference documents conflict, the Engineer shall make the final determination of applicable document.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide segmental retaining walls capable of withstanding the effects of loads due to soil pressures resulting from grades indicated.
1. Include the effects of sloped backfill as indicated on Drawings.
  2. Include the effects of superimposed loads as indicated on Drawings.
  3. Design retaining walls according to NCMA's "Design Manual for Segmental Retaining Walls."

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed segmental retaining walls similar in material, design, and extent to that indicated for a Project that has resulted in construction with a record of successful in-service performance.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where the Project is located and who is experienced in

providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of systems that are similar to those indicated for this Project in material, design, and extent.

- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 548.
- D. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:
  - 1. Test proposed retaining wall units for connection strength according to NCMA SRWU-1.
  - 2. Test proposed backfill materials for pullout behavior according to GRI GG5, Controlled Strain Rate Method for Short-Term Testing (Method A).

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in an undamaged condition.
- B. The Segmental Retaining Wall Installation Contractor shall inspect the materials upon delivery to ensure that the proper type, grade, and color of materials have been delivered.
- C. Store and handle retaining wall units and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure, or other causes. Damaged materials shall not be incorporated into the work.
- D. Precast modular blocks shall be stored in an area with positive drainage away from the blocks. The contractor shall take care to protect the blocks from mud and excessive chipping and breakage. Precast modular blocks shall not be stacked more than three (3) units high in the storage area.
- E. Drainage aggregate and backfill material shall not be piled over unstable slopes or areas of the project site with buried utilities. Drainage aggregate material shall not be staged where it may become mixed with or contaminated by poor draining fine-grained soils such as clay or silt.
- F. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Segmental Retaining Wall Units:
    - a. Licensees of Redi-Rock Retaining Walls, Inc.
    - b. Licensees of Kiltie Corp.; Versa-Lok Retaining Wall Systems Division
    - c. Licensees of Stone Strong, LLC.
    - d. Approved equal

### 2.2 PRECAST MODULAR BLOCK RETAINING WALL UNITS

- A. Concrete Units: High-strength, regular-weight concrete units, specifically designed for use in segmental retaining walls, complying with ASTM C 90, except with net-area compressive strength of 3000 psi (20.7 MPa) for average of 3 units and 2500 psi (17.2 MPa) for individual unit, maximum water absorption of 8 percent, and variation in height limited to 1/16 inch.
1. Provide units with lugs, projections, or holes and pins that locate successive courses in relation to the course below and maintain that alignment as backfill is placed, and that interlock with units above and below.
  2. Provide units with lugs, projections, holes and pins, or hollow cores for filling with drainage fill to interlock with units above and below.
  3. Precast modular block retaining wall units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or performance of the structure. Chips smaller than 1.5” in its largest dimension and cracks not wider than 0.012” and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75” in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.
  4. In certain configurations and/or combinations of blocks, some minor on-site trimming/partial removal of some of the shear knobs may be necessary to allow for proper alignment.

5. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft 6 in (4.42 m).
  6. The precast modular block units shall be manufactured with integrally cast shear knobs that establish a standard horizontal set-back for subsequent block courses. The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the Drawings.
  7. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor.
  8. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C 94.
- B. Colors: The block color shall be selected by the Owner from the available range of colors available from the precast modular block manufacturer.
- C. Surface Texture: The block face texture shall be selected by the Owner for the available range of textures from the precast modular block manufacturer.
- D. Shapes: Each concrete block shall be cast in a single continuous pour without cold joints. Provide units of basic shapes and dimensions indicated.
- E. Special Units: Provide corner units, end units, cap units, and other special shapes as necessary to produce retaining walls of dimensions and profiles indicated and to provide indicated textures on exposed surfaces.

## 2.3 INSTALLATION MATERIALS

- A. Leveling Pad: The precast modular block units shall be placed on a leveling pad constructed from  $\frac{3}{4}$ " crushed stone (refer to section 02200 – Earthwork) and shall be a minimum of 12 inches in depth. The leveling pad shall extend laterally at least a distance of 6 inches from the toe and heel of the lowermost precast modular block retaining wall unit, and as shown on the Drawings.
- B. Cap Adhesive: Product supplied or recommended by retaining wall unit manufacturer for adhering cap units to units below.
- C. Drainage Aggregate and Unit Core Fill: Drainage aggregate and unit core fill shall be  $\frac{3}{4}$ " crushed stone. Refer to section 02200 – Earthwork.
- D. Backfill Soil: Backfill soil shall be structural fill or undisturbed soil. Refer to section 02200 – Earthwork.
- E. Drainage: Drainage weeps shall be installed within the proposed retaining wall to maintain gravity flow of water outside the retained-soil zone. The drainage weeps shall

be installed at the locations shown on the final construction drawings or as otherwise required by the manufacturer and approved by the Engineer/Owner.

F. Polyvinyl Chloride (PVC) Pipe, SDR35: Perforated and Solid Drain Pipe

1. PVC perforated and solid drain pipe shall be push-on joint SDR 35 PVC meeting the requirements of ASTM D3034 for sizes 3-inch to 6-inch. Pipe color shall be in accordance with the uniform color code established by the APWA Utility Location and Coordination Council. Perforated pipe shall have a two rows of holes ½” in diameter located at 5-inches on center and 120 degrees apart.
2. General: Elbows, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps of same-type class of materials as piping unless otherwise indicated.
3. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Elastomeric gaskets shall conform to ASTM D3212. Where petroleum contamination is known or suspected to be in the soil and/or groundwater, nitrile gaskets shall be required.
4. Spigot Pipe Ends: Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an “assembly stripe” imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All work shall be performed in accordance with OSHA, State, and local safety standards, state and local building codes and manufacturer’s requirements.
- B. The General Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the retaining wall, shall be installed concurrent with retaining wall construction. The General Contractor shall coordinate the work of filed sub-bids and subcontractors affected by this requirement.
- C. New utilities installed below the retaining wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.
- D. The General Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.

### 3.2 EXAMINATION

- A. Prior to construction, examine the areas in which segmental retaining walls will be constructed and conditions under which walls will be installed, with Installer present, for compliance with requirements for excavation tolerances, worker safety, condition of subgrades, and other conditions affecting performance of retaining walls.
  - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.
- A. The retaining wall installer will conduct soil testing to establish final soil design parameters. Final retaining wall design will be submitted for approval by the installer to the Engineer for approval.

### 3.3 SEGMENTAL RETAINING WALL INSTALLATION

- A. Place units according to manufacturer's written instructions. Lay units in running bond, overlapping half units of course below.
  - 1. All precast gravity blocks shall be installed at the proper elevation and orientation as shown on the wall profiles and details on the construction plans or as directed by the Engineer. The precast gravity blocks units shall be installed in general accordance with the manufacturer's recommendations. The specifications and drawings shall govern in any conflict between the two requirements.
  - 2. Form corners and ends by using special units.
  - 3. Form corners and ends by cutting units with motor-driven saw.
  - 4. Form corners and ends by splitting with mason's hammer and chisel.
  - 5. Form corners and ends by any method above as indicated in manufacturer's written instructions.
- B. Excavation: Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the project grading plans.
  - 1. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted infill material, or as directed by the Engineer, at the Contractor's expense.
  - 2. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation.
  - 3. Excavation support, if required, is the responsibility of the Contractor.
- C. Leveling Pad Construction:

1. Prior to construction of the precast modular block retaining wall, the leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad area shall be cleared and grubbed. All topsoil, brush, frozen soil, and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified under cut limits shall be under cut and replaced with approved fill as directed by the engineer. Any volume of soils undercut and replaced shall be noted by the Contractor.
  2. Leveling pad shall be placed as shown on the final retaining wall plans with a minimum thickness of 6 inches. The leveling pad shall extend laterally at least a distance of 6 inches from the toe and heel of the lowermost precast modular block retaining wall unit.
  3. Well-graded sand can be used to smooth the top 1/4 inch to 1/2 inch of the leveling pad. Compaction will be with mechanical plate compactors to achieve 95% of maximum standard Proctor density (ASTM D 698).
- E. First Course: Place first course of retaining wall units on leveling base/course for full length of wall. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. No gaps shall be left between the front of adjacent units. Alignment may be done by means of a stringline or offset from base line to the back of the units.
1. Tamp units into leveling base as necessary to bring tops of units into a level plane.
  2. Place and compact fill, either drainage fill or soil fill as indicated, to top of first course. Place fill on both sides of wall at same time without disturbing alignment of units. Fill voids between and within units with clean drainage aggregate.
  3. Clean all excess debris from top of units prior to installing subsequent course.
- F. Subsequent Courses: Sweep excess fill from tops of course below. Place units in firm contact, properly aligned, and directly on course below.
1. For units with lugs designed to fit into holes in units of adjacent course, lay units so lugs are accurately aligned with holes and bedding surfaces are firmly seated on beds of units below.
  2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
  3. For units with pins, carefully align holes in units above with holes below and insert pins according to manufacturer's written instructions.
  4. Place and compact fill as each course is laid. Place fills on both sides of wall at same time, where both sides are indicated to be filled.



4. Fill voids between and within units with drainage aggregate.
  5. Layout and installation of curves and corners shall be in accordance with the plan details or in general accordance with wet-cast retaining wall unit's manufacturer's installation guidelines.
  6. The wall face cant shall not differ more than + 2 degrees from that specified.
  7. Drainage aggregate, unit core fill, and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.
  8. Repeat procedures to extent of wall height.
- G. Cap Units: Place cap units and secure with cap adhesive according to manufacturer's written instructions.

### 3.4 DRAINAGE AGGREGATE AND BACKFILL PLACEMENT

- A. General: Comply with requirements of Division 2 Section 02200 "Earthwork" and retaining wall unit manufacturer's written instructions.
- B. Place, spread, and compact fill in uniform lifts not exceeding a compacted thickness of 8" for full width and length of embankment as wall is laid. Begin at back of wall and place and spread fill toward embankment.
1. Use only hand-operated compaction equipment within 36 inches of wall.
  2. Compact drainage fill to not less than 95 percent maximum dry density according to ASTM D 1556.
  3. Compact soil backfill to not less than 95 percent maximum dry density according to ASTM D 1556.
  4. The Contractor shall protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the drainage fill, soil backfill, or wall infill.
- C. Place filter fabric against back of wall and place a layer of drainage fill at least 12 inches deep behind the filter fabric to within 12 inches of finished grade. Place another layer of filter fabric between drainage fill and soil backfill.
- D. At completion of wall construction, backfill shall be placed level with the final top of wall elevation or approximately 5 inches below coping. If final grading, paving, landscaping and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided

to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

### 3.5 OBSTRUCTIONS IN THE INFILL ZONE

- A. The Contractor shall make all required allowances for obstructions behind and through the wall face in accordance with the Drawings.
- B. Should unplanned obstructions become apparent for which the Drawings do not account, the affected portion of the wall shall not be constructed until the Contractor can appropriately address the required procedures for construction of the wall section in question.

### 3.6 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1/4 inch in 10 feet or 1 inch in 40 feet or more.
- B. Variation from Indicated Batter: For slope of face of wall, do not vary from indicated slope by more than 1/4 inch in 10 feet.
- C. Variation in Plan Position: For ends and faces of walls in relation to property lines, buildings, and other objects, do not vary from plan dimensions by more than 1 inch or from depicted plan relationship (scaled dimensions) by more than 3 inches.
- D. Variation in Linear Wall Line: For walls indicated as straight, do not exceed 1/4 inch in 10 feet or 1 inch in 40 feet or more from a straight line.

### 3.7 FIELD QUALITY CONTROL

- A. Comply with requirements of Division 2 Section 02200 "Earthwork" for in-place soil density testing.
  - 1. In each compacted backfill layer, the geotechnical testing laboratory shall perform at least one in-place field density test for each 100 feet or less of retaining wall length, but no fewer than 2 tests along a wall face.
- B. Inspect and document soil compaction in accordance with these specifications:
  - 1. Required dry unit weight
  - 2. Actual unit dry weight
  - 3. Allowable moisture content
  - 4. Actual moisture content
  - 5. Test Location and Elevation

6. Distance of test location behind the wall face

### 3.8 ADJUSTING AND CLEANING

- A. Remove and replace segmental retaining walls of the following description:
  1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if methods and results are approved by Engineer.
  2. Segmental retaining walls not matching approved samples and mockups.
  3. Segmental retaining walls not complying with other requirements indicated.
- B. Replace in a manner that results in segmental retaining wall's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

### 3.9 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 02832

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## SECTION 02901

### MISCELLANEOUS WORK AND CLEANUP

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to do the miscellaneous work not specified in other sections but obviously necessary for the proper completion of the work as shown on the Drawings.
- B. When applicable the Contractor shall perform the work in accordance with other sections of this Specification. When no applicable specification exists the Contractor shall perform the work in accordance with the best modern practice and/or as directed by the Engineer.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
- D. Work included:
  - 1. The Contractor shall be responsible for the following:
    - i. Installing and maintaining construction warning signs.
    - ii. Installing and maintaining stabilized construction exit.
    - iii. Furnish and install concrete splash pads.
    - iv. Furnish and install precast concrete sill overflow weir.
    - v. Buried Utility Warning and Identification Tape for Ductbanks
    - vi. Crossing and relocating existing utilities.
    - vii. Restoring of driveways and sidewalks.
    - viii. Cleaning up.
    - ix. Incidental work.
    - x. Job photographs, if required.
    - xi. Protection and/or removal and reinstallation of existing signs, lampposts, fence posts, fencing and mailboxes.
    - xii. Protection and bracing of utility poles.
    - xiii. Restoration and replacement of curbing.
    - xiv. Raking and re-seeding of grassed areas disturbed during construction and/or dewatering activities, including silt basin/dewatering activity areas.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Materials required for this Section shall be the same quality of materials that are to be restored. Where possible, the Contractor may re-use existing materials that are removed.

## PART 3 – EXECUTION

### 3.1 INSTALLING AND MAINTAINING CONSTRUCTION WARNING SIGNS

- A. Construction work zone traffic control shall be the contractor's responsibility. Generally, conformance with Part VI of the Manual of Uniform Traffic Control Devices (MUTCD), latest edition, "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations", will be considered to meet this requirement.

### 3.2 INSTALLING AND MAINTAINING STABILIZED CONSTRUCTION EXIT

- A. It shall be the Contractor's responsibility to install and maintain stabilized construction exit(s), as shown on the Drawings, in a condition which shall prevent tracking or flowing of sediment onto public Rights-of-Ways. This may require periodic top dressing with additional stone as conditions demand and repair or cleanout of any measures used to reap sediment. All sediment spilled, dropped, washed, or tracked onto public Rights-of-Ways must be removed immediately.

### 3.3 FURNISH AND INSTALL PRECAST CONCRETE SPLASH PADS

- A. The Contractor is responsible for furnishing and installing precast concrete splash pads at all gutter downspouts, condensate drains, bulk chemical fill stations, surge relief valves, and as shown on the Contract Drawings. The splash pads shall be set into the gravel shoulder. The splash pads for gutter downspouts and condensate drains shall be 12-in by 36-in and a minimum of 3 inches thick. The splash pads for bulk chemical fill stations and surge relief valves shall be 4-ft by 4-ft and a minimum of 3 inches thick.

### 3.4 FURNISH AND INSTALL PRECAST CONCRETE SILL OVERFLOW WEIRS

- A. The Contractor is responsible for furnishing and installing precast concrete sill overflow weirs as shown on the Contract Documents. The precast concrete sill shall be set into riprap. Precast concrete sill shall be concrete curb by United Concrete Products, or approved equal. The precast concrete sill shall be sections of precast concrete curb, placed on their side, and pinned together with #5 rebar connecting pins to form a total length as shown on the Contract Drawings. The precast curb sections shall be 18-in wide (min.) and 7-in deep (min).

### 3.5 BURIED UTILITY WARNING AND IDENTIFICATION TAPE FOR DUCTBANKS

- B. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED [WATER, SEWER, ELECTRIC, GAS, ETC.] PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

### 3.6 CROSSING AND RELOCATING EXISTING UTILITIES

- A. This Item includes any extra work required in crossing culverts, water courses, including brooks and drainage ditches, storm drains, gas mains, water mains, electric, telephone, gas and water services and other utilities. This work shall include but is not limited to the following: bracing, hand excavation and backfill (except screened gravel) and any other work required for crossing the utility or obstruction not included for payment in other items of this specification. Notification of Utility Companies shall be required prior to work being done.
- B. In locations where existing utilities cannot be crossed without interfering with the construction of the work as shown on the Drawings, the Contractor shall remove and relocate the utility as directed by the Engineer or cooperate with the Utility Companies concerned if they relocate their own utility.
- C. At pipe crossings and where designated by the Engineer, the Contractor shall furnish and place screened gravel bedding so that the existing utility or pipe is firmly supported for its entire exposed length. The bedding shall extend to the mid-diameter of the pipe crossed.

### 3.7 RESTORING OF DRIVEWAYS AND SIDEWALKS

- A. Existing public and private driveways disturbed by the construction shall be replaced. Paved drives shall be repaved to the limits and thickness existing prior to construction. Gravel drives shall be replaced and regraded.
- B. Existing public and private sidewalks disturbed by the construction shall be replaced with sidewalks of equal quality and dimension. In general, sidewalks shall be 2-½ inches thick after rolling and compacting and the material shall be top course bituminous asphalt.

### 3.8 CLEANING UP

- A. The Contractor shall remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall restore the site of the work to a neat and orderly condition. Any materials,

and sand or concrete materials shall be cleaned out of the manholes and catch basins. Haybales and siltfence as well as any silt and debris retained by same shall be removed.

### 3.9 INCIDENTAL WORK

- A. Do all incidental work not otherwise specified, but obviously necessary to the proper completion of the Contract as specified and as shown on the Drawings.

### 3.10 PHOTOGRAPHS OF PROJECT

- A. Prior to work, the Contractor may document existing conditions using construction photographs. Photographs for this purpose shall be at the Contractors' expense.

### 3.11 RESTORATION AND REPLACEMENT OF SIGNS, LAMPPOSTS, FENCE POSTS, FENCING AND MAILBOXES

- A. Existing signs, lamp posts, fence posts, fencing and mailboxes which may be damaged by the Contractor or removed by the Contractor during the course of construction shall be reinstalled in a vertical position at the same location from which they were removed. Damaged items shall be replaced with an item equal to or better than the damaged items. A concrete anchor shall be provided as necessary, at no additional cost, to ensure a rigid alignment. Care shall be exercised in the reinstallation of all items to prevent damage to the new construction.

### 3.12 PROTECTION AND BRACING OF UTILITY POLES

- A. The Contractor shall be responsible for making all arrangements with the proper utility companies for the bracing and protection of all utility poles that may be damaged or endangered by the Contractors operations. Work under this item shall include the related removal and reinstallation of guy wires, or support poles whether shown on the Drawings or not.

### 3.13 RAKING AND RE-SEEDING

- A. Grass and landscaped areas disturbed by the Contractor shall be raked and replenished with loam if required. Areas shall be re-seeded as required.

### 3.14 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02901



## SECTION 02920

### TOPSOIL

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section consists of manufacturing, delivering, and placing 6” of topsoil on prepared subgrade areas disturbed by construction. Topsoil, as available, may be stripped, screened, stockpiled and tested for reuse. Topsoil requirements in excess of available on-site will be imported. Both sources will be placed in compliance with this section.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02200 – Earthwork
  - 4. Section 02945 – Lawns and Seeding
  - 5. Section 02950 – Planting

##### 1.3 SUBMITTALS

- A. In accordance with Section-01300 Submittals. Submit soil analysis report for imported topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover: USDA soil textural classification (percentages of sand, silt, and clay); chemical analysis for pH, soluble salts, Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, and Lead; The report shall include additive recommendations based on the analysis and the proposed planting plan provided in the Contract Drawings.
- B. Fertilizer plan

##### 1.4 REFERENCES

- A. The following standards shall apply to the work of this Section.
  - 1. "STANDARDIZED PLANT NAMES," 1942 Edition, American Joint Committee on Horticultural Nomenclature.

2. Tree and Shrub Transplanting Manual, E.B. Himelick, 1991, International Society of Arboriculture.
3. American National Standards Institute (ANSI):
  - Z60.1 American Standard for Nursery Stock, latest edition, published by American Nursery & Landscape Association, (ANLA).

## 1.5 PRODUCT HANDLING

- A. Do not deliver topsoil in frozen, wet, or muddy condition.

## PART 2 – MATERIALS

### 2.1 IMPORTED TOPSOIL

- A. Friable loam, typical of fertile local topsoil; free-from pure clay, weeds, noxious weed seeds, sod, clods and stones larger than 1 inch, toxic substances, litter, or other deleterious material; having a mildly alkaline pH between 6.0 and 7.0. Soluble salts shall not exceed 4 milli-mhos per centimeter.
- B. Topsoil shall conform to the following particle size distribution, as determined by pipette method in compliance with ASTM F-1632:

Sand	40-60%
Silt	30-40%
Clay	5-20%

The maximum particle size shall be 1-inch. If determined by a soil test the existing topsoil that was stripped does not meet these specifications, the topsoil shall be amended to provide an acceptable topsoil for use.

- C. Organic Content: 10% minimum

### 2.2 TOPSOIL REUSE

- A. Topsoil stockpiled from on-site stripping may be utilized if in compliance with the requirements for new topsoil. The contractor is responsible for modifying the existing topsoil as required to meet the specification for new topsoil.
- B. Do not screen topsoil prior to re-use, but topsoil shall be free of sticks, stumps, roots or other objectionable, extraneous matter or debris.

### 2.3 SOIL ADDITIVES

- A. Commercial fertilizer, peat, humus or other additives shall be used to counteract soil deficiencies as recommended by the soil analysis.
- B. Commercial fertilizer shall be a product complying with the State and United States Fertilizer Laws, and suitable for use within Zone I Wellhead Protection Area. Deliver

to the site in the original unopened containers which shall bear the manufacturer's Certificate of Compliance covering analysis. At least 50% by weight of the Nitrogen content shall be derived from organic materials. Fertilizer shall contain the percentages of weight of ingredients as follows, or as recommended by the soil analysis when that is significantly different:

	Nitrogen	Phosphorus	Potash
For all plants	10%	10%	10%

1. **Note: this project is proximate to a public water supply. Only the minimum application of Nitrogen fertilizer shall be used to maintain plantings and to correct deficiencies. Contractor shall submit a fertilizer plan for Engineer review prior to any applications.**
- C. Ground dolomite limestone shall be an approved agricultural limestone containing not less than 85% of total calcium or magnesium carbonates. Limestone shall be ground to such fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20 mesh sieve.
  - D. Humus shall be natural humus. It shall be free from excessive amounts of zinc, low in wood content, free from hard lumps and in a shredded or granular form. According to the methods of testing of A.O.A.C., latest edition, the acidity range shall be approximately 5.5 pH to 7.6 pH and the organic matter shall be not less than 85% as determined by loss on ignition. The minimum water absorbing ability shall be 200% by weight on an oven-dry basis.
  - E. No peat moss shall be used.
  - F. Superphosphate: Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 18% available phosphoric acid.

### PART 3 – EXECUTION

#### 3.1 PREPARATION OF SUBSOIL

- A. Prior to spreading topsoil, subsoil should be rough graded to correspond with finish grades as indicated on the Drawings. Subgrade shall slope to allow for subsurface drainage. Depressions shall be filled, and areas which are highly compacted shall be loosened to a depth which is adequate for the passage of gravitational water through the subsoil. Remove stones over two (2") inches, sticks, rubbish, and other deleterious materials which may impede the healthy and vigorous growth of grass. Move no heavy objects or machinery, except as necessary for the spreading of topsoil, over sod and seed beds after preparation of subgrade.
- B. Subsoil which becomes compacted due to excessive construction activity shall be loosened as directed by the Engineer at no additional cost to the Owner.

#### 3.2 FINE GRADING

- A. After existing pavement has been removed, existing vegetation has been either removed and stockpiled for transplant or removed, scarify subgrade, remove compacted areas and then spread loam mix. After the areas to be loamed have been brought to subgrade, and immediately prior to dumping and spreading the loam, the subgrade shall be loosened by disking or rototilling to a depth of at least three inches (3") to permit bonding of the loam to the subsoil. Remove all stones greater than two inches (2") and all debris or rubbish. Such material shall be removed from the site.
- B. No subsoil or loam shall be handled in any way if it is in a wet, dry, or frozen condition. Sufficient grade stakes shall be set for checking the finished grades. Grades shall be established which are accurate to one-tenth (1/10th) of a foot either way. Connect contours and spot elevations with an even slope. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one inch (1") in diameter shall be removed from the loam. Loam shall also be free of smaller stones in excessive quantities as determined by the engineer.
- C. The whole surface shall then be rolled with a hand roller weighing not more than 100 lbs. per foot of width. During the rolling, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02920

## SECTION 02945

### LAWNS AND SEEDING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all lawn installation and fine grading work and related items as indicated on the Contract Documents and/or as specified in this Section and includes, but is not necessarily limited to, the following:
  - 1. Seeding
  - 2. Maintenance, guarantee, and protection
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02920 – Topsoil
  - 4. Section 02950 - Planting
- C. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

##### 1.3 SUBMITTALS

- A. At least 90 days prior to the first day of the seeding season described in this Section, submit to the Engineer proof of certification of Foreman or Crew Leader as Massachusetts Certified Landscape Professional or Massachusetts Certified Horticulturist in accordance with QUALITY ASSURANCE paragraph of this Section.
- B. Submit proof of landscape contractor's experience to the Engineer in accordance with QUALITY ASSURANCE paragraph of this Section.
- C. At least 30 days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with the requirements of

Division 1 Section, Submittals. Do not order materials until Engineer's approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. Acceptance shall not constitute final acceptance. The Engineer reserves the right to reject on or after delivery any material that does not meet these Specifications.

1. Material Sampling and Testing of Loam Borrow from On-Site or Off-Site Sources shall be specified, performed and paid for under Division 2 Section 02920, Topsoil (Outside Disturbed Areas), of this Specification.
  2. Fertilizer:
    - i. Submit product literature of seeding fertilizer and certificates showing composition and analysis.
    - ii. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.
  3. Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.
  4. Hydroseeding: Prior to the start of hydroseeding, submit a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water.
  5. Wood Cellulose Fiber Mulch: Submit 4 copies of manufacturer's literature and one material sample.
  6. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.
  7. All additives needed to amend a specific soil in order to meet these specifications.
- D. Maintenance Instructions: At the time of Acceptance, the Contractor shall submit complete maintenance instructions for turf care for the Owner's use. The instructions shall be reviewed for approval by the Engineer as a pre-condition for Acceptance.

#### 1.4 EXAMINATION OF CONDITIONS

- A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect grading, or drainage problems shall be reported to the Engineer prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be improved, and he shall assume full responsibility for the work of this Section.
- B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

## 1.5 QUALITY ASSURANCE

- A. Qualification of Landscape Contractor: The work of this Section, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section.
- B. Qualification of Foreman or Crew Leader: All work of seeding shall be supervised by a foreman or crew leader who is a certified landscape professional or a certified horticulturist.
  - 1. Landscape professional shall be a Massachusetts Certified Landscape Professional certified by the Associated Landscape Contractors of Massachusetts.
  - 2. Horticulturist shall be a Massachusetts Certified Horticulturist as certified by the Massachusetts Nursery and Landscape Association.
  - 3. Certification shall be current. Proof of certification shall be submitted per SUBMITTALS paragraph of this Section.
- C. The ratio of laborers to certified landscape professionals or certified horticulturist shall not exceed twelve to one. Certified Landscape Professional or Certified Horticulturist shall be on the project site throughout the day to day performance of the work described in this Section.

## 1.6 PRODUCT HANDLING

- A. Delivery and Storage:
  - 1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Engineer's inspection.
  - 2. Immediately remove from the site all materials which do not comply with the specified requirements
  - 3. Prior to the installation, cover and store all sod in a cool, dry shaded area.
  - 4. Use all means necessary to protect seed from moisture and other contaminants that may adversely effect proper germination.
  - 5. Use all means necessary to protect fertilizers, amendments and other materials from moisture and other contaminants that may adversely effect their efficacy.

## 1.7 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before

spreading topsoil.

## PART 2 – PRODUCTS

### 2.1 LOAM

- A. Loam borrow shall be specified, provided, installed and paid for under the work of the Division 2 Section 02920, Topsoil, of this Specification.

### 2.2 SOIL ADDITIVES

- A. Soil additives shall be specified, provided and paid under Division 2 Section 02920, Topsoil, except for additional applications of fertilizer that shall be specified under this Section, based upon recommendations from soil analysis and testing as specified.

### 2.3 SEED

- A. Seed mixture shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and in no case shall the weed seed content exceed 0.25% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed that has become wet, moldy or otherwise damaged shall not be acceptable. Tall fescue and rygrass shall contain *Acromonium* endophytes. Seed containing endophyte must be kept cool and dry at all times; do not stockpile in the sun.

- 1. Seed Mixture Composition for disturbed areas: Provide low maintenance grass mix as noted on the Contract Drawings.

- i. All grass varieties shall be within the top 50 percent of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.
- ii. Seeding rate shall be a minimum of 6 pounds per 1,000 square feet, or as recommended by the dealer.

- 2. Seed Mixture for infiltration basin side slopes and infiltration basin bottom areas shall contain a mixture of native grasses and wildflowers and be suitable for moist sites, as noted on the Contract Drawings.

- i. Seeding rate shall be a minimum of 6 pounds per 1,000 square feet, or as recommended by the dealer.

- B. Seed may be mixed by an approved method on the site or may be mixed by a dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers that shall bear the dealer's guaranteed analysis. If seed is mixed by a dealer then the Contractor shall furnish the Engineer the dealer's guaranteed statement of the composition of the mixture.

### 2.4 FERTILIZERS



- A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws and the Town of Sharon requirements. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis specified and performed under the Division 2 Section, TOPSOIL, of this Specification.

## 2.5 LIMESTONE

- A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 50 percent will pass through 100 mesh sieve and 90 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

## 2.6 WOOD CELLULOSE FIBER MULCH

- A. Mulch to cover hydroseeded areas with slopes less than 3 to 1 shall be fiber processed from whole wood chips and clean recycled newsprint in a 1:1 proportion manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard.
- B. Moisture content shall not exceed 10 percent, plus or minus 3 percent as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 900 grams water per 100 grams fiber.
- C. The mulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.
- D. The mulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be non-injurious to plant growth.

## 2.7 HERBICIDES, CHEMICALS AND INSECTICIDES

- A. Herbicides, chemicals, and insecticides shall meet all requirements of state and federal laws and the Town of Sharon requirements.
- B. Provide chemicals and insecticides as needed for fungus or pest control. All chemicals and insecticides shall be approved by the Massachusetts Department of Food and Agriculture for the intended uses and application rates.
- C. Provide post-emergent crab grass control throughout the maintenance period to ensure a germinated and mown lawn free of crab grass.

## 2.8 WATER

- A. The Contractor may use water provided by the Town upon request and approval of the DPW, if available. If Town water is not available, the Contractor shall be responsible to furnish adequate supplies at his own cost. All work injured or damaged

due to the lack of water or use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation. The Contractor's use of Town water shall be at his own risk. Provide water schedule upon completion of planting.

### PART 3 – EXECUTION

#### 3.1 FILLING AND COMPACTION

- A. Filling and compaction of loam shall be specified and performed under the work of the Division 2 Section, Topsoil, of this Specification.

#### 3.2 FINE GRADING

- A. Refer to Section 02920 Topsoil.

#### 3.3 SEEDING

- A. Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any seeding.
- B. Limit of proposed grading shall be limit of seeding unless otherwise indicated on the Contract Documents. All lawn areas disturbed outside the limit of seeding shall be prepared and seeded as specified herein at no additional cost.
- C. The season for seeding shall be from March 15 to May 31 and from August 15 to October 31, except as otherwise approved in writing by the Engineer. The actual planting of seed shall be done, however, only during periods within this season which are normal for such work as determined by weather conditions and by accepted practice in this locality. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5 Days of spreading the loam. If seeding out of season as described above, the Contractor is still obligated by all conditions and responsibilities described under 3.4 LAWN MAINTENANCE, until final acceptance of all lawn areas.
- D. Seed only when the bed is in a friable condition, not muddy or hard.
- E. Seeding of Disturbed areas shall be by Hydroseeding Method specified as follows:
  - 1. Prior to the start of work, furnish a certified statement as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding that can be covered with the quantity of solution in the hydroseeder.
  - 2. Hydroseed with wood cellulose fiber mulch at a rate as designated above in Part 2 – PRODUCTS.
  - 3. Prepare the weed-free seedbed with rototillers, disk harrows, or other soil preparation equipment and leave the soil with an irregular open surface. All

rocks and other debris larger than 2.0 inches in diameter shall be removed from the soil surface. The soil at the time of seeding shall be firm, and the surface shall be loose and open. Seed only when the bed is in a friable condition, not muddy or hard.

4. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.
5. Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any hydroseeding.
6. Limit of work shall be limit of hydroseeding unless otherwise indicated on the Contract Documents. All lawn areas disturbed outside the limit of hydroseeding shall be hydroseeded.
7. Seed only when the bed is in a friable condition, not muddy or hard. Construction methods shall conform to hydraulic method requirements specified in the Standard Specification.
8. Hydroseeding shall be a two-step process.
  - i. Step one shall consist of spreading 100 percent of the required seed uniformly over the prepared loam bed so that the seed comes into direct contact with the soil. To mark the progress of the hydroseeding operation the Contractor may add 10 percent of the wood cellulose fiber mulch to the slurry.
  - ii. Step two shall consist of a separate application of wood cellulose fiber mulch immediately following the first step of hydroseeding noted above. Apply the wood cellulose fiber mulch at a rate of 2,000 pounds per acre.

### 3.4 LAWN MAINTENANCE

- A. Maintenance shall begin immediately after any area is seeded or sodded and shall continue for a 60 day active growing period for seeded areas or until Final Acceptance, whichever is longer following the completion of all lawn construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the Fall for adequate germination and growth of grass, then maintenance shall continue into the following Spring for the minimum 60 Day period and including the One (1) Year Maintenance Period.
- B. Maintenance shall include re-seeding, mowings, watering, weeding, fertilizing a minimum of two times in addition to the fertilizer incorporated by harrowing into the

spread loam, and resetting and straightening of protective barriers. Lawn work maintenance shall also include chemical treatments as required for fungus and/or pest control.

- C. For lower maintenance naturalized seeded areas, first cutting should be scheduled after inspection and recommendation by the Engineer. First cutting will typically occur either at end of first growing season (e.g. November-December) or beginning of second growing season (e.g. March-April). However, the Engineer may recommend up to four cuttings during the first full year following installation. The Contractor shall be required to perform any recommended cuttings.
- D. During the maintenance period, any decline in the condition of turf areas shall require immediate action to identify potential problems and to undertake corrective measures.
- E. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment.
  - 1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary to maintain moist soil to a depth of at least two (2) inches for seeded areas and four (4) inches for sodded areas. At no time shall a tank truck be allowed on the reseeded/re-sodded beds.
  - 2. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply water to the required soil depths each 8-hour period.
- F. After the grass in seeded areas has germinated, reseed all areas and parts of areas that fail to show a uniform stand of grass. Reseed such areas and parts of areas repeatedly until all areas are covered with a satisfactory growth of grass with no less than 20 grass shoots per square inch and 2880 grass shoots per square foot. Reseeding together with necessary grading, fertilizing, and trimming shall be done at the Contractor's expense.
- G. Mowing and Edging:
  - 1. The Contractor shall keep lawn areas mowed until Acceptance of the contract by cutting to a height of two (2) inches when growth reaches three (3) inches or as directed by the Engineer.
  - 2. At each mowing, all edges of walks, drives, plant beds and other border conditions shall be edge trimmed by hand or machine to produce straight and uniform edge conditions.
  - 3. Remove and discard from paved areas only clippings and debris generated by each mowing and edging operation legally off-site. Engineer, if practical and

aesthetic, may allow sweeping (not blowing) clippings back into grass. Mowers shall be equipped with mulching blades. Do not remove from grass areas any clippings that have been generated by mowing operations. Do not mow grass when wet.

Fertilizing for seeded lawns: **Note: this project is proximate to a public water supply. Notwithstanding the fertilization schedule outlined below, only the minimum application of Nitrogen fertilizer shall be used to establish and maintain the seeded areas, and to correct deficiencies. The Contractor shall submit a fertilizer plan for Engineer review prior to any applications.** The first application of fertilizer is specified, provided and performed under the Division 2 Section, TOPSOIL. A second application of fertilizer shall be applied to seeded areas at the time of the first mowing and shall be performed under this Section. Nitrogen shall be applied at a rate as approved by the Engineer. Phosphorus and potassium shall be applied proportionally in accordance with the recommendations of the soil tests and the quantities previously integrated into the soil during the first application. \*\*Nitrogen fertilizer shall be composed of 50 percent slowly soluble or slow release nitrogen fertilizer.

### 3.5 APPLYING LIMESTONE

- A. The Contractor shall return to the site at the beginning of the next seeding season as specified above and spread limestone across all lawn areas installed under this Contract. The work of liming the fields shall be as specified under Division 2 Section, TOPSOIL, of this Specification, and performed under this Section. Limestone shall be spread at rates determined by the soil tests specified.

### 3.6 ACCEPTANCE

- A. Following the minimum required maintenance periods for lawn construction, the Contractor shall request the Engineer in writing for a formal inspection of the completed work. Request for inspection shall be received by the Engineer at least 10 Days before anticipated date of inspection.
- B. Acceptance Requirements:
  1. At the end of the maintenance period, seeded areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall seeded area. At least 90 percent of the grass established shall be permanent grass species. If seeded areas are deficient, the Contractor's responsibility for maintenance of all seeded areas shall be extended until deficiencies are corrected. Seeded areas to be corrected shall be prepared and reseeded in accordance with the requirements of this Section.
- C. Furnish full and complete written instructions for maintenance of the lawns to the Owner at the time of acceptance in conformance with Submittals requirements.
- D. Engineer's inspection shall determine whether maintenance shall continue in any part.

3.7 CLEAN UP

- A. Absolutely no debris may be left on the site. Excavated material shall be removed as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Engineer, at no cost to the Owner.

3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02945

## SECTION 02950

### PLANTING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Plant material furnished and placed.
2. Planting maintenance.
3. Warranty period for all plants.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 02020 – Erosion and Sediment Control
4. Section 02200 – Earthwork
5. Section 02920 – Topsoil
6. Section 02945 – Lawns and Seeding

##### 1.3 REFERENCES

- A. The following standards shall apply to the work of this Section.

1. "STANDARDIZED PLANT NAMES," 1942 Edition, American Joint Committee on Horticultural Nomenclature.
2. Tree and Shrub Transplanting Manual, E.B. Himelick, 1991, International Society of Arboriculture.

3. American National Standards Institute (ANSI):

Z60.1 American Standard for Nursery Stock, latest edition, published by American Nursery & Landscape Association, (ANLA).

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. At least 90 days prior to the first day of the planting season described in this Division 2 Section, PLANTING, submit to the Engineer proof of certification of Foreman or Crew Leader as Massachusetts Certified Landscape Professional or Massachusetts Certified Horticulturist in accordance with QUALITY ASSURANCE paragraph of this Section.
- C. At least 30 days prior to ordering materials, the Contractor shall submit to the Engineer the following:
1. Representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Engineer. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Engineer reserves the right to reject, on or after delivery, any material which does not meet these Specifications.
  2. Certification providing nursery name and location for all plant materials.
  3. Manufacturer's product data and a one cubic foot (28 liter) sample per each compost-mulch blend (e.g FiberRoot™, EarthBoost™)
  4. Fertilizer plan
- D. Material Sampling and Testing:
1. Material Sampling and Testing of soils from off-site sources shall be specified, and performed under the work of this Section. Testing of the off-site soils shall occur in-place after the soils have been spread and represents a second testing of the off-site soils. The first sampling and testing shall have occurred prior to delivery of the soils as specified, and performed under the work of this Section. Additional sampling and testing of delivered and stockpiled soils or delivered and spread soils to verify that it meets the test results submitted for approval under the this Section.
  2. Planting Mulch: Submit manufacturer's certification of contents.
  3. Antidesiccant: Submit manufacturer's product data.
  4. Peat: Submit manufacturer's certification of contents.
  5. Mycorrhizal Fungal Inoculant:



- a. Submit manufacturer's product data certifying that inoculant being supplied conforms to these Specifications.
  - b. Submit the purchasing receipt showing the total quantity purchased for the Project prior to installation.
  - c. Submit empty packets of fungal spore inoculant to the Engineer for verification of use.
- 6. Tree Staking System: Submit manufacturer's product data of system.
  - 7. Soil Additives: Submit manufacturer's product data for all soil additives needed to amend a specific soil in order to meet the requirements of this Division 2 Section, PLANTING.

## 1.5 EXAMINATION OF CONDITIONS

- A. All areas to be planted shall be inspected by the Contractor before starting work and any defects such as incorrect grading or inadequate drainage shall be reported to the Engineer prior to beginning this work.
- B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to the potential need for storing and maintaining plants temporarily and/or re-handling plants prior to final installation.
- C. All plants are the full responsibility of the Contractor between the time of digging at the nursery and final acceptance.

## 1.6 QUALITY ASSURANCE

- A. Qualification of Landscape Contractor: The work of this Division 2 Section, PLANTING, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Division 2 Section, PLANTING.
- B. Qualification of Foreman or Crew Leader: All work of unloading, stockpiling, storing, transporting on-site, planting, staking and guying, fertilizing, and maintenance of trees, shrubs, vines, groundcover, and perennials shall be supervised by a foreman or crew leader who is a certified landscape professional or a certified horticulturist.
  - 1. Landscape professional shall be a Massachusetts Certified Landscape Professional certified by the Associated Landscape Contractors of Massachusetts.
  - 2. Certification shall be current. Proof of certification shall be submitted per SUBMITTALS paragraph of this Division 2 Section, PLANTING.
- C. The ratio of laborers to certified landscape professionals or certified horticulturist shall not exceed twelve to one. Certified Landscape Professional or Certified Horticulturist

shall be on the project site throughout the day to day performance of the work described in this Division 2 Section, PLANTING.

D. Plant Materials

1. Quality and size shall conform to the current edition of "Horticultural Standards" for number one grade nursery stock as adopted by the AAN.
2. All plants and plant materials shall comply with all Federal, State and local laws and regulations requiring inspection for plant disease and insect control.

1.7 PRODUCT HANDLING

A. Delivery and Storage:

1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Engineer's inspection.
2. Immediately remove from the site all plants, which are not true to name, and all materials which do not comply with the specified requirements.
3. Use all means necessary to protect plant materials before, during, and after installation and to protect the work and materials of all other trades.
4. All plantings shall arrive on site in a healthy vigorous condition and be maintained as such throughout planting activities.
5. Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

1.8 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner, which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until their removal is mutually agreed upon by all parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.

PART 2 – PRODUCTS

2.1 GENERAL – PLANTING ON GRADE

- A. Loam - friable, typical of local cultivated topsoil containing 5-10% decayed organic matter (humus), no toxic materials, from well drained, arable site, reasonably free of subsoil, stones, earth, clods, sticks, roots or debris.

1. Test for acidity, fertility and general texture by a recognized commercial or government agency. Report findings and recommendations to the Engineer. Add soil conditioners as per testing agency's report and recommendations and to obtain a soil acidity of between pH 5.0-6.0.
  2. Deliver no topsoil in frozen or muddy condition.
- B. Superphosphate - finely ground phosphate rock with eighteen percent (18%) minimum available phosphoric acid.
- C. Bone Meal - commercial raw bone meal, finely ground, 1% nitrogen and 18% phosphorus acid (min.).
- D. Manure - well rotted, unleached, cattle manure, reasonably free of wood shavings, sawdust or other litter and no chemicals or other ingredients harmful to plants. Dehydrated manure (Bovung or equal) is acceptable.
- E. Fertilizer - All plants will be fertilized with a controlled release 16-8-16 analysis fertilizer contained in polyethylene perforated bags with micropore holes. The bag shall contain 4 ounces minimum of water soluble fertilizer to be effective for 8 years. Pills, spikes, tablets and injections are not considered controlled release packets.
1. Deliver as specified in standard containers, showing weight, analysis and manufacturer. Store in a weather-proof place.
- F. Lime - pelletized, dolomite limestone, 70% passing 100 mesh screen.
- G. Compost Mulch - PowerBoost™ shall be used as base for all areas applied. EarthBoost™ shall be used as topdressing and in the plant mix for backfilling planting holes. Compost-mulch shall be consist of a one hundred percent (100%) organic, biodegradable, compost-based, shredded root material. Compost-mulch shall be able to be applied through mechanical blowing equipment. Mulch shall be entirely free of sludge or construction debris. Mulch weight shall be 850 lbs. per cubic yard. Mulch particle size by weight shall be: 100% passing a 6" screen and a minimum of 70% and maximum of 85% passing a 0.75" screen.
- H. Planting mixture - topsoil thoroughly incorporated with well rotted manure or equivalent dehydrated manure or bone meal and peat or EarthBoost™ compost-mulch proportioned 1 c.y. to 7 c.y. topsoil.
- I. Mulch - aged pine bark consisting of the outer bark of pine trees with minimum hardwood bark. Bark shall be thoroughly mixed and aged in stock piles a minimum of 6 months, partially decomposed, dark brown in color, and generally free of chunks of wood thicker than 1/4". Aged pine bark containing an excess of fine particles will not be acceptable.
- J. Water - The Contractor will furnish hose and connections required for watering all plant materials until completion of the project.

- K. Tree Staking - Hardwood Stake - for tree guying - 30" long (min.). For tree staking - 8' long (min.). Install as detailed on the Drawings.
- L. Wire - pliable No. 12 to 14 gauge galvanized soft steel wire with rubber hose or Chain Lock brand plastic tree tie or approved equivalent.
- M. Wrapping material - first quality, heavy, waterproof crepe paper manufactured for this purpose; not less than 4" wide.
- N. Mycorrhizal Fungal Inoculant – live spores packaged in plastic packets. At minimum each packet shall contain: 1) Live spores of VA Endomycorrhizal fungi, vesicular-arbuscular mycorrhizal fungi minimum of 8 species; 2) Live spores of Ectomycorrhizal fungi including *Pisolithus tinctorius*. Mycorrhizal fungal inoculant shall be Myco-Magic manufactured by North Country Organics, Bradford, VT, (802) 222-9661, or approved equal.

## 2.2 SOIL ADDITIVES

- A. Soil additives shall be specified and provided for under Sections 02920 and 02945.

## 2.3 GRADES AND STANDARDS OF PLANTS

- A. The Contractor shall furnish all plants shown on the Contract Drawings, as specified, and in quantities listed on the PLANT SCHEDULE. If there is any discrepancy between quantities listed and shrubs shown, notify the Engineer. Contractor shall be responsible for quantity of shrubs graphically shown on plans. If there is a discrepancy between plant list quantities and graphics, the graphic shall take precedence. No substitutions will be permitted, without written approval by the Engineer. All plants shall be nursery grown unless specifically authorized to be collected as noted on the PLANT SCHEDULE.
- B. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Only plant stock grown within Hardiness Zones 1 through 6b, as established by the USDA Plant Hardiness Zone Map, latest edition, will be accepted.
- C. Plant sources – For planting after June 15, provide plant materials from sources grown in zone 6 or colder. Provide certification from the grower describing location and zone of nursery where plants are grown.
- D. Plants shall be in accordance with ASNS Standards of the American Nursery & Landscape Association except as noted in this Division 2 Section, PLANTING and USDA Standard for Nursery Stock of the American Association of Nurserymen. Botanical plant names shall be in accordance with plant designations by the American Joint Committee on Horticultural Nomenclature.
- E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position.

- F. If, at any time during the performance of the Contract, any plant shows signs of graft incompatibility, as determined by the Engineer, then the tree or shrub and all other similarly grafted plants of the same Genus/Species/Variety shall be rejected and removed from the site. Visual symptoms of graft incompatibility as cause for rejection include:
1. Development of over-growths by rootstock or scion resulting in the development of shoulders or inverted shoulders.
  2. Suckering of the rootstock combined with poor growth or dieback of scion.
  3. Any mechanical weakness between scion and rootstock.
  4. Any marked difference in bark pattern and structure between scion and rootstock.
- G. All shrubs shall meet the following standards:
1. All shrubs shall be healthy and vigorous plants which are very well shaped, heavily branched, densely foliated, and true to form for the variety.
  2. Canes or Trunk(s) and Branches:
    - a. Well formed and sturdy.
    - b. Branching shall be uniformly distributed close to the ground.
    - c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
    - d. Pruning scars shall be clean cut and shall leave little or no protrusion from the trunk or branch.
    - e. Graft unions shall be completely healed.
    - f. No suckers or water sprouts.
    - g. Contain no dead wood.
    - h. Free of cracks, splits, or cambium peeling.
  3. No shrub with pest or mechanical damage will be accepted.
  4. Shrubs shall show no signs of frost or winter damage to the foliage. Foliage shall not be in a state of drought stress. Leaves or needles shall show no signs of wilt or desiccation due to weather stress at any season of the year.

- H. Plant Dimensions - conform to USDA Standard for Nursery Stock, latest edition, as specified. Exceptions as follows:
1. Plants larger than specified may be used if approved by Engineer at no increase in contract price. Increase spread of roots or earth ball in proportion to size of plant.
  2. Undersize plants (10% max.) in any one variety or grade may be used if approved by the Engineer. Provide sufficient plants above size to make average equal to or above specified grade. Undersize plants shall be larger than average size of next smaller grade.

## 2.4 ROOT SYSTEMS FOR ALL PLANTS

- A. Each plant shall have an extensive, symmetrically balanced fibrous root system. Any root ball which shows signs of asymmetry, girdling, injury, or damage to the root system shall be rejected.
- B. Curling or spiraling of the roots along the walls of rigid containers will not be accepted. Curling, spiraling or girdling roots within balled and burlapped material will not be accepted.
- C. All parts of the fibrous root system of all plants shall be moist and fresh with a white color when washed of soil. When the plant is removed from the container, the visible root mass shall be healthy with white root tips. The root systems of all plants shall be free of disease, insect pests, eggs, or larvae.
- D. All trees, and all shrubs which are not grown in containers must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated 8 ounce natural, biodegradable fabric burlap, firmly laced with stout, natural biodegradable cord or twine. The base of the tree trunks shall be wrapped with a protective burlap layer, surrounded by a cardboard trunk protector, and loosely tied with twine.
- E. The diameter and depth of the balls of earth must encompass the fibrous and root feeding system necessary for the healthy recovery of the plant. Minimum root ball diameters and depths shall be in accordance with ASNS standards.
- F. No plants shall be loose in the container.
- G. Container grown plants which have roots growing out of the container will be rejected.
- H. Plants are subject to inspection and approval at place of growth for conformity to specifications as to quality, size, and variety. The expenses incurred by the Engineer for such inspections shall be borne by the Contractor. Engineer reserves right of inspection upon delivery at the site or during progress of work or right of rejection due to damage suffered in handling or transportation. Remove defective plants immediately from site. Plants to be accompanied by State Nursery inspection certification, if required.

## 2.5 WATER

- A. Refer to Division 1 Section 01500, TEMPORARY FACILITIES AND CONTROLS.
- B. All plant materials or beds injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

## 2.6 ANTIDESICCANTS

- A. Antidesiccants shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Manufacturer of antidesiccant shall be subject to the Engineer's approval and shall be used only after approval by the Engineer. Antidesiccant shall be delivered in containers of the manufacturer and shall be mixed and applied according to the manufacturer's instructions.

## 2.7 SEED MIXES

- A. Provide in accordance with Section 02945 and the Contract Drawings.

## PART 3 – EXECUTION

### 3.1 PLANTING

- A. Inspection: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Furnishing and planting of plant material shall include, but shall not be limited to, the digging of planting pits and plant beds, amendment of soils or loam as required to produce planting soil mix, provision of soil additives required to adjust for pH requirements of specific plants, furnishing the plants as specified as well as the labor of planting, fertilizing, and maintenance.
- B. Prior to spreading of soils, subgrades shall have been tested to determine if they are too compact to drain water as specified, and performed under the work of this Section.
- C. The Contractor shall locate plant material sources and ensure that plants are shipped in timely fashion for installation.
- D. Contractor shall locate all existing underground utilities that are within 10 feet of the proposed planting pits and notify the Engineer of any conflicts prior to digging plant pits.
- E. Seasons for Planting:
  - 1. Spring: Deciduous materials - March 21 through June 1; Evergreen materials - April 15 through June 1.

2. Fall: Deciduous materials – September 1 through December 15: Evergreen materials – August 15 through November 1.
3. No planting or seeding shall be completed in frozen soils.

F. Plant Material Inspection:

1. At least one month prior to the expected planting date, the Contractor shall select and tag stock to be planted under this Division 2 Section, PLANTING.
2. The Contractor shall be responsible to certify the availability of quality plants in specified sizes from his/her sources of supply.
3. Unless specifically designated otherwise, a representative of the Engineer may elect to accompany the Contractor on all plant material selection field trips.
4. Representative samples of trees, shrubs, and ground cover plants may be tagged or marked for approval as an "Approved Typical Sample" and shipped to the site. Any shrub or groundcover plant that arrives at the construction site that does not meet the Approved Typical Sample will be rejected by the Engineer.
5. Plants to be inspected shall be in locations and conditions that allow direct and un-obscured inspection by the Engineer. Container grown or balled and burlapped shrubs shall be pulled from holding blocks by the nurseryman for scrutiny by the Engineer at no additional cost to the Owner. Harvested trees held in storage shall not have branches tied up. Harvested trees shall not have trunks obscured by burlap, cardboard trunk protection, or other devices that would otherwise obscure inspection. In the event that branches are tied up, trunks are obscured by burlap or cardboard trunk protection, or root flares hidden by burlap and twine and the Engineer cannot inspect root flares, trunks or branching habit, the Contractor shall bear all responsibility and costs associated with tree rejection at a later date during the course of the Contract.
6. Inspection and approval of plants at the source shall not impair the right of subsequent inspection and rejection upon delivery to the site, or during the progress of the work if the Engineer finds that plants do not meet the requirements of the PLANT SCHEDULE or this Contract, have declined noticeably due to handling abuse, lack of maintenance, or other causes. Cost of replacements, as required, shall be borne by the Contractor.

G. Obtain Engineer's written approval of work of rough grading and finish grading prior to starting the work of planting.

H. Planting:

1. Notify the Engineer three (5) working days prior to the proposed arrival of plant material on the site. If not planted within 24 hours of delivery to the site, all plants shall be maintained in an on-site nursery. Container grown shrubs stored on site shall be shaded from direct sunlight at all times and shall not be stored



directly on paved surfaces. All plants delivered to the site and not planted within 24 hours of delivery shall have their root balls covered with mulch and shall be watered on a daily basis such that root balls are kept moist throughout.

2. Locations for all plants and outlines for planting areas shall be staked on the ground by the Contractor for approval by the Engineer before any plant pits or plant beds are dug. Notify the Engineer no less than 3 days prior to desired inspection date of staking to schedule site visit.
3. Surficial soils (0-12" deep) shall be removed from areas identified with invasive vegetation and disposed of off-site. Care shall be taken to avoid dispersal of soils from invasive vegetation within limits of work.
4. Circular plant pits shall not be required provided that the minimum dimension between the edge of the pit and the face of the rootball is not less than required by this Division 2 Section, PLANTING.
5. All plant pits dug with a machine shall have the sides of the holes scraped with hand shovels to prevent glazing or compaction of the sides of the hole. Remove and stockpile excavated surficial soils (0-12" deep) for reuse as backfill for plant pit. All subsoil excavated from the bottoms of planting pits shall be removed from the site.
6. Plant pits shall be dug to the dimensions noted below.
  - a. Individual plant pits for shrubs shall be three times greater in diameter than the diameter of the root ball. Place root ball directly on subgrade. Slope sides of tree pits at a 45 degree angle.
  - b. Plant beds for shrub massing shall be one large and continuous excavated bed. Extend bed no less than 3 feet beyond limits of shrub root balls on perimeter of bed.
  - c. Plant pits for trees and shrubs shall be dug to the depth of the rootball to be planted.
  - d. Remove all soil from around the root flare of the stem of the plant and from the top of the rootball to determine the true depth of the rootball. All plants that have been planted and have root flares that are buried will be rejected.
7. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation, and at the site until the final planting.
8. Remove container plants from containers prior to planting.
9. Shrubs shall be placed in the center of plant pits, plumb, with the crown of their roots exposed and located above the surrounding finish grade.

10. Prior to completion of planting of Balled and Burlapped plants, remove rope and cut wire baskets from the top 1/3 of the root balls. Pull burlap away from the trunk or stem of the plant and cut burlap from the top 1/3 of the root balls.
  11. Planting shall be backfilled with approved soil to the full depth of the planting pit or bed. Eliminate air pockets and compact the soil by flooding the tree pit or plant bed within 2 hours of planting installation. After water has drained from the planting pit or bed and planting backfill has dried enough additional planting soil shall be spread in pit or bed to bring the finished surface of the planting pit or bed to grades shown on the Contract Documents. A saucer shall be formed around each plant at a depth of 3 inches for trees and for shrubs.
  12. Fertilizer shall be spread over the plant saucer or plant bed between the saucer and the edge of the rootball. Till the fertilizer into the soil to a depth of four inches prior to the placement of the planting mulch. Fertilizer shall be provided for under the Division 2 Section, TOPSOIL, of this Specification. Do not mulch until placement of the fertilizer has been verified by the Engineer. Fertilizer application rates shall be as determined by soil testing, analysis, and testing laboratory recommendations specified.
  13. Immediately following plant placement in holes apply micorrhyzal fungal inoculant. per manufacturer's instructions. Inoculant shall be added after plants have been placed into their holes. Open the required number of packets for each plant and thoroughly mix the inoculant powder in the upper 10 inches of backfill soil. Apply number of packets according to the plant's size at the rates recommended by the manufacturer. Submit the purchasing receipt showing the total quantity purchased prior to installation and the empty packets following installation to the Engineer.
- I. All plants shall be watered immediately following planting as necessary to thoroughly moisten rootball and plant pit loam and thereafter shall be inspected frequently for watering needs and watered, as required, to provide adequate moisture in the planting pit. The Contractor shall inspect tree pits 24 hours after initial watering to confirm that they are draining properly. If surface water or excessively saturated plant pit soils exist, the Contractor shall immediately notify the Engineer. The Engineer will recommend remedial measures based upon site conditions.
  - J. Mulch material shall be placed over entire saucer areas of individual trees and shrubs and over the entire area of planting beds to a depth of 3 inches after settlement, not later than one week after planting. Mulch shall be 0" at all root flairs for all individual plants. Do not apply mulch prior to the first watering of plant materials. Do not apply mulch prior to placement of surface applied fertilizer and verification of placement by the Engineer.
  - K. Pruning:

1. As directed by the Engineer, each plant shall be pruned in accordance with the workmanship requirements of "Pruning Standards" for Class I, fine pruning, to preserve the natural character of the plant.
  2. Tree pruning, as required, shall be undertaken to the full height of affected trees.
  3. All dead wood or suckers and all broken or badly bruised branches shall be removed. Never cut a leader.
- L. Antidesiccant shall be applied to all evergreen and broadleaf evergreen plants in December and again in February, according to manufacturer's application recommendations.
- M. Protect existing lawns from damage. Any damage resulting from planting operations shall be repaired immediately at no cost to the Owner. Repair work shall be as specified and installed under the work of Division 2 Section, Lawns and Seeding, of this Specification.
- N. In the event that rock or underground construction work or obstructions are encountered in any plant pit or bed excavation work, alternate locations will be coordinated with the Engineer. Relocation of plant pits or beds shall be provided at no additional cost to the Owner. Provide the Engineer with no less than 48 hours notice of obstruction so that a site visit can be scheduled to establish new locations for plants.
- O. Absolutely no debris may be left on the site. Repair any damage to site as directed by the Engineer, at no additional cost.
- P. Seed mix shall be applied to clean bare soil. Seed can be applied by hydro-seeding, mechanical spreader or for small areas (less than 100 square feet) by hand. Lightly rake or roll to ensure proper seed to soil contact. Seeded areas shall be lightly mulched with weed free straw to conserve moisture.

### 3.2 MAINTENANCE

- A. Maintenance shall begin immediately after each plant is planted and shall continue for a 90-day Maintenance Period or until the end of the fall planting season following Final Acceptance, whichever is sooner.
- B. Maintenance shall consist of keeping the plants in a healthy growing condition and shall include but is not limited to watering, weeding, cultivating, pruning, re-mulching, straightening of trees to a plumb position, removal of dead material, resetting plants to proper grades or upright position, and maintaining the planting saucer.
1. Plants shall be inspected for watering needs at least twice each week and watered to promote plant growth and vitality. The following watering rates assume that the soil is free draining. If the on-site conditions do not ensure a free draining soil, then notify the Engineer in writing of this condition. Watering rates for trees, shrubs, ground cover, vines and perennials in free

draining soils are presented here as guidelines to ensure that the top six inches of plant bed soil remains moist at all times. Actual watering rates may vary depending upon soil conditions. Guideline rates shall be as follows:

<u>Type of Plant/Size</u>	<u>Weekly Watering Rate</u>
Shrubs	
Up to 2 ft. height	10 gallons
2 - 4 ft. height	20 gallons
4 - 6 ft. height	30 gallons
6 - 8 ft. height	40 gallons

- a. Water shall be applied by 1 inch diameter hose with an attached metering gauge.
  2. For trees in mulched beds, apply water to the ground surface directly under the canopy. Water shall be applied at a sufficiently slow rate to prevent run off from the soil surface but great enough to equal 0.2 inches of water per square foot of canopy area per hour for 5 hours per week.
  3. Planting beds and individual plant pits shall be kept free of weeds, and mulch shall be replaced as required to maintain the specified layer of mulch. Beds and individual pits shall be neat in appearance and maintained to the designed layout.
  4. Plants that die during the maintenance period shall be removed and replaced by the Contractor within one week of notification and replaced during that growing season, unless directed otherwise by the Engineer.
  5. Work of pruning, fertilizing, spraying, and similar activities shall be undertaken only by Certified Arborists and licensed chemical applicators, as pertinent to the work being performed.
- C. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures. The Engineer shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Engineer.
- D. **Note: this project is proximate to a public water supply. Only the minimum application of Nitrogen fertilizer shall be used to maintain plantings and to correct deficiencies. The Contractor shall submit a fertilizer plan for Engineer review prior to any applications.**

### 3.3 ACCEPTANCE

- A. Upon completion of all planting work, the Contractor shall request in writing that the Engineer formally inspect the planting work.
- B. If plant materials and workmanship are acceptable, the Engineer will issue a written Certificate of Conditional Acceptance to the Contractor.
- C. Following the issuance of the Certificate of Conditional Acceptance to the Contractor, the Contractor shall maintain the plants for the minimum 90 day Maintenance Period. At the end of the Monitoring Period, the plant material will be inspected by the Engineer to determine whether or not all planting work has been performed to the requirements of this Division 2 Section, PLANTING.
- D. Acceptance Standards at end of the Monitoring Period: If plant material is reviewed when it is in full leaf, leaves shall be plump with water with a shape indicative of the species and shall be free of insect, pest and disease damage. Twigs shall have living cambium for their full length. Twigs and branches shall have a full bud set for their full length, including terminal buds. Trunks and branches shall be free of frost cracks; sun scald; damage due to insects, pests, and disease; structural defects; and damage resulting from machinery or tools. Plant material inspected and reviewed when the plants are not in full leaf shall have twigs, branches and trunks meeting the above requirements. All plants regardless of the season of review shall have a minimum of 75 percent healthy, balanced branching structure with a healthy terminal leader(s) with viable terminal bud(s).
- E. If any number of plants do not meet these Acceptance Standards at the time of inspection, or if in the Engineer's opinion, workmanship is unacceptable, written notice will be given by the Engineer to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. The Contractor's responsibility for maintenance of all plants shall be extended until replacements are made or other deficiencies are corrected. All plants that do not meet these Acceptance Standards shall be removed from the project within seven days of receipt of the punch list. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner.
- F. Following the correction of all Punch List deficiencies, the Contractor shall request in writing that the Engineer formally inspect the planting work. If plant materials and workmanship are acceptable, the Engineer will issue a written Certificate of Final Acceptance to the Contractor.

#### 3.4 GUARANTEE

- A. The date of the Certificate of Final Acceptance shall establish the commencement of the required one-year guarantee and establishment period for planting work.
- B. At the end of the guarantee and establishment period, a final inspection will be held to determine whether any plant material replacements are required. Each plant shall be plumb, shall have a character that is natural for its species as determined by the Engineer, and shall conform to the Acceptance Standards described in this Division 2 Section, PLANTING. Plants found to be unacceptable shall be removed promptly from

the site and replaced according to this Division 2 Section, PLANTING. A final inspection will be made after the replacement plants have lived through one year.

- C. At the end of the one-year guarantee and establishment period, remove all tree stakes, guys, or anchors installed on trees during the course of the work of this contract.
- D. All replacements shall be plants of the same kind and size. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 02950

DIVISION 3 – CONCRETE

03200 .....Concrete Reinforcing  
03300 .....Cast-In-Place Concrete  
03415 .....Structural Precast Concrete Hollow Core Planks

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## SECTION 03200

### CONCRETE REINFORCING

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

###### A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

###### B. Related Requirements

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 03300 “Cast-In-Place Concrete” for reinforcing used in cast in placed concrete.

##### 1.3 PREINSTALLATION MEETINGS

###### C. Preinstallation Conference: Conduct conference at Project site.

###### 1. Review the following:

- i. Special inspection and testing and inspecting agency procedures for field quality control.
- ii. Construction contraction and isolation joints.
- iii. Steel-reinforcement installation.

##### 1.4 ACTION SUBMITTALS

###### A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Epoxy repair coating.

3. Zinc repair material.
  4. Bar supports.
  5. Mechanical splice couplers.
  6. Structural thermal break insulated connection system.
- B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
  2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of the Engineer.

#### 1.5 INFORMATION SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Material Certificates: For each of the following, signed by manufacturers:
1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- C. Material Test Reports: For the following, from a qualified testing agency:
1. Steel Reinforcement:
  2. Mechanical splice couplers.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. and to avoid damaging coatings on steel reinforcement.
1. Store reinforcement to avoid contact with earth.

2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

## PART 2 – PRODUCTS

### 2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 minimum, deformed.
- B. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- C. Epoxy-Coated Reinforcing Bars:
  1. Steel Bars: ASTM A615/A615M, Grade 60 minimum, deformed bars.
  2. Epoxy Coating: ASTM A775/A775M or ASTM A934/A934M with less than 2 percent damaged coating in each 12-inch bar length.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

### 2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 minimum, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60 minimum, plain-steel bars, ASTM A775/A775M epoxy coated.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - i. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
    - ii. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.

- iii. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - iv. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
  - v. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- D. Mechanical Splice Couplers: ACI 318 Type 2, same material of reinforcing bar being spliced; tension-compression type, dowel-bar type, or mechanical-lap type as indicated on Drawings.
- E. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
- 1. Finish: Galvanized.
- F. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch in diameter.
- G. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.
- H. Zinc Repair Material: ASTM A780/A780M.

## 2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## PART 3 – EXECUTION

### 3.1 PREPARATION

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

### 3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars shall be lapped per structural drawings or as per ACI 318 Class B Tension Lap Splice
  2. Stagger splices in accordance with ACI 318.
  3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
  4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - i. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
  2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
  3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  4. Lace overlaps with wire.
- H. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.

### 3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
1. Place joints perpendicular to main reinforcement.
  2. Continue reinforcement across construction joints unless otherwise indicated.

- 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.
- 3.4 INSTALLATION TOLERANCES
- A. Comply with ACI 117.
- 3.5 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
  - B. Inspections:
    - 1. See Statement of Special inspections
  - C. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.
- 3.6 CONTRACT CLOSEOUT
- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 03200

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, finishes and formwork for elements shown in the drawings.

- B. Related Requirements

- 1. Division 0 - Bidding and Contract Requirements
  - 2. Division 1 - General Requirements
  - 3. Section 02200 "Earthwork," for compacted structural fill under slabs on grade and footings
  - 4. Section 03200 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
  - 5. Section 09900 "Painting and Coatings"

##### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

##### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - i. Contractor's superintendent.
    - ii. Independent testing agency responsible for concrete design mixtures.

- iii. Ready-mix concrete manufacturer.
  - iv. Concrete Subcontractor.
  - v. Special concrete finish Subcontractor.
2. Review the following:
- i. Special inspection and testing and inspecting agency procedures for field quality control.
  - ii. Construction joints, control joints, isolation joints, and joint-filler strips.
  - iii. Semirigid joint fillers.
  - iv. Vapor-retarder installation.
  - v. Anchor rod and anchorage device installation tolerances.
  - vi. Horizontal Tolerances at slab edges sensitive to ACI 117 requirements (E.G. bearing walls at perimeter of building, sensitive façades, columns/walls at perimeter of building)
  - vii. Cold and hot weather concreting procedures.
  - viii. Mass concreting procedures
  - ix. Concrete finishes and finishing.
  - x. Curing procedures.
  - xi. Forms and form-removal limitations.
  - xii. Shoring and reshoring procedures.
  - xiii. Methods for achieving specified floor and slab flatness and levelness.
  - xiv. Floor and slab flatness and levelness measurements.
  - xv. Concrete repair procedures.
  - xvi. Concrete protection.
  - xvii. Initial curing and field curing of field test cylinders (ASTM C31)
  - xviii. Protection of field cured field test cylinders.
  - xix. Supplementary cementitious materials: Review how they may alter the concrete properties associated with the contractors means and methods. Such properties that may be affected includes but are not limited to: workability, set time, air entrainment.



## 1.5 ACTION SUBMITTALS

### A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures:
  - i. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
7. Vapor retarders.
8. Liquid floor treatments.
9. Curing materials.
  - i. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
10. Joint fillers.
11. Repair materials.

### B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Type and source information on concrete materials proposed for use including:
  - i. Cementitious Materials
  - ii. Aggregates
  - iii. Admixtures
  - iv. Water
  - v. Steel fiber or synthetic micro-fiber content
3. Minimum 28-day compressive strength. (f'c)

4. Required average compressive strength,  $f'_{cr}$ , for each class of concrete
  5. Documentation of strength test records of similar class of concrete used to establish standard deviation in accordance with ACI 301, when test records exist
  6. Documentation of compliance with  $f'_{cr}$  of proposed mixture(s) and test age
  7. Strength of concrete at other specified ages, or as required for means and methods.
  8. Durability exposure class.
  9. Maximum w/cm.
  10. Calculated equilibrium unit weight, for lightweight concrete.
  11. Slump limit.
  12. Air content.
  13. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
  14. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
  15. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
  16. Intended placement method.
  17. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings: Comply with ACI SP-066
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - i. Location of construction joints is subject to approval of the Architect.
  2. Include placing drawings that detail fabrication, bending, and placement.
  3. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.

- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
  - 2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Steel Reinforcement:
    - i. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
  - 2. Mechanical splice couplers.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.
- F. Product Data
  - 1. Exposed surface form-facing material.
  - 2. Concealed surface form-facing material.
  - 3. Forms for cylindrical columns.
  - 4. Void forms.
  - 5. Form ties.
  - 6. Form-release agent.
- G. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
  - 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301
  - 3. Location of construction joints is subject to approval of the Architect and Engineer.
  - 4. Indicate location of waterstops.
  - 5. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.

6. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
7. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
8. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
9. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

H. Field Quality Control Plans, as occur:

1. Hot Weather Concrete
2. Cold Weather Concrete
3. Mass Concrete

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
  1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
  1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
  1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
  1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

## 1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature are expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 90 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## 1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 – PRODUCTS

### 2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

### 2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I/II , gray. Only Type II, Type IV and Type V permitted for mass concrete.
2. Supplemental Cementitious Materials (SCM's):
  - i. Fly Ash: ASTM C618, Class C or F.
  - ii. Slag Cement: ASTM C989, Grade 120.
  - iii. Blended Hydraulic Cement: ASTM C595, Type IS, portland blast-furnace slag Type IP, portland-pozzolan Type IL, portland-limestone Type IT, ternary blended cement.
  - iv. Silica Fume: ASTM C1240 amorphous silica.
  - v. Performance-Based Hydraulic Cement: ASTM C1157: Type GU, general use Type HE, high early strength Type MS, moderate sulfate resistance Type HS, high sulfate resistance Type MH, moderate heat of hydration Type LH, low heat of hydration.

For ASTM C595, exceeding 25% cement replacement, and all ASTM C1157 cements it is required that an engineered mix design be submitted with past performance data for the same mix and for it to be stamped by a qualified Professional Engineer.

C. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Alkali-Silica Reaction: Comply with one of the following:
  - i. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
  - ii. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.

- iii. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
  - 2. Maximum Coarse-Aggregate Size: See Concrete Mixtures section for size
  - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- 1. Water-Reducing Admixture: ASTM C494, Type A.
  - 2. Retarding Admixture: ASTM C494, Type B.
  - 3. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
  - 4. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
  - 5. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494, Type C.
- F. Water and Water Used to Make Ice: ASTM C94, potable

## 2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

## 2.4 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch, or equal product approved by the engineer.
  - 1. Available Products
    - i. Colloid Environmental Technologies Company (CETCO). WATERSTOP-RX
- B. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  - 1. Profile: Ribbed with center bulb

2. Dimensions: 9 inches by 3/8 inch thick (225 mm by 10 mm thick); nontapered.

## 2.5 FORM-FACING MATERIALS

### A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in this specification
  - i. Plywood, metal or other approved panel materials.
  - ii. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a) APA HDO (high-density overlay).
    - b) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
    - c) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
    - d) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

### B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

### C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

### D. Chamfer Strips: Wood, metal PVC, or rubber strips, 3/4 by 3/4 inch minimum.

### E. Reglets: Fabricate reglets of not less than 0.0217-inch-thick galvanized steel sheet. Temporarily fill or cover face of opening of reglet to prevent intrusion of concrete or debris.

### F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

### G. Rustification Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.



- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form release agent with rust inhibitor for steel form-facing materials.
  - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- I. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.6 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
  - 1. Verify products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.7 CURING MATERIALS

- A. Water: Potable or complying with ASTM C1602
- B. Curing Compound
  - 1. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
- C. Curing and Sealing Compounds:
  - 1. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
  - 2. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

## 2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

## 2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109.

## 2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type of concrete noted in the general notes, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301. Proportioning of concrete mix shall be performed according to ACI 211.1

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Supplemental Cementitious Materials (SCM):

1. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - i. Fly Ash or Other Pozzolans: 25 percent by mass.
  - ii. Slag Cement: 50 percent by mass.
  - iii. Silica Fume: 10 percent by mass.
  - iv. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
  - v. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
2. If mix designs exceed 25% Portland cement replacement it is required that an engineered mix design be submitted with past performance data for the same mix and for it to be stamped by a qualified Professional Engineer.
3. SCM's may change workability, cause delayed strength gain, and other properties pertaining to Means and Methods. The contractor shall be responsible for coordinating with the mix designer to limit SCM's within a mix such that the mix can achieve or exceed the required structural properties and the Contractor's Means and Methods.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing admixture, as required, in pumped concrete, concrete for heavy-use industrial slabs concrete for parking structure slabs, and concrete with a w/cm below 0.50.

3. Use corrosion-inhibiting admixture in concrete mixtures where indicated on structural drawings.

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

### 3.3 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in this specification, or within the Architectural Concrete specification.
- C. Limit concrete surface irregularities as follows:
  1. Surface Finish-2.0: ACI 117 Class B, ¼ inch.
  2. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

- D. Construct forms tight enough to prevent loss of concrete mortar.
  - 1. Minimize joints.
  - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
  - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
  - 2. Provide top forms or inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slops in finished concrete surfaces.
  - 1. Provide and secure units to support screed strips
  - 2. Use strike-off templates or compacting-type screeds.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. At construction joints, overlap forms onto previously placed concrete not less than 12 inches
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
  - 1. Determine sizes and locations from trades providing such items.
  - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- K. Construction and Movement Joints:
  - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
  - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 3. Place joints perpendicular to main reinforcement.
  - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

6. Space vertical joints in walls as indicated on Drawings.
  - i. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - ii. Do not place vertical joints within shear walls unless otherwise specified or written approval of the Engineer
- L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
  3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.5 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  2. Face laps away from exposed direction of concrete pour.
  3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.

7. Protect vapor retarder during placement of reinforcement and concrete.
  - i. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

### 3.6 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  2. Place joints perpendicular to main reinforcement.
    - i. Continue reinforcement across construction joints unless otherwise indicated.
    - ii. Do not continue reinforcement through sides of strip placements of floors and slabs.
  3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  6. Space vertical joints in walls as indicated on Structural Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
  7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Structural Engineer of Record in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.
  3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - i. Do not use vibrators to transport concrete inside forms.



- ii. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
  - iii. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
  - iv. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
- 1. Do not place concrete floors and slabs in a checkerboard sequence.
  - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 3. Maintain reinforcement in position on chairs during concrete placement.
  - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 5. Level concrete, cut high areas, and fill low areas.
  - 6. Slope surfaces uniformly to drains where required.
  - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  - 8. Do not further disturb slab surfaces before starting finishing operations.

### 3.8 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes: Unless otherwise noted on the Structural or Architectural Drawings, per ACI 301, provide a SF-1.0 for surfaces not exposed to public view and a SF-2.0 for surfaces exposed to public view.
- 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
    - i. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    - ii. Remove projections larger than 1 inch.
    - iii. Tie holes do not require patching.
    - iv. Surface Tolerance: ACI 117 Class D.
    - v. Apply to concrete surfaces not exposed to public view .

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
    - i. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    - ii. Remove projections larger than 1/4 inch.
    - iii. Patch tie holes.
    - iv. Surface Tolerance: ACI 117 Class B.
    - v. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
  3. ACI 301 Surface Finish SF-3.0:
    - i. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    - ii. Remove projections larger than 1/8 inch.
    - iii. Patch tie holes.
    - iv. Surface Tolerance: ACI 117 Class A.
    - v. Locations: As noted on Structural or Architectural drawings.
- B. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
  2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.9 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
  1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
  2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

3. Apply float finish to surfaces as indicated on the Architectural drawings.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces as indicated on the Architectural drawings. .
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, see general notes for flatness and levelness requirements.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces as indicated on the Architectural Drawings. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

### 3.10 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases as indicated on Drawings, in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 4000 psi at 28 days.
  - 4. Install dowel rods to connect concrete base to concrete floor as indicated on Drawings.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  - 6. Prior to pouring concrete, place and secure anchorage devices.
    - i. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - ii. Cast anchor-bolt insert into bases.
  - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

### 3.11 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  3. If forms remain during curing period, moist cure after loosening forms.
  4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    - i. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - ii. Continuous Sprinkling: Maintain concrete surface continuously wet.
    - iii. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    - iv. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    - v. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      - a) Recoat areas subject to heavy rainfall within three hours after initial application.
      - b) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
  2. Interior Concrete Floors:
    - i. Floors to Receive Curing and Sealing Compound:
      - a) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      - b) Recoat areas subjected to heavy rainfall within three hours after initial application.
      - c) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### 3.12 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved the percentage of the 28 day f'c value as specified on the Drawings. If no value is specified, a minimum of 70% shall be used.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
  - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces
  - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
  - 1. Align and secure joints to avoid offsets.
  - 2. Do not use patched forms for exposed concrete surfaces unless approved by the Architect.

### 3.13 TOLERANCES

- A. Conform to ACI 117, Unless Noted Otherwise
- B. Horizontal tolerances at slab edges shall be decreased to ½” in lieu of 1” at slab edges with wood/light gauge bearing walls, brick façade, or where concrete walls/columns are flush with the slab edge.

### 3.14 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
  - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Do not apply to concrete that is less than 28 days old.
  - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.

4. Rinse with water; remove excess material until surface is dry.
  5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

### 3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s).
  2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

### 3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
  2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
    - i. Limit cut depth to 3/4 inch.
    - ii. Make edges of cuts perpendicular to concrete surface.
    - iii. Clean, dampen with water, and brush-coat holes and voids with bonding agent.

- iv. Fill and compact with patching mortar before bonding agent has dried.
  - v. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
    - i. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    - ii. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
  - i. Correct low and high areas.
  - ii. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
  - i. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
  - i. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - ii. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.



- i. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
  - ii. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
  - i. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
  - ii. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
  - iii. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
  - iv. Place, compact, and finish to blend with adjacent finished concrete.
  - v. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
  - i. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - ii. Dampen cleaned concrete surfaces and apply bonding agent.
  - iii. Place patching mortar before bonding agent has dried.
  - iv. Compact patching mortar and finish to match adjacent concrete.
  - v. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner shall engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner shall engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - i. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - a) Project name.
      - b) Name of testing agency.
      - c) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      - d) Name of concrete manufacturer.
      - e) Date and time of inspection, sampling, and field testing.
      - f) Ambient air temperature.
      - g) Date and time of concrete placement.
      - h) Location in Work of concrete represented by samples.
      - i) Date and time sample was obtained.
      - j) Truck and batch ticket numbers.
      - k) Design compressive strength at 28 days.
      - l) Concrete mixture designation, proportions, and materials.
      - m) Field test results.
      - n) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
      - o) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength,

aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Steel reinforcement
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
  - i. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
  - i. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - ii. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
  - i. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - ii. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.
  - i. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:

- i. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
  - i. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M:
  - i. Cast and laboratory cure six 4-inch by 8-inch cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
  - i. Test the samples at the following intervals:
    - a) 2 cylinders at 7 days
    - b) 3 cylinders at 28 days
      - i) If any of the first two tested cylinders are below the specified 28 day f'c, hold the remaining cylinders for 56 day testing
    - c) 1 additional cylinder to be tested at contractors discretion based on desired construction sequencing (i.e. 3 or 14 day breaks)
  - ii. A compressive-strength test to be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi or less, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:
  - i. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect or EoR.

- ii. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect or EoR.
  - a) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
- 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

### 3.18 PROTECTION

#### A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

### 3.19 CONTRACT CLOSEOUT

- #### A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 03300

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## SECTION 03415

### STRUCTURAL PRECAST CONCRETE HOLLOW CORE PLANKS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. General Notes, Sections, Plans, Typical Details, and other notes indicated on the structural drawings. In all cases of conflict, information indicated on the structural drawings and included in the structural General Notes shall govern.

##### 1.2 SUMMARY OF WORK

- A. This Section specifies pre-cast concrete hollow core planks & accessories, including:
  - 1. Floor planks.
  - 2. Connection plates, brackets, and hangers.
  - 3. Grouting plank joint keys.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

##### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Regionally Manufactured Materials: Materials that are manufactured within 500 miles of Project location. Manufacturing refers to final assembly of components into building product that is installed at Project site.
- C. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered within 500 miles of Project site. If only a fraction of a product or material is extracted / harvested / recovered and manufactured locally, then only that percentage, by weight, shall contribute to regional value.

##### 1.4 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Placement of bearing, anchorage, and connection devices.

## 1.5 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Anchorage devices for mechanical and electrical equipment hangers.

## 1.6 REFERENCES

- A. ACI 301 Structural Concrete for Buildings.
- B. ACI 318 Building Code Requirements for Reinforced Concrete.
- C. ANSI/AWS D1.1 Structural Welding Code Steel.
- D. ANSI/AWS D1.4 Structural Welding Code Reinforcing Steel.
- E. ASTM A36 Structural Steel.
- F. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- G. ASTM A416 Undercoat Seven Wire Stress Relieved Strand for Prestressed Concrete.
- H. ASTM A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- I. ASTM A666 Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications.
- J. ASTM C150 Portland Cement.
- K. PCI MNL 116 Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
- L. PCI MNL 120 Design Handbook Precast and Prestressed Concrete.
- M. PCI MNL 123 Manual on Design of Connections for Precast Prestressed Concrete.
- N. PCI MNL 124 PCI Design for Fire Resistance of Precast Prestressed Concrete.
- O. PCI Manual for the Design of Hollow Core Slabs.
- P. UL Underwriters' Laboratories.

## 1.7 DESIGN REQUIREMENTS

- A. Size components to withstand design loads in an unrestrained condition as follows:
  - 1. Refer to structural drawings for design loads.
  - 2. Maximum Allowable Deflection of Floor Planks:  $1/360$  span.
- B. Design planks to accommodate misalignment of structure, construction tolerances, deflection of other building structural members, and clearances of intended openings.



- C. Grout Keys: Capable of transmitting horizontal shear of 2,000 lb/ft.
- D. Calculate structural properties of framing members in accordance with ACI 318.

#### 1.8 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01330.
- B. Submit shop drawings indicating plank locations, unit identification marks, connection details, edge conditions, support conditions, dimensions, openings, and relationship to adjacent materials.
- C. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.
- D. Submit product data under provisions of Section 01330.
- E. Submit product data indicating standard component configurations, design loads, deflections, and cambers.
- F. Submit fabricator's installation instructions under provisions of Section 01330.

#### 1.9 QUALITY ASSURANCE

- A. Perform Work in accordance with the requirements of PCI MNL 116, PCI MNL 120, and PCI MNL 123.
- B. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

#### 1.10 QUALIFICATIONS

- A. Fabricator: Company specializing in manufacturing the work of this Section with three years documented experience and certified by the Prestressed Concrete Institute Plank Certification Program.
- B. Erector: Company specializing in erecting the work of this Section with (3) years documented experience.
- C. Design pre-cast concrete members in accordance with PCI Manual for the Design of Hollow Core Slabs under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located in the State of Massachusetts.
- D. Welder: Qualified within previous 12 months in accordance with ANSI/AWS D1.1 and ANSI/AWS D1.4.

#### 1.11 REGULAROTRY REQUIREMENTS

- A. Conform to ACI 318 and Massachusetts State Building code for design load and construction requirements applicable to work of this Section.

## 1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01600.
- B. Store and protect products under provisions of Section 01600.
- C. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
- D. Mark each member with date of production and final position in structure.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Materials: ACI 318.
- B. Tensioning Steel Tendons: ASTM A416, Grade 250K or 270K, of sufficient strength commensurate with member design.
- C. Reinforcing Steel: ASTM A615, deformed steel bars.
- D. Grout: Non shrink, non metallic, minimum yield strength of 10,000 psi at 28 days.
- E. Density: Normal weight Concrete or approved equal. (145pcf maximum density)
- F. Fire Rating: 2 Hour minimum fire rating for untopped hollow-core plank.

### 2.2 ACCESSORIES

- A. Connecting and Supporting Devices: ASTM A36 carbon steel plates, angles, items cast into concrete, or items connected to steel framing members, inserts, conforming to PCI MNL 123 prime painted hot dip galvanized in accordance with ASTM A153. Do not paint surfaces in contact with concrete or surfaces requiring field welding.
- B. Core Hole End Plugs: Cardboard insert and concrete fill.
- C. Hanger Tabs: Galvanized steel, designed to fit into grouted key joints, capable of supporting 500 lbs dead load, predrilled to receive hanger.
- D. Bearing Pads: High density plastic, 1/8 inch thick, smooth both sides.

### 2.3 FABRICATION

- A. Conform to PCI MNL 116.
- B. Embed anchors, inserts, plates, angles, and other items at locations indicated on Drawings.

- C. Provide required openings and embed accessories provided by other Sections, where indicated.
- D. Cut exposed ends of stressing tendons.
- E. Provide smooth finish at bottom of plank without any honeycombs.

## 2.4 COMPONENTS

- A. Nominal Thickness: 10"
- B. Nominal Plank Width: 4'-0" minimum

## 2.5 FINISHING

- A. Plant Finish: Finish members to PCI MNL-116 Standard grade.

## 2.6 FABRICATION TOLERANCES

- A. Conform to PCI MNL 116.
- B. Maximum Variation From Intended Camber: 1/8 inch in 10 feet.
- C. Maximum Out of Square: 1/8 inch/10 feet non cumulative.
- D. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.
- E. Maximum Bowing of Members: Length of Bow/ 360.

## 2.7 TESTS

- A. Provide analysis and testing of stressing tendons under provisions of Section 01400.
- B. Test samples in accordance with applicable ASTM standard.
- C. Materials: ACI 318.
- D. Tensioning Steel Tendons: ASTM A416, Grade 250K or 270K, of sufficient strength commensurate with member design.
- E. Reinforcing Steel: ASTM A615, deformed steel bars.
- F. Grout: Non shrink, non metallic, minimum yield strength of 5,000 psi at 28 days.

## 2.8 ACCESSORIES

- A. Connecting and Supporting Devices: ASTM A36 carbon steel plates, angles, items cast into concrete, or items connected to steel framing members, inserts, conforming to PCI MNL 123 prime painted hot dip galvanized in accordance with ASTM A153. Do not paint surfaces in contact with concrete or surfaces requiring field welding.

- B. Core Hole End Plugs: Cardboard insert and concrete fill.
- C. Hanger Tabs: Galvanized steel, designed to fit into grouted key joints, capable of supporting 500 lbs dead load, predrilled to receive hanger.
- D. Bearing Pads: High density plastic, 1/8 inch thick, smooth both sides.

## 2.9 FINISHING

- A. Plant Finish: Finish members to PCI MNL-116 Standard grade.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verify that prepared openings are ready to receive work and field measurements are as shown on shop drawings and Drawings.
- B. Beginning of installation means installer accepts existing site conditions.

### 3.2 PREPARATION

- A. Prepare support devices for the erection procedure and temporary bracing

### 3.3 ERECTION

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Align and maintain uniform horizontal and end joints, as erection progresses.
- C. Maintain temporary bracing in place until final connection is made. Protect members from staining
- D. Install bearing pads and sill seal at bearing ends of planks as indicated.
- E. Adjust differential camber between precast members to tolerance before final attachment.
- F. Install hanger tabs in joints as required on drawings.
- G. Grout plank joints; trowel smooth. Tape seal underside of plank joints to prevent grout leakage
- H. Transition dissimilar elevations of adjoining planks with grout to a maximum slope of 1:12
- I. Secure units in place. Perform welding in accordance with ANSI/AWS D1.1.
- J. Apply concrete bonding agent to top of precast concrete planks

### 3.4 TOLERANCES

- A. Erect members level and plumb within allowable tolerances.
- B. Conform to PCI MNL 116.
- C. Exposed Joint Dimension: 3/8 inch plus or minus 1/4 inch 6 mm.
- D. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise Architect/Engineer. Execute modifications as directed.

3.5 PROTECTION

- A. Protect members from damage caused by field welding or erection operations.
- B. Provide non-combustible shields during welding operations

3.6 CLEANING

- A. Clean weld marks, dirt, or blemishes from surface of exposed members.

3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 03415

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DIVISION 4 – MASONRY

04001 ..... Masonry (Filed Sub-Bid Required)  
04810 ..... Unit Masonry (Masonry Filed Sub-Bid Required)

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SECTION 04001

MASONRY  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
  - 1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 04001 – MASONRY

- 2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.
  - 3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.
- C. Sub-Sub-Bid Requirements: None required under this Section.
  - D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, A-1, A-2, A-3, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-16, A-18, A-19, A-20, A-22, A-23, A-24, A-25, A-26, A-27, S-1, S-2, S-3, S-5, S-6, S-7, S-8, S-9, S-10, S-13, and S-16.
  - E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:
    - 1. All work of: Section 04001 – Masonry and Section 04810 – Unit Masonry.

F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:

1. Division 1 – General Requirements

G. Alternates: Not Applicable.

END OF SECTION 04001

## SECTION 04810

### UNIT MASONRY

(Part of Filed Sub-Bid Section 04001 – MASONRY – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Masonry lintels.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.
8. All hoisting and scaffolding for completion of masonry work.
9. Masonry waste disposal.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 07920 "Joint Sealants" for sealing control and expansion joints in unit masonry.
4. Section 09900 "Painting and Coating" for field painting exposed CMU walls.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For the following:
1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
  2. Control/Expansion Joints: Provide layout indicating locations of all control/expansion joints. Provide details for all conditions.
- D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
    - i. Include material test reports substantiating compliance with requirements.
    - ii. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  2. Cementitious materials. Include brand, type, and name of manufacturer.
  3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  4. Grout mixes. Include description of type and proportions of ingredients.
  5. Reinforcing bars.
  6. Joint reinforcement.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
  2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements in ACI 530.1.
- J. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with hot-weather requirements in ACI 530.1.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
1. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
  2. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
  3. Prism Test: For each type of construction provided, according to ASTM C1314 at 28 days.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as directed by Engineer.
  2. Build mockups for typical masonry wall construction in sizes approximately 48 inches long by 48 inches high by full thickness.
    - i. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
  3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
  4. Protect accepted mockups from the elements with weather-resistant membrane.
  5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - i. Approval of mockups is also for other material and construction qualities specifically approved by Engineer in writing.
    - ii. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Engineer in writing.
  6. Demolish and remove mockups when directed by the Engineer.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01040 "Project Coordination."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.6 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

## 1.7 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths ( $f_m$ ) at 28 days.
  - 1. Determine net-area compressive strength ( $f_m$ ) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

## 1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602/1.8C whenever the following conditions exist:

1. The ambient temperature falls below 40 deg F.
2. The temperature of masonry units is below 40 deg F.
3. Implement the following minimum procedures:
  - i. The temperature of masonry units shall not be less than 20 deg F when laid in the masonry. Remove visible ice on masonry units prior to installation.
  - ii. Heat the mortar sand or mixing water to produce mortar temperatures between 40 deg F and 120 deg F at the time of mixing. Maintain mortar above 32 deg F until used in masonry.
  - iii. Use heat sources where ambient temperatures are between 20 deg F and 25 deg F on both sides of the masonry under construction. Install wind breaks when wind velocity is in excess of 15 mph.
  - iv. Where ambient temperature is below 20 deg F, provide an enclosure for the masonry under construction and use heat sources to maintain temperature above 32 deg F within the enclosure.
  - v. Where mean daily temperatures are between 32 deg F and 40 deg F, protect completed masonry from rain and snow by covering with a weather resistive membrane for 24 hours after construction.
  - vi. Where mean daily temperatures are between 25 deg F and 32 deg F, completely cover completed masonry with a weather resistive membrane for 24 hours after construction.
  - vii. Where mean daily temperatures are between 20 deg F and 25 deg F, completely cover completed masonry with insulating blankets, or equal protection, for 24 hours after construction.
  - viii. Where mean daily temperatures are below 20 deg F, maintain masonry temperature above 32 deg F for 24 hours after construction by enclosure with supplementary heat, by electric blankets, by infrared heat lamps, or other acceptable methods.
4. Do not lay masonry units that are wet or frozen.
5. Remove masonry damaged by freezing conditions.
6. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602/1.8D, whenever the ambient air temperature exceeds the following:



1. 100 deg F, or 90 deg F with a wind velocity greater than 8 mph.
2. Implement hot weather protection in accordance with Article 2.1.2.1(d).
3. Do not spread mortar beds more than 4 feet ahead of masonry. Set masonry units within one minute of spreading mortar.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

### 2.2 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
  1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions where indicated.
  2. Provide factory fabricated bullnose units for outside corners.
- B. Concrete Masonry Units: ASTM C 90.
  1. Products: Subject to compliance with requirements, provide products by one of the following:
    - i. Jandris & Sons.
    - ii. Nitterhouse Masonry Products, LLC.
    - iii. Westbrook Block, Inc.
  2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
  3. Weight Classification: Normal weight.
  4. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
  5. Exposed Faces: Manufacturer's standard color and texture.

### 2.3 MASONRY LINTELS

- A. General: Provide masonry lintels as indicated, complying with requirements below.

- B. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

## 2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: The use of masonry cement is not permitted.
- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following, or equal:
    - i. Euclid Chemical Company (The); Accelguard 80.
    - ii. GCP Applied Technologies; Morset.
    - iii. RussTech; Mortarset-NC.
- G. Water: Potable.

## 2.5 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Limit cementitious materials in mortar to portland cement and lime.
  - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar Mixes: At Contractor's option, provide job-mixed mortar or preblended dry mortar mix. Provide colors required for each application indicated.

- C. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide the following, or equal:
    - i. Spec Mix; Portland Lime & Sand.
- D. Mortar Types for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated:
  - 1. For masonry below grade or in contact with earth, use Type S.
  - 2. For reinforced masonry, use Type M or S.
  - 3. For interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
    - i. Use fine grout for 6 inch thick concrete masonry wythes.
    - ii. Use course grout for 8-inch thick or greater concrete masonry wythes.
  - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

## 2.6 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

## 2.7 MASONRY JOINT REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter (9 gauge).
  - 4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter (9 gauge).

5. Wire Size for Veneer Ties: W2.8 or 0.188-inch diameter (3/16-inch).
  6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
1. Products: Subject to compliance with requirements, provide one of the following:
    - i. Heckmann Building Products; Ladder Type 1100.
    - ii. Hohmann & Barnard, Inc.; #220 Ladder Mesh.
    - iii. Wire-Bond; Series 200 Core Clear Ladder Type.

## 2.8 TIES AND ANCHORS, GENERAL

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with the following:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
  2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
  2. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

## 2.9 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

- C. Postinstalled Anchors: Provide torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
  - 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
  - 1. Control Joints: Provide compressible filler, 3/8-inch thick and 3 inches wide.
    - i. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Heckmann Building Products; Neoprene Expansion Joints 354.
      - 2) Hohmann & Barnard, Inc.; NS Closed Cell Neoprene Sponge.
      - 3) Wire-Bond; #3300 Expansion Joint.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - i. Blok-Lok; VS Series PVC Control Joint.
    - ii. Hohmann & Barnard, Inc.; #VS Series – PVC Control Joint.
    - iii. Wire-Bond; PVC Control Joint.
- D. Grout Screen: Fabricated from monofilament polypropylene mesh to prevent grout falling through; without interfering with mortar bond.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - i. Advanced Building Products Inc.; Grout Catch.
    - ii. Heckman Building Products, Inc.; Grout Stop.
    - iii. Hohmann & Barnard, Inc.; MGS.
    - iv. Wire-Bond; Grout Stop 3612.

- E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.148-inch (9 gauge) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
    - i. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    - ii. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    - iii. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

## 2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - i. Diedrich Technologies, Inc.
    - ii. EaCo Chem.
    - iii. PROSOCO.
- B. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

### 3.3 TOLERANCES

#### A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
- 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
- 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

#### B. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

- 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in the following bond pattern(s); do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
  1. Running bond.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  1. Install compressible filler in joint between top of partition and underside of structure above.



2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
  1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

### 3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
  1. Space reinforcement not more than 16 inches o.c.
  2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
    - i. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

### 3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
  2. Install control joints in interior concrete masonry partitions where indicated, and as follows. During wall layout, verify locations of all control joints with Architect.
    - i. Spacing of control joints in straight walls not to exceed 20 feet horizontally.
    - ii. Install control joints at intersections of walls and column enclosures.

### 3.8 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

### 3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
- D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

### 3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to the Massachusetts State Building Code.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
- C. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
1. Payment for these services will be made by Owner.
  2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.
- F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

### 3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

### 3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
  - 1. Disposal: Separate, salvage, recycle and dispose of materials in accordance with the Commonwealth of Massachusetts "Waste Ban" 310 CMR 19.017.

### 3.13 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 04810

DIVISION 5 – METALS

05001	.....	Miscellaneous and Ornamental Iron (Filed Sub-Bid Required)
05400	.....	Cold Formed Metal Framing
05500	.....	Metal Fabrications (Miscellaneous and Ornamental Iron Filed Sub-Bid Required)
05519	.....	Metal Grating Stairs

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SECTION 05001

MISCELLANEOUS AND ORNAMENTAL IRON  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
  - 1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 05001 – MISCELLANEOUS AND  
ORNAMENTAL IRON

- 2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.
- 3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.
- C. Sub-Sub-Bid Requirements: None required under this Section.
- D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, A-1, A-2, A-3, A-4, A-8, A-9, A-10, A-11, A-24, A-25, A-26, A-28, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10, S-11, S-13, S-14, and S-16.
- E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:
  - 1. All work of: Section 05001 – Miscellaneous and Ornamental Iron and Section 05500 – Metal Fabrications.



- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
  2. Division 2 – Site Work
- G. Alternates: Not Applicable.

END OF SECTION 05001

## SECTION 05400

### COLD-FORMED METAL FRAMING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

###### A. Section Includes:

1. Load-bearing wall and roof framing supporting insulated metal wall and roof panels at dormers.
2. Hat channel furring.

###### B. Related Requirements:

1. Section 06105 "Miscellaneous Rough Carpentry" for wood blocking and top plates installed in metal framing, wood joists, and plywood wall panels installed over metal framing.
2. Section 13120 "Metal Building Systems" for structural purlins and insulated metal wall and roof panels.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For each type of cold-formed steel framing product and accessory.

###### C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

- D. Delegated-Design Submittal: For cold-formed steel framing.

- E. Qualification Data: For testing agency.

- F. Welding certificates.
- G. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
  - 1. Steel sheet.
  - 2. Expansion anchors.
  - 3. Power-actuated anchors.
  - 4. Mechanical fasteners.
  - 5. Vertical deflection clips.
  - 6. Horizontal drift deflection clips
  - 7. Miscellaneous structural clips and accessories.
- H. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at the project site.

#### 1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the Commonwealth of Massachusetts and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
  1. ClarkDietrich Building Systems.
  2. MarinoWare; a division of Ware Industries.
  3. SCAFCO Steel Stud Company.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Assurance," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
  1. Design Loads: As indicated in Structural Drawings.
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - i. Exterior Load-Bearing Wall Framing: Horizontal deflection of **1/240** of the wall height; and/or as required for insulated metal panels.
    - ii. Roof Rafter Framing: Vertical deflection of **1/240** of the horizontally projected span for live loads; and/or as required for insulated metal panels.
  3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
  4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

- i. Upward and downward movement of 3/4 inch (min.)
- C. Cold-Formed Steel Framing Design Standards:
  - 1. Roof Systems: AISI S210.
  - 2. Headers: AISI S212.
  - 3. Lateral Design: AISI S213.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

### 2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: ST33H (min.).
  - 2. Coating: G60 (min.)
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: ST33H (min.).
  - 2. Coating: G60 (min.)

### 2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0538 inch (min.)
  - 2. Flange Width: 1-5/8 inches (min.)
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0538 inch (min.)
  - 2. Flange Width: 1-1/2 inches (min.)
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0538 inch (min.)

2. Flange Width: 1-5/8 inches (min.)-
- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch (min.)
  2. Flange Width: 1-5/8 inches (min.)

## 2.5 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
  2. Flange Width: 1-5/8 inches minimum.

## 2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Foundation clips.
  7. Gusset plates.
  8. Stud kickers and knee braces.
  9. Joist hangers and end closures.
  10. Hole reinforcing plates.
  11. Backer plates.

## 2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

## 2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell polyurethane foam, 1/4 thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - i. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - ii. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
  - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - i. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - ii. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
  - 1. Anchor Spacing: 24 inches, as shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
  - 1. Stud Spacing: 16 inches (max.).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
  - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches (max.). Fasten at each stud intersection.
  - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 INSTALLATION OF JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
  - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
  - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
  - 1. Joist Spacing: 16 inches maximum.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
  - 1. Install web stiffeners to transfer axial loads of walls above.

- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
  - 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
  - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

### 3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 05400

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## SECTION 05500

### METAL FABRICATIONS

(Part of Filed Sub-Bid Section 05001 – MISCELLANEOUS AND  
ORNAMENTAL IRON – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Furnish and install stainless steel ladder(s), including complete structural engineering of all members, fasteners and inserts.
- 2. Furnish and install aluminum ladder(s), including complete structural engineering of all members, fasteners and inserts.

- B. Products furnished, but not installed, under this Section include the following:

- 1. Steel angles for anchoring precast concrete planks to CMU walls.
- 2. Stainless steel angles with stud anchors cast into concrete at vertical coiling door threshold.
- 3. Steel angles used in support of vertical coiling doors.
- 4. Stainless steel angle supports for aluminum grating.
- 5. Galvanized steel bollards.
- 6. Stainless steel hooks and chains.
- 7. Anchor bolts, pipe sleeves, and inserts to be cast in concrete, unless specified elsewhere.
- 8. All other site or shop fabricated miscellaneous metals unless otherwise excluded.

- C. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements.
- 2. Division 1 – General Requirements.

3. Section 03300 "Cast-in-Place Concrete" for installing metal fabrications indicated to be cast into concrete.
4. Section 03410 "Plant Precast Structural Concrete" for installation of cast-in weld plates and steel angles anchoring precast concrete roof planks.
5. Section 05519 "Metal Grating Stairs" for aluminum stair assemblies.
6. Section 08348 "Floor Doors" for floor doors and hatches provided by that Section.
7. Section 09900 "Painting and Coatings" for painting metal fabrications where indicated.
8. Division 15 Sections for metal fabrications associated with mechanical work.

### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For the following:
  1. Paint (primer) products.
  2. Grout.
- C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  2. Provide templates for anchors and bolts specified for installation under other Sections.
  3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation.
  4. Provide Shop Drawings for the following:
    - i. Miscellaneous steel angles and trim.
    - ii. Stainless steel and aluminum ladders.
    - iii. Bollards.
    - iv. Stainless steel hooks and chains.

- D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For professional engineer.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- I. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

#### 1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 3. AWS D1.6, "Structural Welding Code--Stainless Steel."

#### 1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.6 PROJECT CONDITIONS

- A. Temporary Support Facilities: Furnish and install all temporary lifts, hoists, staging, scaffolding, rigging, labor and materials, and temporary support to perform all operations in connection with the installation of this Work. Remove all temporary support facilities when no longer required.
- B. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Provide allowance for trimming and fitting at site.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Assurance," to design ladders, hand rails, and other assemblies indicated.
- B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - i. Uniform load of 50 lbf/ ft. applied in any direction.
    - ii. Concentrated load of 200 lbf applied in any direction.
    - iii. Uniform and concentrated loads need not be assumed to act concurrently.
- D. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- F. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Bolts: ASME B18.2.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1.
- J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

## 2.7 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

## 2.8 STAINLESS STEEL LADDERS

A. General: Provide fixed metal ladders to comply with OSHA fall protection regulation 29 CFR 1910.27, and the following:

1. Comply with ANSI A14.3, unless otherwise indicated.

B. Stainless Steel Ladders: Custom fabrication. Refer to Structural Drawings.

## 2.9 ALUMINUM LADDERS

A. General: Provide fixed metal ladders to comply with OSHA fall protection regulation 29 CFR 1910.27, and the following:

1. Comply with ANSI A14.3, unless otherwise indicated.

B. Aluminum Ladders:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **O’Keeffe’s Inc.; Model 502 Heavy Duty Tubular Rail** or a comparable product by one of the following:

- i. Precision Ladders, LLC.
- ii. Royalite Manufacturing, Inc.

2. Space siderails 24 inches apart.

3. Siderails: Continuous extruded aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inches wide, and 1/8 inch thick.

4. Rungs: Extruded aluminum tubes, not less than 1-1/4 inches deep and not less than 1/8 inch thick, with serrated tread surfaces and capable of withstanding 1,500 lb. load.

5. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.

6. Support each ladder at top and bottom with welded or bolted aluminum brackets. Reinforce each ladder as required to span heights indicated.

7. Finish: Mill.

## 2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

## 2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Final field painting by Section 09900 "Painting and Coatings."

## 2.12 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## 2.14 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 05500



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## SECTION 05519

### METAL GRATING STAIRS

(Part of Filed Sub-Bid Section 05001 – MISCELLANEOUS AND  
ORNAMENTAL IRON – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Industrial Class stairs with aluminum-grating treads and platforms.
  - 2. Aluminum railings and guards.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 05500 “Metal Fabrications” for miscellaneous stainless steel support framing.

##### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
  - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
  - 2. Deliver such items to Project site in time for installation.

##### 1.4 ACTION SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For metal grating stairs and the following:
  - 1. Gratings.
- C. Shop Drawings:
  - 1. Include plans, elevations, sections, details, and attachment to other work.
  - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
  - 3. Include plan at each level.
  - 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
- D. Delegated-Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the Commonwealth of Massachusetts.
- B. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
  - 1. Keep aluminum members off ground and spaced by using pallets, dunnage, or other supports and spacers.
  - 2. Protect aluminum members and packaged materials from corrosion and deterioration.
  - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
    - a. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft..
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
  - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the Massachusetts State Building Code.
  - 1. Component Importance Factor: 1.5.

### 2.2 ALUMINUM

- A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.

- B. Extruded Bars and Shapes: ASTM B221, alloys as follows:
  - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
  - 2. 6061-T1, for grating crossbars.
- C. Aluminum Sheet: ASTM B209, Alloy 5052-H32.
- D. Extruded Structural Pipe: ASTM B429, Alloy 6061-T6 and 6063-T6.
  - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated or required by structural performance.

## 2.3 FASTENERS

- A. General: Provide Type 304 stainless-steel fasteners for exterior use.
  - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
  - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for [interior] [exterior] use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
  - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  - 2. Locate joints where least conspicuous.
  - 3. Fabricate joints that are exposed to weather in a manner to exclude water.
  - 4. Provide weep holes where water may accumulate internally.

## 2.6 FABRICATION OF ALUMINUM-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

- B. Stair Framing:
1. Fabricate stringers of aluminum.
    - a. Stringer Size: As required to comply with "Performance Requirements" Article.
  2. Construct platforms and tread supports of aluminum headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
    - a. Provide closures for exposed ends of channel framing.
  3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from swaged aluminum grating with 1-1/2-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c.
    - a. Surface: Plain.
    - b. Finish: Mill.
  2. Fabricate grating treads with cast-abrasive nosing and with angle or plate carrier at each end for stringer connections.
    - a. Secure treads to stringers with bolts.
  3. Fabricate grating platforms with nosing matching that on grating treads.
    - a. Secure grating to platform framing with bolts.
- D. Risers: Open.
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
1. Material and Finish: Aluminum plate to match finish of other aluminum items.
  2. Fabricate to dimensions and details indicated.

## 2.7 FABRICATION OF RAILINGS AND GUARDS

- A. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-1/2-inch-diameter top and bottom rails and 1-1/2-inch-diameter posts.

- B. Welded Connections: Fabricate railings and guards with welded connections.
  - 1. Fabricate connections that are exposed to weather in a manner that excludes water.
    - a. Provide weep holes where water may accumulate internally.
  - 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
  - 3. Weld all around at connections, including at fittings.
  - 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 5. Obtain fusion without undercut or overlap.
  - 6. Remove flux immediately.
  - 7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter as shown in NAAMM AMP 521.
- C. Form changes in direction of railings and guards as follows:
  - 1. As detailed.
  - 2. By bending.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
  - 1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing and guard members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
  - 1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
  - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
  - 2. For aluminum railings and guards, provide stainless steel fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.



## 2.8 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to structure or to weld plates cast into concrete unless otherwise indicated.
  - 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.
    - a. Clean bottom surface of baseplates.
    - b. Set baseplates on wedges, shims, or leveling nuts.
    - c. After stairs have been positioned and aligned, tighten anchor bolts.
    - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
    - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
      - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
      - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  - 3. Comply with requirements for welding in "Fabrication, General" Article.

### 3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
  - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
  - 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
  - 4. Secure posts, rail ends, and guard ends to building construction as follows:
    - a. Anchor posts to framing by bolting to supporting members.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 05519

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DIVISION 6 – WOOD AND PLASTICS

06105	.....	Miscellaneous Rough Carpentry
06400	.....	Architectural Woodwork
06741	.....	FRP Fabrications

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## SECTION 06105

### MISCELLANEOUS ROUGH CARPENTRY

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Wood blocking and nailers.
2. Marine grade plywood wall panels.
3. Plywood backing panels.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 05400 “Cold-Formed Metal Framing” for furring associated with marine grade plywood wall panels.
4. Section 06400 “Architectural Woodwork” for interior PVC trim.
5. Section 07620 “Sheet Metal Flashing and Trim” for formed flashing installed over wood blocking.
6. Section 08710 “Door Hardware” for door hardware and other installation requirements.
7. Section 09900 “Painting and Coatings.”
8. Section 13120 “Metal Building Systems” for framing receiving furring and marine grade plywood panels.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  - 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- C. Evaluation Reports: For the following, from ICC-ES:
  - 1. Preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Power-driven fasteners.
  - 4. Powder-actuated fasteners.
  - 5. Expansion anchors.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

## 1.6 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent.
- C. Plywood: DOC PS 1.
  - 1. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
  - 2. Factory mark panels to indicate compliance with applicable standard.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic, chromium or chromated copper arsenate (CCA).



- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat plywood and miscellaneous carpentry, including the following:
  - 1. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
- E. Manufacturers: Subject to compliance with requirements, provide products by one the following:
  - 1. Georgia Pacific.
  - 2. Hoover Treated Wood Products, Inc.
  - 3. Koppers Performance Chemicals.

### 2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

- E. Application: Treat the following:
  - 1. Plywood backing panels.
- F. Products: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dricon.
  - 2. Hoover Treated Wood Products, Inc.
  - 3. Koppers Performance Chemicals.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
- B. For items of dimension lumber size, provide Construction or No. 2 lumber with 15 percent maximum moisture content and the following species:
  - 1. Hem-fir (north); NLGA.
- C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.5 WALL SHEATHING

- A. Marine-Grade Plywood Wall Panels: Exterior sheathing, AB grade, manufactured with Douglas fir or Western Larch veneers.
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: As indicated, 3/4 inch.

## 2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

## 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, fire retardant treated, or in area of high relative humidity, provide fasteners of with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with

defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- D. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2305.2, "Fastening Schedule," in the Massachusetts State Building Code.
- E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

### 3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood: Install 1-by-3-inch nominal- size furring vertically 24 inches o.c.

### 3.4 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

### 3.5 FIRE-RETARDANT-TREATED (FRT) MATERIALS INSTALLATION

- A. Cutting to length, drilling holes, joining cuts and light sanding are permissible. It is not necessary to field treat cut ends to maintain flame spread rating.
  - 1. Ripping, milling, and surfacing of FRT lumber is not permitted.
  - 2. FRT plywood can be cut in either direction without loss of fire protection.

3.6 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 06105

## SECTION 06400

### ARCHITECTURAL WOODWORK

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Cellular PVC trim boards for interior standing and running trim for windows and doors.
- B. Related Sections include the following:
  - 1. Section 06105 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
  - 2. Section 09900 "Painting and Coatings" for field painting of PVC trim.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- D. Samples for Verification:
  - 1. For cellular PVC trim, with 1/2 of exposed surface finished; 50 sq. in.
- E. Warranties: Special warranties specified in this Section.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Fabricator.

#### 1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products, or installer approved by fabricator.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01040 "Project Coordination."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

#### 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

#### 1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

#### 1.8 WARRANTY

A. Manufacturer's Warranty for Cellular PVC Trim: Manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to, deterioration, delamination, and excessive swelling from moisture.

1. Warranty Period: 25 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 STANDING AND RUNNING TRIM

A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.

1. Products: Subject to compliance with requirements, provide products by one of the following:
  - i. AZEK Exteriors.
  - ii. Klear.
  - iii. Versatex.
2. Performance and physical characteristic requirements:
  - i. Density: ASTM D 792, not less than 0.55 g/cu.cm.
  - ii. Heat Deflection Temperature: Not less than 150 deg F, per ASTM D 648.
  - iii. Coefficient of Linear Expansion: Not more than  $3.2 \times 10^{-5}$  inches/inch x deg F.
  - iv. Water Absorption: Not more than 1 percent, per ASTM D 570.
  - v. Flame-Spread Index: 25 or less, per ASTM E 84.
3. Trim Boards: 4/4-inch thickness (unless otherwise noted on Drawings) in widths indicated.
4. Sheets: 4/4-inch thickness.
5. Color: White.
6. Texture: Smooth.

### 2.2 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Adhesive for Cellular PVC Trim: Cellular PVC cement product recommended by trim manufacturer to bond trim joints.
- C. Sealants: Urethane based sealants without silicone, complying with applicable requirements in Division 07 Section "Joint Sealants"; recommended by sealant manufacturer and manufacturer of substrates for intended application.
- D. Fasteners for Finish Carpentry: Provide stainless steel nails screws recommended by manufacturer in sufficient length to penetrate into wood substrate.
  1. The use of staples, brads, finish nails and wire nails is not permitted.



2. Provide hidden fastening system complete with screws, plugs and setting tools for concealed fastening.
  - i. Product: Subject to compliance with requirements, provide the following, or equal for use with cellular PVC trim product selected:
    - a. Cortex Hidden Fastening System.

### 2.3 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of the work indicates acceptance of substrates.
- D. Clean substrates of projections and substances detrimental to finish application.

### 3.2 INSTALLATION

- A. Install cellular PVC trim to comply with manufacturer's written instructions.
- B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of trim available. Do not use pieces less than 24 inches long except where necessary.
  1. Use scarf joints for end-to-end joints.
  2. Stagger end joints in adjacent and related members.

- C. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Install trim boards with two fasteners per every framing member. Trimboards 12-inches and wider, and sheets, require additional fasteners per manufacturer's recommendation. Install fasteners no more than 2-inches from the end of the board.
  - 1. Fasten all trim boards and sheets with stainless steel screws.
  - 2. Predrilling for fasteners may be required in low temperatures. Comply with manufacturer's recommendations.
  - 3. Allow for 1/8-inch per 18 foot of run for expansion and contraction.
- E. Glue all PVC to PVC joints with cellular PVC cement to prevent joint separation. Secure glue joint with fasteners on each side of the joint to allow adequate bonding time.
- F. Provide plugs in all fastener holes. Sand all plugs smooth with face of trim.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean exterior finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

### 3.4 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 06400

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## SECTION 06741

### FRP FABRICATIONS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. FRP gratings and treads.
2. FRP structural shapes.
3. FRP railings, including removable railings.
4. Fasteners and accessories.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 03300 “Cast-In-Place Concrete.”
4. Section 04810 “Unit Masonry.”

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For glass-fiber-reinforced-plastic gratings and treads.
- C. Shop Drawings: Include plans, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For gratings, treads, railings, and stair and platform assemblies, including analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation.
- E. Warranty: Special warranty specified in this Section.

## 1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years' experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. **Storage of Products:** All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities between 70 and 85 degrees F until they are required.

## 1.6 COORDINATION

- A. **Coordinate installation of anchorages for gratings, grating frames, and supports.** Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## 1.7 FIELD CONDITIONS

- A. **Field Measurements:** Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

## 1.8 WARRANTY

- A. **Special Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace materials that do not comply with requirements or that fail within specified warranty period.

1. **Warranty Period:** Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. **Delegated Design:** Engage a qualified professional engineer, as defined in Section 01400 "Quality Assurance", to design FRP fabrications.

- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Floors: Uniform load of 100 lbf/sq. ft. or concentrated load of 300 lbs., whichever produces the greater stress.
  2. Limit deflection to L/360 or 1/4 inch, whichever is less.
- C. Structural Performance of Stairs: Provide FRP stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft.
  2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
  3. Uniform and concentrated loads need not be assumed to act concurrently.
  4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- D. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
    - i. Uniform load of 50 lbf/ ft. applied in any direction.
    - ii. Concentrated load of 200 lbf applied in any direction.
    - iii. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - i. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - ii. Infill load and other loads need not be assumed to act concurrently.
- E. Structural shapes shall be designed with a factor of safety of three for bending, shear, and bearing.
- F. Liquid Chemical Compatibility:
1. Potassium Hydroxide (45%) – Occasional inundation.
  2. Sodium Hypochlorite (12.5%) – Occasional inundation.
  3. Sodium Bisulfite (38%) – Occasional inundation.

4. Sodium Fluoride, Liquid (4%) – Occasional inundation.

2.2 GLASS-FIBER-REINFORCED-PLASTIC, GENERAL

- A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
- B. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.
- C. Resin shall be Vinyl Ester, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
- E. All fire-retardant molded grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall not burn past the 25 mm reference mark and will be classified HB per ASTM D635.
- F. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.3 PULTRUDED FRP GRATINGS, STAIR TREADS AND RAILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by **Fibergrate Composite Structures Inc.** or comparable products by one of the following:
  - 1. Creative Pultrusions, Inc.
  - 2. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.
  - 3. Strongwell Corporation.
- B. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.
- C. Fabricate grating and Stair Treads from pultruded bearing bars and cross rods. Assemble grating using a locking cross-rod design that makes a permanent connection between the cross-rod and bearing bar, and is completely bond into a one-piece panel.
  - 1. Color: Safety yellow.

2. Traffic Surface: Applied abrasive finish.
- D. Provide Type 316L stainless steel grating hold down clamps spaced as required by manufacturer, but not greater than 4 feet on center. Provide two at each support with a minimum of four per panel.
- E. Provide embedded angle support frames with continuous integral anchor for grating set in concrete openings unless noted otherwise.
- F. Stairs: Fabricate stairs from FRP structural shapes in rise and run as indicated on Drawings.
1. Provide kickplates where required by OSHA, or as indicated on the Contract Documents. Kick plate shall be 4 inches by 1/2-inch (corrugated) by 1/4-inch thick pultruded shape attached to posts with stainless connectors.
- G. Railings: Fully bond all post to rail connections with an epoxy adhesive and with an internal connection for added strength and durability. Provide smooth transitions between post and rail connections.
1. Fabricate handrail to standard two-rail design unless noted otherwise.
  2. Post Locations:
    - i. No greater than 12 inches from horizontal or vertical change in handrail direction, unless otherwise indicated on Contract Documents.
    - ii. Post centers shall be no greater than 60 inches apart on any straight run of rail, unless otherwise indicated on Contract Documents.
    - iii. Post centers shall be no greater than 48 inches apart on inclined rail section, unless otherwise indicated on Contract Documents.
  3. Provide side mounted, base mounted, embedded, or removable anchorage mounted handrail as noted on Drawings. Accurately locate handrail sections and erect plumb and level.
  4. Color: Safety yellow.

## 2.4 STRUCTURAL SHAPES

- A. Manufacturers: Subject to compliance with requirements, provide products by **Fibergrate Composite Structures Inc.** or comparable products by one of the following:
1. Creative Pultrusions, Inc.
  2. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.
  3. Strongwell Corporation.
- B. Structural Shapes: Manufacture structural shapes by the pultrusion process.



1. Provide size and shapes as indicated on the Contract Drawings. All resins shall be resistant to ultraviolet light, shall be flame resistant and shall meet the requirements of ASTM D635 and ASTM E84, Class 1 with a maximum flame spread rating of 25. All exposed edges shall be sealed with a compatible resin system. The resin systems shall be as follows:
  - i. Vinyl ester resin system to be provided in, over and adjacent to containment areas.
  - ii. Isophthalic polyester resin to be provided in all other areas.
- C. Provide structural shapes containing a glass fiber reinforced vinyl ester resin matrix, approximately 50 percent glass by weight with a synthetic surface veil outer layer covering the exterior surfaces. Provide glass strand rovings shall be for longitudinal strength. Provide continuous strand glass mats or stitched reinforcements shall for transverse strength
  1. Provide Type 316L stainless steel bolts and washers.
  2. Abrade joint surfaces to be bonded to remove surface gloss and be free of burrs or other foreign materials that would prevent proper adhesion.

## 2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners. Select fasteners for type, grade, and class required.
- B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.6 FABRICATION

- A. Shop Assembly: Shop fabricate grating sections to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

1. Measurements: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
  2. Layout: Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
  3. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's instructions
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
  - C. Form gratings from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
  - D. Fit exposed connections accurately together to form hairline joints.
  - E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  - F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
  - G. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

## 2.7 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Glass-Fiber-Reinforced-Plastic Gratings: Fabricate from glass-fiber-reinforced-plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
  1. Unless otherwise indicated, use shapes made from same resin as gratings.
  2. Equip units indicated to be cast into concrete or built into masonry with integral anchors.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.

### 3.2 INSTALLING GLASS-FIBER-REINFORCED-PLASTIC GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.
- B. Position grating sections flat and square with ends bearing minimum 1-1/4 inches on supporting structure.
- C. Set grating set in concrete openings with embedded angle support frames having continuous integral anchor unless noted otherwise.
- D. Maximum Grating Clearances:
  - 1. 1/4-inches from vertical steel sections.
  - 2. 1/2-inches from concrete and masonry walls.
  - 3. 1/4-inches between sections and at ends.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 06741

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07001	..... Waterproofing, Damp-Proofing, and Caulking (Filed Sub-Bid Required)
07131	..... Self-Adhering Sheet Waterproofing (Waterproofing, Damp-Proofing, and Caulking Filed Sub-Bid Required)
07210	..... Thermal Insulation
07243	..... Water-Drainage Exterior Insulation And Finish System (EIFs)
07440	..... Concrete Faced Insulated Panels
07620	..... Sheet Metal Flashing and Trim
07841	..... Penetration Firestopping
07920	..... Joint Sealants (Waterproofing, Damp-Proofing, and Caulking Filed Sub-Bid Required)

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SECTION 07001

WATERPROOFING, DAMP PROOFING, AND CAULKING  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 07001 – WATERPROOFING, DAMP PROOFING, AND CAULKING

2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.

3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.

C. Sub-Sub-Bid Requirements: None required under this Section.

D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-16, A-17, A-18, A-19, A-20, A-21, A-22, A-23, A-24, A-25, A-26, A-27, A-28, S-1, S-2, S-8, S-9, S-13, S-14, and S-15.

E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 07001 – Waterproofing, Damp Proofing, and Caulking and Section 07131 – Self-Adhering Sheet Waterproofing, and Section 07920 – Joint Sealants.

F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:

1. Division 1 – General Requirements

G. Alternates: Not Applicable.

END OF SECTION 07001

## SECTION 07131

### SELF-ADHERING SHEET WATERPROOFING (Part of Filed Sub-Bid Section 07001 – WATERPROOFING, DAMP-PROOFING, AND CAULKING – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Modified bituminous sheet waterproofing.
2. Blindside sheet waterproofing.
3. Molded-sheet drainage panels.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 03300 “Cast-in-Place Concrete” for concrete surfaces to receive self-adhering and blindside sheet waterproofing.
4. Section 07210 “Thermal Insulation” for perimeter insulation installed with sheet waterproofing.
5. Section 07440 “Concrete Faced Insulated Panels” for concrete faced perimeter insulation installed with sheet waterproofing.
6. Section 07920 "Joint Sealants" for joint-sealant materials and installation.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.



- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- D. Samples: For the following products:
  - 1. 12-by-12-inch square of waterproofing and flashing sheet.
  - 2. 4-by-4-inch square of drainage panel.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- G. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials, including molded sheet drainage panels, through one source from a single manufacturer.
- C. Mockups: Before beginning installation, install waterproofing to 100 sq. ft. of wall to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality.
  - 1. If Engineer determines mockups do not comply with requirements, reapply waterproofing until mockups are approved.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## 1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
  - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
  - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Installer Warranty: Written warranty, signed by Installer, agreeing to repair or replace materials installed according to manufacturer's written recommendations that fail in performance, materials, or workmanship within specified warranty period.
  - 1. Warranty Period (Leak Free): Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Not less than 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with federal requirements controlling the use of volatile organic compounds (VOC).

1. Products: Subject to compliance with requirements, provide one of the following:
  - i. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
  - ii. GCP Applied Technologies; Bituthene 4000.
  - iii. Henry Company; Blueskin WP 200.
  - iv. Meadows, W. R., Inc.; SealTight Mel-Rol.
2. Physical Properties:
  - i. Tensile Strength: 325 psi minimum; ASTM D 412, Die C, modified.
  - ii. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
  - iii. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
  - iv. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
  - v. Puncture Resistance: 50 lbf minimum; ASTM E 154.
  - vi. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
  - vii. Water Absorption: 0.10 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
  - viii. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

## 2.2 BLINDSIDE SHEET WATERPROOFING

A. Bonded HDPE for Blindside Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of an HDPE film coated with pressure-sensitive adhesive and protective release liner, total 46-mil thickness, with the following physical properties:

1. Products: Subject to compliance with requirements, provide one of the following:
  - i. Carlisle Coatings & Waterproofing Inc.; CCW MiraPly-H.
  - ii. GCP Applied Technologies; Preprufe 300.
  - iii. Henry Company; Blueskin PreSeal 435.
  - iii. Meadows, W.R., Inc.; SealTight Precon.
2. Tensile Strength, Film: 4000 psi minimum; ASTM D 412.
3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
4. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.
5. Lap Adhesion: 8 lbf/in. minimum; ASTM D 1876, modified.
6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
7. Puncture Resistance: 200 lbf minimum; ASTM E 154.

8. Water Vapor Permeance: 0.01 perms maximum; ASTM E 96/E 96M, Water Method.

## 2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  1. Furnish liquid-type auxiliary materials that comply with Commonwealth of Massachusetts VOC limits.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
  1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
  2. Detail Strips: 62.5-mil- thick, felt-reinforced self-adhesive strip, 9 inches wide, with release film on adhesive side.
- H. Protection Course: Unfaced, fan-folded, extruded-polystyrene board insulation, nominal thickness 1/4 inch with compressive strength of not less than 8 psi per ASTM D 1621.

## 2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft.

1. Products: Subject to compliance with requirements, provide one of the following:
  - i. Carlisle Coatings & Waterproofing Inc.; CCW MiraDrain 6200.
  - ii. GCP Applied Technologies; Hydroduct 220.
  - iii. Henry Company; Henry DB 220.
  - iv. Meadows, W. R., Inc.; Mel-Drain 5035.
2. Drainage Core: Three-dimensional, nonbiodegradable, molded-plastic-sheet material designed to effectively conduct water to foundation drainage system under maximum soil pressures.
  - i. Minimum Compressive Strength: 15,000 psi when tested according to ASTM D-1621.
  - ii. Maximum Flow Rate: 16 gpm/foot at 1 hydraulic gradient and 3,600 psf normal pressure when tested according to ASTM D 4716.
  - iii. Film Backing: Plastic, protective-film, backing sheet attached to surface facing building wall.
3. Filter Fabric: Nonwoven geotextile fabric of polypropylene (PP) or polyester fibers, or combination of both.
  - i. Weight: 4.0 oz./sq. yd., per ASTM D3776.
  - ii. Water Flow Rate: 150 gpm/sq.ft. minimum, per ASTM D4491.
  - iii. Grab Tensile Strength: 80 lbs. minimum, per ASTM D4632.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
  1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  3. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
  - 1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
  - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
    - i. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

### 3.3 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.

- F. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- H. Install protection course with butted joints over waterproofing membrane immediately.
  - 1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

### 3.4 BLINDSIDE SHEET WATERPROOFING INSTALLATION

- A. Install bonded blindside sheet waterproofing according to manufacturer's written instructions.
- B. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.
- C. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- D. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- E. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.”

### 3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation before installing drainage panels.

### 3.6 INSULATION INSTALLATION

- A. Install concrete faced insulation as specified in Section 07440 “Concrete Faced Insulated Panels.”
- B. Install perimeter wall insulation as specified in Section 07210 “Thermal Insulation.”
- C. Install one layer of board insulation over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.
- D. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.

### 3.7 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Engineer.

### 3.8 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Do not leave waterproofing membrane exposed to direct sunlight longer than 14 days.
- C. Protect waterproofing from damage and wear during remainder of construction period.
- D. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- E. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- F. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

### 3.9 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07131



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## SECTION 07210

### THERMAL INSULATION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Perimeter wall insulation (supporting backfill).
  - 2. Mineral wool insulation.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Division 2 Sections for backfilling.
  - 4. Section 03300 “Cast-in-Place Concrete” for concrete foundations.
  - 5. Section 07131 “Self-Adhering Sheet Waterproofing.”
  - 6. Section 07440 “Concrete Faced Insulated Panels.”

##### 1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

##### 1.4 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
- C. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- D. Low-emitting product certification.

- E. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- F. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation (Perimeter Wall): ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Products: Subject to compliance with requirements, provide one of the following:
  - i. Dow Chemical Company; Styrofoam Brand Square Edge.
  - ii. GreenGuard; XPS Type IV.
  - iii. Owens Corning; Foamular 250.
2. Type IV, 1.60 lb/cu. ft.
3. Thermal Resistance: 5 year aged R-values of 5.4 and 5.0 minimum, at 40 deg. F and 75 deg. F respectively.
4. Compressive Strength: ASTM D1621, 25 psi.
5. Water absorption: ASTM C272, 0.3% by volume maximum.

### 2.2 MINERAL-WOOL BLANKET INSULATION (THERMAL)

A. Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Johns Manville; MinWool Sound Attenuation Fire Batts (SAFB).
2. Rockwool; COMFORTBATT.
3. Thermafiber; SAFB.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. R-Value: Minimum 3.7 per inch.
2. Nominal density of 2.5 lb/cu. ft minimum.
3. Thickness: As indicated, not less than 3- inches.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF PERIMETER INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
  - 1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.
- B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- C. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

### 3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07210

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## SECTION 07243

### WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. Section includes:

- 1. Water-drainage exterior insulation and finish system (EIFS) applied over air/vapor barrier over concrete.

- B. Related Sections:

- 1. Division 0 – Bidding and Contract Requirements.
- 2. Division 1 – General Requirements.
- 3. Division 2 Sections for backfilling.
- 4. Section 03300 “Cast-in-Place Concrete” for concrete foundations.
- 5. Section 07440 “Concrete Faced Insulated Panels.”
- 6. Section 07620 “Sheet Metal Flashing and Trim.”

##### 1.3 SYSTEM DESCRIPTION

- A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
- B. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

##### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.



## 1.5 ACTION SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type and component of EIFS indicated.
- C. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
  - 1. Include similar Samples of joint sealants involving color selection.
- E. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including a typical control joint filled with sealant of color selected, and each aesthetic reveal.
  - 1. Include exposed trim and accessory Samples to verify color selected.
  - 2. Include sealants Samples to verify color selected.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by manufacturers certifying that EIFS and joint sealants comply with requirements.
- C. Material or Product Certificates: For each insulation and joint sealant, from manufacturer.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each water-/weather-resistive barrier, insulation, reinforcing mesh, joint sealant, and coating.
- E. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Evaluation Reports: For fasteners, water-resistive coating, adhesive membrane flashing, and EIFS (including insulation).

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
- B. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
  - 2. Full-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with UBC Standard 26-4 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
  - 3. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
  - 4. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
  - 5. Potential Heat: Acceptable level when tested according to NFPA 259.
  - 6. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.
  - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

#### 1.10 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

#### 1.11 COORDINATION

- A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and drainage plane that is behind water-drainage EIFS.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.
- B. Basis of Design Product: Subject to compliance with requirements, provide **Sto Corp.; StoTherm ci XPS Classic** or comparable product by one of the following:
  1. Dryvit Systems, Inc.; Outsulation Plus MD System
  2. Senergy; Degussa Wall Systems, Inc.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with the following:
  1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
  2. Weathertightness: Resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in

deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.

B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:

1. Abrasion Resistance: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.
2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per ASTM E 2485.
3. Accelerated Weathering: Five samples per ICC-ES AC235 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 154 or ASTM G 155.
4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per ASTM E 2485.
5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3273.
6. Salt-Spray Resistance: No deleterious affects when tested according to ASTM B 117.
7. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ASTM C 297 / E 2134.
8. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch-thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 2.86 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per ASTM E 331.
9. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
10. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per ASTM E 2486; and meeting or exceeding the following:
  - a. High Impact Resistance: 90 to 150 inch-lb.
11. Drainage: According to ASTM E 2273 and ICC-ES AC235.
12. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC235 when tested per ASTM E 330.

## 2.3 MATERIALS

- A. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
- B. Primer/Sealer: EIFS manufacturer's standard substrate conditioner with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
- C. Primary Air / Vapor Barrier Material: Ready-mixed flexible spray or roller applied air and moisture barrier material.
- D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate; with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and complying with one of the following:
  - 1. Product: Subject to compliance with requirements, provide the following, or equal:
    - a. **Sto Corp.; Sto BTS Plus.**
  - 2. Factory-blended dry formulation of Portland cement, dry polymer admixture, and fillers specified for base coat.
- E. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- F. Extruded-Polystyrene Board Insulation: ASTM C 578.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Chemical Company; Styrofoam Panel Core 20.
    - b. Owens Corning; Foamular CI-C.
  - 2. Type X, 15 psi minimum.
  - 3. Thermal Resistance: 5 year aged R-values of 5.4 and 5.0 minimum, at 40 deg. F and 75 deg. F respectively.
  - 4. Compressive Strength: ASTM D1621, 16 psi.
  - 5. Water absorption: ASTM C272, 0.3% by volume maximum.
  - 6. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.

7. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
  8. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated but not more than 6-inches thick or less than thickness allowed by ASTM C 1397.
  9. Board Insulation Closure Blocks: EIFS manufacturer's standard density, size, and configuration.
- G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
  2. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
  3. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
  4. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
- H. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
  2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
- I. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- J. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
  2. Texture: As selected by Engineer from manufacturer's full range.
  3. Color: As selected by Engineer from manufacturer's full range.
- K. Water: Potable.
- L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
5. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

## 2.4 ELASTOMERIC SEALANTS

- A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Section 07 92 00 "Joint Sealants" for products corresponding to description indicated below:
  1. Single-component, nonsag, neutral-curing silicone sealant.
- B. Sealant Color: As selected by Engineer from manufacturer's full range.

## 2.5 MIXING

- A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.
- B. Examine flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Begin coating application only after surfaces are dry.
  - 2. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

### 3.3 EIFS INSTALLATION, GENERAL

- A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

### 3.4 SUBSTRATE PROTECTION APPLICATION

- A. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
  - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- B. Waterproof Adhesive/Base Coat: Apply over sloped surfaces, window sills, and surfaces within 24-inches of grade, to protect substrates from degradation.
- C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

### 3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.



1. Weep Screed/Track: Use at bottom termination edges, at window and door heads of water-drainage EIFS unless otherwise indicated.
2. Window Sill Flashing: Use at windows unless otherwise indicated.
3. Expansion Joint: Use where indicated on Drawings.
4. Casing Bead: Use at other locations.

### 3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
1. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
  2. Apply adhesive to ridges on back of insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.
  3. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
  4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
  5. Apply insulation over drainage mat and dry substrates in courses with long edges of boards oriented horizontally.
  6. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
  7. Begin first course of insulation from a level base line and work upward.
  8. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
  9. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings, and not less than 4 inches from aesthetic reveals.
    - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
  10. Place insulation with adhesive strips and channels, slots, or waves aligned in the vertical position for drainage. Align drainage channels, slots, or waves with channels, slots, or waves in insulation boards above and below.
  11. Interlock ends at internal and external corners.
  12. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
  13. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.

14. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch.
15. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
16. Interrupt insulation for expansion joints where indicated.
17. Install insulation closure blocks using ribbon-and-dab method to create air zones where indicated.
18. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
19. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
20. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
21. Treat exposed edges of insulation as follows:
  - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
  - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
  - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
22. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-/weather-resistive barrier.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.

### 3.7 BASE-COAT INSTALLATION

A. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

- B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
  - 1. High-impact reinforcing mesh: Install at all locations.
  
- C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
  - 1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
  - 2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

### 3.8 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
  
- B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

### 3.9 INSTALLATION OF JOINT SEALANTS

- A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Section 07920 "Joint Sealants" and in ASTM C 1481.
  - 1. Apply joint sealants after base coat has cured but before applying finish coat.
  - 2. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
  - 3. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
  - 4. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
  - 5. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
  - 6. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

3.10 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

3.11 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07243

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## SECTION 07440

### CONCRETE FACED INSULATED PANELS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Concrete faced insulated perimeter wall panels (exterior, below/at grade foundation).
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 03300 “Cast-in-Place Concrete.”
  - 4. Section 07131 “Self-Adhering Sheet Waterproofing.”
  - 5. Section 07210 “Thermal Insulation” for below grade insulation supporting backfill.
  - 6. Section 07620 “Sheet Metal Flashing and Trim” for formed stainless steel counterflashing associated with concrete faced insulated wall panels.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- C. Evaluation Reports: For following products, from ICC-ES:
  - 1. Concrete faced insulated panels.
- D. Special Warranty: Sample of special warranties included in this Section.

## 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.
- B. Installer Qualifications: Company approved by manufacturer of concrete insulated panels for the installation of specified product within a minimum of five (5) years of exterior sheathing application experience.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- C. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of concrete faced insulated panel system that fail due to manufacturing defects within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONCRETE FACED INSULATED WALL PANELS

- A. Concrete Faced Insulated Wall Panels: Extruded polystyrene board to ASTM C 578 Type IV, rigid, closed cell, with integral high density skin, c/w integral 5/16 inch thick latex-modified concrete facing.
1. Basis of Design Product: Subject to compliance with requirements, provide the following, or equal:
    - i. T. Clear Corporation; WallGUARD.
  2. Cement Board Thickness: 5/16 inch.
  3. Insulation Thickness: 3- inches.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively:
1. Type IV, 1.60 lb/cu. ft.
  2. Thermal Resistance: 5 year aged R-value of 5.0 minimum, at 75 deg. F.
  3. Compressive Strength: ASTM D 1621, 40 psi.
  4. Water absorption: Maximum 0.7 percent by volume, tested ASTM D2842.
  5. Water vapor permeance: 0.8, tested to ASTM E96/E96M.
  6. Coefficient of lineal thermal Expansion:  $3.5 \times 10^{-5}$  inches per inch x degree F, tested to ASTM D696.
- C. Clips and Fasteners: Corrosion-resistant type, sized to suit application; as supplied by insulation manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.



- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 INSTALLATION OF CONCRETE FACED INSULATED PANELS

- A. Open and inspect panels for irregularities prior to installation. Notify manufacturer in writing of defective materials.
- B. Install in accordance with manufacturers written guidelines for concrete application.
- C. Fasten sheathing to substrate using manufacturers recommended screws, adhesive and other accessories.
- D. Layout concrete-faced insulation boards to maximize board sizes. Do not use boards less than 6 inches wide.
- E. Install concrete-faced insulation board system in orientation as indicated or to maximize full sheets. Complete with fastening clips and cap flashing in accordance with manufacturer's installation guidelines.

### 3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07440

## SECTION 07620

### SHEET METAL FLASHING AND TRIM

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. The work covered under this Section of the Specifications includes the following:

- 1. Formed Products:

- i. Formed stainless steel counterflashing at concrete face insulated panels.

- 2. All hoisting and scaffolding necessary for the completion of the work.

- 3. Waste disposal.

- B. Related Sections:

- 1. Section 06105 "Miscellaneous Rough Carpentry" for wood blocking.

- 2. Section 07440 "Concrete Faced Insulated Panels."

- 3. Section 13120 "Metal Building Systems" for insulated metal wall panels and trim for openings.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

- 1. Identification of material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  4. Details of termination points and assemblies, including fixed points.
  5. Details of special conditions.
  6. Details of connections to adjoining work.
  7. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.
- D. Fabrication Samples: For copings and roof edge flashings made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.
- E. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
  2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
  3. Accessories and Miscellaneous Materials: Full-size Sample.
- G. Qualification Data: For qualified fabricator.
- H. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- I. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject

to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical flashing, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
  2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
  3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Engineer, Owner's Representative, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
  2. Review methods and procedures related to sheet metal flashing and trim.
  3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
  4. Review special roof details, roof drainage, roof penetrations, and condition of other construction that will affect sheet metal flashing.
  5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## 1.6 COORDINATION

- A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

## 1.7 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## PART 2 - PRODUCTS

### 2.1 SHEET METALS

- A. Stainless Steel Sheet: ASTM A240 / A240M, Type 316, dead soft, fully annealed, with smooth, flat surface.
  - 1. Finish: 2D (dull, cold rolled).

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

- i. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
  - ii. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

### 2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

## 2.4 WALL SHEET METAL FABRICATIONS

- A. Wall Sheet Metal Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Form with 2-inch-high, end dams where flashing is discontinuous. Fabricate from the following materials:
  - 1. Stainless Steel Sheet, 24 gauge.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  5. Install sealant tape where indicated.
  6. Torch cutting of sheet metal flashing and trim is not permitted.
  7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

### 3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate



installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

### 3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

### 3.6 WASTE DISPOSAL

- A. Unless otherwise indicated, excess materials are Contractor's property. At completion of roofing work, remove from Project site.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07620

## SECTION 07841

### PENETRATION FIRESTOPPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Penetrations in fire-resistance-rated walls, including opening penetrations.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 03300 “Cast-in-Place Concrete.”
  - 4. Section 04810 “Unit Masonry.”
  - 5. Division 15 – Mechanical.
  - 6. Division 16 – Electrical.

- C. Work of this Section includes:

- 1. Plumbing Subcontractor: Penetrations of all new fire barriers, smoke barriers, and fire resistant rated floor and roof assemblies for plumbing and vent piping related to plumbing and natural gas systems.
  - 2. HVAC Subcontractor: Penetrations of all new fire barriers, smoke barriers, and fire resistant rated floor and roof assemblies for piping and ductwork related to HVAC systems.
  - 3. Electrical Subcontractor and Sub-Subcontractors: Penetrations of all new fire barriers, smoke barriers, and fire resistant rated floor and roof assemblies for electrical conduit, cables, and cable trays related to electrical, security and technology systems.
  - 4. General Contractor: Penetrations of all new and existing fire barriers, smoke barriers, and fire resistant rated floor and roof assemblies for all other Work.

### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
  - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
  - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
  - 3. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests is to be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- E. Qualification Data: For Installer.
- F. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- G. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

H. Safety Data Sheets.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    - i. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    - ii. Classification markings on penetration firestopping correspond to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01040 "Project Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

## 1.7 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Do not use products and materials that contain flammable solvents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application in the Through-Penetration Firestop System Schedule at the end of Part 3 that are produced by one of the following manufacturers:
  - 1. Hilti, Inc.
  - 2. 3M; Fire Protection Products Division.
  - 3. Tremco; Tremstop Fire Protection Systems Group.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

- B. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
  - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
  - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

### 2.3 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
  - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G 21.

- F. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
    - i. Slag-/rock-wool-fiber insulation.
    - ii. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - iii. Fire-rated form board.
    - iv. Fillers for sealants.
  2. Temporary forming materials.
  3. Substrate primers.
  4. Collars.
  5. Steel sleeves.

## 2.4 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials required in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic or plastic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Pillows/Bags/Blocks: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
  - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
  - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

## 2.5 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:



1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

### 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems, and on both sides of partition, so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
1. The words "WARNING - PENETRATION FIRESTOPPING SYSTEM - DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE."
  2. Contractor's name, address, and phone number.
  3. Through-penetration firestop system designation of applicable testing and inspecting agency.
  4. Date of installation.
  5. Through-penetration firestop system manufacturer's name.
  6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
1. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

### 3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Firestop Systems with No Penetrating Items.
  - 1. Available UL-Classified Systems: C-AJ-001-0999.
- C. Firestop Systems for Metallic Pipes, Conduit or Tubing:
  - 1. Available UL-Classified Systems: C-AJ-1001-1999 and W-L-1001-1999.
- D. Firestop Systems for Nonmetallic Pipe, Conduit or Tubing:
  - 1. Available UL-Classified Systems: C-AJ-2001-2999 and W-L-2001-2999.
- E. Firestop Systems for Electrical Cables:
  - 1. Available UL-Classified Systems: C-AJ-3001-3999 and W-L-3001-3999.
- F. Firestop Systems for Cable Trays:
  - 1. Available UL-Classified Systems: C-AJ-4001-4999 and W-L-3001-3999.
- G. Firestop Systems for Insulated Pipes:
  - 1. Available UL-Classified Systems: C-AJ-5001-5999 and W-L-5001-5999.
- H. Firestop Systems for Miscellaneous Electrical Penetrants (Busducts):
  - 1. Available UL-Classified Systems: C-AJ-6001-6999 and W-L-6001-6999.
- I. Firestop Systems for Miscellaneous Mechanical Penetrants (Ductwork):
  - 1. Available UL-Classified Systems: C-AJ-7001-7999 and W-L-7001-7999.
- J. Firestop Systems for Groupings of Penetrants:
  - 1. Available UL-Classified Systems: C-AJ-8001-8999 and W-L-8001-8999.

3.8 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07841

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## SECTION 07920

### JOINT SEALANTS

(Part of Filed Sub-Bid Section 07001 – WATERPROOFING, DAMP-PROOFING,  
AND CAULKING – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Silicone joint sealants.
- 2. Pourable polyurethane sealants at horizontal traffic surfaces.
- 3. Preformed foam joint sealants.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements.
- 2. Division 1 – General Requirements.
- 3. Section 07243 “Water Drainage Exterior Insulation and Finish System (EIFS)” for joint sealants furnished and installed as part of EIFS system.
- 4. Section 08413 “Aluminum-Framed Entrances and Storefronts” for joint sealants furnished and installed as part of aluminum-framed installations.
- 5. Section 08513 “Aluminum Windows” for joint sealants furnished and installed as part of aluminum window installations.
- 6. Section 08950 “Fiberglass-Sandwich-Panel Assemblies” for joint sealants furnished and installed as part of fiberglass-sandwich-panel assembly installations.
- 7. Section 13120 “Metal Building Systems” for joint sealants furnished and installed as part of the metal building system.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: For each joint-sealant product indicated.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.
- F. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- J. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- K. Warranties: Special warranties specified in this Section.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
  - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
  - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
  - 2. Each type of sealant and joint substrate indicated.
- E. Preinstallation Conference: Conduct conference at Project site.

## 1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.



1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

#### 1.7 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period for Urethane: Five years from date of Substantial Completion.
  2. Warranty Period for Silicone: 20 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Colors of Exposed Joint Sealants: As selected by Engineer from manufacturer's full range.

### 2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
  1. Basis of Design Product: Subject to compliance with requirements, provide **Tremco; Spectrem 2** or one of the following:
    - i. Dow Corning Corporation; 795.
    - ii. Pecora Corporation; 864.

### 2.3 POURABLE POLYURETHANE JOINT SEALANTS

- A. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.
  1. Basis of Design Product: Subject to compliance with requirements, provide **Tremco; THC-900** or one of the following:
    - i. BASF Corporation-Construction Systems; MasterSeal SL 2.
    - ii. Pecora Corporation; Dynatrol II-SG.
    - iii. Sherwin Williams; Loxon 2K SL.

## 2.4 PREFORMED JOINT SEALANTS

- A. Preformed Foam Sealant: silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
1. Basis of Design Product – Single-Sided: Subject to compliance with requirements, provide **EMSEAL Joint Systems, Ltd.; SEISMIC COLORSEAL** or comparable product by one of the following:
    - i. MM Systems Corp.
    - ii. Joint Master/InPro Corporation.
  2. Basis of Design Product – Double-Sided: Subject to compliance with requirements, provide **EMSEAL Joint Systems, Ltd.; SEISMIC COLORSEAL-DS** or comparable product by one of the following:
    - i. MM Systems Corp.
    - ii. Joint Master/InPro Corporation.
  3. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
    - i. All products shall be certified in writing to be: a) capable of withstanding 150°F for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within 24 hours at room temperature 68°F.
    - ii. Density: Manufacturer's standard.
    - iii. Material shall be capable of movements of +50%, -50% (100% total) of nominal material size.
    - iv. Silicone external color facings to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating.
  4. Width: As indicated – verify in field.
  5. Fabrication: Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

6. Color: As selected by Engineer from manufacturer's full range.

## 2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - i. Concrete.
    - ii. Masonry.
    - iii. Unglazed surfaces of ceramic tile.
  3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - i. Metal.
    - ii. Glass.
    - iii. Porcelain enamel.
    - iv. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.
1. Apply a thin bead of sealant to the end of the silicone facing only.
  2. Peel off release paper to expose mounting adhesive on one face of material. Feed material into joint, working sequentially in one direction starting at the bottom of the joint. Recess 3/8-inch from wall surface.
  3. When material is fully expanded against both sides of the joint, install corner caulking bead where the sealant facing meets the substrate.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - i. Perimeter joints at frames of doors and louvers.
    - ii. Other joints as indicated.
  - 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
  - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors, for each material.
- B. Joint-Sealant Application: Interior nontraffic seismic joints.
  - 1. Joint Locations:
    - a. Seismic and expansion joints in interior joints as indicated.
  - 2. Preformed Joint Sealant: Preformed foam sealant.
  - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - i. Isolation joints in cast-in-place concrete slabs.
    - ii. Penetrations in cast-in-place concrete slabs on grade.
    - iii. Other joints as indicated.
  - 2. Urethane Joint Sealant: Multicomponent, pourable, traffic grade, Class 25.

3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors, for each material.
- D. Joint-Sealant Application: Interior joints in all other vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - i. Control and expansion joints on exposed interior surfaces of exterior walls.
    - ii. Perimeter joints of exterior openings where indicated.
    - iii. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
    - iv. Perimeter joints between interior wall surfaces and frames of interior doors.
    - v. Other joints as indicated.
  2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
  3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 07920



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DIVISION 8 – DOORS AND WINDOWS

08001	.....Metal Windows (Filed Sub-Bid Required)
08161	.....FRP Flush Doors (Metal Windows Filed Sub-Bid Required)
08331	.....Overhead Coiling Doors
08348	.....Floor Doors
08410	..... Aluminum-Framed Entrances (Metal Windows Filed Sub-Bid Required)
08513	..... Aluminum Windows (Metal Windows Filed Sub-Bid Required)
08710	.....Door Hardware (Metal Windows Filed Sub-Bid Required)
08800	..... Glazing (Metal Windows Filed Sub-Bid Required)
08950	..... Fiberglass-Sandwich-Panel Assemblies (Metal Windows Filed Sub-Bid Required)

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SECTION 08001

METAL WINDOWS  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
  - 1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 08001 – METAL WINDOWS

- 2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.
- 3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.
- C. Sub-Sub-Bid Requirements: None required under this Section.
- D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, A-1, A-2, A-3, A-5, A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-19, A-20, A-21, A-22, A-23, A-24, S-3, S-5, S-6, and S-16.
- E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:
  - 1. All work of: Section 08001 – Metal Windows, Section 08161 – FRP Flush Doors,

Section 08413 – Aluminum-Framed Entrances and Storefronts, Section 08513 – Aluminum Windows, Section 08710 – Door Hardware, Section 08800 – Glazing, and Section 08950 – Fiberglass-Sandwich-Panel Assemblies.

- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
- G. Alternates: Not Applicable.

END OF SECTION 08001

## SECTION 08161

### FRP FLUSH DOORS

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Fiberglass reinforced polyester (FRP) / aluminum hybrid flush doors, factory glazed and factory finished.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 08413 “Aluminum-Framed Entrances and Storefronts” for aluminum frames for FRP doors.
  - 4. Section 08710 "Door Hardware" for door hardware for FRP flush doors.
  - 5. Section 08800 “Glazing” for factory glazing of FRP flush doors.
  - 6. Division 16 Sections for electrical service and connections for powered operators, sensors, and accessories.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- C. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details.

3. Locations of reinforcement and preparations for hardware.

4. Details of accessories.

D. Other Submittals:

1. Schedule: Provide a schedule of FRP doors prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with Door Hardware Schedule.

E. Samples for Initial Selection: For units with factory-applied finishes.

1. Include similar Samples of seals, gaskets, and accessories involving color selection.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of FRP flush door.

G. Maintenance Data: For FRP flush doors to include in maintenance manuals.

H. Warranty: Special warranty included in this Section.

#### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain FRP flush doors from single source from single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Store materials under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

#### 1.6 PERFORMANCE REQUIREMENTS

A. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

B. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

- C. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.
- D. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.
- E. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.
- F. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.
- G. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.
- H. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of **0.37** BTU/hr x sf x degrees F. Minimum of 55 CRF value.
- I. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels, ASTM E 84:
  - 1. Flame Spread: Maximum of 25.
  - 2. Smoke Developed: Maximum of 450.
- J. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.
- K. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.
- L. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.
- M. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.
- N. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.
- O. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.
- P. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.
- Q. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.
- R. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.
- S. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.
- T. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.



- U. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

## 1.7 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace FRP flush doors that fail in materials or workmanship within specified warranty period.
  1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  2. Warranty Period: Ten years from date of Substantial Completion.
  3. Warranty Period: Limited lifetime for failure of corner joinery, core deterioration, delamination or bubbling of door skin.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated by **Special-Lite, Inc.** or comparable product by one of the following:
  1. CMI Architectural.
  2. Kawneer.

### 2.2 FRP FLUSH DOORS

- A. General: Provide doors of design indicated.
  1. Standard Door: Provide the following door type for non-rated exterior and interior doors:
    - i. Special-Lite, Inc.; SL-17.
  2. Fire Rated Door: Provide the following door type for fire rated interior doors:
    - i. Special-Lite, Inc.; SL-21.

B. Construction:

1. Door Thickness: 1-3/4 inches.
2. Stiles and Rails:
  - i. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
  - ii. Minimum 2-5/16" deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
  - iii. Screw or snap in place applied caps are not acceptable.
  - iv. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
  - v. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
  - vi. Meeting stiles to include integral pocket to accept pile brush weather seal.
3. Corners:
  - i. Mitered.
  - ii. Secured with 3/8" diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
  - iii. 1-1/4" x 1-1/4" x 3/16" 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
  - iv. Weld, glue, or other methods of corner joinery are not acceptable.
4. Fire Rated Doors: Provide Type 304 stainless steel door perimeter channel, 3/4-inch by 1-7/8- inch by 0.062-inch thickness.

C. Face Sheets: Fiberglass reinforced polyester (FRP) face sheets, 0.120-inch thickness, finish color throughout.

1. Protective coating: Abuse resistant engineered surface.
2. Texture: Pebble.
3. Color: As selected by Engineer from manufacturer's full range.

D. Cores:

1. Standard: Poured in place polyurethane foam, with R-value 9 and density of 5 pcf.
2. Fire Rated: WSCP-412 proprietary mineral core, 1-1/2-inch thickness, 18 pcf minimum density.
  - i. Rating: As indicated.

- E. Cutouts: Factory install vision lites in manufactured cutouts.
- F. Hardware: Furnished by Section 08710 "Door Hardware."
  - 1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
  - 2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
  - 3. Factory install hinges, exit devices, locksets and door plates furnished by Section 08710 "Door Hardware."
    - i. Manufacturer to color match hinges to door.
    - ii. Remainder of hardware including closers, thresholds and weatherstripping field installed by Section 08710 "Door Hardware."
- G. Hardware, Fire Rated: Furnished by Section 08710 "Door Hardware."
  - 1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
  - 2. Field apply factory supplied gaskets and seals, full width intumescent and smoke seal required at top of door, smoke seals required on both jambs.
  - 3. Factory install hinges, exit devices, locksets and door plates furnished by Section 08710 "Door Hardware."
    - i. Manufacturer to color match hinges to door.
    - ii. Remainder of hardware including closers, thresholds and weatherstripping field installed by Section 08710 "Door Hardware."

## 2.3 HARDWARE

- A. Entrance Door Hardware: For hardware other than that furnished by this Section, as specified in Division 08 Section "Door Hardware" and in the hardware sets included in the Door and Hardware Schedule.
- B. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Concealed adjustable bottom brush. Install door manufacturer's multidirectional adjustable bottom with double nylon brush weatherstripping. Door bottom must be concealed and adjust to accommodate irregular tapered floor conditions.
  - 2. Concealed adjustable meeting stile astragal. Install door manufacturer's adjustable astragal with double pile and weather seal weatherstripping.

## 2.4 FABRICATION

- A. Fabricate doors to be rigid and free of defects, warp, or buckle.
- B. Hardware Preparation: Factory prepare doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 and ANSI/NAAMM-HMMA 861.
  - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation for hardware.
  - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

### 3.2 PREPARATION

- A. Drill and tap doors to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install FRP doors plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. FRP Flush Doors: Fit doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Doors:

- i. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
  - ii. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
  - iii. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
  - iv. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80, and the following:
  - i. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
  - ii. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
  - iii. Between Bottom of Door and Top of noncombustible Threshold: Maximum 3/8 inch.
  - iv. Between Bottom of Door and Top of noncombustible Finish Floor (No Threshold): Maximum 3/4 inch.
  - v. Between Bottom of Door and all other Finish Floor Coverings: Maximum 1/2 inch.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work.
- B. Clean doors promptly after installation in accordance with manufacturer's instructions. Do not use harsh cleaning materials or methods that could damage finish.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08161

## SECTION 08331

### OVERHEAD COILING DOORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Vertical coiling insulated service doors, including frame, guides, counterbalance system, hardware, perimeter weatherstripping, electric operator, chain operator, safety devices, and push-button control station.
  - 2. Factory-applied powder coat finish.
  - 3. All appurtenances and accessories.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 13120 “Metal Building Systems” for exterior opening framing and trim.
  - 4. Division 16 Sections for electrical service and connections for powered operators and accessories.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
  - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
  - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

3. Include description of automatic closing device and testing and resetting instructions.
- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Show locations of replaceable fusible links.
  3. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
1. Include similar Samples of accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Curtain Slats: 12 inches long.
  2. Bottom Bar: 6 inches long, with sensor edge.
- F. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Summary of forces and loads on walls and jambs.
- G. Qualification Data: For qualified Installer.
- H. Warranty: Special warranty specified in this Section.
- I. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 1.5 WARRANTY

- A. Special Warranty for Overhead Coiling Doors: Manufacturer's standard form in which manufacturer agrees to repair or replace components of overhead coiling doors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Doors: Two years from date of Substantial Completion.
  - 2. Warranty Period for Finish: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
  - 1. Obtain operators and controls from overhead coiling-door manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
  - 1. Design Wind Load: Determine loads based on Components and Cladding Wind Pressure Chart on Structural Drawings, and in accordance with the Massachusetts State Building Code.
  - 2. Testing: According to ASTM E 330.
  - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
  - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- B. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

### 2.3 INSULATED SERVICE DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide **McKeon; ClimateGuard IS3000 Series** or one of the following:



- i. Cornell Iron Works, Inc.; Model ESD20.
  - ii. Overhead Door Corporation; 625 Series.
  - iii. Raynor; DuraCoil Standard.
- B. Operation Cycles: Not less than 20,000.
  1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.
- D. Curtain R-Value: 8.7 deg F x h x sq. ft./Btu. (not less than 7.7).
- E. Door Curtain Material: Galvanized steel.
- F. Door Curtain Slats: Flat profile slats with cross section not less than 3" wide by 1-7/16" deep.
- G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- H. Hood: Galvanized steel.
  1. Shape: Square.
  2. Mounting: Face of wall.
- I. Electric Door Operator:
  1. Usage Classification: Light duty, up to 10 cycles per hour.
  2. Operator Location: Top of hood.
  3. Motor Exposure: Interior.
  4. Emergency Manual Operation: Push-up type.
  5. Obstruction Detection Device: Automatic photoelectric sensor and electric sensor edge on bottom bar; self-monitoring type.
    - i. Sensor Edge Bulb Color: As selected by Engineer from manufacturer's full range.
  6. Remote-Control Station: Interior.
- J. Door Finish:
  1. Powder-Coated Finish: Custom premium powder coat color to match color as selected by Engineer.

2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

## 2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 20 gauge and as required to meet requirements.
  2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
  3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
  4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.
- B. Bottom Bar for Service Doors: Consisting of two angles, each not less than 2 by 2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel to match curtain slats and finish.
- C. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- D. Guides: Each guide assembly shall be fabricated of a minimum 3" x 3" steel support angle, a 3" x 4" inner guide angle and a 4" x 4" outer guide angle. Provide neoprene weather seals extending the full height of both guides.
- E. Mounting Brackets: Fabricated of hot rolled 3/16" steel plate minimum, brackets shall be provided to house ends of the counterbalance barrel assembly.

## 2.5 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: 22 gauge, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

## 2.6 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
  1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
  2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

## 2.7 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

## 2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit,

solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
  2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location: Operator location indicated for each door.
1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets.
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
1. Electrical Characteristics:
    - i. Phase: Single phase.
    - ii. Volts: 115 V.
    - iii. Hertz: 60.
  2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
  3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
  4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
  5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening.
1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

- i. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation with chain hoist. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

## 2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness. Custom color as selected by Engineer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.

- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

### 3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

### 3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train (minimum two hours on site) Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08331

## SECTION 08348

### FLOOR DOORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Floodtight floor hatches for flush-mounted installation in cast-in-place concrete floor slabs and curbs.
  - 2. Safety accessories associated with floor hatches.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 03300 "Cast-in-Place Concrete."
  - 4. Section 05500 "Metal Fabrications" for metal ladders associated with floor doors.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product.
  - 1. Include construction details, materials, individual components and profiles, and finishes.
- C. Shop Drawings: Show fabrication and installation details for floor doors. Show layouts of accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- D. Product Schedule: For floor doors. Use same designations indicated on Drawings.
- E. Warranty: Special warranty specified in this Section.

## 1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which floor door manufacturer agrees to repair or replace parts which fail to function in normal use within the warranty period. Materials shall be free of defects in material and workmanship for specified period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ALUMINUM FLOOR DOORS

A. Angle Frame, Floodtight Aluminum Floor Door:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Acudor Products, Inc; Model AW-APS** or a comparable product by one of the following:
  - i. U.S.F. Fabrications, Inc.
  - ii. Babcock-Davis.
  - iii. Bilco Company (The).
  - iv. Nystrom, Inc.
2. Size: As indicated in drawings; custom sizes where required.
3. Frame: Mill finish aluminum, angle profile, 3/8" thick, with 3/16" x 1-1/2" strap anchors welded around the frame for casting into concrete.
4. Door: Single leaf; 1/4-inch-thick, reinforced diamond-pattern mill-finish aluminum plate.
5. Loading Capacity: 1560-lbf/sq. ft. live load.
6. Gasket: 9/16" OD x 1/8"ID, EPDM gasket.
7. Hardware:
  - i. Material and Finish: Type 316 stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and brackets, hinges, pins, and fasteners.
  - ii. Hinges: Heavy-duty butt hinges with stainless steel pins.
  - iii. Operating Mechanism: Adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with vinyl grip that allows for one-handed closure.
  - iv. Latch: Stainless steel floodtight cam locks and flush floodtight handle.

B. Safety Accessories: Safety net.



- C. Ladder-Assist Post: Floor-hatch manufacturer's standard device for attachment to access ladder.
  - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
  - 2. Height: 42 inches above finished roof deck.
  - 3. Material: Steel tube.
  - 4. Post: 1-5/8-inch- diameter pipe.
  - 5. Finish: Manufacturer's standard baked enamel or powder coat.

## 2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.3 FABRICATION

- A. General: Provide floor doors manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure floor doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder locks, furnish two keys per lock and key all locks alike.
- E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that comes in contact with concrete.

## 2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor doors.
- B. Verify locations in the field with Engineer.

### 3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

### 3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

### 3.5 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08348

## SECTION 08410

### ALUMINUM-FRAMED ENTRANCES

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. Section Includes:

- 1. Aluminum storefront framing.
- 2. Composite insulated metal panels.
- 3. All joint sealants associated with aluminum-framed entrances and storefront assembly and installation.

- B. Related Sections:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 04810 “Unit Masonry” for masonry openings receiving aluminum frames.
- 4. Section 06105 “Miscellaneous Rough Carpentry” for wood blocking installed with aluminum entrances.
- 5. Section 07920 "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
- 6. Section 08161 “FRP Flush Doors” for FRP doors to be installed in aluminum framing system.
- 7. Section 08710 "Door Hardware" for hardware to the extent not specified in this Section.
- 8. Section 08800 "Glazing" for glazing requirements to the extent not specified in this Section.

- C. The work of this Section includes, but is not limited to the following:

- 1. Furnish and install aluminum door frames.
- 2. Furnish and install FRP doors in aluminum door frames.
- 3. Furnish and install mineral wool insulation infill at mullions and frames.

### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
  - a. Deflection exceeding specified limits.
  - b. Thermal stresses transferring to building structure.
  - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
  - d. Glazing-to-glazing contact.
  - e. Noise or vibration created by wind and by thermal and structural movements.
  - f. Loosening or weakening of fasteners, attachments, and other components.
  - g. Sealant failure.
  - h. Failure of operating units.

- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the Commonwealth of Massachusetts, using performance requirements and design criteria indicated.

- C. Structural Loads:

1. Wind Loads: Provide entrance systems capable of withstanding indicated wind-load design pressures calculated using a “design wind pressure” as determined from the Massachusetts State Building Code, and as confirmed by the Fabricator’s design engineer.
  - a. Basic Wind Speed: 141 mph.
  - b. Risk Category: IV.
  - c. Exposure Category: C.
2. Seismic Loads: Provide entrance systems capable of withstanding the effects of earthquake motions calculated according to the Massachusetts State Building Code, as determined by the Fabricator’s design engineer.

- D. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch and clearance between members and operable units directly below them to less than 1/16 inch.
- E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
  2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
- I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 55 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.30 Btu/sq. ft. x h x deg F when tested according to AAMA 1503, and glazed with 1-inch insulated glass units.

## 1.5 ACTION SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
  - 1. Include project specific plans, elevations, sections, details, and attachments to other Work, and not solely manufacturer's standard details.
- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
  - 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
    - a. Indicate coordination of security door contacts with security system requirements.
      - 1) Do not prepare doors and frames without an approved security systems shop drawing and sample of the Contract.
- D. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of aluminum-framed systems.
  - 2. Include design calculations.
- E. Samples for Initial Selection: For units with factory-applied color finishes.
- F. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- C. Preconstruction Test Reports: For sealant.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- E. Warranties: Sample of special warranties.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
  - 1. Do not revise intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If revisions are proposed, submit comprehensive explanatory data to Engineer for review.
- D. Accessible Entrances: Comply with applicable provisions in the 2010 ADA Standards and AAB.
- E. Source Limitations for Aluminum-Framed Systems: Obtain aluminum-framed entrances from a single source from a single manufacturer.

- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical wall area as directed by the Engineer.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Adhesive or cohesive sealant failures.
    - e. Water leakage through fixed glazing and framing areas.
    - f. Failure of operating components.
  - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
  - 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special Project Warranty: Submit Installer's warranty, signed by Installer, covering Work of this Section, including all installation components of aluminum windows for the following warranty period:
  - 1. Warranty Period: Two years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 EXTERIOR FRAMING

- A. Basis of Design Product: Subject to compliance with requirements, provide **Special-Lite; SL-600TB** or one of the following:
1. EFCO; Series 406X.
  2. Kawneer; Trifab VG 601UT.
  3. Oldcastle Building Envelope; Series 6000 MultiPlane.
- B. Framing Members: Manufacturer's standard extruded-aluminum framing members, minimum wall thickness of 0.125", and reinforced as required to support imposed loads.
1. Construction: Thermally improved.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
  4. Depth of Frame: 6".
  5. Face of Frame: 2".
  6. Bottom Rail: Height as indicated on Drawings.
  7. Surface applied door stops: 0.625 inch by 1.75 inch with replaceable weatherstripping.

### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

### 2.3 FRAMING SYSTEMS, GENERAL

- A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads to install hardware only, finished to match framing system.
- C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

## 2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

## 2.5 INSULATED METAL PANELS

- A. Composite Insulated Metal Panels: Prefinished ASTM B209 aluminum sheets over a corrugated polyallomer (CPA) stabilizers on both faces with an insulating foam core.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide **Mapes Architectural Panels; Mapes-R+** or comparable product by one of the following:
    - a. Citadel Architectural Products, Inc.; GlazeGuard 1000 WR.
    - b. Laminators, Inc.; Thermolite (with ISO core).
  - 2. Total Thickness: 3 inches, with 1-inch glazing pocket depth.
  - 3. Overall Panel Thickness: As indicated on Drawings.
  - 4. Interior and Exterior Substrate: Corelite (HDPE).
  - 5. Interior and Exterior Skin: Aluminum.
    - a. Thickness: 0.021 inch.
    - b. Finish: Matching framing system.

- c. Texture: Smooth.
- 6. Thermal Insulation Core: Manufacturer's standard polystyrene core.
  - a. U-Value: 0.11 or 0.24 maximum.
- 7. Surface-Burning Characteristics: Class A when tested according to ASTM E 84 as follows:
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
- 8. Color: Custom to match aluminum framing.

## 2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: For hardware other than that furnished by this Section, as specified in Section 08710 "Door Hardware" and in the hardware sets included in the Door and Hardware Schedule.
- B. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
  - 2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- C. Silencers: BHMA A156.16, Grade 1.

## 2.7 ACCESSORY MATERIALS

- A. Sealant: For sealants required within fabricated assemblies, provide storefront manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.
- B. Exterior and Interior Joint Sealants: Comply with Section 07920 "Joint Sealants."
- C. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

## 2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  - 4. Physical and thermal isolation of glazing from framing members.
  - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 6. Provisions for field replacement of glazing from exterior.
  - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
  - 1. At exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes. Coordinate finish hardware installation to prevent interruption to door stops or gasketing.
- H. Prepare doors and frames to receive security systems hardware in accordance with final security systems shop drawings and templates provided by security systems hardware supplier.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.9 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color: Custom to match aluminum windows.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

### 3.2 INSTALLATION

#### A. General:

- 1. Comply with manufacturer's written instructions.
- 2. Do not install damaged components.
- 3. Fit joints to produce hairline joints free of burrs and distortion.
- 4. Rigidly secure nonmovement joints.
- 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
- 6. Seal joints watertight unless otherwise indicated.

#### B. Metal Protection:

- 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
- 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

#### D. Set continuous sill members and flashing in full sealant bed as specified in Section 07920 "Joint Sealants" to produce weathertight installation.

#### E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

#### F. Furnish and install glazing as specified in Section 08800 "Glazing."

#### G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

- 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
- 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

- H. Furnish and install perimeter joint sealants as specified in Section 07920 "Joint Sealants", to produce weathertight installation.

### 3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
  - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
  - 2. Alignment:
    - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

### 3.4 FIELD QUALITY CONTROL

- A. Field testing to be performed by a third party testing agent retained by the Contractor.
  - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed framing shall take place as follows:
  - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by the Owner's Commissioning Agent shall be tested according to AAMA 501.2 and AAMA 501 and shall not evidence water penetration. See also Section 019113.
    - a. No water penetration is permitted.
  - 2. Testing Extent: Test entrances and storefronts as selected by the Commissioning Agent and a qualified independent testing and inspecting agency. Entrances and storefronts shall be tested immediately after complete installation.
  - 3. Test Reports: Shall be prepared according to AAMA 501.
- C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
  - 1. For entrance doors indicated to be accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.
- B. Clean aluminum surfaces immediately after installing aluminum-framed systems. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean glass immediately after installation. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect aluminum framed surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact surfaces, remove contaminants immediately according to manufacturer's written recommendations.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08410

## SECTION 08513

### ALUMINUM WINDOWS

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Fixed and operable aluminum-framed windows for exterior locations.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements

- 2. Division 1 – General Requirements

- 3. Section 07920 "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.

- 4. Section 08800 "Glazing" for glazing requirements for aluminum windows.

- 5. Section 13120 "Metal Building Systems" for exterior opening framing and trim.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

- C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

- 1. Mullion details, including reinforcement and stiffeners.

- 2. Joinery details.

- 3. Expansion provisions.



4. Flashing and drainage details.
  5. Weather-stripping details.
  6. Thermal-break details.
  7. Glazing details.
  8. Window cleaning provisions.
  9. For installed products indicated to comply with design loads, include structural analysis data prepared by or under the supervision of a qualified professional engineer licensed in the Commonwealth of Massachusetts detailing fabrication and assembly of aluminum windows and used to determine the following:
    - i. Structural test pressures and design pressures from wind loads indicated, and the Massachusetts State Building Code.
    - ii. Deflection limitations of glass framing systems.
  10. Provide verification on Shop Drawings that manufacturer has reviewed and approved submitted details.
  11. Confirm that performance ratings and warranties apply with this installation.
- D. Delegated-Design Submittal: For aluminum windows indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Samples for Initial Selection: For units with factory-applied color finishes.
1. Include similar Samples of hardware and accessories involving color selection.
- F. Samples for Verification: For aluminum windows and components required, prepared on Samples of size indicated below.
1. Main Framing Member: 12-inch- long, full-size sections of extrusions with factory-applied color finish.
- G. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- H. Qualification Data: For Installer, professional engineer and testing agency.
- I. Field quality-control test reports.
- J. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

K. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

L. Warranty: Special warranty specified in this Section.

#### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

#### 1.5 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

1. AW: Architectural.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

## 1.6 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance, not less than 4'-0" x 6'-0".
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the Commonwealth of Massachusetts, using performance requirements and design criteria indicated.
- C. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
    - i. Exposure Category: Exposure C.
    - ii. Risk Category: III.
    - iii. Basic Wind Speed: 141 mph.
  2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
- D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of data for aluminum windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
  - C. Source Limitations for Aluminum-Framed Systems: Obtain aluminum windows from a single source from a single manufacturer.
  - D. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
    1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.
  - E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
    1. Build mockup of typical wall area as directed by Engineer
      - i. Include one full size window unit of each operating type with typical flashing installed at head, jamb and sill; insulation, and interior trim.
    2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
    3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - F. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  - G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- i. Failure to meet performance requirements.
    - ii. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
    - iii. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
    - iv. Failure of insulating glass.
    - v. Failure due to air leakage and water infiltration.

- 2. Warranty Period:

- i. Window System: 10 years from date of Substantial Completion.
    - ii. Glazing: 10 years from date of Substantial Completion.
    - iii. Metal Finish: 20 years from date of Substantial Completion.

- B. Special Project Warranty: Submit Installer's warranty, signed by Installer, covering Work of this Section, including all installation components of aluminum windows for the following warranty period:

- 1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **EFCO Corporation; XTherm Series 325X** or one of the following:

- 1. Kawneer; OptiQ AA 4325 Series.
  - 2. Oldcastle Building Envelope; Signature Series 3375.

## 2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
  - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
  - 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
  - 1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
- F. Replaceable Weather Seals: Comply with AAMA 701/702.
- G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

## 2.3 ALUMINUM WINDOWS

- A. Operation: Fixed and Project-In (hopper).
- B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.

1. Minimum Performance Class and Grade (Fixed): AW-PG150-AP.
  2. Minimum Performance Class and Grade (Projected): AW-PG120-AP.
- C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of not less than 68 for frame and 50 for glass.
- D. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F for fixed fenestration and 0.32 Btu/sq. ft. x h x deg F for operable fenestration.
1. Refer to Section 088000 "Glazing" for insulated glass units. Provide basis of design insulated glass units indicated or comparable units to provide fixed and operable aluminum windows with maximum U-values indicated to comply with 2021 IECC.
- E. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.33 for all orientations.
- F. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283.
1. Maximum Rate: 0.10 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. for fixed and projected units.
- G. Water Resistance: No water leakage when tested in accordance with ASTM E 331/ASTM E 547.
1. Test Pressure: 15 percent of positive design pressure, but not less than 12 lbf/sq. ft.

## 2.4 GLAZING

- A. Glass and Glazing Materials: Comply with Section 08800 "Glazing" for insulated glass units and glazing requirements applicable to glazed aluminum window units.

## 2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze.
- B. Project-In Hardware:
1. Operating hardware shall be 4-bar stainless steel arms or equal.
  2. Concealed multi-point locking with a turn handle.

- i. Handle Color: As selected by Engineer from manufacturer's full range.
- 3. Weatherstrip: Santoprene.
- 4. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; one pole operator and pole hanger per room that has operable windows more than 72 inches above floor.
  - i. Provide spring latching hardware.
- C. Sill Cap/Track: Extruded-aluminum track with natural anodized finish, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
- D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

## 2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on outside of window and provide for each operable exterior sash or ventilator, unless otherwise indicated on interior side.
  - 1. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  - 1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
  - 2. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch wall thickness.
  - 3. Finish: Match aluminum window members.
- C. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch- diameter, manufacturer's standard coated aluminum wire.
  - 1. Wire-Fabric Finish: Charcoal gray.



## 2.7 ACCESSORIES

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Caulk Stops: Extruded-aluminum caulk stops in configurations indicated on Drawings.
- C. Interior Trim: Continuous extruded-aluminum clips and snap trim in configurations indicated on Drawings.

## 2.8 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
  - 1. Construction: Thermally broken.
  - 2. Depth of Frame: Not less than 3-1/4", not greater than 3-1/2".
- B. Framing and Sash Members: Manufacturer's standard extruded-aluminum framing members, wall thickness of not less than 0.065", and reinforced as required to support imposed loads.
  - 1. Frame Components: Mechanically fastened.
  - 2. Operable Window:
    - i. All vent extrusions shall be tubular.
    - ii. Each corner shall be mitered, reinforced with an extruded corner key, hydraulically crimped, and "cold welded" with epoxy adhesive.
    - iii. Each vent shall utilize two rows of weather stripping installed in specifically designed dovetail grooves in the extrusion. The exterior gasket will be omitted at the vent bottom rail for project-out vents and at the vent top rail for project-in vents, allowing air to pressure equalize the void between the vents and frame.
    - iv. The vent shall present a flush appearance with the exterior and interior of the main frame when in the closed position.
- C. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- D. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  - 1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

- i. Thermal barrier: Insulbar or equal, consisting of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
  - ii. Poured and debridged urethane thermal barriers are not permitted.
- 2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
- 3. Mechanical fasteners, welded components, and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and vent corners.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
- G. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- H. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- I. Factory-Glazed Fabrication: Glaze aluminum windows in the factory. Comply with requirements in Section 08800 "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
- J. Glazing Stops: Provide snap-on glazing stops coordinated with Section 08800 "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance

of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color: As selected by Engineer from manufacturer's full range, excluding micas and metallics.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
  - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
  - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
  - 1. Install windows from the exterior.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction. Seal all joints in panning system.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Furnish and install perimeter joint sealants specified in Section 07920 "Joint Sealants", to produce weathertight installation.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor to engage a qualified third-party testing agency to perform tests and inspections and prepare test reports.
  - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
  - 2. Testing to be coordinated with and witnessed by Engineer, Owner's Project Manager, and Owner's Commissioning Agent.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum windows.
  - 1. Testing Methodology:
    - i. Air Infiltration: ASTM E 783; test pressure 6.24 psf with maximum allowable infiltration rate of 0.1 cfm per square foot of window frame.
    - ii. Water Penetration Resistance: ASTM E 1105, Procedure A; test pressure 12 psf.
  - 2. Testing Extent: Test aluminum windows as selected by the Engineer or Owner's Commissioning Agent. Aluminum windows shall be tested immediately after complete installation.
- C. Remove and replace noncomplying aluminum windows and retest as specified above.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08513

## SECTION 08710

### DOOR HARDWARE

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Commercial door hardware for swinging doors.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 06105 “Miscellaneous Rough Carpentry.”
  - 4. Section 08161 “FRP Flush Doors.”
  - 5. Section 08413 “Aluminum-Framed Entrances.”
  - 6. Division 16 – Electrical.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
  - 1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after

final check of operation, be incorporated into the Work, within limitations of keying requirements.

- D. Qualification Data: For Architectural Hardware Consultant.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks, and closers.
- F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include the following:
  - 1. Final hardware schedule, as-built.
  - 2. Keying schedule.
  - 3. Product cut sheets for each item installed.
  - 4. Parts list and numbers for each item installed.
  - 5. Maintenance information for each item installed.
  - 6. Name, address and phone number of local representative of each item installed.
- G. Warranty: Special warranty specified in this Section.
- H. Other Action Submittals:
  - 1. Door Hardware Sets: Prepared by or under the supervision of the Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - i. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - ii. Content: Include the following information:
      - a. Identification number, location, hand, fire rating, and material of each door and frame.
      - b. Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
      - c. Complete designations of every item required for each door or opening including name and manufacturer.
      - d. Fastenings and other pertinent information.
      - e. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      - f. Explanation of abbreviations, symbols, and codes contained in schedule.
      - g. Mounting locations for door hardware.
      - h. Door and frame sizes and materials.

- i. List of related door devices specified in other Sections for each door and frame.
  - j. Name, address and phone number of local representative of each item installed.
- iii. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant and following Keying Conference, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
- 1. Installer's responsibilities include supplying and installing door hardware, and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
  - 2. Installer shall have warehousing facilities in Project's vicinity.
  - 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Regulatory Requirements: Comply with applicable provisions in 2010 ADA Standards and the Massachusetts Architectural Access Board (AAB).
- 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
  - 2. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.



3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- E. Keying Conference: Conduct conference at Project site. In addition to Owner, Engineer, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  2. Preliminary key system schematic diagram.
  3. Requirements for key control system.
  4. Address for delivery of keys.
- F. Preinstallation Conference: Conduct conference at Project site. In addition to Owner, Engineer, Contractor, and Architect, a representative of each major hardware category shall be present to instruct installers on the proper installation and adjustment of door hardware. Review methods and procedures related to installation of door hardware including, but not limited to, the following:
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Review required testing, inspecting, and certifying procedures.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
  1. Each item to be individually packaged in manufacturer's original container.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

#### 1.6 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- i. Structural failures including excessive deflection, cracking, or breakage.
- ii. Faulty operation of operators and door hardware.
- iii. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion, except as follows:

- i. Exit Devices: Three years from date of Substantial Completion.
- ii. Manual Closers: 10 years from date of Substantial Completion.
- iii. Hinges: Lifetime.

## 1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish two complete sets of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware. Furnish two extra fasteners of each type and finish installed.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule, and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

## 2.2 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by **Hager-Companies; Hager-Roton** or one of the following:
    - i. Bommer Industries, Inc.
    - ii. McKinney Products Company; an ASSA ABLOY Group company.
    - iii. Pemko Manufacturing Co.
    - iv. Select Products Limited.
  - 2. Grade: 1-150.
  - 3. Type: Fully concealed.

## 2.3 MECHANICAL LOCKS AND LATCHES

- A. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1, Series 1000, heavy-duty.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **Schlage; an Allegion Company; L Series L9010** or comparable product by one of the following:
    - i. Corbin Russwin Architectural Hardware, an ASSA ABLOY Group company; Series ML2000.
    - ii. SARGENT Manufacturing Company, an ASSA ABLOY Group company; Series 8200.
- B. Lock Functions: As indicated in door hardware schedule.
- C. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  - 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
- D. Lock Backset: 2-3/4 inches.
- E. Lock Trim:
  - 1. Levers: Solid brass, bronze or stainless steel; cast or forged and through-bolted with a 2-piece spindle.

- i. Provide tactile warning at hazardous locations.
  2. Escutcheons (Roses): Wrought.
  3. Dummy Trim: Match lever lock trim and escutcheons.
  4. Lever Design: #07.
  5. Finish: Satin stainless steel.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  2. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

## 2.4 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices: BHMA A156.3, Grade 1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Von Duprin; an Allegion Company; 99 Series**, or comparable product by one of the following:
    - i. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company; 5000 Series.
    - ii. SARGENT Manufacturing Company; an ASSA ABLOY Group company; 80 Series.
- B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- C. Rim Exit Devices: Grade 1.
1. Type: 1, rim.
  2. Actuating Bar: Push pad.
  3. Material: Satin chrome.
- D. Mortise Exit Devices: Grade 1.
1. Type: 3, mortice.
  2. Actuating Bar: Push pad.

3. Material: Satin chrome.
- E. Exit Device Outside Trim: Lever with cylinder.
1. Match design for lock trim, Lever Design #07; solid stainless steel; cast or forged and through-bolted with a 2-piece spindle; satin stainless steel finish
  2. Push Pad: Extend push pad a minimum of one-half of the door width. Provide flush mounted end cap with two-point attachment to the door.
  3. Provide the following for each device:
    - i. Nylon bearings and stainless steel springs.
    - ii. Security dead latching feature.
    - iii. Spacers as required for flush mounting of mechanism case.
  4. Provide all non-fire-rated exit devices with hex key dogging.
- F. Electrified Exit Device Options (as scheduled) – Types and functions indicated as follows:
1. Electric Strike: One standard and one electric strike with disconnect for wiring harness at top of mullion.
  2. Power Supplies: Furnished by Door Hardware Supplier, installed by the Electrical Contractor.

## 2.5 LOCK CYLINDERS

- A. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical; permanent cores that are removable; face finished to match lockset.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  1. Number of Pins: Six (confirm with Owner).
  2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
    - i. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders, employing "restricted keyway."

D. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 12 construction temporary change keys and 2 temporary core control keys.

- a. Owner will replace construction cores with permanent cores.

E. Manufacturer: Same manufacturer as for locks and latches.

## 2.6 KEYING

- A. Keying System (by Owner): Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. Existing System: Grand master key locks to Owner's standard system.

B. Keys (by Owner): Nickel silver.

1. Quantity: In addition to one extra key blank for each lock, provide the following:
  - i. Cylinder Change Keys: Three.
  - ii. Master Keys: Five.
  - iii. Grand Master Keys: Five.
  - iv. Great-Grand Master Keys: Five.

## 2.7 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide **LCN Closers; an Allegion Company; 4000 Series Cush-N-Stop** or one of the following:
  - i. Norton Door Controls; an ASSA ABLOY Group company; PR7500/PR7700.
  - ii. SARGENT Manufacturing Company; an ASSA ABLOY Group company; 351 Series.

- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

- C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- D. Surface Closer with Cover: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  - 1. Mounting: Heavy-duty, parallel arm, unless otherwise indicated.
  - 2. Type: Hold-open arm (unless otherwise noted), heavy-duty.
  - 3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
  - 4. Provide all drop plate brackets, shims and angle brackets as required to complete installation of closers on doors and frames.
  - 5. Cover Material: Steel.
  - 6. Finish: Powder coat, color selected from manufacturer's full standard range.

## 2.8 OVERHEAD HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **Allegion plc; Glynn Johnson Model 79H** or a comparable product by one of the following:
    - i. DORMA USA, Inc.
    - ii. Hager Companies.
- B. Overhead Surface-Mounted Rod Holders: Type 8; Grade 1; hold open and release by push and pull of door unless roller cam is set in inactive position; with stop, shock absorber, and adjustable spring tension; for single-acting doors opening 110 degrees.

## 2.9 FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - i. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
    - ii. Allegion.
    - iii. Burns Manufacturing Incorporated.
- B. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch- diameter, spring-tension plunger.

## 2.10 MECHANICAL STOPS AND HOLDERS

- A. Wall Bumpers: Grade 1; brass base metal with rubber bumper; 2-1/2-inch diameter, minimum 3/4-inch projection from wall; with backplate for concealed fastener installation.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide **IVES Hardware; an Allegion company; Model WS401CVX** or comparable product by one of the following:
    - i. Burns Manufacturing Incorporated.
    - ii. Hager Companies.
    - iii. Rockwood Manufacturing Company.
  - 2. Bumper Configuration: Convex.
  - 3. Finish: As selected by Engineer.

## 2.11 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
  - 1. Products: Subject to compliance with requirements, provide products indicated by **Pemko Manufacturing Co.** or one of the following:
    - i. Reese Enterprises.
    - ii. Zero International.
- B. General: Provide continuous weather-strip gasketing on exterior doors and interior doors where indicated. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  - 2. Door Bottoms: Apply to bottom of door, forming seal with threshold or floor when door is closed.
- C. Rigid, Housed, Perimeter Gasketing: Sponge silicone gasket material held in place by aluminum housing; fastened to frame stop with stainless steel screws.
  - 1. Product: Subject to compliance with requirements, provide one of the following:
    - i. Pemko Manufacturing Co.; Model 305\_S.
  - 2. Finish: Clear anodized.



D. Door Sweeps: Black nylon brush gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.

1. Product: Subject to compliance with requirements, provide one of the following:
  - i. Pemko Manufacturing Co.; Model 18100\_NB.
2. Gasket Material: Nylon brush.
3. Housing Material: Aluminum.
4. Finish: Clear anodized.

## 2.12 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis of Design Product: Subject to compliance with requirements, provide **Pemko Manufacturing Co.; Model 252x5AFG** or a comparable product by one of the following:
  - i. Hager Companies.
  - ii. National Guard Products.
  - iii. Reese Enterprises.

B. Saddle Thresholds:

1. Type: Fluted top.
2. Base Metal: Aluminum, thermally broken.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

## 2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Engineer.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws

according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.14 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings, and in accordance with the Massachusetts State Building Code, the 2010 ADA Standards and the Architectural Access Board.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as indicated in keying schedule.
  - 2. Furnish permanent cores to Owner for installation.
- E. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

### 3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for

final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

### 3.8 DOOR HARDWARE SETS

- A. Set #1 – Exterior [01, 03]
  1. Continuous Hinge.
  2. Rim Exit Device (99L-NL x 996L-NL).
  3. Cylinder (exit device exterior trim).
  4. Closer w/ hold open.
  5. Perimeter Gasketing.
  6. Door Bottom Sweep.
  7. Threshold.
- B. Set #2 – Exterior, pair [00]
  1. Continuous Hinge (2).
  2. Mortise Exit Device (9975L-NL x 996L-NL).

3. Cylinder (exit device exterior trim).
4. Closer w/ hold open.
5. Overhead Holder.
6. Flush Bolts (top & bottom).
7. Perimeter Gasketing (2).
8. Split Astragal Seals.
9. Door Bottom Sweep (2).
10. Threshold.

C. Set #3 – Interior [02]

1. Continuous Hinge.
2. Rim Exit Device (99L-BE x 996L-BE).
3. Closer w/ hold open.
4. Perimeter Gasketing.
5. Door Bottom Sweep.
6. Threshold.

D. Set #4 – Interior [07]

1. Continuous Hinge.
2. Rim Exit Device (99L x 996L).
3. Cylinder (exit device exterior trim).
4. Closer.
5. Perimeter Gasketing.
6. Door Bottom Sweep.
7. Wall Stop.

E. Set #5 – Interior [04, 05, 09]

1. Continuous Hinge.
2. Lock Set (L9070).

3. Cylinder.
4. Closer w/ hold open.
5. Perimeter Gasketing.
6. Door Bottom Sweep.
7. Wall Stop.

F. Set #6 – Interior [06]

1. Continuous Hinge.
2. Lock Set (L9440).
3. Closer w/ hold open.
4. Perimeter Gasketing.
5. Door Bottom Sweep.
6. Wall Stop.

G. Set #7 – Interior (90 minute rated) [08]

1. Continuous Hinge.
2. Lock Set (L9070).
3. Cylinder.
4. Closer.
5. Perimeter Gasketing.
6. Door Bottom Sweep.
7. Wall Stop.

### 3.9 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08710

## SECTION 08800

### GLAZING

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Insulated glass for factory-glazed FRP door lites.
- 2. Insulated glass for factory-glazed aluminum windows.
- 3. Insulated glass for installation in fixed thermally-broken aluminum-framed entrances.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 08161 “FRP Flush Doors” for factory glazing FRP flush doors.
- 4. Section 08410 “Aluminum-Framed Entrances and Storefronts” for installing glazing in thermally-broken aluminum-framed entrances and for insulated metal panels.
- 5. Section 08513 “Aluminum Windows” for factory glazing fixed aluminum windows.

##### 1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

## 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - i. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads", and the Massachusetts State Building Code.
      - a. Basic Wind Speed: 141 mph.
    - ii. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      - a. Load Duration: 3 seconds or less.
    - iii. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
  - 1. Center-of-Glass Values: Based on using LBL-35298 WINDOW 5.2 computer program for the following methodologies:
    - i. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
    - ii. Solar Heat Gain Coefficient: NFRC 200.
    - iii. Solar Optical Properties: NFRC 300.



## 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
  5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

## 1.6 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each glass product and glazing material indicated.
- C. Samples: For the following products, in the form of 12-inch- square Samples for glass.
1. Insulating glass for each designation indicated.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.

- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
  - 1. Insulating glass.
  - 2. Glazing sealants.
- I. Warranties: Special warranties specified in this Section.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
  - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

## 1.10 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

### 2.2 INSULATING GLASS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated by **Guardian Glass** or comparable products by one of the following:

1. Viracon, Inc.
2. Vitro Architectural.

B. Provide the following Low-E coatings as indicated for insulated units in Part 3:

1. Basis-of-Design Products: Subject to compliance with requirements, provide the following:
  - i. Low-E1: Guardian Glass; SunGuard SNX 62/27.
  - ii. Low-E2: Guardian Glass; SunGuard IS 20 Interior Surface LE on the #4 surface.

C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
2. Sealing System: Dual seal, with primary and secondary sealants as follows:
  - i. Polyisobutylene and silicone.
3. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
  - i. Spacer Material: Aluminum with bronze, color anodic finish.
  - ii. Desiccant: Molecular sieve or silica gel, or blend of both.
  - iii. Corner Construction: Manufacturer's standard corner construction.

## 2.3 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
  1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of Exposed Glazing Sealants: As selected by Engineer from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - i. Dow Corning Corporation; 795.
    - ii. GE Advanced Materials - Silicones; SilPruf SCS2000.
    - iii. Pecora Corporation; 895.
    - iv. Tremco Incorporated; Spectrem 2.
  2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 50.
  4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
  - i. Use O Glazing Substrates: Coated glass and aluminum coated with a high-performance coating.

## 2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  1. AAMA 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
  1. Type 1, for glazing applications in which tape acts as the primary sealant.
  2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.



- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.7 INSULATING-GLASS TYPES

#### A. **Glass Type A: Double Glazed.**

1. Overall Unit Thickness: 1-inch.
2. Thickness of Indoor and Outdoor Lites: 6.0 mm.
3. Interspace Content: Argon.
4. Outdoor Lite: Clear fully tempered float glass.
5. Indoor Lite: Clear fully tempered glass.
6. Low-E1 Coating: Sputtered on second surface.
7. Low-E2 Coating: Sputtered on fourth surface.
8. Visible Light Transmittance: 60 percent minimum.
9. Winter Nighttime U-Factor: 0.20 maximum.
10. Solar Heat Gain Coefficient: 0.25 maximum.
11. Outdoor Visible Reflectance: 11 percent maximum.
12. Provide safety glazing labeling.

#### B. **Glass Type B: Triple Glazed.**

1. Overall Unit Thickness: 1-11/16-inches (1-3/4 inches maximum).
2. Thickness of Each Lite: 6.0 mm.
3. Interspace Content: Argon.
4. Outdoor, Interior, and Indoor Lites: Clear fully tempered float glass.
5. Low-E1 Coating: Sputtered on second surface.
6. Low-E2 Coating: Sputtered on fourth surface.
7. Visible Light Transmittance: 41 percent minimum.
8. Winter Nighttime U-Factor: 0.12 maximum.
9. Solar Heat Gain Coefficient: 0.20 maximum.
10. Outdoor Visible Reflectance: 13 percent maximum.
11. Provide safety glazing labeling.

### 3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08800

## SECTION 08950

### FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

(Part of Filed Sub-Bid Section 08001 – METAL WINDOWS – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems for wall assemblies as follows:

1. Structural aluminum box beam superstructure.
2. Factory prefabricated structural insulated translucent sandwich panels.
3. Aluminum installation system.
4. Flexible flashing.
5. Furnish and install all sealants and related materials associated with fiberglass sandwich panel assembly installations.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Section 13120 “Metal Building Systems” for exterior opening framing and trim.

##### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 Section "Quality Assurance," to design fiberglass-sandwich-panel assemblies.
- B. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
  2. Thermal movements.
  3. Movements of supporting structure.
  4. Dimensional tolerances of building frame and other adjacent construction.
- C. Failure includes the following:
1. Deflection exceeding specified limits.
  2. Water leakage.
  3. Thermal stresses transferred to building structure.
  4. Noise or vibration created by wind and thermal and structural movements.
  5. Loosening or weakening of fasteners, attachments, and other components.
  6. Delamination of fiberglass-sandwich-panel faces from panel cores.
- D. Structural Loads:
1. Design Loads: In accordance with the Massachusetts State Building Code and minimum design wind loads for components and cladding indicated on Structural Drawings.
  2. Design fiberglass sandwich panel assemblies to accommodate lateral building drift and differential foundation settlement as indicated on Structural Drawings.
  3. Seismic Loads: In accordance with the requirements of the Massachusetts State Building Code.
  4. Load Combinations: Calculate according to the Massachusetts State Building Code.
- E. Deflection of Assemblies:
1. Vertical Assemblies: Limited to 1/60 of clear span for each assembly component.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 1.5 PERFORMANCE TESTING

- A. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
- B. Structural-Performance Test: ASTM E 330.
  - 1. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- C. Air-Infiltration Test: ASTM E 283.
  - 1. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft.
  - 2. Maximum Air Leakage: 0.01 cfm/sq. ft.
- D. Test for Water Penetration under Static Pressure: ASTM E 331.
  - 1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
  - 2. Water Leakage: None.
- E. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
  - 1. Wall Assemblies:
    - i. Thermal Transmittance (U-Factor) for Walls: Fixed glazing and framing areas shall have U-factor of not more than **0.23** Btu/sq. ft. x h x deg F as determined according to NFRC 100.
    - ii. Solar-Heat-Gain Coefficient for Walls: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than **0.30** as determined according to NFRC 200.
    - iii. Visible Light Transmittance: minimum 13 percent, maximum 20 percent.
  - 2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.01 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

3. Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

## 1.6 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.
- C. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For fiberglass-sandwich-panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural engineer responsible for their preparation.
- E. Samples for Initial Selection: For units with factory-applied color finishes.
- F. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
  1. Sandwich panels: 14" x 28" units
  2. Factory finished aluminum: 5" long sections
- G. Fabrication Sample: Of each frame system intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
  1. Joinery.
  2. Anchorage.
  3. Expansion provisions.
  4. Fiberglass sandwich panels.
  5. Flashing and drainage.
- H. Qualification Data: For qualified Installer, manufacturer and testing agency.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.
- J. Preconstruction Testing Program: For assemblies, developed specifically for Project. Include plans, elevations, sections, and details of laboratory mockup.
- K. Maintenance Data: For assemblies to include in maintenance manuals.

- L. Field quality-control test reports.
- M. Warranties: Special warranties specified in this Section.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.
- B. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."
- C. Professional Structural Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the Commonwealth of Massachusetts and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations that are similar to those indicated for this Project in material, design, and extent.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
  - 1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.
- E. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.
- F. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- G. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
- H. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."

- I. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  1. Build mockup of typical assembly area as directed by Engineer.
  2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

## 1.9 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - i. Structural failures including, but not limited to, excessive deflection.
    - ii. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - iii. Water leakage.
  2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
  1. Defects include, but are not limited to, the following:
    - i. Fiberbloom.
    - ii. Delamination of coating, if any, from exterior face sheet.
    - iii. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
    - iv. Delamination of panel face sheets from panel cores.
  2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
  1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
  2. Warranty Period: 10 years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Kalwall Corporation; Translucent Wall System** or a comparable product by the following:
1. CPI Daylighting; Insulated Translucent Wall-Lights.
  2. Major Industries; Guardian 275.

### 2.2 ALUMINUM FRAME SYSTEMS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermal strut; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance.
- C. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.060 inch thick.
- D. Frame-System Gaskets: Manufacturer's standard.
- E. Frame-System Sealants: As recommended in writing by manufacturer.
1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
  2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- G. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- H. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- I. Frame System Fabrication:
1. Fabricate components before finishing.
  2. Fabricate components that, when assembled, have the following characteristics:
    - i. Profiles that are sharp, straight, and free of defects or deformations.
    - ii. Accurately fitted joints with ends coped or mitered.
    - iii. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
  3. Fabricate sill closures with weep holes and for installation as continuous component.
  4. Reinforce components as required to receive fastener threads.
  5. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

## 2.3 FIBERGLASS SANDWICH PANELS

- A. Panel Construction: Flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
- B. Translucent Face Sheets: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use. Face sheets shall not deform, deflect, or drip when subjected to fire or flame. Thermoplastic (polycarbonate or acrylic) faces are not acceptable.
1. Face-Sheet, Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
  2. Face-Sheet Burning Extent: 1 inch or less per ASTM D 635.
  3. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
  4. Interior Face-Sheet, Flame-Spread Index: Not more than 50 per ASTM E 84.

C. Panel Thickness: 4 inches.

D. Panel Strength Characteristics:

1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested according to ASTM E 72 at 34 lbf/ sq. ft., with a maximum 0.090-inch set deflection after 5 minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk according to ASTM E 661.

E. Grid Core:

1. I-Beam Construction: Thermally broken composite I-beam grid core shall be of 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16”.
2. I-beam Thermal break: Minimum 1”, thermoset fiberglass composite.
3. Grid Pattern: 12 x 24 Shoji.

F. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council “Acceptance Criteria for Sandwich Panel Adhesives”.
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
  - i. 50% Relative Humidity at 68° F: 540 PSI
  - ii. 182° F: 100 PSI
  - iii. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
  - iv. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

G. Exterior Face Sheet:

1. Thickness: 0.070 inch.
2. Color: Crystal.
3. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three

white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.

4. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
5. Erosion Protection: Integral, embedded-glass erosion barrier.

#### H. Interior Face Sheet:

1. Thickness: 0.045 inch.
2. Color: White.

#### I. Panel Fabrication: Factory assemble and seal panels.

1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
  - i. White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.
2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

### 2.4 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

### 2.5 SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
  1. Basis of Design Product: Subject to compliance with requirements, provide **Tremco; Spectrem 2** or one of the following:
    - i. Dow Corning Corporation; 795.
    - ii. Pecora Corporation; 864.

## 2.6 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
  - 1. Color: As selected by Engineer from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - 6. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
  - 7. Seal joints watertight, unless otherwise indicated.

- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
  - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
  - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner reserves the right to engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
  - 1. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
    - i. Test Procedures: Test under uniform static air pressure.
    - ii. Static-Air-Pressure Difference: As indicated.
    - iii. Water Penetration: None.
  - 2. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 08950

DIVISION 9 – FINISHES

09001	.....	Painting (Filed Sub-Bid Required)
09511	.....	Acoustical Panel Ceilings
09653	.....	Resilient Base
09671	.....	Resinous Flooring
09900	.....	Painting and Coatings (Painting Filed Sub-Bid Required)



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SECTION 09001

PAINTING  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 09001 – PAINTING

2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.

3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.

C. Sub-Sub-Bid Requirements: None required under this Section.

D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, C-4, C-6, C-7, CD-2, CD-5, A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-16, A-17, A-18, A-19, A-20, A-21, A-22, A-23, A-24, A-25, A-26, A-27, A-28, A-30, M-9, M-10, M-11, M-12, M-13, M-14, M-15, M-16, M-17, M-18, M-19, M-20, M-21, M-22, M-23, M-24, M-25, M-27, M-29, M-30, M-31, M-32, M-33, MD-1, MD-2, MD-3, MD-4, P-2, P-3, P-4, P-5, P-6, P-8, P-9, FP-2, FP-3, FP-4, FP-5, and FP-6.

E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 09001 – Painting and Section – 09900 Painting and Coatings.
- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
  2. Division 2 – Site Work
  3. Division 3 – Concrete
  4. Division 4 – Masonry
  5. Division 5 – Metals
  6. Division 6 – Wood and Plastics
  7. Division 7 – Thermal and Moisture Protection
  8. Division 8 – Doors and Windows
  9. Division 9 – Finishes
  10. Division 11 – Equipment
  11. Division 15 – Mechanical
- G. Alternates: Not Applicable.

END OF SECTION 09001

## SECTION 09511

### ACOUSTICAL PANEL CEILINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Acoustical panels and exposed suspension systems for ceilings.
  - 2. Acoustical joint sealants.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.

##### 1.3 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

##### 1.4 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension system members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

4. Minimum Drawing Scale: 1/8 inch = 1 foot.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
    1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
    2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
  - E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
  - F. Research/Evaluation Reports: For each acoustical panel ceiling and components.
  - G. Maintenance Data: For finishes to include in maintenance manuals.
  - H. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01040 "Project Coordination."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## 1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and partition assemblies.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Panels: Full-size panels equal to 10 percent of quantity installed, for each ceiling panel type.
  - 2. Suspension System Components: Quantity of each exposed component equal to 10 percent of quantity installed, for each suspension system type.

## 1.10 WARRANTY

- A. Special Warranty for Acoustical Panel Ceilings and Suspension Systems: Manufacturer's standard form in which manufacturer agrees to replace acoustical panel ceilings and suspension systems that fail in materials or workmanship within specified warranty period.
  - 1. Failure of ceiling panels includes sagging and warping, and growth of mold, mildew and stain causing bacteria.
  - 2. Failure of suspension systems includes rusting.
  - 3. Warranty does not cover damages that may occur from vibrations, fire, water, freezing temperatures, accident or any form of abuse or exposure to abnormal conditions.
  - 4. Warranty Period: 30 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the Massachusetts State Building Code.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2. Smoke-Developed Index: 450 or less.

## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- C. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated by **Armstrong World Industries, Inc.** or a comparable product by one of the following:
  - 1. CertainTeed, Inc.
  - 2. USG Interiors, Inc.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
  - 1. Ceiling Type:
    - i. Basis of Design Product: **Armstrong World Industries, Inc.; Calla #2822.**
      - a. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with acoustically transparent membrane with factory applied latex paint.
      - b. Pattern: E (lightly textured).
      - c. Color: White.
      - d. LR: Not less than 0.86.
      - e. NRC: Not less than 0.85.
      - f. CAC: Not less than 35.
      - g. AC: Not less than 170.
      - h. Edge/Joint Detail: Square Tegular.
      - i. Thickness: 1 inch.
      - j. Modular Sizes: 24 x 24 inches.
      - k. Antimicrobial Treatment: BioBlock + and HumiGuard Plus.

- C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- I. Hold-Down Clips: Provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
  - 1. Provide hold down clips at all vestibules.



## 2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 coating designation, with prefinished, cold-rolled, 15/16-inch- wide, metal caps on flanges.
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong World Industries, Inc.; Prelude XL 15/16” Exposed Tee System** or a comparable product by one of the following:
    - i. CertainTeed; 15/16” Classic Stab System.
    - ii. USG Interiors, Inc.; Donn DX/DXL.
  2. Structural Classification: Intermediate duty system.
  3. Face Design: Flat, flush.
  4. Face Finish: Painted white, typical.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

## 2.7 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  2. Products: Subject to compliance with requirements, provide one of the following:
    - i. Green Glue; Green Glue Noiseproofing Sealant.
    - ii. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - iii. Sherwin Williams; 950A.
    - iv. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3. Install hold-down clips in areas indicated.

#### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

#### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 09511

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SECTION 09653

RESILIENT BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Resilient base.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.

1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 percent (50 linear feet for every 500 linear feet) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## 1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Limited Warranty: Written warranty, signed by manufacturer agreeing to repair or replace resilient accessories, installed according to manufacturer's written recommendations, that fail in performance, materials, or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 RESILIENT BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Tarkett; Traditional Duracove** or a comparable product by one of the following:
  - 1. FLEXCO; Base 2000 Wall Base.
  - 2. Roppe Corporation, 700 Series Base.
- B. Resilient Base Standard: ASTM F 1861.
  - 1. Material Requirement: Type TP (rubber, thermoplastic).
  - 2. Manufacturing Method: Group I (solid, homogeneous).
  - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Inside and Outside Corners: Job formed.
- G. Color: As selected by Engineer from manufacturer's full range.

### 2.2 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

### 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 09653

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## SECTION 09671

### RESINOUS FLOORING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. This Section includes:
  - 1. High-performance resinous flooring systems.
  - 2. Floor preparation.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Section 07920 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- C. Samples for Initial Selection: For each type of exposed finish required.
- D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- F. Material Test Reports: For each resinous flooring component.
- G. Material Certificates: For each resinous flooring component, signed by manufacturer.

- H. Maintenance Data: For resinous flooring to include in maintenance manuals.
- I. Warranty: Special warranty included in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
  - 1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
  - 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Apply full-thickness mockups on 48-inch- square floor area selected by Engineer.
    - a. Include 48-inch length of integral cove base.
  - 2. Simulate finished lighting conditions for Engineer's review of mockups.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

## 1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Limited Warranty: Written warranty, signed by manufacturer agreeing to repair or replace resinous flooring, installed according to manufacturer's written recommendations, that fails in performance, materials, or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.
  - 2. Exclusions from warranty include the following:
    - a. Problems caused by moisture, hydrostatic pressure, or alkali in the subfloor.
    - b. Damage to flooring products from high heels or spiked shoes.

## PART 2 - PRODUCTS

### 2.1 RESINOUS FLOORING, GENERAL

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

### 2.2 RESINOUS FLOORING

- A. Basis of Design Product: Subject to compliance with requirements, provide **Dur-A-Flex, Inc; Hybri-Flex EQ** or comparable product by one of the following, or approved equal:
  - 1. Neogard.
  - 2. Sherwin Williams.
- B. System Characteristics:
  - 1. Color: As selected by Engineer from manufacturer's full range.
  - 2. Wearing Surface: Slip resistant.
  - 3. Integral Cove Base: 6- inches high.

4. Overall System Thickness: 1/4-inch.
- C. System Components: Manufacturer's standard components that are compatible with each other and as follows:
1. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and SL aggregate, with a nominal thickness of 1/8-inch.
  2. Broadcast aggregate: Dur-A-Flex, Inc. Q11 or Q28 quartz aggregate, as selected by Engineer from manufacturer's full range.
  3. Broadcast: Dur-A-Flex, Inc. Dur-A-Glaze #4, epoxy based two-component resin.
  4. Seal coats: Dur-A-Flex, Inc Dur-A-Glaze #4, epoxy-based, two-component resin.
  5. Top coat: Dur-A-Flex, Inc. Armor Top aliphatic urethane two-component resin.
- D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
1. Compressive Strength: 12,500 psi per ASTM C 579.
  2. Tensile Strength: 2,600 psi per ASTM C 307.
  3. Flexural Modulus of Elasticity:  $6.2 \times 10^5$  per ASTM D 790.
  4. Water Absorption: 0.04% per ASTM D 570.
  5. Indentation: .025 percent maximum per MIL-D-3134.
  6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
  7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
  8. Abrasion Resistance: 24 mg maximum weight loss per ASTM C 501.
  9. Flammability: Self-extinguishing per ASTM D 570.
  10. Hardness: 75-80 Shore D per ASTM D 2240.
  11. Bond Strength: 400 psi 100 percent concrete failure per ACI 503R.
- E. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM C 267 for immersion in the following reagents for not less than 7 days:
1. KOH – Potassium Hydroxide (45%)
  2. NaOCl – Sodium Hypochlorite (12.5%)
  3. NaHSO<sub>3</sub> – Sodium Bisulfite (38%)
  4. NaF – Sodium Fluoride, Liquid (4%)
  5. NaF – Sodium Fluoride, Solid
  6. Acetic Acid 5 percent
  7. Acetone
  8. Amonium Hydroxide 10 percent
  9. Citric Acid 10 percent
  10. Cola
  11. Ethylene Glycol
  12. Formaldehyde 10 percent
  13. Gasoline
  14. Hydrochloric Acid 10 percent and 20 percent

15. Lactic Acid 10-50 percent
16. Mineral Spirits
17. Nitric Acid 10 percent
18. Phosphoric Acid 10-80 percent
19. Salad Oil
20. Sodium Carbonate 2 percent and 20 percent
21. Sodium Chloride 10 percent
22. Syrup
23. Urine
24. Xylene

### 2.3 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. General: Test, prepare, and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
  1. Resinous flooring contractor is responsible for performing all substrate tests required by the resinous flooring manufacturer's written instructions, including but not limited to ASTM F-2170 and ASTM F-1869.
  2. General Contractor is responsible for moisture mitigation work or other decontamination work required to comply with resinous flooring manufacturer's written instructions.
- B. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.



### 3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
    - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply reinforcing membrane to substrate cracks.
- D. Integral Cove Base: Apply cove base mix, 6 inches high, to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
- E. Apply topcoats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- F. Install four color logos in locations indicated on Drawings.

### 3.3 FLOOR SYSTEM INSTALLATION

- A. System Installation: Install specified system in five distinct steps as follows:
  - 1. Substrate preparation.
  - 2. Topping/overlay application with quartz aggregate broadcast.
  - 3. Resin application with quartz aggregate broadcast.
  - 4. Topcoat application.
  - 5. Second topcoat application.
- B. Topping
  - 1. The topping shall be applied as a self-leveling system. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
  - 2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
  - 3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.

4. The topping shall be applied over horizontal surfaces using 1/2- inch “v” notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 90 sf/gal.
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. Quartz aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs/sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Topcoat

1. The first pigmented topcoat shall be squeegee applied with a coverage rate of 90 sf/gal.
2. The topcoat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. The first topcoat will be back rolled and cross rolled to provide a uniform texture and finish
4. The second pigmented topcoat (Armor-Top) shall be roller applied with a coverage rate of 500 sf/gal.
5. The finish floor will have a nominal thickness of 1/4- inch.

### 3.4 CLEANING AND PROTECTING

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 09671

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## SECTION 09900

### PAINTING AND COATINGS

(Part of Filed Sub-Bid Section 09001 – PAINTING – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Section includes surface preparation and the application of paint and coating systems on the following substrates:
  - 1. Concrete curbs, except where indicated to receive hardener and sealer (by Section 03300).
  - 2. Concrete slabs and walls to receive chemical resistant coatings.
  - 3. Concrete and pre-cast concrete plank ceilings.
  - 4. Concrete water storage tanks, interior lining.
  - 5. Concrete masonry units (CMU), interior.
  - 6. Marine grade plywood wall sheathing.
  - 7. Interior PVC trim.
  - 8. Mechanical pipes and valves, including ductile iron and PVC.
  - 9. Pumps.
  - 10. Plumbing – gas piping only.
  - 11. Interior and exterior PVC piping.
  - 12. Site work features identified for field painting.
  - 13. Piping and equipment identification.
  - 14. Primary steel structural steel of pre-engineered metal building.
  - 15. All other interior and exterior surfaces to be field painted or coated.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not

specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Engineer / Owner will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical equipment and plumbing (gas only) that do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
    - i. Factory finished steel railings.
    - ii. Finished mechanical equipment.
    - iii. Plumbing and HVAC equipment.
    - iv. Instrumentation panels.
    - v. Light fixtures and wiring devices.
    - vi. Switchgear.
    - vii. Distribution cabinets in closets or equipment rooms.
  2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - i. Foundation spaces.
    - ii. Furred areas.
    - iii. Ceiling plenums.
    - iv. Pipe spaces.
    - v. Duct shafts.
    - vi. Clearwells.
  3. Finished metal surfaces include the following:
    - i. Anodized or coated aluminum.
    - ii. Stainless steel.
    - iii. Chromium plate.
    - iv. Copper and copper alloys.
    - v. Bronze and brass.
  4. Operating parts include moving parts of operating equipment and the following:
    - i. Valve and damper operators.
    - ii. Linkages.
    - iii. Sensing devices.
    - iv. Motor and fan shafts.
  5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Division 2 SITE WORK sections for hydrants and other site work items to be field finished by this Section.
4. Section 03300 “Cast-In-Place Concrete” for hardeners, sealers, and special coatings to be field applied by this Section.
5. Section 03410 “Plant Precast Structural Concrete” for precast concrete ceilings to be field finished by the Section.
6. Section 04810 “Unit Masonry” for CMU to be field finished by this Section.
7. Section 06105 “Miscellaneous Rough Carpentry” for marine grade plywood wall sheathing to be field finished by this Section.
8. Section 06400 “Architectural Woodwork” for interior PVC trim to be field finished by this Section.
9. Division 11 EQUIPMENT for piping, valves, and other equipment to be field finished or labeled by this Section.
10. Division 15 MECHANICAL for plumbing, fire protection, and HVAC items to be field finished or labeled by this Section.

### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
  1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
  1. Submit Samples on rigid backing, 8 inches square.
  2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- D. Qualification Data: For firms and persons specified in Part 1 “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineer / Owners and Owners, and other information specified.
- E. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  2. VOC content.
- F. Maintenance Data: For coatings to include in maintenance manuals. Include the following:
1. Area summary with Finish Schedule and area detail designating where each product, color, and finish is used.
  2. Product data pages.
  3. Safety data sheets.
  4. Care and cleaning instructions.
  5. Touch-up procedures.
  6. Color samples of each color and finish (gloss level) used.
  7. Manual: Provide Sherwin Williams; “Custodian Project Color and Product Information” manual, or equal.
- G. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
1. Quantity: Furnish an additional 1 gallon of each material and color applied.

#### 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Engineer / Owner will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - i. Wall Surfaces: Provide samples of at least 100 sq. ft. for each color and accent color.
  2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
  3. Final approval of color selections will be based on benchmark samples.
    - i. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Engineer / Owner at no added cost to Owner.
  4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer / Owner specifically approves such deviations in writing.
  5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.6 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
  4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.



## 1.7 PROJECT CONDITIONS

- A. Temporary Support Facilities: Furnish and install all temporary lifts, hoists, staging, scaffolding, rigging, labor and materials, and temporary support to perform all operations in connection with the installation of this Work. Remove all temporary support facilities when no longer required.
- B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- C. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. PPG Industries, Inc. (PPG).
  - 3. Sherwin-Williams Co.
  - 4. Tnemec Company Inc.
  - 5. Dupont.
  - 6. Others as noted in Painting and Coatings Schedule.
- B. Subject to compliance with the requirements of this Section, products that may be incorporated into the Work are listed in the Painting and Coatings Schedule in PART 3.

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content for Interior Paints and Coatings:

1. All interior paints and coatings shall comply with the VOC content regulations of the Ozone Transportation Commission (OTC) effective in the Commonwealth of Massachusetts. For interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - i. Flat Coatings: 100 g/L.
  - ii. Nonflat Coatings: 150 g/L.
  - iii. Nonflat-High Gloss Coatings: 250 g/L.
  - iv. Primers, sealers and undercoaters: 200 g/L.
  - v. Floor Coatings: 250 g/L.

C. Colors: As selected by Engineer / Owner from manufacturer's full range.

D. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed products.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Masonry (Clay and CMU): 12 percent.
  2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  1. Notify Engineer / Owner about anticipated problems when using the materials specified over substrates primed by others.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Engineer / Owner Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
  2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
  1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  2. Sand surfaces that will be exposed to view, and dust off.
  3. Prime edges, ends, faces, undersides, and backsides of wood.
  4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 PREPARATION AND SURFACE REPAIRS FOR WATER STORAGE TANK

- A. Comply with NSF Std. 600.
- B. Preparation: All CIP concrete surfaces scheduled for lining shall be abrasive blast clean per SSPC SP #13 Standard. Provide a continuous surface profile equal to ICRI CSP #6.
- C. Concrete Repairs: Where required, patch all spalled concrete surfaces on walls, ceiling and floors requiring patching of ¼” or greater depth with Tnemec Series 217 Mortar-Crete following Manufacturers installation and curing methods. Re-Prep cured Series 217 to provide required surface profile.
- D. Interior Wall Parge Coat: Once Deep-Hole Patching is complete, apply one full parge-coat of Tnemec Series N218 Mortar-Clad to all prepared concrete surfaces at a minimum 1/16” thickness.

### 3.4 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Paint civil items including, but not limited to, septic tank vent, bollards, swing gate, and fire hydrants.
- F. Painting Mechanical, Plumbing, Fire Protection, HVAC, and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
  - 1. Mechanical Work:

- i. Uninsulated metal piping.
  - ii. Uninsulated plastic piping.
  - iii. Pipe hangers and supports.
  - iv. Mechanical equipment that is indicated to have a factory-primed finish for field painting, including but not limited to pumps (including base and motor).
2. Plumbing Work:
  - i. Gas piping (interior and above grade).
3. Fire Protection Work:
  - i. Piping.
  - ii. Pipe hangers and supports.
4. HVAC Work: None.
5. Electrical Work: None.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer / Owner, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 PAINTING AND COATINGS SCHEDULE

- A. Water Storage Tank, Interior Lining:
  1. Lining Finish Coat: Shall be one full coat of Tnemec Series 22 or FC22 Epoxoline, a 100% solid by volume NSF Std. 600 approved epoxy liner applied to 25.0-35.0 mils DFT.
  2. Repair any pinholes and/or voids in the applied lining with Tnemec Series FC 22 Touch-Up repair system. Apply any sealants at interior vertical expansion joints and roof to wall junction following the application of the cure of the liner.

B. Exterior Ferrous Metal

1. First Coat:

- i. Tnemec 90-1K97.
- ii. PPG PMC 68.
- iii. Dupont Urethane Ganicin Zinc Rich Primer.

2. Second Coat:

- i. Tnemec N69 Hi-Build Epoxoline II.
- ii. PPG PMC Amerlock 400 Hi-Build Epoxy.
- iii. Dupont 25P High Solids Epoxy.

3. Third Coat:

- i. Tnemec 1075 Endura-Shield.
- ii. PPG PMC Amerlock 450H Polyurethane Topcoat.
- ii. Dupont High Solids Imron Urethane.

C. Interior Plywood:

1. First Coat:

- i. Benjamin Moore; Fresh Start Multi-Purpose Latex Primer N023.
- ii. PPG; 6-855 Interior Latex Enamel Undercoater.
- iii. Sherwin-Williams; Premium Wall and Wood Primer B28W08111 Series.

2. Second and Third Coats:

- i. Benjamin Moore; Advance Waterborne Interior Alkyd Semi-Gloss 793.
- ii. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Acrylic Latex.
- iii. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series.

D. Interior CMU Walls:

1. First Coat:

- i. Tnemec 130 Envirofil.
- ii. PPG PMC Nu-Clad 114A.
- iii. Dupont 25P.

2. Second Coat:

- i. Tnemec 280 Tneme-Glaze.
- ii. PPG PMC Amercoat 133.
- iii. Dupont 100% Solids Epoxy.

3. Third Coat:
  - i. Tnemec 1080 Endura-Shield.
  - ii. PPM PMC Amercoat 335.
  - iii. Dupont Imron WB Urethane.

E. Interior Metals:

1. First Coat: Shop primed under other Section where specified. If not shop primed, provide primer recommended by finish coating manufacturer.
2. Second Coat:
  - i. Tnemec N69 Hi-Build Epoxoline II.
  - ii. PPG PMC Amerlock 400 Hi-Build Epoxy.
  - iii. Dupont 25P.

F. Interior and Exterior PVC Piping

1. Surface Preparation: As recommended by paint manufacturer for substrate material.
2. First Coat:
  - i. Manufacturer's recommended primer for substrate.
3. Second Coat:
  - i. Tnemec Series 27WB Typoxy.
4. Third Coat:
  - i. Tnemec Series 1029 Enduratone.

G. Interior Chemical Containment Areas (Concrete)

1. Surface Preparation: Shot-blast or mechanically abrade concrete to remove all coatings, laitance, curing compounds, hardeners, sealers, and other contaminants and to provide surface profile; Reference: ICRI CSP3-5. Verify dryness by testing for Moisture Vapor Transmission Rate via an Anhydrous Calcium Chloride Test: Reference: ASTM F 1869. Test pH levels via litmus paper testing to assure pH levels have been neutralized. Concrete shall have been cured for 28 days minimum before application of materials.
2. Coating Schedule:
  - i. Filler / Surfacer: Fil all voids and construction joints and form 1/2 inch cant cove inside containment areas with Series 218 Mortar Clad, trowel applied.

- ii. Prime Coat: One full coat of Tnemec Series 201 Epoxoprime at 6.0-8.0 mils DFT; primed surfaces shall not be allowed to set hard but shall be tacky as approved when next coating material is applied.
- iii. Intermediate Coat: Mix and apply Series 239 bedding coat at 8.0-10.0 mils DFT. Embed the fiberglass reinforced mat into wet resin. Following cure, apply a second coat of Series 239 Novolac saturation coat over fiberglass mat 10.0-12.0 mils DFT.
- iv. Finish Coat: One full finish coat of Tnemec Series 282 Tneme-Glaze to cured intermediate coat at 6.0-8.0 DFT.
- v. Apply chemically compatible polysulfide joint sealant / bonding agent / fluoroelastomer, or other product as recommended by the coating manufacturer, for any drill anchors or similar penetrations in the chemical containment areas.

### 3.7 PIPING IDENTIFICATION AND LABELING

- A. All piping shall be painted in accordance with MassDEP’s standard color scheme and as directed by the Engineer.
- B. After painting, piping shall be identified and labeled by stenciling using same paint specified for use on pipe; sticker labels for piping is not acceptable Stenciling shall be of wording and color selected by the Engineer and sized as flows:

<u>Outside Diameter of Pipe or Covering:</u>	<u>Size of Legend Letters:</u>
3/4 inch to 1-1/4 inch	1/2 inch
1-1/2 inch to 2 inch	3/4 inch
2-1/2 inch to 6 inch	1-1/4 inch
8 inch to 10 inch	2-1/2 inch
Over 10 inch	3-1/2 inch

- C. Labeling:
  - 1. Arrows shall be applied indicating direction of flows”
    - i. Where the letter “a” is equal to 3/4 of the outside diameter of the pipe or pipe covering, the arrow length shall be twice “a” long by 3/8 inch “a” wide.
    - ii. Arrow head shall be an equilateral triangle with side equal to “a”.
    - iii. Maximum “a” dimension shall be 6 inches.
  - 2. Where pipe passes through a wall, use pipe labels and directional arrows on each side of wall.
  - 3. Use pipe labels and directional arrows every 50 feet (max. spacing) along continuous pipe lines.



4. Provide pipe labels and directional arrows at each riser and “T” joint.
5. Point directional arrowheads in the direction of pipe flow and away from pipe label.
6. Engineer will assist in determining pipe contents and direction of flows.

### 3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 09900

DIVISION 10 – SPECIALTIES

10140	.....	Signage
10200	.....	Fixed Louvers
10800	.....	Toilet and Bath Accessories

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## SECTION 10140

### SIGNAGE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Room/Door Signs.
  - 2. Fiberglass Signs for information, egress and safety, including load limits.
  - 3. Hazardous Materials Signs.
  - 4. Identification Labels for pipes (stainless steel and insulated pipes only) and equipment.
  - 5. Installation and mounting accessories.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: Include material descriptions, typical dimensions and finishes for each type of sign and identification label, and manufacturer's color selectors, as applicable.
- C. Shop Drawings: Schedule of all signs and identification labels with sizes, text and other relevant information and drawings showing layouts of signs to scale, mounting methods, grounds, mounting heights, and message list for each sign, including lettering and Braille layout, where applicable.
- D. Samples for Verification: One typical sign and identification label of each type to verify lettering, color selections, readability and other characteristics.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Engineer's Approval: Schedule of signs and identification devices shall be specifically reviewed and approved by the Engineer, including but not limited to the following: locations, number of signs, clarity of sign graphics, size and readability of the text.
- C. Fire Department Approval: As directed by the Engineer and Owner, submit fire and life safety signage for review and acceptance by the local Fire Department.
- D. Reference Standards and Regulatory Requirements: Comply with the requirements of the following:
  - 1. Americans with Disabilities Act (ADA).
  - 2. American Society of Mechanical Engineers (ASME): A13.1, Scheme for the Identification of Piping Systems.
  - 3. Occupational Safety and Health Act (OSHA)
  - 4. National Fire Protection Association (NFPA):
    - i. 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
    - ii. HAZ-01, Fire Protection Guide to Hazardous Materials.

## 1.5 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

## PART 2 - PRODUCTS

### 2.1 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
  - 1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
- B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
  - 1. Panel Material: Opaque acrylic sheet.

2. Raised-Copy Thickness: Not less than 1/32 inch.

## 2.2 ROOM/DOOR SIGNS

- A. Two color melamine (acrylic) plastic sign, with radius corners, raised border, lettering and ADA Braille, indicating Room/Door number, Room name.
- B. Manufacturers:
  - 1. ASI.
  - 2. Best.
  - 3. Mohawk.
  - 4. Or approved equal.

## 2.3 FIBERGLASS SIGNS

- A. Signs for caution/safety/operator information, including signs listing load limits at fiberglass grates, safety information about chemicals, and other signs as directed by the Engineer. Text as directed by Engineer; letter sizes as required for legibility at a distance of 15 feet; sign sizes as required by sign text.
- B. Material: Three-ply laminated fiberglass, minimum 1/8 in. thick, with contrasting color core message layer between two clear weather-resistant surface layers.
- C. Quantity: Twenty (20) signs.
- D. Manufacturers:
  - 1. Best.
  - 2. Brady Signmark.
  - 3. Or approved equal.

## 2.4 HAZARDOUS MATERIALS SIGNS

- A. Conform to NFPA 704 and NFPA HAZ-01.
- B. Material: Fiberglass, 1/8 in. thick; die-cut vinyl background, letters and numbers with pressure sensitive adhesive.
- C. Manufacturers:
  - 1. Emed Co.
  - 2. Brady Signmark.
  - 3. Or approved equal.

## 2.5 IDENTIFICATION LABELS

### A. Labels for Stainless Steel and Insulated Pipe:

1. Labels:
  - i. Snap-on, reversible type with lettering and directional arrows, sized for outside diameter of pipe and insulation.
  - ii. Provided with ties or straps for pipes of 6 inches and larger diameter.
  - iii. Designed to firmly grip pipe so labels remained fixed in vertical pipe runs.
2. Material: Heavy-duty vinyl or polyester, suitable for exterior use, long-lasting and with resistance to moisture, grease and oils.
3. Letters and Arrows: Black on OSHA safety-yellow background.
4. Color Field and Letter Height: Meet ASME A13.1.
5. Message: Piping system name or pipe contents.
6. Manufacturers and Products:
  - i. Brady Signmark: B-915 Brady Snap-On and Strap-on Pipe Markers.
  - ii. Seton Identification Products: Ultra-mark Pipe Markers.
  - iii. Or approved equal.

### B. Equipment Labels:

1. Labels for equipment with assigned tag numbers, where specified.
2. Letters: White engraved, 3/4 in. minimum height, on black background.
3. Materials: Aluminum or stainless steel with baked-on finish suitable for use in wet, oily, exposed, abrasive and corrosive areas; or fiberglass with encased lettering; or multi-layered acrylic.
4. Furnish 1 in. margin with holes for mounting at each end of label; on fiberglass labels, furnish grommets at each hole.
5. Height: 2 in. minimum and 3 in. maximum.
6. Length: 14 in. minimum and 18 in. maximum.
7. Uniform Size: All equipment labels to be the same size, unless otherwise required/approved by the Engineer.
8. Message: Equipment names and tag numbers as used in equipment specification.
9. Manufacturers and Products:

- i. Brady Signmark.
- ii. Seton Identification Products.
- iii. Or approved equal.

## 2.6 ANCILLARY MATERIALS

- A. Fasteners: Stainless steel screws, bolts or other fastener type of size and type required by the substrate for secure installation of sign.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items provided under other Sections are sized and located to accommodate signs and identification labels.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
  - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
  - 3. Comply with OSHA and ADA requirements.
- B. Information, Egress and Safety Signs:
  - 1. Install facing natural traffic movement pattern; locate for high visibility with minimum restriction of working area around walkways and equipment.
  - 2. Install to allow removal with ordinary hand tools without scarring/marring equipment or structure.
- C. Hazardous Materials Signs:



1. Install where required by NFPA No. 704 and UFC, Chapter 79, and as directed by the Engineer.
2. Install at entrances to spaces where hazardous materials are stored, dispensed, used or handled and on sides of stationary tanks.

### 3.3 IDENTIFICATION LABELS

#### A. Labels for Stainless Steel and Insulated Pipe:

1. Locate at connections to equipment, valves or branching fittings at wall boundaries.
2. At exposed piping not normally in view, such as above suspended ceilings.
3. Install in accordance with manufacturer's instructions; apply to pipe only after painting in vicinity is complete and approved by the Engineer.

#### B. Equipment Labels:

1. Locate and install on equipment or concrete base, as directed by the Engineer.
2. Install to equipment or base for easy removal and replacement with ordinary hand tools.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 10140

## SECTION 10200

### FIXED LOUVERS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Fixed, extruded-aluminum louvers.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements
  - 3. Section 07920 “Joint Sealants.”
  - 4. Section 13120 “Metal Building Systems” for exterior opening framing and trim.
  - 5. Division 15 Sections for dampers and for louvers that are a part of mechanical equipment.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
- D. Samples for Initial Selection: For units with factory-applied color finishes.

- E. Samples for Verification: For each type of metal finish required.
- F. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

#### 1.5 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings, and in accordance with the Massachusetts State Building Code.

- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to the Massachusetts State Building Code.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.8 WARRANTY

- A. Manufacturer shall provide standard limited warranty for louver systems for a period of five years from date of installation, no more than 60 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - i. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - ii. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - iii. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

- D. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use 300 series stainless-steel fasteners.
  - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide subsills made of same material as louvers for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Wind-Drive-Rain-Resistant Louver:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **Greenheck; Model EHH-401** or comparable product by one of the following:
    - i. Ruskin Company.
    - ii. American Warming and Ventilating, Inc.; a Mestek company.
    - iii. Construction Specialties, Inc.
    - iv. Industrial Louvers, Inc.
  - 2. Louver Depth: 4 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.

4. Blade profile: Sightproof, mounted horizontally and spaced approximately 2 inches center to center.
5. Louver Performance Ratings:
  - i. Free Area: Not less than 6.70 sq. ft. (42%) for 48-inch- wide by 48-inch-high louver.
  - ii. Maximum Recommended Air Flow through Free Area: 1043 feet per minute.
  - iii. Air Flow: 7051 cubic feet per minute.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
  2. Finish: Mill finish unless otherwise indicated.
  3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
  1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

## 2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Insulated metal sheet attached to back of louver.
  1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

## 2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color: As selected by Engineer from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07920 "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Engineer, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 10200



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## SECTION 10800

### TOILET AND BATH ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Washroom accessories.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.
  - 3. Division 15 Section “Plumbing” for under-lavatory guard.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated on Drawings.
  - 2. Identify products using designations indicated on Drawings.
- D. Warranty: Sample of special warranty.

- E. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Engineer.
- B. Accessibility: Comply with applicable provisions in the 2010 ADA Standards and the Massachusetts Architectural Access Board (AAB).

#### 1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- E. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

## 2.2 WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated by **Bobrick Washroom Equipment, Inc.** or a comparable product by one of the following:

1. AJW Architectural.
2. American Specialties, Inc.
3. Bradley Corporation.

B. Grab Bar:

1. Basis-of-Design Product: **Bobrick; B-6806.99 Series.**
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18 gauge.
  - i. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Provide in straight lengths, in sizes indicated.

C. Mirror Unit:

1. Basis-of-Design Product: **Bobrick; B-290 Series.**
2. Frame: Type 430 stainless-steel angle, 1/2 inch x 1/2 inch x 3/8 inch channel with bright polish finish, one-piece roll-formed construction.
  - i. Corners: Welded and ground smooth.
  - ii. Backing: Galvanized steel fastened to frame with concealed screws and equipped with integral horizontal hanging brackets near the top and bottom of the mirror.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
  - i. Wall bracket of 20 gauge galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Mirror: No. 1 quality, 1/4-inch select float glass, with all edges protected by plastic filler strips. Provide protective backing of full-size, shock absorbing, water resistant, nonabrasive, 3/16-inch thick polyethylene padding.
5. Sizes: 24 x 40 inches.

D. Robe Hook:

1. Basis-of-Design Product: **Bobrick; B-6707.**
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
  - i. Flange and Support Arm: 22 gauge stainless steel with concealed 16 gauge stainless steel mounting bracket, all-welded construction. Secure to wall plate with stainless steel setscrew.
  - ii. Concealed Wall Plate: 16 gauge stainless steel.
  - iii. Cap: 10 gauge stainless steel, welded to support arm.

E. Automatic Paper Towel Dispenser:

1. Basis-of-Design Product: **Bradley 2494.**

F. Automatic Soap Dispenser:

1. Basis-of Design Product: **Bradley 6A01-11.**

G. Toilet Paper Dispenser:

1. Basis-of-Design Product: **Bobrick B-2888.**

## 2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 10800

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DIVISION 11 – EQUIPMENT

11200	.....Interior Process Piping and Valves
11201	.....Iron and Manganese Removal System
11202	.....PFAS Removal System
11203	.....Granular Activated Carbon (GAC) Media
11204	.....Ion Exchange (IX) Resin
11241	.....Chemical Metering Pumps
11310	.....Vertical Turbine Pumps
11311	.....End Suction Pumps
11312	.....Multi-Stage In-Line Vertical Pumps
11313	.....Chemical Transfer Pumps
11371	.....Vacuum Priming System
11373	.....Floating Decanters
11377	.....Rotary Positive Displacement Blower
11501	.....Process Gauges



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## SECTION 11200

### INTERIOR PROCESS PIPING AND VALVES

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0, and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the furnishing of all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the furnishing, installation, and testing of interior process piping systems, including piping, pipe fittings and specials, mechanical couplings, mechanical groove couplings, wall fittings, valves, flexible pipe connectors, strainers, jointing materials, pipe hangers and supports, and accessories of the various materials, sizes, classes, joints, and types, and appurtenant work, at the locations and to the general arrangements and details as indicated and/or as directed, complete in place, in accordance with the Drawings and Specifications.

- B. Related Sections include the following:

1. Division 1 – General Requirements
2. Division 2 – Site Work
3. Division 9 – Finishes
4. Division 10 – Specialties
5. Division 11 – Equipment
6. Division 13 – Special Construction
7. Division 15 – Mechanical
8. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections.

1. Shop Drawings: Include materials lists, catalog cuts, and complete specifications for all piping materials including gaskets and connections. Shop drawings for all pumps, valves, valve operators, strainers, hangers and supports, wall pipes, wall sleeves, flexible connections, hydrants, nozzles, cleanouts, and other like manufactured items. Detailed piping layout drawings of all interior and exterior piping and valves including location, type, and number of proposed pipe supports. Drawings of exterior piping shall also show the relationship between the work included in this section and that included in others where in close proximity.
- B. Shop drawings for all pipe hangers and supports from building superstructure shall be submitted with Section 13120 Metal Building Systems shop drawings.
- C. Operation and Maintenance Manuals: Furnish six (6) hard copies and one (1) electronic Adobe PDF searchable version on thumb drive or CD-ROM. Refer to Section 01730 – Operations and Maintenance Data for additional requirements.
- D. American Iron and Steel (AIS) Certification for all materials specified herein.
- E. Welding Qualifications:
1. Weld Inspection and Testing Agency: Certification and qualifications.
  2. Welding Inspector: Certification and qualifications.
  3. Welders:
    - i. List of qualified welders and welding operators.
    - ii. Current test records for qualified welder(s) and weld type(s) for factory and field welding.
  4. Weld Procedures: Records in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s).
  5. Nondestructive inspection and testing procedures.
  6. Test logs.
  7. Certified welding inspection and test results.
- F. Quality Assurance Qualifications
1. Independent Inspection and Testing Agency:
    - i. Ten years' experience in field of welding and welded pipe and fittings' testing required for this Project.
    - ii. Calibrated instruments and equipment, and documented standard procedures for performing specified testing.

- iii. Certified in accordance with ASNT SNT TC 1A for testing procedures required for this Project.
  - iv. Testing Personnel: Qualified for nondestructive test methods to be performed.
  - v. Inspection Services: Qualified welding inspector.
- 2. Welding Inspector: AWS certified, AWS QC 1 qualified, with prior inspection experience of welds specified.
- 3. Welder and Welding Operator Qualifications:
  - i. Qualified by accepted inspection and testing agency before starting work in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code.
  - ii. Qualified to perform groove welds in Positions 2G and 5G for each welding process and pipe material specified.
  - iii. Qualification tests may be waived by Engineer based on evidence of prior qualification.
- G. Quality Control: Provide services of independent inspection and testing agency for welding operations.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 - Quality Assurance and as specified.
- B. The materials and equipment covered in this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and these Specifications. The Specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- C. All iron and steel pipe, fittings, and valves shall be manufactured in North America and shall meet all American Iron and Steel (AIS) requirements.
- D. Actuators (Electric)
  - 1. Actuators for all valves to be the product of one manufacturer. Contractor to coordinate with pressure filter vendors on all valves and actuators.
  - 2. Actuators shall be designed in accordance with latest AWWA specification. Actuators to be manufacturer's standard cataloged product and modified to provide compliance with the specifications and the service conditions specified and indicated.
  - 3. Provide services of factory-trained Service Engineer, specifically trained on type

of equipment specified:

- i. Service Engineer must have a minimum of five (5) years of experience on the type and size of equipment specified. Service Engineer must be present on site for all items listed below. Man-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
  - ii. Installation: Supervise setting, alignment, field erection; coordination of piping, electrical and miscellaneous utility connections: 4 man-days minimum for electric actuators.
  - iii. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified. 2 man-days minimum for electric actuators.
  - iv. Field Performance Testing: Field performance test equipment specified. 2 man-days minimum for electric actuators.
  - v. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classrooms sessions. 1 man-day for electric actuators.
  - vi. Credit to the Owner all unused service man-days specified above at the manufacturer's published field service rate.
4. Any additional time required of the factory trained service engineer to assist in placing the equipment in operation or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
  5. Manufacturer of actuators must have at least five (5) operating installations with actuators of the type and size specified and in the same service as specified operating for not less than three (3) years.

#### E. Diaphragm Valves

1. All diaphragm valves to be the product of one manufacturer.
2. Diaphragm valves shall be designed in accordance with latest AWWA specification. Diaphragm valves to be manufacturer's standard cataloged product and modified to provide compliance with the specifications and the service conditions specified and indicated.
3. Provide services of factory-trained Service Engineer, specifically trained on type of equipment specified:
  - i. Service Engineer must have a minimum of five (5) years of experience on the type and size of equipment specified. Service Engineer must be present on site for all items listed below. Man-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
  - ii. Installation: Supervise setting, alignment, field erection; coordination of piping, electrical and miscellaneous utility connections: 2 man-days minimum

- for diaphragm valves.
  - iii. Functional Testing and Inspection of Equipment: Calibrate, check alignment and perform a functional test. Tests to include all items specified. 2 man-days minimum for diaphragm valves.
  - iv. Full System Performance Testing: Field performance test equipment specified. 1 man-day minimum for diaphragm valves.
  - v. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classrooms sessions. 1 man-day minimum for diaphragm valves.
  - vi. Credit to the Owner all unused service man-days specified above at the manufacturer's published field service rate.
- 4. Any additional time required of the factory trained service engineer to assist in placing the equipment in operation or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
  - 5. Manufacturer of diaphragm valves must have at least five (5) operating installations with diaphragm valves of the type and size specified and in the same service as specified operating for not less than three (3) years.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment and material complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Store products in manufacturer's packaging until ready for installation.

#### 1.6 DESIGN CONDITIONS

- A. All anchors, bolts, inserts, supports, pipe wall fittings, pipe sleeves and such other materials occurring in connection with concrete and masonry work shall be furnished and placed accurately and maintained securely in position to lines and grades at the time of concrete and masonry placement. All necessary templates shall be provided.
- B. Drawings are diagrammatic and do not attempt to show each and every offset or all fittings. All changes and adjustments to the drawing layouts as required for conformity of the work to the structures as constructed, to equipment, to approved shop drawings, or to fit work of other trades shall be as approved by the Owner, and shall be included as part of the work under this Section of the Specifications at no additional expense to the Owner.

#### 1.7 PIPE SCHEDULE

Pipes, fittings and specials, appurtenances, and jointing shall be in accordance with the following schedule. This schedule is set forth as a guide as to types of materials and

jointing required. The lack of mention of any specific pipe shall not relieve the Contractor from the responsibility of furnishing and installing all piping as required or directed for a complete job. The schedule indicates the types of pipe required for the principal piping systems included under this Section of the Specifications and is presented herein for convenience of references for the Contractor.

PLANT PIPING SYSTEM	PIPE MATERIAL AND JOINTING
Raw Water Oxidized Water Filter Influent Filter Effluent Filter to Waste Slow Refill Filtered Water Finished Water Backwash Waste Backwash Supply Water Recycle Water Sludge	Flanged D.I. pipe, D.I. fittings and specials; pipe, fittings, and specials to be cement-lined; thickness class as specified herein
Bag Filter Influent/Effluent	Mechanical grooved D.I. pipe, D.I. fittings and specials; pipe, fittings, and specials to be cement-lined; thickness class as specified herein
Air Scour Air Draindown Air Gauge Connections Air Scour Blower Supply Air Scour Blower Exhaust Differential Pressure Transmitter Tubing	304 Stainless Steel; jointing varies
Sodium Hypochlorite Tubing Sodium Bisulfite Tubing Sodium Fluoride Tubing	FEP (fluorinated ethylene propylene) tubing
Potassium Hydroxide Tubing	Stainless steel braided PTFE (polytetrafluoroethylene) lined tubing
Sodium Hypochlorite Feed System Piping Sodium Bisulfite Feed System Piping Sodium Fluoride Feed System Piping	High chemical resistance, normal impact Schedule 80 Type I PVC piping; fittings, injection- molded, high chemical resistance, normal impact, for use with Type I PVC Schedule 80 pipe, solvent weld joint

PLANT PIPING SYSTEM	PIPE MATERIAL AND JOINTING
Potassium Hydroxide Feed System Piping	316 Stainless Steel
Sodium Hypochlorite Carrier, Overflow, and Vent Piping Sodium Bisulfite Carrier, Overflow, and Vent Piping Sodium Fluoride Carrier, Overflow, and Vent Piping Potassium Hydroxide Carrier, Overflow, and Vent Piping Analyzer Drain Analyzer Tubing Equipment Drains	Schedule 40 PVC; Type 1 PVC fittings, solvent weld joint
Sample Tap Lines Gauge and Valve Connections Analyzers Finished Water (100') Sample Line	Type L Copper; solder joints
Sample Sink Drain	Hubless Cast Iron Pipe

## 1.8 COORDINATION

- A. Contractor shall coordinate with PFAS Removal and Iron and Manganese Removal pressure filter vendors to assure all pipe and pipe fittings are the product of the same manufacturer.
- B. Contractor shall coordinate with PFAS Removal and Iron and Manganese Removal pressure filter vendors to assure all valves are the product of the same manufacturer.
- C. Contractor shall coordinate with PFAS Removal and Iron and Manganese Removal pressure filter vendors to assure all actuators are the product of the same manufacturer.
- D. Contractor shall coordinate with PFAS Removal and Iron and Manganese Removal pressure filter vendors to assure all pressure gauges are the product of the same manufacturer.

## PART 2 – PRODUCTS

### 2.1 PIPES

- A. Ductile Iron (DI) Pipe and Pipe Fittings. Flanged ductile iron pipe shall be classified by Underwriters Laboratories Inc., in accordance with ANSI/AWWA A21.15/C115.



## 1. General

- i. Cement-mortar linings: ductile iron pipe, cast iron and ductile iron pipe fittings and specials, where indicated, shall be double thick cement-mortar-lined in accordance with ANSI Specification A 21.4. Thickness of the mortar lining shall be 1/8-inch for pipe 12-inches and smaller and 3/16-inch for pipe larger than 12- inches.
- ii. Exterior Coating: The exterior surfaces of all other pipe and fittings shall be thoroughly cleaned and given one shop coat of (1.5– 3 mils DFT) of red oxide primer. The coating used shall be compatible with the coats to be field applied. The shop coat shall be applied in accordance with the paint manufacturer's recommendations.
- iii. Ductile iron pipe, cast iron or ductile iron pipe fittings and specials shall have cast upon them the class, thickness designation and initials of the manufacturer.
- iv. Pipe fittings with integrally cast bases shall be provided where indicated and as directed.
- v. All piping shall be lead free and NSF 61 certified.

## 2. Flanged Piping

- i. Ductile iron pipe with screwed-on flanges shall be centrifugally cast pipe conforming to ANSI Specification A-21.51 of latest editions. Flanges for flanged pipe shall conform to ANSI Specifications B16.1, latest edition, for American 125 Standard and in addition they shall have long hubs. After flanges have been screwed onto the pipe the face of the flange and end of the pipe shall be re-faced together in the shop and the flange shall be sealed with epoxy compound to prevent corrosion of threads from the outside. Flanges shall be faced and drilled to American 125 Standard and to match the facing and drilling of the equipment, valves and to such other items to which they are attached. Ends of pipe connecting to flexible mechanical couplings shall be suitable for and properly prepared for making the joint with the flexible mechanical coupling. Pipe shall be lined as specified herein. All interior ductile iron pipe shall be a minimum of Class 53.
- ii. Ductile iron or cast iron flanged joint fittings shall be of the types indicated or as required and approved, and shall conform to the requirements of ANSI Specifications A21.10, latest edition, Class 250. Flanges shall be cast integral with the pipe fittings and specials and shall be faced and drilled in accordance with ANSI Specifications B 16.1, latest edition, for American 125 Standard, and facing and drilling of all flanges shall match that of the equipment, valves, and such other items to-which they are attached. Blank flanges shall be provided as required. Flanged fittings not available under ANSI Specification 21.10 shall be provided as required and shall conform to the application ANSI Specifications B 16.1 or B 16.2. Pipe fittings and specials shall be lined as specified herein. Pipe fittings, specials and adapters shall be of the sizes, dimensions and types as indicated, as specified, as required for the proper fitting of the completed work, and as approved by the Owner.

- iii. All flanged joints for ductile iron pipe shall be made with bolts or bolt studs with a nut on each end and SBR rubber gaskets extending at least to the inside of the bolts. SBR rubber gaskets shall conform to AWWA C111 latest revision. Bolts and nuts shall be carbon steel. Bolt studs and nuts shall be of the same quality as machine bolts. A sample of the gaskets shall be submitted to the Engineer for approval.

### 3. Mechanical Grooved Piping

- i. Ductile iron pipe with mechanical grooved couplings shall be centrifugally cast pipe conforming to AWWA C606 of latest revision. The pipe shall be radius cut grooved for rigid joints. Flexible joints may be used to design considerations, as shown on drawings or detailed elsewhere in these specifications. Installation shall be in accordance with manufacturer's recommendations. Grooving dimensions are the same for any one pipe OD regardless of pipe class and pressure. The outside surface of pipe between the groove and pipe end must be smooth and free from deep pits or swells to provide leak-tight seat for the mechanical groove pipe gasket. All rust, loose scale, oil, grease and dirt shall be removed. Penned surfaces may require corrective action in order to provide leak-tight gasket seal.
- ii. Fittings for mechanical grooved pipe shall conform to requirements of ANSI Specification A-21.10 with the exception of the end preparation. The end preparation shall be radius cut grooved for rigid joints. Coupling housings shall be ductile iron conforming to the requirements of ASTM Specification A-536. Sizes 3-inches through 12-inches shall be of two segments; sizes 14-inches and larger shall be four or more segments. Couplings shall be manufactured by Victaulic (Style 31), Gruvlok, or approved equal. Lightly coat pipe ends and all gasket surfaces with lubricant or other non petroleum-non-petroleum base lubricant suitable for potable water use. Bolts shall be carbon steel heat treated and grade B plated, conforming to ASTM Specification A-183 and A-307, minimum tensile I 10,000 psi. Bolts shall be of oval neck, track head design. Gaskets shall be of the mechanical grooved coupling design with short center leg to bridge pipe ends, and shall have properties as designated by ASTM Specification D-2000. Gaskets shall be as manufactured by Victaulic (FlushSeal® design), Gruvlok, or approved equal. Such gaskets shall be suitable for the required service. Nuts shall be plated steel heavy hex, conforming to ASTM Specification A-563. Transition flanges for direct connection of 125 pounds cast iron flanged valves, pumps, or other equipment, directly to grooved pipe or fittings shall be as manufactured by Victaulic (Style 341), Gruvlok, or approved equal. Transition flanges shall conform to the requirements of ASTM Specification A-536. Gaskets shall have properties as designated by ASTM Specification D-2000 and shall be suitable for the required service. Couplings for transitioning between IPS steel pipe and AWWA ductile iron sized pipe shall be as manufactured by Victaulic (Style 307), Gruvlok, or approved equal. Couplings shall consist of two ASTM A536 ductile iron housings, pressure-responsive, synthetic rubber gasket (grade to

- suit the intended service) having properties as designated by ASTM Specification D- 2000, and grade B plated steel bolts conforming to ASTM A-183 and A-307 and plated steel heavy hex nuts conforming to ASTM A-563.
- iii. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.
  - iv. Cement-mortar linings: ductile iron pipe, cast iron and ductile iron pipe fittings and specials, where indicated, shall be double thick cement-mortar-lined in accordance with ANSI Specification A 21.4. Thickness of the mortar lining shall be 1/8-inch for pipe 12-inches and smaller and 3/16-inch for pipe larger than 12- inches.
  - v. Exterior Coating: The exterior surfaces of all other pipe and fittings shall be thoroughly cleaned and given one shop coat of (1.5– 3 mils DFT) of red oxide primer. The coating used shall be compatible with the coats to be field applied. The shop coat shall be applied in accordance with the paint manufacturer's recommendations.
  - vi. Ductile iron pipe, cast iron or ductile iron pipe fittings and specials shall have cast upon them the class, thickness designation and initials of the manufacturer.
  - vii. Pipe fittings with integrally cast bases shall be provided where indicated and as directed.
  - viii. All piping shall be lead free and NSF 61 certified.

#### B. Hubless Cast Iron Pipe

1. Sanitary Waste Pipe and Fittings: Cast iron sanitary waste pipe shall be hubless cast iron pipe meeting the requirements of the editions of ASTM A888 or CISPI 301 currently in effect.
  - i. Heavy-Duty, Hubless-Piping Couplings:
    - (a) Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufactures offering products that may be incorporated into the work include, but are not limited to, the following:
      - (i) ANACO-Husky
      - (ii) Clamp-All Corp
      - (iii) Dallas Specialty & Mfg. Co.
      - (iv) MFAB, Inc.
      - (v) Mission Rubber Company; a division of MCP Industries, Inc.

- (vi) Stant
- (vii) Tyler Pipe

2. Standards: ASTM C1277 and ASTM C1540
3. Description: Stainless steel shield with stainless steel bands and tightening devices: and ASTM C564, rubber sleeve with integral, center pipe stop.

#### C. Stainless Steel Piping

1. Stainless Steel piping and tubing shall be 304L or 316L, ASTM A312/312M, seamless annealed, pickled and passivated, meeting the following thickness schedule:
  - i. Piping: 2-inch and less - Schedule 40S.
  - ii. Piping 2.5-inch to 8-inch - Schedule 10S.
  - iii. Tubing: Dimensions and materials shall conform to ASTM A269.
2. All piping 2-inches and larger shall be butt welded as per ASTM A403/A403A, Grade WP304L, conforming to ANSU B16.9 and MSS SP43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise. At valves and equipment all piping shall be flanged.
3. All piping 1 to 1.5-inch shall be threaded forged as per ASTM A182/A182M, Grade 304L. At valves and equipment all piping shall be threaded or flanged.
4. All piping  $\frac{3}{4}$ -inch or smaller shall be threaded forged as per ASTM A182/A182M, Grade F304. At valves and equipment piping shall be either threaded or flanged.
5. Accessories:
  - i. All flanges shall be forged, ASTM A182/A182A, Grade F304L, Class 150 or Class 300, slip on welding neck, 1/16-inch raised face, ANSI B16.5 standard.
  - ii. All gaskets for air services shall be 1/8-inch thick homogenous black rubber (EPDM), hardness 60 (shore A), rated to 300 degrees F, conforming to ASME B16.21 and ASTM D1330 Steam Grade. All gaskets for chemical service shall be EPDM.
  - iii. All bolts shall be Type 316 Grade B8M hex head bolts with Grade 8M hex head nuts for general conditions of service. In corrosive environments or applications, Type 304 stainless steel bolts Grade B8 with copper-silicon hex head nuts ASTM B98 Grade A shall be used.

#### D. Plastic Pipe and Fittings

1. Unplasticized polyvinylchloride (PVC) pipe and fittings shall be Type 1, high chemical resistance, normal impact, Schedule 80 pipe made of virgin polyvinylchloride and conforming to ASTM D 1785 latest edition.

2. Unplasticized polyvinylchloride (PVC) pipe and fittings shall be Type 1, high chemical resistance, normal impact, Schedule 40 pipe made of virgin polyvinylchloride and conforming to ASTM D 1784 latest edition.
  3. FEP (fluorinated ethylene propylene) tubing shall meet the requirements of ASTM D3296 and ASTM D2116. Tubing shall be FDA-approved in accordance with 21 CFR 177.1550, USP Class VI, and NSF 61 approved. FEP tubing shall be ALTAFLUOR® 200 FEP as manufactured by Altaflo LLC or Engineer approved equal.
  4. PTFE (polytetrafluoroethylene) tubing shall be FDA approved per 21 CFR 177.1550, US Pharmacopeia Class VI, and NSF 61 approved. The tubing shall be 304 stainless steel high tensile braided with a PTFE lining. PTFE tubing shall be rated for a maximum working pressure of 200 psi.
  5. Fittings used in chemical feed systems shall contain no Viton parts or components.
  6. All piping and tubing shall be NSF 61 certified.
  7. Pipe fittings shall be of the same material and shall be of the proper classification and wall thickness for use with Schedule 80 pipe, Schedule 40 pipe, or tubing. PVC joints in piping shall be solvent weld connections. Tubing connectors/adaptors for tubing shall be PVC. A sufficient number of unions and tubing connectors/adaptors shall be provided to allow for convenient removal of piping.
  8. Connections to pipe of other materials, connections to equipment, and connections at such other locations, as indicated or directed, shall be made with flanges. All flanges shall be 150-pound pipe flanges and flanged connections shall be made using SBR rubber gaskets and carbon steel bolts and nuts. SBR rubber gaskets shall conform to AWWA C111 latest revision. Flanges shall be faced and drilled to American 125 Standard and as required to match the facing and drilling of the flanges to which they are to be connected.
  9. Tubing Connection System: Adapters shall be supplied to connect PVC pump head to FEP piping for chemical feed piping as shown on the Contract Drawings. Tubing shall be secured to the PVC using a coupling nut, ferrule, o-ring, and threaded fitting. Hose clamps will not be accepted. The adapter shall be constructed of PVC. Tubing socket adapter shall be manufactured by McMaster Carr, or Engineer approved equal.
  10. Strainers: Strainers shall be Y-pattern type with a 20-mesh screen. All materials in the strainer shall be compatible for the service intended. Strainers shall be installed so as to allow for removal of screens without disconnecting piping.
- E. Copper Piping: Copper Piping shall be of the thickness specified herein or as shown on the drawings, and shall be of the longest lengths commercially available.
1. Copper pipe shall conform to ASTM B-42.

2. Fittings shall be cast bronze for copper pipe and cast bronze or copper stream-lined fittings for copper tubing conforming to ASTM B-30 UNS Alloy No. C83800.
3. All piping shall be lead free and NSF 61 certified.
4. Unions shall be bronze with ground joints and shall be semi-finished.
5. Joints for copper fittings shall be made with solder composed of 95 percent tin and 5 percent antimony.
6. Contractor shall provide copper drain lines for well service, air/vacuum, and air release valves.

## 2.2 WALL SLEEVES

- A. Cast iron wall sleeves shall be provided for all pipes passing through reinforced floors, and brick or concrete masonry unit walls, except manholes. The Contractor shall be responsible for having wall sleeves readily available and tightly secured in the form work at time of concrete placement.
- B. Cast iron wall sleeves shall be standard type, Class 250 with integrally cast wall flange. The wall sleeves shall be of the dimensions required and as directed with ends flush with both faces of the wall and for proper fitting of the carrying pipe through wall sleeve with suitable annular space. Cast iron wall sleeves shall be of approved type, dimension and wall thicknesses.
- C. For pipe penetrations through existing reinforced concrete floors, and wall brick or concrete and masonry unit walls, Contractor shall core hole through concrete of sufficient diameter for pipe and annular space to accommodate seal. Cast-iron wall sleeves shall not be used for penetrations through existing concrete or brick walls or floors.
- D. The annular space created by the wall sleeve and the pipe or the existing concrete and the piping shall be positively sealed with "Link Seal", manufactured by Thunderline Corporation, or an approved equal. Seals shall be the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled annular with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assemblies positioned in the annular space, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall opening. The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members. Where the wall sleeve penetrates a wall between a tank and an interior room shall have link seals on both the interior and exterior faces of the wall. All wall sleeves above this elevation shall have link seals on the interior wall only.

- E. The Contractor shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabricating or installing the seals. The inside diameter of each wall opening shall be sized as recommended by the manufacturer to fit the pipe and Link Seal to assure a watertight joint.
- F. The Contractor shall be familiar with the installation of the seals according to the manufacturers' instruction bulletin that illustrates the proper procedure for installing and tightening the seal to provide a water tight pipe penetration.
- G. Wall and/or floor sleeves with closure for which the above sleeves are not suited as described shall be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast water stop of 1/2 inch minimum thickness and 2 1/2 inches minimum height. Mechanical joint gaskets shall be EPDM. Wall sleeves shall be Omni Sleeve, or approved equal.

### 2.3 WALL PIPES

- A. Wall pipes shall be used where pipe of sizes 4-inch and larger penetrates structure walls and at other locations shown on the drawings. Wall pipes shall be of ANSI 21.51 ductile iron pipe of ANSI 21.50 thickness class 53 as a minimum.
- B. Wall pipe shall have a cast central fin of minimum 1/2 in. thickness and 1-1/2 in. to 2 in. high at the midpoint of the wall. Joints shall be ANSI A21.11 mechanical joint for the external joint and ANSI A21.15 flange joint for the interior joint. Flanges, facing, and drilling shall conform to ANSI B16.1, Class 125. Where flanges are flush with the structure wall, they shall be drilled and tapped for studs.
- C. Wall pipes shall be double cement lined and coated with bituminous seal coating conforming to ANSI B21.4.
- D. All pipes shall be lead free and NSF 61 certified.

### 2.4 EXPANSION JOINTS

- A. Provide, where indicated on the drawings, specified or detailed, expansion joints of the single arch, rubber type for equipment and piping. Provide restraint of all expansion joints with tie-rods.
- B. All expansion joints shall be lead free and NSF 61 certified.
- C. Flexibility capacity (minimum), in inches or degrees,

Nom. Dia. (in)	Axial Comp.	Axial Ext.	Lateral Deflection	Torsional Deflection	Angular Deflection
1-3	7/16	1/4	1/2	3	13
4-6	7/16	1/4	1/2	3	8
8-18	11/16	3/8	1/2	2	3

D. Provide joints of pressure ratings as follows:

1. Plant water lines, water lines - minimum 140 psi rating
2. Backwash Air - 30 psig

E. The temperature rating of the expansion joints shall be minimum 200 deg. F for water service.

F. The temperature rating of the expansion joints shall be minimum 300 deg. F for air service.

G. For air service, install on each blower at inlet and outlet flange. Thrust restraint rods on discharge if not otherwise restrained.

H. Expansion joints installed on solids laden lines shall be provided with filled arches. Movement capabilities of the filled arch joints shall be at least 50 percent of those hereinbefore specified for the unfilled arch joint.

I. Construction for service other than chlorine solution

1. Joint consists of arched body with steel retaining rings. Body wraps around retaining ring to act as flange face.
2. Body – Water Service
  - i. Inner tube: Neoprene
  - ii. Reinforcement: bonded polyester/neoprene plies, unexposed to atmosphere.
  - iii. Outer cover: Hypalon coated neoprene
3. Body – Air Service
  - i. Inner tube: Kevlar reinforced Viton
  - ii. Reinforcement: bonded polyester/neoprene plies, unexposed to atmosphere.
  - iii. Outer cover: Kevlar reinforced Viton
4. Retaining rings: 304 stainless steel or hot-dipped galvanized steel, unless otherwise approved.



5. The temperature rating of the joint shall be as noted above.
6. Manufacturers
  - i. General Rubber Corp., S. Hackensack, NJ
  - ii. Mercer Rubber Co., Toledo, OH
  - iii. or approved equal
- J. Refer to Section 13215 – Chemical Storage Tanks for chemical feed tank flexible connection/expansion joints.
- K. Metal Bellows for Stainless Steel Piping:
  1. Utilized to allow for thermal expansion due to differences between installation and operating temperatures.
  2. Type: Single-ply, annular corrugated metal bellows with limit rods. Circumferential convolution welds not permitted.
  3. Material: Type 316 stainless steel.
  4. End connections: ASME 150-pound stainless steel flanges.
  5. Minimum Design Working Pressure: 150 psig at 750 degrees F.
  6. Length: Minimum of four convolutions and minimum manufacturer recommendation for vibration isolation.
  7. Verify with Manufacturer suitability for intended service and process flow stream.
  8. Manufacturers and Products:
    - i. Hyspan Precision Products, Inc.; Series 1500
    - ii. Pathway Bellows, Inc.; Style CT.

## 2.5 FLANGED COUPLING ADAPTERS

- A. Flanged coupling adapter for jointing of plain ends of ductile iron pipe to flanges shall be of the proper size and suitable for use on the piping on which it is installed. The coupling shall be of cast ductile iron construction. Coupling shall have a bolt circle, bolt size, and spacing to ANSI 150 lb. flange drilling. The coupling gasket shall be Grade 27 Buna S - NSF 61 listed and compounded to resist water. The temperature range of the gasket shall be -20°F to 180°F. Bolts and nuts shall be low alloy steel to AWWA C111/ANSI A21.11. The coupling shall be provided with not less than four tie rods extending from flange connections on each side of the couplings. Follower rings shall be amply proportioned to take, without deformation, the strains imposed on the coupling by the installation. The ends of the pipes shall be prepared and the

couplings installed in accordance with the printed recommendations of the manufacturer of the couplings. The Contractor shall be responsible for verifying dimensions of piping materials necessary to ensure proper fabrication, installation and fitting of the contract work. Flange Coupling Adaptor shall be Dresser, Inc. Style 128-W with lock pins or Engineer approved equal.

## 2.6 FILLER RINGS

- A. Filler rings of the same materials, facing and drilling as the flanges they are used with shall be provided in flanged piping where necessary and approved for the proper fitting and layout of the piping and to limit interference between wafer butterfly valves and ductile iron pipe lining or cast iron fittings.

## 2.7 TAPPED CONNECTIONS

- A. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed that listed in the appropriate table of the Appendix to the ANSI A 21.51 based on three full threads for ductile iron.
- B. Where the size of the connection exceeds that given above for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or approved.
- C. All drilling and tapping of ductile iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition to produce good, clean cut threads of the correct size, pitch, and taper.
- D. Sample taps are to extend to the mid-point of the pipeline using injection type nozzle and corporation. All sample taps within the water treatment plant or well stations shall be a smooth-nosed style. No threads shall be on any tap.

## 2.8 VALVES

### A. Gate Valves

1. Gate valves, two inches and smaller, shall be 125 pound bronze with solid wedge, screwed-in bonnet, inside screw, non-rising stem, and screwed ends.
2. Gate valves larger than two inches shall be resilient wedge gate valves. Resilient wedge gate valves shall meet the most recent version of the AWWA standard specification AWWA C509. Gate valves shall be open left.

### B. Swing Type Check Valves

1. Check valves shall be rubber seated dampened swing check with outside counterweight and lever and shall meet the requirements of AWWA C508. The valve shall permit flow in one direction only and close tightly without slamming. The valve shall be cast iron (ASTM A126-13) with cast iron disc of similar material. The hinge shaft shall be stainless steel with disc arm and counterweight arm keyed thereon. The body seat shall be all bronze or stainless steel. The valve shall be as manufactured by GA Industries, or approved equal.
2. All valves shall be lead-free and NSF 61 certified.
3. The valves shall be compatible with a 125 pound ANSI drilled flange. Valves shall be cleaned and shop primed on the outside with a rust inhibitive priming system.
4. Check valves (two inches and smaller) shall be 300-pound bronze curving design with screwed-in bonnet, re-grinding bronze disc, and screwed ends. Disc shall be suspended at the top with a stainless steel shaft. All check valves shall be horizontally mounted.

#### C. Silent Type Check Valves

1. Silent check valves shall be threaded style, spring-loaded, and of the operating type that begins to close as the forward flow diminishes and is fully closed at zero velocity. The valve shall permit flow in one direction only and close tightly without slamming. The valve body, disc, and spring shall be 316 stainless steel. The compression seal shall be PTFE. Valve shall be capable of operating in a vertical position. Valve shall be rated for a minimum temperature of 180°F and minimum pressure of 230 psi. The valve shall be Model 812XT by Flomatic or Engineer approved equal.
2. Valve shall be lead-free, and NSF 61 certified for drinking water.
3. Valve shall meet the requirements of ASME B16.34.
4. Valve shall be rated for continuous submerged service in a groundwater well application.

#### D. Silent Globe Style Check Valves

1. Check valves shall be of the silent operating type that begins to close as the forward flow diminishes and is fully closed at zero velocity. The valve shall permit flow in one direction only and close tightly without slamming. The valve shall be cast iron (ASTM A48 Class 35). The seat and disc shall be ASTM B584 Alloy C83600 cast bronze. The compression spring shall be 304 stainless steel with ground ends. The valve shall be manufactured by Danfoss, Inc. Model 402BT or Engineer approved equal.

2. The valves shall be compatible with a 125-pound ANSI drilled flange. Valves shall be cleaned and shop primed on the outside with a rust inhibitive priming system.

#### E. Ball Check Valves

1. Working Water Pressures: For 2-inch and larger: 150 psi.
2. Valve Body: Provide body constructed of ductile iron with integral flanges, faced and drilled per ANSI B16.1 Class 125 and provide non-clogging design with unobstructed waterway when the valve is open. Valve shall be suitable for continuous submerged conditions and installation in the horizontal or vertical position as indicated on the drawings.
3. Cover: Ductile iron cover with gasket of suitable material for service indicated and specified.
4. Ball: ASTM A126 Class B cast iron with vulcanized Buna-N coating.
5. Hardware: Nuts, bolts, and washers shall be carbon steel.

#### F. Check Valve for Air Service. Refer to Section 11377.

#### G. Bronze Ball Valves

1. Bronze ball valves shall be of bronze construction. The shaft and packing nut shall be constructed of brass and the ball shall be constructed of hard chrome-plated brass. Shaft packing shall be glass reinforced PTFE. Packing shall be tightened by means of a gland bearing strip. Replacement of the packing shall be accomplished without removing the actuator. The handle shall be stainless steel with vinyl insulator. Ball shall have a straight-through passageway, and shall be of the full port design. Valves shall be rated for 150 psi service. All valves shall be lead free and NSF 61 certified.

#### H. Cam-and-Grove Couplings

1. Cam-and-Groove hose couplings for chemical fill pipes and sludge truck connection shall be provided where shown on the Contract Drawings. The female coupling material shall be compatible with each chemical application and sized as specified on the Contract drawings. The couplings shall be provided with a cap. The couplings shall be attached to the process piping with NPT threads. The contractor shall coordinate the coupling with the Owner and Engineer.

#### I. Plastic Valves

1. Polyvinylchloride (PVC) valves shall be manufactured of the same PVC Type I Grade I molding compound used for the fittings to assure proper compatibility of system components. Seats, seals, and other components shall be suitable for the

intended service.

2. Ball valves for PVC lines shall be true union PVC valves with fully serviceable, replaceable valve component design. Valve design shall allow for entire valve body removal by turning back the union nut at both ends of the valve without disturbing the pipe. Valves shall have self-adjusting floating teflon seats. Packing material shall be chemically compatible with the liquid service. Valves shall carry a pressure rating of 150 psi at 75 degrees F water. Valve shall be manufactured to ASTM F 1970. All valves shall be NSF 61 certified.
3. Vented ball valves for PVC lines shall be true union PVC valves with fully serviceable, replaceable valve component design. Vented ball valves shall have a drilled ball and shall be used for sodium hypochlorite applications. Valve design shall allow for entire valve body removal by turning back the union nut at both ends of the valve without disturbing the pipe. Valves shall have self-adjusting floating teflon seats. Packing material shall be chemically compatible with the liquid service. Valves shall carry a pressure rating of 150 psi at 75 degrees F water. Valve shall be manufactured to ASTM F 1970. All valves shall be NSF 61 certified.
4. Ball check valves for PVC lines shall be true union with full serviceable, replaceable valve component design. Valve design shall allow for entire valve body removal by turning back the union nut at both ends of the valve without disturbing the pipe. All valve components shall be replaceable and valve shall be suitable for either horizontal or vertical installations. Valves shall have self-adjusting floating teflon seats. Packing material shall be chemically compatible with the liquid service. Valves shall carry a pressure rating of 150 psi at 75 degrees F water. Valve shall be manufactured to ASTM F 1970.
5. Sediment Strainer: Sediment Strainers shall be PVC body. Seal material shall be chemically compatible with the liquid service. Valves shall be true-union design and constructed of transparent PVC. Standard screens shall be 20 mesh PVC. Strainer shall carry a pressure rating of 150 psi at 75 degrees F water and shall have NSF 61 Certification for use in drinking water applications. Strainer shall be manufactured by Asahi/America Corp or Engineer approved equal.
6. Air Release/Degassing Valve: An air release/degassing valve shall be installed on chemical transfer piping at the highest point prior to entering the day tank as shown on the Contract Drawings. The valve shall release any air built up in the pipe during chemical transfer and the outlet port being piped back to the day tank. The valve shall be constructed of PVC with a polypropylene float. Seal material shall be chemically compatible with the liquid service. All wetted parts shall be compatible with their intended chemical application. Valves shall have a pressure rating of 100 psi. Air release/degassing valves shall be manufactured by Plast-O-Matic, or Engineer approved equal.

#### J. Ball Valve – Electrical Actuator

1. Ball valves for PVC lines shall be true union PVC valves with fully serviceable, replaceable valve component design. Valve design shall allow for entire valve body removal by turning back the union nut at both ends of the valve without disturbing the pipe. Valves shall have self-adjusting floating teflon seats. Packing material shall be chemically compatible with the liquid service. Valves shall carry a pressure rating of 150 psi at 75 degrees F water. Valve shall be manufactured to ASTM F 1970. For chemical service applications, valve wetted parts shall be suited for the intended service.
2. Electric Actuators shall meet the following requirements:
  - i. Power: single phase 120VDC power
  - ii. Handwheel for manual operation when power is not available. Handwheel shall be open left.
  - iii. Cycle time: 11 seconds (minimum).
  - iv. Open and closed limit switches.
  - v. Electric Actuators for ball valves shall be ECP3 by Hayward or Engineer Approved equal. Refer to Electric Operators/Actuators of this Section for additional requirements.

#### K. Stainless Steel Ball Valves

1. Stainless steel ball valves shall be of Type 304 or 316 stainless steel construction, as shown on the Contract Drawings. Body shall be of rigid construction and symmetrically cast. The shaft and ball shall be integrally cast and shall be Type 304 or 316 stainless steel. Seats shall be recessed in a machined groove. Shaft packing shall be a braided band. Packing shall be tightened by means of a gland bearing strip. Replacement of the packing shall be accomplished without removing the actuator. Ball shall have a straight-through passageway, and shall be of the full port design. Valves shall be rated for 150 psi service. For chemical service applications, valve wetted parts shall be suited for the intended service. All valves shall be NSF 61 certified.

#### L. Butterfly Valves - Water Service, Manual Actuator

1. Butterfly type valves shall be flanged, wafer style, cast iron body, resilient seat, tight closure, vertical seating valves. Valves shall have cast iron disc with stainless steel edge discs, EPDM seats, and model MDT handwheel operators. Valves shall conform to American Water Works Association, Specification C504, latest edition, Class 150B. The Contractor shall furnish the services of a valve manufacturer's representative who shall check all valve installations and make all necessary adjustments to assure proper and satisfactory operation of the valves. All valves shall be open left and shall have a position indicator permanently cast on the valve operator. Acceptable valve manufacturers are Pratt, DeZurik, M & H, or equal. All

valves shall be lead free and NSF 61 certified.

2. Valve bodies and flanges: Laying lengths for valves shall be as given in Table 1 of AWWA C504-06. Valve bodies shall be constructed of cast iron conforming to ASTM Designation: A 126, Class B, or ASTM Designation: A 48, Class 40. Cast iron waterways surfaces shall be epoxy coated. Valve body flange drilling shall conform to ANSI Specification B 16.1, Class 125 with full through drilled holes.
3. Valve shafts shall be made of stainless steel Type 304, in accordance with Table 3 of AWWA C504.
4. Valve discs shall be of cast design. Valve disc material shall be of cast iron conforming to ASTM Designation: A 48, Class 40 or A-126, Class B with all exposed cast iron surfaces coated with an approved epoxy base coating applied to a dry film thickness of not less than 12 mils.
5. Valve seats for all valves shall be designed to provide tight shut-off at a pressure differential of 150 psi upstream, zero psi downstream. Rubber seats shall be applied to the cast iron valve disc and clamped thereon using a retaining ring and the mating seat surface shall be Type 304 stainless steel applied to the cast iron body. Subject to the review of the Engineer, the rubber seat may be molded and bonded into the valve cavity and the disc shall be of cast iron, ASTM A-126 Class B with 316 stainless steel seating edges. Valve seats, valve seat assemblies and materials shall be subject to the review of the Engineer.
6. Valve bearings shall be of the permanently self-lubricating sleeve type. Valves shall be equipped with a 2-way thrust bearing permanently set at the factory which will permit the valve to be mounted in any position. Each valve shall have a self-lubrication sleeve type bearing for the valve operator. The housing for the bearing shall be rigidly attached to the valve body. All valve bearings shall be non-metallic throughout and of approved types.
7. Shaft seals: All valves shall be provided with shaft seals designed for use by stuffing boxes with pull-down packing. Stuffing boxes shall be of cast iron conforming to ASTM Designation: A 126, Class B, with cast bronze gland assemblies and flax packing or may be the split v chevron type.
8. Manual Operators: Operators shall conform to AWWA Standard C504 and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping or fluttering. Valve operators shall be open left and of the traveling nut type, self locking without uni-directional sustained force from the valve, self lubricating, rated for operation when submerged at a water pressure of 10 psi, and shall be equipped with a position indicator. Multi-position hand-lever actuators shall be provided where indicated. The operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chain wheels. Chainwheels shall be provided on all valve operators when the centerline of the valve is more than six (6) feet above the

finished floor level. Operator components shall withstand an input of 300 foot pounds at extreme operator position without damage.

M. Butterfly Valve - Water Service, Electrical Actuator

1. Butterfly type valves shall be flanged, wafer style, cast iron body, resilient seat, tight closure, vertical seating valves. Valves shall have cast iron discs with stainless steel edge, EPDM seats, and electric actuators (refer to Paragraph 2.13 of this Section for additional requirements). Valves shall conform to American Water Works Association, Specification C504, latest edition, Class 150B. The Contractor shall furnish the services of a valve manufacturer's representative who shall check all valve installations and make all necessary adjustments to assure proper and satisfactory operation of the valves. All valves shall be open left and shall have a position indicator permanently cast on the valve operator. Acceptable valve manufacturers are Pratt, DeZurik, M & H, or equal. All valves shall be lead free and NSF 61 certified.
2. Valve bodies and flanges: Laying lengths for valves shall be as given in Table 1 of AWWA C504-06. Valve bodies shall be constructed of cast iron conforming to ASTM Designation: A 126, Class B, or ASTM Designation: A 48, Class 40. Cast iron waterways surfaces shall be epoxy coated. Valve body flange drilling shall conform to ANSI Specification B 16.1, Class 125 with full through drilled holes. Valve shafts shall be made of stainless steel Type 304, in accordance with Table 3 of AWWA C504.
3. Valve discs shall be of cast design. Valve disc material shall be of cast iron conforming to ASTM Designation: A 48, Class 40 or A-126, Class B with all exposed cast iron surfaces coated with an approved epoxy base coating applied to a dry film thickness of not less than 12 mils.
4. Valve seats for all valves shall be designed to provide tight shut-off at a pressure differential of 150 psi upstream, zero psi downstream. Rubber seats shall be applied to the cast iron valve disc and clamped thereon using a retaining ring and the mating seat surface shall be Type 304 stainless steel applied to the cast iron body. Subject to the review of the Engineer, the rubber seat may be molded and bonded into the valve cavity and the disc shall be of cast iron, ASTM A-126 Class B with 316 stainless steel seating edges. Valve seats, valve seat assemblies and materials shall be subject to the review of the Engineer.
5. Valve bearings shall be of the permanently self-lubricating sleeve type. Valves shall be equipped with a 2-way thrust bearing permanently set at the factory which will permit the valve to be mounted in any position. Each valve shall have a self-lubrication sleeve type bearing for the valve operator. The housing for the bearing shall be rigidly attached to the valve body. All valve bearings shall be non-metallic throughout and of approved types.
6. Shaft seals: All valves shall be provided with shaft seals designed for use by



stuffing boxes with pull-down packing. Stuffing boxes shall be of cast iron conforming to ASTM Designation: A 126, Class B, with cast bronze gland assemblies and flax packing or may be the split v chevron type.

7. Electric Actuators - Electric Actuator shall be provided with handwheel for manual operation when power is not available. Handwheel shall be open left. Refer to Paragraph 2.13 of this Section for additional requirements.

#### N. Butterfly Valve - Air Scour and Backwash Air Service

##### 1. Manufacturers

- i. Pratt Valve Company;
- ii. Keystone Valve U.S.A., Houston, Texas;
- iii. Crane Valve Company; or
- iv. Engineer approved equal.

##### 2. General

- i. Valves on the blower discharge pipes shall be of materials suitable for air service at temperatures of 0 degrees to 300 °F.
- ii. Valves shall be at least Class 25, rated for at least 25 psi air service.
- iii. Valves shall be specifically designed for air service.
- iv. Valves shall be capable of bi-directional, drop tight service to 150 psi. The temperature range shall be as stated above.
- v. Operators shall be provided as indicated on the Contract Drawings and specified elsewhere under this Section.
- vi. Valves shall have a position indicator.
- vii. Butterfly valves for modulating service shall be manufactured to withstand long term, continuous movement in response to flow control signals.
- viii. All actuators shall be sized for air service applications.
- ix. Valve shall open left (counter-clockwise)
- x. All valves shall be lead-free and NSF 61 certified.

##### 3. Body

- i. Material: Cast iron, ASTM Designation A126, Class B. Valves shall be either wafer (2- 36 inches) or flanged (42 – 48 inches) design. Drilling shall be per ANSI Designation B16.1, Class 125/150.

##### 4. Disc

- i. Material: Disc material shall be of aluminum bronze or ductile iron with nickel edge, ASTM Designation B148, Alloy 952.
- ii. Disc edges and hubs shall be hand polished to a 32 AARH or better finish to

- reduce frictional torque.
- iii. Type: Air profile design.

#### 5. Seat

- i. Material: EPDM, one-piece, compatible with specified valve operating temperatures and pressures stated herein.
- ii. Cover the entire inner surface of the valve body, including a positive sealing surface around the shaft. Elastomer seat shall be in the body. Seat on disc edge is not acceptable.
- iii. Seat shall fully isolate the valve body, stem and journal areas.
- iv. Seat shall be dovetail EPDM and shall be field replaceable without use of special tools. Bonding to body is unacceptable.
- v. Seat shall be configured to provide gasket surfaces for mating flanges.

#### 6. Bearings

- i. Type: Self-lubricating, corrosion-resistant sleeve.
- ii. Contained in integral hubs of valve body.
- iii. Upper and lower inboard bearings shall be RTFE lined stainless steel or bronze.
- iv. Heavy duty corrosion resistant top bushing shall be provided to absorb side-thrust.

#### 7. Shaft Seals

- i. Designed for use with standard O- ring seals.
- ii. Packing to be bi-directional, self adjusting double V-cup packing.
- iii. Packing material shall be suitable for the temperature and service conditions stated in this section.

#### 8. Stem

- i. Stem shall be one piece 18-8 stainless steel.

#### 9. Disk-Stem Connection

- i. The disc and stem shall be connected by a 316 stainless steel torque plug (2-12 inches), 316 stainless steel disc screws (14-20 inches), and 17-4 pH stainless steel taper pins (24-48 inches). Connection shall provide positive engagement of disc and stem. Loose or slip fit connection between disc and stem will not be allowed.

#### 10. Manual Valve Operators

- i. Manual butterfly valves as noted in the design drawings shall be lever operated.

The lever shall be able to latch in intermediate positions.

- ii. Electrically actuated butterfly valves as noted in the design drawings shall have totally enclosed gear actuators of an approved NSF 61 grease lubricated or oil bath type with handwheel except where chainwheel is specified hereinafter. All actuators shall clearly indicate valve position.
- iii. The maximum force necessary to operate the manual mechanisms shall be 40-lb. pull for handwheels and chainwheels, and a maximum of 150 ft.-lbs. Force for operating nuts.

O. Air Release Valve, ½ to 2-inches

1. Suitable for water service, automatically exhaust small amounts of entrained air that accumulates in a system. In CLOSED position, seat against resilient seat to prevent water leakage.
2. Rated 150 psi working pressure, cast iron or ductile iron body and cover, stainless steel float and trim, NPT threaded inlet and outlet, built and tested to AWWA C512. Contractor shall provide copper drain line for air release valves.
3. Manufacturers and Products:
  - i. Pipeline Air Release Valves:
    - (a) APCO Valve and Primer Corp.; Series 50, 200A
    - (b) Val-Matic Valve; Series 15A to 25.5.
    - (c) Or Engineer approved equal.
  - ii. Filter Air Release Valves:
    - (a) APCO Valve and Primer Corp.; Series 200A
    - (b) Or Engineer approved equal.

P. Well Service Air Valve

1. Well service air valve shall be fully automatic float operated valves designed to exhaust air which is present in the pump column on pump startup and allow air to re-enter the column on pump shutdown or should a negative pressure occur. The valve design shall incorporate a throttling device providing adjustable control of the exhaust rate and allow free flow into the valve through a separate inlet port. The valve shall be manufactured and tested in accordance with AWWA C512. The valves shall be suitable for potable water service and NSF 61 certified.
2. The valve body, cover, and baffle shall be constructed of ASTM A126 Class B cast iron for Class 125 valves. The float, guide shafts, and bushings shall be constructed of Type 316 stainless steel. Non-metallic guides and bushings are not acceptable. Resilient seats shall be Buna-N.
3. Valve shall be Val-Matic Model 101ST, or Engineer approved equal.

Q. Surge Relief Valve (SRV-232, SRV-322)

1. A high-pressure relief valve shall be provided to open the valve if an obstruction in the line blocks the flow and increases line pressure. The valve shall be of ductile iron construction with bronze trim and shall be a single seated, hydraulically operated, pilot controlled, diaphragm actuated globe valve. The main valve shall have a single removable seat and resilient disc. The valve stem shall be guided at both ends by a guide bushing in the valve bonnet and an integral bushing in the valve seat ring. The pilot control system shall consist of a diaphragm actuated pilot valve, adjustable normally closed relief pilot, adjustable needle valves for time delay and closing speed control. To isolate the control system from the main valve, inlet and outlet ball valves shall be provided. The valve shall be sized to meet the intended design requirements, and shall be flanged to meet ANSI Class 125 and have a maximum pressure rating of 400 psi. The valve shall be Cla-Val Model 52-01 or Engineer approved equal. The manufacturer shall submit a certification stating that the supplied pressure relief valve is suitable for the intended service.

R. Pressure Anticipator and Surge Relief Valve (SRV-739)

1. A pressure relief and surge anticipator valve shall function to anticipate pressure surges and open to dissipate the surge. A high-pressure relief valve shall also be provided to open the valve if an obstruction in the line blocks the flow. The valve shall be of ductile iron construction with bronze trim and shall be a single seated, hydraulically operated, pilot controlled, diaphragm actuated globe valve. The main valve shall have a single removable seat and resilient disc. The valve stem shall be guided at both ends by a guide bushing in the valve bonnet and an integral bushing in the valve seat ring. The pilot control system shall consist of a three-way solenoid pilot, accumulator, three-way diaphragm actuated pilot valve, adjustable normally closed relief pilot, adjustable needle valves for time delay and closing speed control. To isolate the control system from the main valve, inlet and outlet ball valves shall be provided. The valve shall be sized to meet the intended design requirements, and shall be flanged to meet ANSI Class 125 and have a maximum pressure rating of 400 psi. The valve shall be Cla-Val Model 52-03 or Engineer approved equal. The manufacturer shall submit a certification stating that the supplied pressure relief and surge anticipator valve is suitable for the intended service.

S. Pressure Sustaining Valve (PSV-348A, PSV-348B)

1. The pressure sustaining valve shall be hydraulically operated, single-diaphragm actuated, and globe pattern.
2. Refer to the mechanical schedule in the Contract Drawings for a description and operating conditions of the solenoid controlled diaphragm valves.
3. The valve shall consist of three major components:
  - i. The body with seat installed.

- ii. The cover with bearing installed.
  - iii. The diaphragm assembly.
4. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not acceptable. Pistons operating the main valve or pilot controls are not acceptable.
  5. The valve body and cover shall be of cast ductile iron ASTM A-536 with interior/exterior heat fusion epoxy coating and type 316 stainless steel trim. The valve shall be flanged with 150 lb. flanges. No fabrication or welding shall be used in the manufacturing process. The valve shall contain an EPDM Rubber disc. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and close shocks. O-ring type discs are not acceptable. Hourglass shaped disc retainers and V-type or slotted type disc guides are not acceptable.
  6. The diaphragm assembly shall contain a non-magnetic type 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures. The diaphragm assembly shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut-off. The stem shall be drilled and tapped in the cover end to receive and affix limit switches and/or position indicator transmitters as indicated on the Contract Drawings.
  7. The diaphragm shall be flexible, non-wicking, and NSF 61 approved. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center stem hole for the main valve stem shall be sealed from the operating pressure. The diaphragm shall withstand a Mullins Burst Test of a minimum 600-psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.
  8. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing shall be threaded into the cover. The seat in 6" or smaller valves shall be threaded into the main valve body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. Pinned covers shall not be acceptable. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.

9. The valve shall be provided with a limit switch assembly for FULLY CLOSED and OPEN indication, valve, position, pilot system isolation cocks, opening and closing speed control, and a check valve feature.
10. The valve manufacturer shall provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damages for each valve supplied.
11. Pilot Control System - Modulating
  - i. The pilot control system shall be a three-way solenoid, which shall fully close the main valve when energized and open it for pilot control when de-energized. Control of the solenoid valve shall be via the SCADA system. The solenoid shall be 24 VDC with NEMA 4X enclosure. The solenoid body shall be Brass ASTM B283. The solenoid shall fail open due to loss of power.
  - ii. An electronically actuated pilot shall be provided with the valve to remotely control valve position. The actuator speed shall be factory set to less than one RPM with a maximum of nine (9) turns. Actuator position feedback shall be supplied standard and shall be a 4-20 mA analog signal. The remote command input 4-20 mA analog signal shall be automatically ranged in engineering units within the range set by the built-in electronic limiters. The valve shall be supplied with electronic range limiters that shall reduce the controllable range to a portion within the full pilot spring range.
  - iii. A manual system to by-pass the solenoid shall also be provided. The pilot control system shall also include a “wye” strainer, provision for independent operating pressure, atmospheric drain, isolation needle valves for maintenance and testing purposes, valve position transmitter, open and closed limit switches, and independently adjustable opening and closing speed controls.
  - iv. The valve shall include a valve position transmitter designed to provide electronic indication of the valve position. The assembly shall be mechanically actuated by the opening or closing movement of the diaphragm valve. The transmitter shall output a 4-20 mA analog signal that is in direct proportion to main valve position. Measurement range shall be suitable for entire valve stroke. It shall be housed in a NEMA 4X enclosure and be factory installed on the valve. Refer to Division 13 - Special Construction and Instrumentation Drawings for additional requirements.
  - v. All control of the pressure sustaining valve shall be directly from the SCADA system and no interim, proprietary control panels shall be accepted.
  - vi. Provide all additional appurtenances as required for a complete, functional pilot control system and valve.

## 12. Spare Parts

- i. Provide one spare solenoid valve of each type provided for valve control.

13. The valve shall be Cla-Val Model 50-01 with CRL-34 electronically actuated pilot control system, or engineer approved equal.

T. Backwash Supply Pressure Reducing Valve (PRV-832)

1. The pressure reducing valve shall be hydraulically operated, single-diaphragm actuated, and globe pattern.
2. Refer to the mechanical schedule in the Contract Drawings for a description and operating conditions of the solenoid controlled diaphragm valves.
3. The valve shall consist of three major components:
  - i. The body with seat installed.
  - ii. The cover with bearing installed.
  - iii. The diaphragm assembly.
4. The main valve shall be provided with stainless steel anti-cavitation trim. The anti-cavitation features of the seat and disc guide detail shall have flow slots equally spaced around their perimeters. The seat slots shall be orientated around the perimeter of the seat so that fluid entering the valve shall flow through the seat slot detail converges in the center chamber of the seat allowing potential cavitation to dissipate. The disc guide slots shall be positioned around the perimeter of the disc guide, configured and oriented in an angular direction so that fluid flow exiting through the slots is diverted away from direct impact into pressure boundary surfaces. Flow exiting the disc guide slots is directed in an angular path to increase the distance between the slot geometry and pressure boundary surfaces. If cavitation conditions exist, the increased distance between the slots and pressure boundary surfaces minimizes the potential for damage by allowing the cavitation bubbles to dissipate before they contact pressure boundary surfaces. The slotted seat and disc guide components shall control anti-cavitation characteristics. The disc guide shall slide in the seat and allow controlled flow through the seat slots into the central seat chamber where flow shall continue from the seat chamber and exit through the angularly oriented slots of the disc guide. The seat and disc guide features used together shall provide anti-cavitation characteristics suitable for applications where a large, controlled pressure drop is desired.
5. The diaphragm shall be flexible, non-wicking, and NSF 61 approved. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center stem hole for the main valve stem shall be sealed from the operating pressure. The diaphragm shall withstand a Mullins Burst Test of a minimum 600-psi per layer of nylon fabric and shall be cycle tested 100,000 times to ensure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.
6. To ensure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. All necessary repairs and/or modifications other than replacement of the

main valve body shall be possible without removing the valve from the pipeline.

7. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment, provided the valve is installed and used in accordance with all applicable instructions.
8. The valve shall be provided with an isolation valve, solenoid system isolation cocks, opening and closing speed control, a check valve feature, solenoid pilot system, and electronic controller.
9. The backwash supply pressure reducing valve shall control backwash supply flow under the following conditions:
  - i. GAC backwash:
    - (a) Flow: 945 gpm
    - (b) Influent pressure: 91.5 psi
    - (c) Effluent pressure: 23.1 psi
  - ii. IX backwash:
    - (a) Flow: 100 gpm
    - (b) Influent pressure: 94.2 psi
    - (c) Effluent pressure: 0.2 psi
  - iii. Fe/Mn backwash flow:
    - (a) Flow: 465 gpm
    - (b) Influent pressure: 93.1 psi
    - (c) Effluent pressure: 17.8 psi
  - iv. Fe/Mn slow refill:
    - (a) Flow: 155 gpm
    - (b) Influent pressure: 93.7 psi
    - (c) Effluent pressure: 3.6 psi
10. The valve manufacturer shall provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage for each valve supplied.
11. Electronic Valve Controller
  - i. The pilot control system shall include (2) two-way solenoid valves, which shall be operated by a manufacturer-furnished electronic controller to control the backwash supply flow. The solenoid valves shall be 24 VDC-powered with a NEMA 4X enclosure. The solenoid body shall be Brass ASTM B283.
  - ii. The main valve shall fully close upon loss of power.
  - iii. The electronic valve controller shall meet the following requirements:
    - (a) (6) 4-20 mA analog inputs
    - (b) (6) dry contact digital inputs
    - (c) (4) 4-20 mA analog outputs
    - (d) (2) solenoid solid state relays
    - (e) (2) mechanical relays for alarms



- (f) 4 GB SD storage
  - (g) CSV file format
  - (h) File transfer to USB memory
  - (i) 4.3" 480 x 272 color display (24 bit)
  - (j) IP-68 submersible.
- iv. Provide all additional appurtenances as required for a complete, functional control system and valve.

## 12. Spare Parts

- i. Provide two spare solenoid valves of each type provided for valve control.
- ii. Provide two rubber valve repair kits.

13. The valve shall be Cla-Val Model 131-22BCDPSVY KO DS SSB 150AG 24VDC with VC-22D electronic valve controller, or Engineer approved equal.

## U. Needle Valves

- 1. Valves shall be of stainless steel and have NPT connections. Valve shall have a metal-to-metal seat and PTFE packing. Valve shall be provided with a T-handle.

## V. Solenoid Valves

- 1. Valves shall be direct acting packless three-way or two-way solenoid valves for water service as indicated on the Contract Drawings. Valves shall be normally closed, unless otherwise shown suitable for operation with 24 VDC power and have continuous duty Class A insulation and general purpose enclosure. Valve body shall be forged brass with safe body working pressure of at least 250 psi, NPT connections, with Buna-N seat, wetted parts shall be of stainless steel. Valves shall operate satisfactorily when mounted in any position.

## 2.9 VALVE TAGS

- A. All valves in piping except individual valves provided with equipment shall be tagged with an aluminum or brass disc, wired to the valve, die-stamped with identifying numbers or letters.
- B. A flow diagram, identifying the number and duty of each tagged valve, framed under safety glass, shall be furnished and mounted by the Contractor in the Electrical/Control room, at major equipment, or as directed by the Engineer.

## 2.10 PIPE SUPPORT SYSTEMS

- A. All supports and parts required for the installation of the piping systems shall conform to the requirements of Chapter 1, Section 6 of the ANSI Code for Pressure Piping (B-31.1), except as modified and supplemented by the requirements set forth herein. All piping shall be supported in such a manner to fulfill this specification. Pipe supports

and restraints shall be adequate for the maximum test pressure specified herein or 1.5 times the apparent working pressure, whichever is greater. General Contractor shall provide and install all pipe supports for piping, valves, equipment, and ancillary items described within Division 11. Piping with centerlines greater than or equal to seven (7) feet above the finished floor shall be supported from the pre-engineered metal building sub-frame or pre-cast concrete ceiling. Refer to Division 13, Structural Drawings, and Architectural Drawings for additional requirements.

1. Supporting appurtenances shall be arranged to prevent undue stress on equipment to which piping is connected. The supporting system shall be arranged without causing damaging deflection to the support member. Supporting appurtenances shall provide the desired pitch, as specified or required, for proper drainage of the piping. The pipe suspension shall prevent excessive stress, excessive variation in supporting force, and possible resonance with imposed vibration while the system is in operation. Supporting appurtenances, when used with copper piping, shall be copper, bronze or PVC dipped galvanized steel.
2. All piping shall be supported independently of the equipment to which it is connected. All equipment shall be removable without needing temporary supports for adjacent piping. Any anchors for all supporting appurtenances shall be drilled expansion bolt type, power-driven stud anchors are not acceptable. Expansion bolts shall be stainless steel, similar and/or equal to Kwik-Bolt.
3. All metallic supporting appurtenances, except those used for copper piping, and as otherwise noted, shall be galvanized conforming to ASTM A-153 for threaded items, and ASTM A-123 for all other items. Supporting appurtenances in the high humidity areas shall be stainless steel. Normal humidity service shall be defined as all spaces where there are no water-containing open tanks or channels. High humidity service shall be defined as any spaces near open water-containing tanks or channels. All pipe support systems in the chemical containment area shall have a shop-applied PTFE coating system similar to Xylan 1424 or Engineer approved equal. Hangers shall not become disengaged by movements of the supported pipe. Lock nuts shall be used on all hangers. All piping systems shall be supported by hangers that can vertically adjust for the leveling of lines after piping is in place. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing. All hanger rods, except those that are stainless steel, shall conform to ASTM A-575. Hanger rod diameters shall be as recommended by pipe hanger manufacturers for the type of pipe, hanger size, and spacing used.
4. Piping shall be supported according to the Spacing Schedule below, and/or the MSS Standard Practice SP-69, (Manufacturers Standardization Society of the Valve and Fitting Industry), whichever spacing is closer. A support shall also be located within four inches of each side of all fittings and valves. Vertical runs of pipe shall be supported independently of the connected horizontal runs. All vertical pipes shall be supported at each floor or at intervals not greater than ten feet, by approved pipe collars, clamps, brackets, or wall rests. Hangers shall be placed on

each side of a flexible coupling, as close to the coupling as possible. At expansion joints, hangers supporting the flexible couplings shall be placed on either side of the joint. Hangers shall prevent transverse movement.

SPACING SCHEDULE\*, \*\*

PIPE SIZE (INCH)	STEEL PIPE SCH. 20-80 (FEET)	STAINLESS STEEL (FEET)	COPPER PIPING (FEET)	DUCTILE IRON PIPE (FEET)	C/PVC PIPE (FEET)
½	5	-	5	-	3
¾	6	-	6	-	3
1	7	-	6	-	3.5
1 ½	9	-	8	-	3.5
2	10	10	9	6	4
2 ½	11	-	10	-	4.5
3	12	-	10	6.5	4.5
3 ½	13	-	11	-	-
4	14	10	12	8.5	5
6	17	10	14	9	6
8	19	10	14	10.5	6.5
10	22	10	15	12	-
12	23	10	17	13	6.5
14	-	10	-	14	-
16	-	10	-	15.5	-

\* Additional supports and restraints at bends shall be installed for all pump system piping as necessary to prevent deformation and movement of the pipe under maximum flows and pressures.

\*\* C/PVC pipe spacing schedule based on uninsulated pipe carrying liquid having a specific gravity of 1.45 and a temperature of 120 degrees Fahrenheit.

5. If the pipe to be supported is not listed, then the spacing for the next smaller pipe size shall be used. There shall be a minimum of one support per pipe lay length on uninterrupted horizontal runs. This support shall be placed within one foot of the joint. If the pipe manufacturer recommends a smaller spacing interval than specified herein, then the manufacturer's spacing shall be used.
6. All supports, saddles, bearing plates, and hangers shall provide by direct contact, a minimum of 80° support around the pipe, except as specified herein. Where continuous concrete inserts are used, the maximum concentrated load on the end two inches of inserts, with laying lengths of eight inches or longer, shall not be more than 50 percent of the maximum recommended channel loading.

- B. Concrete pipe saddles shall cradle horizontal piping when it is supported from below. Where space limitation prevents using concrete pipe saddles, steel pipe saddles shall be used.
- C. Base elbows, tees, and concrete pedestals shall be provided at all vertical runs of pipe and shall be supported on a base elbow and/or concrete pedestal. All concrete supports shall be formed up to the spring line of the pipe. After completion of curing, piping shall be adjusted to the proper grade.
- D. A metal framing system manufactured by Unistrut, Globe-Strut, Power Strut, or equal, may be used for supporting the piping system. The metal framing system shall be designed by the Contractor and installed according to manufacturer's recommended procedure, and shall be capable of supporting the piping system, as specified herein. Do not weld or tack weld to any beam, joist, or column without prior approval by the Engineer. Materials shall be as described below, except as noted and required in subparagraph above:
  - 1. Channels, inserts and closure strips shall be cold formed mild steel, conforming to ASTM A-36.
  - 2. Fittings shall be hot rolled steel, conforming to ASTM A-307 or ASTM A-575.
  - 3. Fasteners shall conform to ASTM A-307.
  - 4. All pieces shall be galvanized.
- E. Reference Section 05500 for structural steel requirements.
- F. Restraints
  - 1. All valves and fittings shall be restrained, so that all thrusts shall be supported independent of the piping system. Thrust shall not be supported by walls unless specifically designed for and indicated on Drawings. All restraints shall conform to pipe manufacturer's recommendation.
  - 2. For interior piping, restraints shall be located as follows:
    - i. Anchors shall be placed so all forces will be balanced.
    - ii. Tie downs shall be used to hold the pipe in position where velocity and surge forces will cause pipe movement. They shall control stress due to thermal expansion at wall pipes, sleeves, and equipment.
- G. Guides shall be used to prevent transverse motion at flexible couplings used as expansion joints.
  - 1. Tie Rods: On piping, where flexible couplings are located near fittings or valves, stainless steel tie rods shall span the coupling from the two adjacent flanges. Such

restraints can be deleted at the discretion of the Engineer, if both pipe ends are anchored in a concrete structure with no fitting or valve within the span. Where the Engineer intends to have flexible couplings used as expansion couplings, tie rods may be omitted. All tie rods shall be sized, spaced, and installed according to the manufacturer's recommended procedure, or as directed by the Engineer.

2. Restrained Joints: Where indicated on Drawings, restrained joints shall be installed. Restraints shall be Megalug as manufactured by Ebaa Iron Co., or approved equal. Restraints for push-on joints shall be series 800 coverall as manufactured by Ebaa Iron Co., or equal.

#### 2.11 SIGHT FLOW INDICATORS (ROTOMETERS)

- A. Materials: Bronze body with threaded ends, tapered glass tube calibrated in GPM, stainless steel float.
- B. Performance: Rotometers shall be sized for a flow rate of 0.025-0.25 gpm, or as otherwise requested by the Engineer.
- C. Rotometers shall be manufactured by Blue-White (Model F-550), or Engineer approved equal.

#### 2.12 FLUSHING CONNECTIONS

- A. Flushing connections shall be provided where indicated on the Contract Drawings. Flushing connections shall be 3/4" female threaded hose connection with 3/4" isolation ball or vented ball valve. Flushing connection shall be compatible with the intended service.

#### 2.13 ELECTRIC OPERATORS/ACTUATORS

- A. Each actuator for an open/close type valve shall include the motor, operator unit gearing, limit switch gearing, position limit switches, torque switches, stem nut or drive nut, declutch lever or knob auxiliary handwheel, and remote position control selector switch, all as a self-contained unit with local pushbuttons and indicating lights.
  1. Enclosure:
    - i. NEMA types 4X/6P.
  2. Provide an internal watertight double sealed compartment to protect switches, contacts, motor and internal electronics from ingress of moisture and dust when the external terminal cover is removed.
- B. Electrically actuated butterfly valves as noted in the design drawings shall have totally enclosed gear actuators of an approved NSF 61 grease lubricated or oil bath type with

handwheel except where chainwheel is specified hereinafter. Each actuator for a modulating type valve shall include the motor, operator unit gearing, limit switch gearing, limit and torque sensors. Torque sensors shall use hall effect sensors. Incremental encoders requiring batteries to retain settings upon loss of power shall not be accepted. Position and torque settings will be stored in permanent non-volatile memory. Actuator shall include stem nut or drive nut, declutch lever or knob, auxiliary handwheel, position control with 4 to 20mA input and 4 to 20mA position transmitter, and integral remote position controls, all as a self-contained non-intrusive unit with local pushbuttons and indicating lights.

1. Enclosure:

i. NEMA types 4X/6P.

2. Provide an internal watertight double sealed compartment to protect switches, contacts, motor and internal electronics from ingress of moisture and dust when the external terminal cover is removed.

C. Motors:

1. Class F with 15-minute duty rating.

2. Motor: High starting torque, low inertia, low stall torque type to prevent over travel. Motor shall be totally enclosed, non-ventilated construction.

3. Motor shall be of sufficient size to open or close the valve against the maximum expected differential pressure when voltage to the motor terminals is 10% above or below nominal voltage. The motor shall be prelubricated and all bearings shall be of the anti-friction type.

4. Internal motor thermal overloads shall be provided to protect against motor overloads. The motor shall be an independent sub-assembly such that the power gearing shall not be an integral part of the motor assembly.

5. The motor shall be de-energized without damage in the event of a stall condition when attempting to move a jammed valve. The motor shall be de-energized in the event of an overtorque condition.

6. Thermal devices (one for each phase of power) shall be imbedded in the motor windings to de-energize the motor in case of overheating. Lost phase protection shall be provided for motor protection.

D. Provide a positive declutching lever that will disengage the motor and motor gearing mechanically but not electrically to move from motor operation to handwheel operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation. It shall not be possible for the unit to be simultaneously in manual and motor

operation.

1. Provide handwheel with arrow and the word CLOSE or SHUT cast on handwheel to indicate turning direction to close.
  2. Handwheel must not rotate during power operation.
  3. Provide handwheel and low gear ratio combined to give maximum rate of movement possible with 40lb (18 kg) of rim effort.
- E. Operating unit gearing shall be totally enclosed in a grease-filled cast iron gear case suitable for operation in any orientation. Oil lubrication is not permitted. Grease shall be NSF 61 approved. The gear case shall contain sensors capable of continuously recording temperatures and vibration within the actuator. Actuator gearing shall be hardened steel with alloy bronze worm wheel.
- F. Fully wire electric motor operators at factory and furnish complete with terminal strips for external power and control connections. All external wiring shall terminate in a removable plug and socket head to allow easy disconnection of all power and control voltages. Wiring shall be tropical grade insulated stranded cable.
- G. Provide controls as indicated or specified in Division 13 - Special Construction and Contract Drawings.
- H. Provide OPEN/STOP/CLOSE/RESET pushbuttons and a LOCAL/OFF/REMOTE selector switch lockable in any of the three positions. Provide inputs to Instrumentation and Control System as specified and indicated.
1. The Reset pushbutton shall be provided to facilitate actuator commissioning.
  2. It shall be possible to select maintained or non-maintained control independently for either the local or remote modes.
  3. It shall be possible to program the output direction of the actuator without removal of any covers.
  4. It shall be possible to re-orient local pushbutton controls in 90° increments.
- I. Limit Switch and Limit Switch Gearing (For Open/Close Type Valves):
1. Type: Intermittent, totally enclosed in its own gear case, grease-lubricated, and shall be made of bronze or stainless steel. Limit switches shall be of the heavy duty, 250V silver-plated. Grease shall be NSF 61 approved.
  2. Limit switches shall be of the adjustable type capable of being set to trip at any point of valve travel between fully open and fully closed, and not be subject to breakage or slippage due to overtravel.

3. Each valve actuator shall have a minimum of two rotor-type switch assemblies and a minimum of eight heavy-duty contacts. Contacts shall be convertible between N.O. and N.C.
4. The switches shall provide for visual verification of switch position without disassembly.

J. Torque Switch (For Open/Close Type Valve):

1. Provide a double torque switch for each valve actuator for both directions of travel.
  - i. Each side of the switch shall have a numbered dial and shall be adjustable.
  - ii. Mount a calibration tag near each switch correlating dial setting with unit output torque.
  - iii. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices.
  - iv. The torque switch shall be wired to shut off the actuator motor in the event excessive torque is being generated in either direction of travel.

K. Stem Nut:

1. The valve actuator shall have a stem nut of high tensile bronze or other material, compatible with the valve stem and suited to the application.

L. Electrical:

1. The motor shall operate on 120 VAC one-phase power and control shall be 24VDC power. The motor starter and associated controls shall be supplied with each operator.
2. The control system for each operator shall include limit switches, reversing contactor consisting of two mechanically interlocked contactors with two additional electric contacts, local 3-button control station O/C/S, local/remote selector switch, all housed in a NEMA 4X enclosure. Provisions shall be made in the controller to allow connections to terminal strips.
3. The actuator display on modulating valves shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully closed in 0.1% increments.
4. For open/close service valves, position indicator shall be a mechanical dial indicator.

M. Lubrication:

1. Rotating power train components shall be immersed in oil or grease with provisions for inspection and re-lubrication without disassembly. Lubricants shall be suitable for ambient conditions of -20°F to +150°F and NSF 61 approved.



N. Modulating Valve Position:

1. Position and torque shall be sensed by absolute encoder using hall effect sensors. Position and torque settings will be stored in permanent non-volatile memory. Torque and travel adjustment parameters shall be as follows:
  - i. Position setting range 1 to 500 or 10 to 5,000 turns, with resolution of 2.81 degrees and accuracy to 5.0 degrees of actuator output.
  - ii. Torque setting: 40% to 100% of rated torque.
  - iii. Torque switch bypass to be provided for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid-travel against high inertia loads.
2. Local indication: the actuator shall include a digital position indicator with a display from fully open to fully closed in 1% increments.
3. Five indicating lights shall be included which are programmable local indicating lights to indicate functions including, but not limited to: end position CLOSED, end position OPEN, fault, selector switch in REMOTE and actuator moving.
4. Actuator shall provide a 4 to 20 mA analog position feedback signal.
5. Actuator shall provide a 4 to 20 mA analog torque feedback signal corresponding to required valve torque for diagnostics and preventative maintenance.

O. Integral Starter:

1. The starter shall be suitable for up to 60 starts per hour for open/close service and up to 1,500 starts per hour for direct mount actuators used in modulating service.

P. Control Capabilities for Open/Close Valve Actuators:

1. The following control capabilities must be available:
  - i. Input remote control signals for open/stop/close (maintained contacts)
  - ii. Input remote control signals for open/close 'push to run' (momentary).
2. Programmable electronic torque switch bypass initialized in end and intermediate positions. Settable from 0-5 seconds.
3. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of the contactor coils.
4. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

Q. Control Capabilities for Modulating Valve Actuators:

1. The following control capabilities must be available:
  - i. 4-20 mA positioner to incorporate the following features: automatic end position settings, adaptive behavior (automatic setting of deadband), programmable deadband time, programmable tolerance for open/close end positions, programmable behavior on loss of signal, split range operation.
  - ii. Programmable electronic torque switches bypass initialized in end and intermediate positions. Settable from 0-5 seconds.
  - iii. Programmable emergency input for fail to any intermediate or end of travel positions when required.
  - iv. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

R. Monitoring Facilities for Modulating Valve Actuators:

1. Facilities shall be provided for monitoring actuator operation and availability as follows:
  - i. Liquid Crystal Display (LCD) – minimum four lines back-lit for setting menu showing status indication and diagnostic information.
  - ii. Retrievable (lifetime and re-settable) data logs including:
    - a) Motor run time
    - b) Total number of cycles
    - c) Number of torque trips in each direction of travel
    - d) Number of limit switch trips at each end of travel
    - e) Total torque trip faults
    - f) Motor thermal overloads,
  - iii. Diagnostic capability, which will store and enable download of historical actuator operation, torque data to permit analysis of actuator, valve in-service performance and status signal according to NAMUR recommendation NE 107 via local display.

S. Modulation:

1. The 4" Fe/Mn Filter Influent Control Valves (BFV-236A, -236B, -236C) shall be modulating valves. Modulating valves shall be equipped with a folomatic/cpt analog card capable of receiving a 4-20 mA input for valve positioning and capable of providing a 4-20 mA output signal for remote indication of valve position. The analog response card shall be internally powered from within the actuator. Supply each actuator with a start-up kit comprising installation instructions, electrical wiring diagram, and sufficient spare cover screws and seals to make good any site losses during the commissioning. A remote control shall be provided for actuators located 6' or more above the finished floor elevation.

- T. Supply each actuator with a start-up kit comprising installation instructions, electrical wiring diagram, and sufficient spare cover screws and seals to make good any site

losses during the commissioning. A remote control shall be provided for actuators located 6' or more above the finished floor elevation.

U. Manufacturer shall act as a single source for all components.

V. Manufacturers:

1. 4" Modulating Valves shall be equipped with S70-E031-113G0-536 by Bray International Inc ([www.bray.com](http://www.bray.com)), AUMA Riester GmbH & Co. ([www.auma.com](http://www.auma.com)), Rotork ([www.rotork.com](http://www.rotork.com)), Emerson ([www.emerson.com](http://www.emerson.com)), or Engineer approved equal.
2. 6" Modulating Valves shall be equipped with S70-E061-113G0-536 by Bray International Inc ([www.bray.com](http://www.bray.com)), AUMA Riester GmbH & Co. ([www.auma.com](http://www.auma.com)), Rotork ([www.rotork.com](http://www.rotork.com)), Emerson ([www.emerson.com](http://www.emerson.com)), or Engineer approved equal.
3. 2" and 4" Open/Close Valves shall be equipped with S70-E031-113DA-536 by Bray International Inc ([www.bray.com](http://www.bray.com)), AUMA Riester GmbH & Co. ([www.auma.com](http://www.auma.com)), Rotork ([www.rotork.com](http://www.rotork.com)), Emerson ([www.emerson.com](http://www.emerson.com)), or Engineer approved equal.
4. 6" Open/Close Valves shall be equipped with S70-E061-113DA-536 by Bray International Inc ([www.bray.com](http://www.bray.com)), AUMA Riester GmbH & Co. ([www.auma.com](http://www.auma.com)), Rotork ([www.rotork.com](http://www.rotork.com)), Emerson ([www.emerson.com](http://www.emerson.com)), or Engineer approved equal.
5. 8" Open/Close Valves shall be equipped with S70-E121-113DA-536 by Bray International Inc ([www.bray.com](http://www.bray.com)), AUMA Riester GmbH & Co. ([www.auma.com](http://www.auma.com)), Rotork ([www.rotork.com](http://www.rotork.com)), Emerson ([www.emerson.com](http://www.emerson.com)), or Engineer approved equal.

## 2.14 INSULATION

A. Piping insulation shall be provided where indicated on M sheets of Contract Drawings.

B. Air Scour/Backwash Air Pipe:

1. Pipe Insulation: Fiberglass ASTM C547, Class 1 (-20°F to 500°F). Fiberglass, UL-rated, preformed, sectional rigid, minimum 4 pounds per cubic foot (PCF) density, K factor 0.23 maximum at 75°F mean, with factory-applied all-service jacket (ASJ) composed of reinforced kraft paper and aluminum foil laminate. Jacket shall have self-sealing lap to facilitate closing longitudinal and endjoints.
2. Manufacturers and Products:
  - i. Johns Manville, Micro-Lok;
  - ii. Owens/Corning Fiberglass, 25 ASJ/SSL;
  - iii. or Engineer approved equal.

3. Pipe Insulation Finish System: Aluminum roll jacketing. For straight run piping, wrought aluminum alloy 3003, 5005, 1100 or 3105 to ASTM B209 with H-14 temper, minimum 0.016-inch thickness, with smooth mill finish. Provide factory applied moisture barrier consisting of 40-pound kraft paper with 1 mil thick low density polyethylene film, heat and pressure bonded to inner surface of the aluminum jacketing. Fitting covers shall be same material as aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, special fittings, etc. Manufacturer and Product shall be ITW Pabco/Childers Aluminum Roll Jacketing and Insulating Fitting Covers or Engineer approved equal.

C. Chemical Tubing:

1. All chemical tubing in carrier piping and in contact with corners and other hard surfaces shall be insulated to protect the tubing against wear and tear. The chemical insulation shall be EPDM or otherwise compatible with the chemical service. The chemical tubing insulation shall be manufactured by Aeroflex (Aerocel AC), or Engineer approved equal.

- D. Insulation finishes to be labeled according to Specification Section 10140. Insulation finishes are not required for chemical tubing insulation.

## 2.15 CHEMICAL INJECTORS

- A. Chemical injectors shall be provided where indicated on the plans. Chemical injectors shall be the retractable type, with corporation stop and compression gland, PVC solution tube, ball check valve, and rated for a minimum of 100 psi. Ball check valves for potassium hydroxide applications shall have EPDM seats. Ball check valves for sodium hypochlorite applications shall have Viton seats. The injectors shall be Saf-T-Flo Water Services Corporation Series EB-120 or Engineer approved equal.

## 2.16 SAMPLE SINK FIXTURES

- A. The sample sink faucets shall be gooseneck style, smooth-nose type, without interior or exterior threads and shall not have a screen, aerator, or other such appurtenance in accordance with the Guidelines for Public Water Systems, Section 2.9 – Sample Taps. Sample sink faucets shall be the Monterrey Lavatory Faucet by American Standard, or Engineer approved equal.

## 2.17 GENERAL

- A. The interior process piping and valve system components shall arrive assembled with piping and valves system shop-assembled/installed to the fullest extent possible given the site, building, and access constraints. All other appurtenances mentioned herewith shall also be included for a complete and operational system.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. All interior process piping and valves shall be installed according to the manufacturer's printed instructions, as indicated and specified.
- B. Set and adjust valve settings (e.g. pilot systems, limit switches, etc.) during startup and testing to meet process requirements, as determined by the Engineer, at no additional cost to the Owner. Refer to additional requirements as noted in the Valve Schedule of the Contract Drawings.
- C. All equipment shall be field tested in accordance with Section 01650 – Facility Start-Up/Commissioning.
- D. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- E. Install identifying labels permanently to equipment.
- F. Contractor shall be responsible for coordinating installation with space and installation limitations at site, refer to Contract Drawings.

### 3.2 GENERAL

- A. Handling of Pipe. The loading, hauling, unloading and handling of pipes and appurtenances shall be accomplished without damage to same. Dropping of pipe and appurtenances directly to the ground or floor will not be permitted. Suitable buffers or runners shall be provided. The Contractor shall be liable for any damage to the pipe or appurtenances until they are accepted in the completed work. Each pipe section shall be handled into its final position only in such a manner and by such means as the Engineer approves as satisfactory, and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the pipe or to any property. As far as practicable, the Contractor shall be required to furnish slings, straps, and/or approved devices to provide satisfactory support of the pipe when it is handled.
- B. Tools for Pipe Installation. The Contractor shall furnish all tools, torque wrenches, materials and labor necessary to make the joints in pipe in strict accordance with the manufacturer's specifications. Proper and suitable tools and appliances for the safe and convenient handling and installation of pipes shall be used. The Contractor shall exercise reasonable precaution during his operation in order to avoid damaging the material. All pipes, fittings or appurtenances which are so damaged shall be replaced by him at his sole expenses.
- C. Installation. All materials and equipment shall be installed in a neat workmanlike manner, and as recommended by the manufacturer. All piping shall be installed true to line and grade and rigidly supported. Before setting wall sleeves and pipes to be cast-in-place, the Contractor shall check all plans and figures which may have a direct

bearing on his pipe location and he shall be responsible for the proper location of his pipes during the construction of the buildings. All interior piping shall have sufficient number of unions or their equivalent to allow convenient disassembly and removal of piping. All valves and appurtenances shall be installed in accordance with manufacturer's directions at locations shown on the drawings. All in-line devices provided under instrumentation shall be installed as part of the work of this section.

- D. Cleaning and Plugging Pipe. The pipes and fittings shall be thoroughly cleaned before being installed and shall be kept clean until accepted in the finished work. The ends of all uncompleted lines shall be tightly closed with temporary plugs at all times when pipe installation is not in progress to prevent foreign material from entering the pipe.
- E. Screwed Connections. All threads shall be clean, machine cut, and all pipe shall be reamed before erection. Screwed joints shall be made up with good quality thread compound applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. Teflon tape or teflon compound may be used for steel, polyvinyl chloride, chlorinated polyvinyl chloride and copper threaded connections.
- F. Arrangements. Except as otherwise required, changes in direction shall be made using proper fittings, and unless shown otherwise piping shall run parallel and at right angles to walls and floors. Systems shall be arranged with low points and drains to permit complete drainage of the system. Control piping may be arranged with unions or union connections at low points to permit draining. Unions or flanges shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipe lines or adjacent branch lines.
- G. Penetrations. All penetrations in walls, floors and ceilings shall be sealed watertight to the satisfaction of the Engineer.
- H. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc. Clean all debris, dirt, gravel, etc, from inside of piping before placing valves in place.
- I. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which do not operate easily or are otherwise defective.
- J. Set plumb and support valves adequately in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for easy access.
- K. Provide sleeve type coupling or flexible type grooved coupling on downstream side of buried valves to assist in valve removal.

- L. Provide valves with extension stems where required for convenience of operation. Provide extension stems for valves installed underground and elsewhere so that operating wrench does not exceed 6 ft. in length.
- M. Provide chain wheel operators on all valves 2-in., and larger where handwheel or lever exceeds 6-ft., 6-in. above floor or operating platform. Provide geared operator where required to position chainwheel in vertical position.
- N. Chain of chain operators to extend within 3 ft. of operating floor. Provide two S- shaped hooks for each chain to enable chain to be hooked away from personnel traffic.

### 3.3 PLASTIC PIPING (PVC)

- A. The installation of plastic pipe for pressure service shall be strictly in accordance with the manufacturer's technical data and printed instructions and as follows:
  - 1. General. The solvent welding procedure detailed herein applies to all Polyvinyl Chloride (PVC) pressure piping systems including molded fittings and socket type pump and valve connections.
  - 2. Cement. Shall be a grade specifically recommended by the piping manufacturer for the size and schedule of pipe specified.
  - 3. Pipe Preparation.
    - i. Cutting. Pipe shall be cut in accordance with the recommendations of the pipe manufacturer.
  - 4. Deburring and Beveling. All burrs, chips, filings, and the like shall be removed from both the pipe inside diameter and outside diameter before joining. All pipe ends shall be beveled approximately 1/16-inch to 3/32-inch back from the edge at an angle of 10 to 15 degrees. Fitting Preparation. Prior to solvent welding, all fittings and couplings shall be removed from their cartons and exposed for at least one hour to the same temperature conditions as the pipe in order to assure that they are thermally balanced before joining.
  - 5. Cleaning. Pipe and fittings shall be clean of all loose dirt and moisture from the inside diameter and outside diameter of the pipe end and the inside diameter of the fitting. DO NOT ATTEMPT TO SOLVENT WELD WET SURFACES.
  - 6. Priming. Apply primer to the pipe approximately one-half (1/2 of the pipe diameter and in accordance with the manufactures recommendations). Apply primer freely in the socket keeping surface wet and applicator wet and in motion 5 to 15 seconds. Avoid puddling in socket. For checking penetration, you should be able to scratch or scrape a few thousandths of the primed surfaces away. Repeated applications to either or both surfaces may be necessary. Weather conditions do affect priming

action. In cold weather more time is required for proper penetration.

7. Solvent Cement Application. Solvent cement application shall be in accordance with the manufacturer's recommendation with a minimum of two coats. All excess cement shall be cleaned from the surfaces of the pipe and fittings. Solvent cement shall be NSF 61 certified.
8. Joining. Joining of PVC pipe and fitting shall be in accordance with the manufacturer's recommendations and only at the below solvent welding joining temperatures and joint drying times:
  - i. The actual joining should not be done in atmospheric temperatures below 40°F or above 90°F, or when exposed to direct sunlight.
  - ii. Not less than 48 hours of joint drying time shall elapse for all sizes of pipe and drying temperatures before the joint is moved or subjected to any appreciable internal or external pressure.

Note: Joints for plastic pipe shall be solvent welded except flanged or screwed where required. For plastic to steel, cast iron pipe or ductile iron pipe connections, complete metal pipe assembly first. Use flanged connections and tighten bolts evenly to prevent warping of rigid plastic pipe. A torque wrench may be used for a tight seal on gasket. Joints shall conform to manufacturer's recommendations. Installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. In making solvent weld connections, the solvent should not be spilled on valves or allowed to run from joints. All completed pipe lines shall remain undisturbed for 48 hours to develop complete strength at all joints.

### 3.4 STAINLESS STEEL PIPING

- A. Cleaning: All equipment, piping, valves, instruments, and accessories in air scour/backwash air service shall be cleaned in compliance with the Compressed Gas Association (CGA) Pamphlet G-4.1, "Cleaning Equipment for Oxygen Service", latest edition. For items cleaned prior to shipment to the construction site, they shall be properly packaged and stored to protect from contamination. Precleaned items shall be provided a final cleaning/purge with all piping and appurtenances installed.
- B. Welding
  1. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME A: B31.1 for Pressure Piping, and if recommended by piping or fitting manufacturer.
  2. Weld Identification: Mark each weld with symbol identifying welder.
  3. Pipe End Preparation:
    - i. Machine Shaping: Preferred.



- ii. Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.
  - iii. Beveled Ends for Butt Welding: ASME B16.25.
4. Surfaces:
- i. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
  - ii. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
  - iii. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.
5. Alignment and Spacing:
- i. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
  - ii. Root Opening of Joint: As stated in qualified welding procedure.
  - iii. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.
6. Climatic Conditions:
- i. Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 32 degrees F.
7. Stainless Steel and Alloy Piping: If the ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.
8. Surface Defects: Chip or grind out those affecting soundness of weld.
9. Weld Passes: As required in welding procedure.
10. Weld Quality: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in applicable piping code.

### 3.2 TESTING OF PROCESS PIPING AND VALVES

- A. General. All piping and valve systems shall be leak tested by the Contractor in the presence of the Engineer. The Contractor shall provide typed and witnessed test reports

for all such tests. All piping and valve systems not complying with the leak test shall be repaired or replaced by the Contractor to the satisfaction of the Engineer and be re-tested all at no additional cost to the Owner.

1. **After the pipelines have been completed and all supports and restraints have been installed, the Contractor shall perform all pressure tests.** The Contractor shall be responsible for furnishing all labor, materials, and equipment so that such tests can be accomplished at the time and locations necessary.
2. All lines shall be hydrostatically tested for a period of two consecutive hours. The test pressure shall be that of the pipe design pressure or 1.5 times the apparent working pressure, whichever is the greater. The piping and valve system shall withstand the test pressure with a maximum loss of ten percent of the test pressure.
3. Piping, valves, and those items contacting process water shall be disinfected as specified under AWWA Standards C651 - Disinfecting Water Mains, latest version. Refer to Section 02615 – Ductile-Iron Pipe and Fittings and Section 13201 – Disinfection of Water Systems.

B. Pneumatic Test for Pressure Piping for Air Services

1. Do not perform on:
  - i. PVC or CPVC pipe.
  - ii. Piping larger than 12 inches.
  - iii. Buried and other non-exposed piping.
2. Fluid: Oil-free, dry air.
3. Procedure:
  - i. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.
  - ii. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
  - iii. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
  - iv. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
  - v. Correct visible leakage and retest as specified.
4. Allowable Leakage: Piping system, exclusive of possible localized instances at blower or valve packing, shall show no visual evidence of leakage.
5. All air system piping shall be cleaned and purged prior to being put into service.

### 3.3 ACTUATOR COMMISSIONING AND TEST REPORTS

#### A. Commissioning:

1. Each actuator will be provided with a commissioning kit consisting of a wiring diagram and installation and operation manual. In order to minimize the amount of spare parts required, parts such as covers, plug and sockets, must be interchangeable throughout all model sizes. Refer to Specification Section 11201 Iron and Manganese Removal System for typical spare parts list.
2. Provide certification and an operation and maintenance manual for each actuator. Refer to Specification Section 01730 Operation and Maintenance Data for additional requirements.

#### B. Shop Testing:

1. Test performance of each actuator. Provide individual test certificates at no additional cost to the Owner. Simulate a typical valve, gate, or equipment load and record results.
2. Insulation test on motor and control circuit (electric actuator only).
3. In addition, record details of specification on the test certificate, such as gear ratios for both manual and automatic drive, closing direction, wiring diagram code number, and if applicable remote transmitter resistance and interposing relay voltage.
4. In event that specified tests indicate that actuator will not meet specifications, Engineer has the right to require complete witnessed tests for all actuators at no additional cost to the Owner. Repeat tests until specified results are obtained. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

#### C. Field Testing:

1. After installation of equipment, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service engineer, conduct running test for each actuator in presence of Engineer to determine its ability to operate without vibration or jamming and to operate at the speeds specified. During tests, observe and record, motor and signal inputs. Promptly correct or replace all defects or defective equipment revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results and results acceptable to the Engineer are obtained. Contractor to provide all labor, equipment, and materials necessary for conducting tests.
2. Prior to the successful completion of all performance tests, make all adjustments

necessary (including limit switch adjustments) to place equipment in specified working order. Limit switch positions shall be determined in the field and adjusted as necessary in coordination with the Engineer/Owner during performance testing.

3. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to satisfaction of the Engineer that units will perform the service specified and indicated.
4. Refer to Specification Section 01650 Facility Start-up/Commissioning for additional requirements.

### 3.4 VALVE FIELD TESTING

- A. All valves tested in conjunction with hydrostatic testing of the respective piping.
- B. Test all valves' smoothness of operation after installation, and make any necessary adjustments, repairs, or replacements.

### 3.5 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.6 PAINTING

- A. As specified in Division 9 - Finishes.

### 3.7 PIPING IDENTIFICATION

- A. Stainless steel pipe shall be labeled in accordance with Section 10140 - Signage.
- B. Insulated pipe shall be labeled in accordance with Section 10140 - Signage.
- C. All other piping shall be stenciled as specified in Division 9 - Finishes.

### 3.8 FIELD QUALITY CONTROL FOR WELDING

A. Minimum Duties of Welding Inspector:

1. Job material verification and storage.
2. Qualification of welders.
3. Certify conformance with approved welding procedures.
4. Maintenance of records and preparation of reports in a timely manner.
5. Notification to Engineer of unsatisfactory weld performance within 24 hours of weld test failure.

B. Required Weld Examinations:

1. Perform examinations in accordance with Piping Code ASME B31.1.
2. Perform examinations for every pipe thickness and for each welding procedure, progressively, for all piping covered by this section.
3. Examine at least one of each type and position of weld made by each welder or welding operator.
4. For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

3.9 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 11200

## SECTION 11201

### IRON AND MANGANESE REMOVAL SYSTEM

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Furnish all labor, equipment, appliances, materials, and performing all operations in connection with providing and installing a complete continuous regeneration vertical pressure type iron and manganese removal system as shown on the Contract Drawings and as specified herein. The filtration system shall be designed and constructed using materials suitable for potable water use meeting the standards of AWWA, ANSI, and NSF. The vertical filtration system shall meet the approval of the Engineer and all requirements of the Massachusetts Department of Environmental Protection.
- B. The Contractor shall be responsible for a completely installed and operational iron and manganese removal system. They shall be responsible for delivering, furnishing, installing, testing, and start-up of all mechanical, instrumentation, and electrical components including, but not limited to: filter vessels and appurtenances, air scour blower, piping, valves, and instrumentation and controls. The Contractor shall be responsible for media loading.
- C. The Iron and Manganese Removal Filter Manufacturer (Fe/Mn Filter Manufacturer) shall be responsible for the design, fabrication, and supply of the iron and manganese removal system, including but not limited to: filter vessels, filter underdrain and appurtenances, media, air scour blower, piping, valves, and instrumentation and controls. The Fe/Mn Filter Manufacturer shall be responsible for supplying the piping to and from the filtration system up to the connections to the Filter Influent, Filter Effluent, Backwash Waste, and Backwash Supply headers. The Fe/Mn Filter Manufacturer shall also be responsible for assisting the Contractor in all field testing and start-up activities required to furnish and install a completely operational system.
- D. All filter system instrumentation and control hardware, software, etc. shall be furnished and installed in strict accordance with the instrumentation and control Contract Drawings and with Division 13 – Special Construction. All interconnecting wiring and conduit, motor starters and appurtenant electrical work associated with the filtration system shall be furnished and installed by the Electrical Filed-Sub Bidder in accordance with Division 16.

E. The following items in this Section generally include, but are not limited to:

1. Filter Vessels;
2. Inlet Distribution System;
3. Air Scour Distribution System;
4. Gravel Retaining Screen Assembly;
5. Underdrain Distributors;
6. Sand Valves;
7. Support Gravel;
8. Filtration Media;
9. Control and Isolating Valves;
10. Valve Actuators;
11. Filter Face and Interconnecting Piping;
12. Air Scour Blower;
13. Filter Instrumentation and Controls;
14. Start-up, Training and Testing;
15. Operation and Maintenance Manuals; and
16. Ancillary accessories and appurtenances required to complete the work.

F. Related Sections include the following:

1. Division 1 – General Requirements
2. Division 9 – Finishes
3. Division 11 – Equipment
4. Division 13 – Special Construction
5. Division 16 – Electrical

### 1.3 SUBMITTALS

A. In order to ensure that the iron and manganese removal system shall be effective in meeting the effluent requirements for a safe drinking water supply, the Contractor shall provide the following information in accordance with the Conditions of

Contract and Division 1 Specification Sections and as specified herein. This data shall demonstrate the Fe/Mn Filter Manufacturer's ability to design, manufacture, deliver, install, and start-up the filtration system in a timely manner and provide on-going technical support.

1. Contractor Experience Qualifications: The Contractor shall submit the following information for a minimum of six (6) projects in New England where the Contractor has installed similar water treatment equipment of equal or larger size. This information shall demonstrate the ability to design and/or supply, deliver, and install an effective filtration system.
  - i. The Contractor shall provide a filtration system description including system design flow rate and general arrangement of similar systems previously installed.
  - ii. The Contractor shall provide references (individual's name, company, and telephone number) for each of the systems described.
2. Fe/Mn Filter Manufacturer's Experience Qualifications: The Contractor shall submit the following to the Engineer to evaluate the Fe/Mn Filter Manufacturer's experience. The Fe/Mn Filter Manufacturer shall be a single manufacturer experienced in the design, fabrication, delivery, and start-up of filtration equipment. The Contractor shall submit an affidavit stating which Fe/Mn Filter Manufacturer it intends to use. The Contractor must also provide information demonstrating the Fe/Mn Filter Manufacturer's ability to design, fabricate, and supply an effective filtration system. The Fe/Mn Filter Manufacturer shall submit the below information for a minimum of ten (10) projects in New England, including a minimum of one active project in Massachusetts (or evidence of Massachusetts Department of Environmental Protection New Technology Approval), where the selected Fe/Mn Filter Manufacturer has furnished pressure filtration equipment, comparable in size, for groundwater treatment:
  - i. The name and locations of the previously supplied filtration systems, including vessel size and design flow rates.
  - ii. The full name and telephone number of the individual who is knowledgeable in the operation and maintenance of the previously supplied equipment.
  - iii. Fe/Mn Filter Manufacturer's technical support qualifications: The Contractor shall submit the following information exhibiting the Fe/Mn Filter Manufacturer's ability to provide on-going support to the Engineer and Owner to ensure an effective operation of the filtration system:
    - (a) List the key individuals and their supervisors who can provide technical support in the engineering, laboratory, and service departments.
3. In the event that it is impossible to conform to certain details of the specifications due to manufacturing techniques or supplier component changes, describe completely all non-conforming aspects. Failure to explain any deviation(s) may be grounds for rejection.



4. All submitted details and drawings shall clearly show the relations of the various parts to the main members and lines of the equipment, and shall also show where correct fabrication of the work depends upon field measurements.
  5. Information considered confidential in nature must be clearly marked and so designated.
  6. Approval submittal: No work shall proceed, nor shall any material be delivered to the construction site until the Contractor/Fe/Mn Filter Manufacturer have submitted shop drawings to the Engineer, and the Engineer has reviewed, approved, and returned same. No payment shall be made for any Work not approved by the Engineer. Within eight (8) weeks after receipt of the Notice to Proceed, the following data shall be submitted to the Engineer in the form of a searchable and indexed PDF (on CD, USB drive, or via electronic file transfer service):
    - i. Project schedule indicating submittals, equipment delivery, installation, and start-up.
    - ii. Process flow diagram indicating line sizes, valves, and connections.
    - iii. Piping and instrumentation diagram indicating line sizes, valves, and instrumentation and control systems. Refer to Division 13 – Special Construction for additional instrumentation and control submittal requirements.
    - iv. Filter tank detail drawings and filter interior detail drawings of the filtration vessel and distributors.
    - v. General arrangement drawings including a plot plan (orientation layout) for setting the equipment indicating equipment shipping and operating weights.
    - vi. Detailed data sheets on all equipment to be provided.
    - vii. Detailed layout drawings showing all piping details (not schematics) and all connection locations.
    - viii. Schematic wiring diagrams on the proposed operation of the filtration equipment and control system.
    - ix. Valve and equipment list detailing all major components with reference tag numbers and a detailed description of each item.
  7. Process guarantee as described herein.
- B. American Iron and Steel (AIS) Certification for all materials specified herein.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- B. The Contractor’s attention is directed to the fact that the iron and manganese removal system is an integrated system and, as such, it shall be furnished by one manufacturer which shall provide all materials, equipment, and controls and accept all responsibility for the satisfactory installation and operation and control of the process. All controls for electrically operated or motor driven equipment shall be complete including all necessary auxiliary relays to require only wiring and

connections to the equipment control circuit. All necessary fuses and switches required by the Fe/Mn Filter Manufacturer shall be provided with the equipment.

- C. The Contract Drawings and Specifications indicate the electrical power that is to be provided. All other devices necessary for the proper operation of the iron and manganese removal system from these power sources shall be furnished with the system. Components furnished shall be of the manufacturer's highest standards for the service intended unless otherwise indicated on the Contract Drawings or in the Specifications.
- D. The filter system and equipment specified shall be standard equipment and totally suited for the application as detailed herein. The equipment to be furnished shall be satisfactory and safely designed, in accordance with the design parameters as detailed in these contract documents. It shall be constructed for continuous, automatic operation, for extended periods.
- E. When two or more units of a specific type of equipment are to be provided, they shall be the product of a single manufacturer. Multiple units and their parts shall be identical and interchangeable to the greatest extent possible.
- F. All items shall be designed and constructed in full accordance with all applicable state and local codes and regulations. Labor, materials, and costs required to meet state codes shall be the responsibility of the Contractor and the Filter Manufacturer.
- G. All materials in contact with drinking water shall be lead-free in accordance with NSF 61.
- H. Fe/Mn Filter Manufacturer must provide the filter system components, including but not limited to, piping, valves, valve actuators, filter interior systems, media, and air scour blower, regardless of manufacturer, as a complete and integrated package to ensure proper coordination and compatibility of equipment.
- I. Provide services of factory-trained Service Engineer, specifically trained on type of equipment specified:
  - 1. Submit qualifications of Fe/Mn Filter Manufacturer's Service Engineer for approval.
  - 2. Personnel-day requirements listed exclusive of travel time, and do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.
  - 3. Installation: Sufficient time to assist in location of anchor bolts; setting, leveling, alignment, field erection, etc.; coordination of piping, electrical, miscellaneous utility connections, but not less than:
    - i. 5 days

4. Programming Coordination: Sufficient time to coordinate filter system programming/logic requirements with the Application Engineer, but not less than:
  - i. 2 days
  - ii. Refer to Paragraph 1.7.C for more details.
5. Pre-Test System Review: Sufficient time to evaluate iron and manganese removal system readiness for startup and testing but not less than:
  - i. 2 days
6. Start-up, Functional Acceptance Testing, and Inspection: Sufficient time for calibration; testing and start-up; water only backwash and air/water backwash testing; valve set-point calibration; and additional services for preparation of full system performance and demonstrating testing but not less than:
  - i. 3 days
7. Instruction: Sufficient time for classroom and/or field operation and maintenance instruction, but not less than:
  - i. 3 days
8. Instruction shall be scheduled separately from installation checkout and field testing, unless approved by the Engineer.
9. Full System Performance Testing: Sufficient time for field performance testing, but not less than:
  - i. 1 day
10. Full System Demonstration Testing: Sufficient time for field performance testing, but not less than:
  - i. 2 days
11. Credit to the Owner unused service man-days specified above, at the manufacturer's published field service rate plus travel costs.

#### 1.5 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.

- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain the filtration system and ancillary filtration support systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  - 1. Instructions relevant to all modes of equipment operation.
  - 2. Service and trouble-shooting instructions as may be available from select manufacturers of equipment supplied.
  - 3. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  - 4. Instructions for testing and calibrating electronic components as may be required to determine proper performance.
  - 5. Installation instructions regarding the installation of all interior assemblies.
  - 6. Installation instructions for loading all filter media and gravel support beds.
  - 7. A complete list of materials furnished.
  - 8. All applicable Safety Data Sheets.
  - 9. Names, functional titles, addresses, and phone numbers of technical personnel available for on-going technical support.
  - 10. Refer to Division 13 – Special Construction for instrumentation and control operation and maintenance requirements.
  - 11. As-Built Mechanical drawings and dimensional information showing the actual layout and location of equipment components within the structures. One (1) complete set of reproducible drawings marked "As Built" plus six (6) sets of 11x17 prints to be incorporated in the Operations and Maintenance manuals. A USB drive, CD, or folder via electronic file transfer service of all drawings in AutoCAD version 2021 format.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which the parts are intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material, and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## 1.7 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.
- C. PLC and SCADA programming shall be by the Application Engineer. The Fe/Mn Filter Manufacturer shall provide filter sequencing programming/logic (PLC ladder logic including cross-reference tables, I/O listings, tag names and database configurations), technical assistance, and guidance to the Application Engineer for programming of the equipment and systems described herein. A Fe/Mn Filter Manufacturer representative shall attend coordination meetings and factory, field, and startup/commissioning activities.
- D. Fe/Mn Removal pressure filter vendor shall coordinate with Contractor to assure all pipe and pipe fittings are the product of the same manufacturer.
- E. Fe/Mn Removal pressure filter vendor shall coordinate with Contractor to assure all valves are the product of the same manufacturer.
- F. Fe/Mn Removal Pressure filter vendor shall coordinate with Contractor to assure all actuators are the product of the same manufacturer.
- G. Fe/Mn Removal pressure filter vendor shall coordinate with Contractor to assure all process gauges are the product of the same manufacturer.
- H. Fe/Mn Removal pressure filter vendor shall coordinate with Contractor to assure all instrumentation are the product of the same manufacturer.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. The following describes equipment, materials, and services necessary to provide a completely installed vertical pressure filtration system. The filtration system shall include three 7-foot diameter vertical pressure filters and all other appurtenances mentioned in this Section for a complete and operational system.

- B. A filter system that is offered that differs in detail and arrangement from that shown in the Contract Drawings may require change in design and construction. All costs, which may result from such changes in design and construction, are to be borne entirely and unconditionally by the Contractor.

## 2.2 EQUIPMENT SUPPLIER

- A. Fe/Mn Filter Manufacturer shall act as a single source for all components and shall accept entire system responsibility.
- B. The equipment covered by these specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.
- C. Available Suppliers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
  - 1. Hungerford & Terry, Inc., Clayton, NJ ([www.hungerfordterry.com](http://www.hungerfordterry.com))
  - 2. Layne, A Granite Company of Woodlands, Texas (<https://www.graniteconstruction.com/company/our-brands/layne>)
  - 3. The Pureflow Filtration Div. of California Environmental Controls, Inc., Whittier, CA ([www.pfdiv.com](http://www.pfdiv.com))

Note: The filter contract drawings are based upon Hungerford & Terry, Inc.'s filter system. Any proposed "OR EQUAL" filter suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.3 DESIGN REQUIREMENTS

- A. The filtration system shall be specifically designed to provide filtration and treatment for iron and manganese removal. The filter media consists of anthracite, manganese dioxide coated catalytic media (GreensandPlus™), and gravel. Sodium hypochlorite shall be fed ahead of the filtration system.
- B. The design requirements are as follows:
  - 1. The pressure filter equipment shall be designed based on the following requirements:
    - i. Maximum System Design Flow Rate: 590 gpm
    - ii. Average System Design Flow Rate (typical operations): 500 gpm
    - iii. Unit design flow rate with all units in service (typical operations): 167 gpm
    - iv. Unit design flow rate with one unit out of service: 250 gpm
    - v. Filter loading rate with all units in service (typical operations): 4.33 gpm/s.f.
    - vi. Filter loading rate with one unit out of service: 6.50 gpm/s.f.
    - vii. Maximum allowable filter loading rate: 8 gpm/s.f.

- viii. Normal maximum operating pressure: 100 psi
  - ix. Influent water quality (Historic Worst):
    - Iron (Fe): 1.78 mg/L
    - Manganese (Mn): 0.240 mg/L
2. The filter backwash water source shall be finished water from the distribution system.
  3. Each filter shall complete a “water only” backwash operation as indicated in 13465 – Sequence of Operations:
    - i. Backwash: 465 gpm (12.0 gpm/s.f)
    - ii. Bed Settle: 3 minute time delay
    - iii. Filter to Waste: Match normal filter flow
  4. Each filter shall also complete a weekly (operator adjustable) air/water backwash operation as indicated in 13465 – Sequence of Operations:
    - i. Draindown (Air Assisted)
    - ii. Air Scour: 30 cfm (0.8 cfm/s.f.)
    - iii. Air/Water Wash: 30 cfm (0.8 cfm/s.f.)/167 gpm (4.3 gpm/s.f.)
    - iv. Slow Refill: 167 gpm (4.3 gpm/s.f.)
    - v. Backwash: 465 gpm (12.0 gpm/s.f.)
    - vi. Bed Settle: 3-minute time delay
    - vii. Filter to Waste: 167 gpm (4.3 gpm/s.f.)
  5. Process guarantee: The Filter Manufacturer shall review the filter influent raw water quality and the specific requirements of these specifications, and shall guarantee in writing that the equipment supplied hereunder shall consistently produce a plant effluent having iron and manganese concentrations as noted below:
    - i. Iron (Fe): Maximum concentration of less than 0.15 mg/L
    - ii. Manganese (Mn): Maximum concentration of less than 0.025 mg/L
    - iii. Filter Run Time: Minimum 48 hours (typical operations) prior to 10 psi filter bed headloss

## 2.4 EQUIPMENT DESCRIPTION

### A. Pressure Filters

1. The system shall consist of three (3) vertical pressure filters, 7-foot O.D. by 63-inch straight shell height.
2. The pressure filter tanks shall be of welded steel construction using SA-516 Grade 70 steel and shall be tested to withstand a hydrostatic pressure thirty (30) percent in excess of the designed working pressure of 100 psi. The tanks shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped accordingly.

3. Each tank shall include the following features:
  - i. One (1) 18-inch diameter manway with davit and a spare gasket
  - ii. One (1) 14-inch x 18-inch manway with spare gasket
  - iii. Flange pad or nozzle type connections as shown on the Contract Drawings
  - iv. Four (4) lifting lugs
  - v. Four (4) structural steel I-beam type support legs
4. Tank interiors are to be white metal sandblasted per SSPC Designation SP10 and lined with a Tnemec Series 21 phenalkamine epoxy potable water (AWWA/NSF 600 certified) tank coating system (or certified equals including Sherwin-Williams, Ameron, Carboline, or approved equal) consisting of the following:
  - i. One (1) coat (3.0 - 5.0 mils DFT) of Tnemec Series 21 Epoxoline primer.
  - ii. One (1) coat (4.0 - 6.0 mils DFT) of Tnemec Series 21 Epoxoline intermediate.
  - iii. One (1) coat (4.0 - 6.0 mils DFT) of Tnemec Series 21 Epoxoline finish.
5. Tank exteriors are to be commercial sandblasted per SSPC Designation SP6 and painted with one (1) shop coat (3 - 5 mils DFT) of Tnemec 66-1211 primer (or certified equals including Sherwin-Williams, Ameron, Carboline, or approved equal).
6. Finish painting of the tank exteriors shall be field applied by the Painting Filed-Sub Bid in accordance with Division 9.
7. The pressure filter tanks shall be supported by concrete pedestals, refer to the Contract Drawings. The tanks shall be anchored to the pedestals as required to resist seismic forces as determined by provisions of the Massachusetts Building Code, latest edition.

#### B. Filter Inlet Distribution System

1. Each filter shall have a hub-lateral type inlet distributor/backwash collector system furnished and installed. Filter inlet distribution system shall be designed with Schedule 80 PVC pipe and fittings. The hub shall extend down from the tank top head and include two (2) lateral arms, each ending with two (2) upturned elbows. The distributing system shall be designed for uniform distribution of inlet water over the entire filter bed and for the uniform collection of the backwash water during the backwash operation. A splash plate type distributor is not acceptable. Filter inlet distribution system shall be designed to allow 40% expansion of the filter bed.

#### C. Backwash Air Distribution System

1. Each filter tank shall be furnished and installed with an air scour distributor of stainless steel construction. The distributor shall consist of Schedule 40, Type 304 stainless steel pipe with 150 lb., Type 304 stainless steel threaded fittings and flanges. Each distributor shall consist of a 2-inch stainless steel manifold



with 3/8-inch slotted stainless steel threaded and capped laterals on 7.5-inch maximum centers. The air scour distributor shall be firmly supported from the vessel bottom using a 1-inch stainless steel support pipe and stainless steel U-bolts.

2. Each lateral shall have a series slotted openings by first milling a longitudinal slot every 3.5 inches, approximately one (1) inch long and 1/50th of an inch in width, two thirds (2/3) of the way through the side wall of the 1/2-inch lateral. An orifice 1/8 inch long and slightly less than 1/50th of an inch in width shall be punched through the remainder of the side wall. The end of each lateral shall receive one 1/16" diameter hole as low as possible in the cap.

#### D. Gravel Retaining Screens

1. The gravel retaining screen assembly prevents the possibility of gravel bed upset and must be included. Each filter tank shall have a gravel retaining screen assembly consisting of all necessary 2-inch Type 304 stainless steel angles, Type 304 stainless steel flats, steel tank clips, Type 304 stainless steel screen and Type 304 stainless steel welding studs and fasteners. Tank clips shall be 1/4-inch thick plate 1.5 inches wide x 3.5 inches long and shall be factory welded to the tank wall. These clips act as connecting points for the stainless steel support angles and flats of various lengths. Angle clips for support of the air scour distributor shall be bolted to the cross angles. The cross angles shall support an eight (8) mesh Type 304 stainless steel screen with a wire diameter of 0.028 inches with an approximate overlap of three (3) inches. The stainless steel cross flats hold and secure the screen to the cross angle supports. The filter tank is to include a row of Type 316 stainless steel Nelson pointed end welding studs every eight (8) inches around the circumference for screen attachment. The steel cross angles shall include the welding studs every twelve (12) inches.

#### E. Underdrain System

1. Each filter tank shall be furnished and installed with a nonferrous underdrain system designed to uniformly distribute backwash water and for collection of filtered water. The distributor shall be of polypropylene construction. The laterals shall be constructed of schedule 80 PVC, and shall be curved to follow the contour of the tank bottom head. The filter tank bottom head shall include Type 304 stainless steel threaded studs and clips to securely clamp the laterals in place.

#### F. Gravel Supporting Bed

1. A gravel support bed shall be incorporated in the bottom of each filter tank, consisting of five (5) layers of graded gravel, with the largest size gravel loaded into the filter first and the succeeding smaller sizes placed on top. The gravel graduations shall be as follows:
  - i. 1/8" x 1/16": 3 inches;
  - ii. 1/4" x 1/8": 3 inches;

- iii. 1/2" x 1/4": 1.5 inches;
  - iv. 3/4" x 1/2": 1.5 inches;
  - v. 1.5" x 3/4": 3 inches; and
  - vi. 1.5" x 3/4": head fill.
2. The gravel shall be washed, screened, and shipped in clearly marked fifty (50) pound bags. The gravel must meet the requirements of AWWA Designation B100-89.

#### G. Filtration Media

1. Each filter shall be provided with GreensandPlus™ filter media manufactured by Inversand Company to form an 18-inch bed depth. The filter media shall meet the following criteria:
- i. Specific Gravity: approximately 2.4;
  - ii. Effective Size: 0.30 to 0.35 mm;
  - iii. Uniformity Coefficient: less than 1.6;
  - iv. Screen Grading: 18x60 mesh; and
  - v. Certifications: WQA Gold Seal Certification to NSF/ANSI 61.
2. In addition to the GreensandPlus™ filter media, the Filter Manufacturer shall provide specially graded anthracite to form an 18-inch bed depth. The anthracite shall meet the following criteria:
- i. Specific Gravity: approximately 1.6;
  - ii. Effective Size: 0.6 to 0.8 mm; and
  - iii. Uniformity Coefficient: less than 1.6.
3. The GreensandPlus™ media and anthracite bed depth shall total 36-inches.
4. All filter media shall be shipped in bags, palletized, and stretch wrapped.
5. All filter media shall be accepted under NSF Standard 61.
6. GreensandPlus™ filter media shall be loaded into the filters and conditioned in accordance with the Fe/Mn Filter Manufacturer's recommendations. Filter fines must be removed from the filter prior to loading the anthracite.
7. All filter media shall be field installed by the Contractor.

#### H. Filter Exterior Valving

1. Each filter shall be furnished with automatic and manual valves consisting of the following:
- i. Automatic Valving - Liquid Service
    - (a) Electrically actuated butterfly valves. Valves shall be furnished and installed for each filter, including the following:
      - (i) Filter Influent (BFV-236A, -236B, -236C): 4 inches;

- (ii) Filter Effluent (BFV-238A, -238B, -238C): 4 inches;
  - (iii) Backwash Supply (BFV-240A, -240B, -240C): 4 inches;
  - (iv) Backwash Waste (BFV-241A, -241B, -241C): 4 inches;
  - (v) Filter to Waste (BFV-242A, -242B, -242C): 4 inches;
- (b) Recycle Backwash Waste Tank Isolation Valves (BFV-836A, -836B, -836C): 4-inches shall also be furnished and installed.
- (c) Backwash Waste Tank Isolation Valves (BFV-834A, -834B, -834C): 6-inches shall also be furnished and installed.
- (d) Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- ii. Manual Valves - Liquid Service
  - (a) The manual butterfly valves shall be in accordance with AWWA Designation C504 and shall be wafer style. Valves shall be furnished for the following:
    - (i) Filter Influent Isolation (BFV-235A, -235B, -235C): 4 inches; and
    - (ii) Filter Effluent Isolation (BFV-239A, -239B, -239C): 4 inches.
  - (b) Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- iii. Automatic Valves - Backwash Air Service
  - (a) The valves shall be electric actuated butterfly valves rated for air service. Valves shall be furnished for the following:
    - (i) Filter Air Scour (BFV-243A, -243B, -243C): 2 inches; and
    - (ii) Filter Draindown Air (BFV-244A, -244B, -244C): 2 inches.
  - (b) Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- iv. Automatic Air Release Valves (ARV-237A, -237B, -237C)
  - (a) Filter air release valves shall be sized by the Fe/Mn Filter Manufacturer. The valve shall be a fully automatic float operated valve designed to exhaust air during the filling of the filter system and close upon liquid entry or should a negative pressure occur. The valve shall also release accumulated air from the system when the system is in operation and under pressure. The valve shall provide adjustable control of the exhaust rate. The valve shall be single body construction. The valves shall be installed as shown on the Contract Drawings.
  - (b) Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- v. Sample Valves
  - (a) Each filter shall be furnished with NSF 61 stainless steel valves for sample ports and taps as shown on the Contract Drawings.

## I. Filter System Piping

### 1. Water Service Piping

- i. All filter face and interconnecting piping shall consist of Class 53 ductile iron pipe. Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- ii. All piping shall include an internal cement lining and bituminous seal coat in accordance with AWWA Designation C104. Provide filler flanges (or other

Engineer approved method) to limit interference between wafer butterfly valves and ductile iron pipe lining or cast iron fittings.

2. Air piping

- i. All backwash air piping shall be constructed of 304 stainless steel. Refer to Section 11200 – Interior Process Piping and Valves for requirements.

3. General notes

- i. All pipe supports for face and interconnecting piping are to be furnished by the Contractor and coordinated with the Filter Manufacturer. Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- ii. All system face and interconnecting piping shall be furnished with the required bolts, studs, nuts, and gaskets. Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- iii. Refer to Section 11200 – Interior Process Piping and Valves for exterior coating requirements.

J. Air Scour Blower Packages

1. Refer to Section 11377 – Rotary Positive Displacement Blower requirements.

K. Start-Up Chemicals

1. The Contractor shall coordinate with the Filter Manufacturer to provide those chemicals required for initial conditioning of the media. Charging of the filter media shall be completed with sodium hypochlorite in accordance with the media supplier's recommendations.
2. The Contractor shall provide sodium hypochlorite (12.5% by weight) in quantities as required for start-up and performance testing of the filtration system.

L. System Accessories

1. Filter Pressure Equipment

- i. Furnish and install for each pressure filter a differential pressure transmitter. Refer to Section 13325 – Process Instrumentation & Control Products requirements and the Contract Drawings. The Fe/Mn Filter Manufacturer shall coordinate with the Contractor to ensure that all flow meters provided as a part of the project are the same make and model.
- ii. Furnish and install a pressure gauge for each filter inlet and outlet. Refer to Section 11501 – Process Gauges requirements and the Contract Drawings.
- iii. Each pressure transmitter and gauge shall be furnished with stainless steel supply tubing, Swagelock tube fittings, and manual isolating valves.

2. Filter Influent Flow Equipment

- i. Each filter shall be equipped with an electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe. Refer to Section 13325 – Process Instrumentation & Control Products requirements and the Contract Drawings. The Fe/Mn Filter Manufacturer shall coordinate with the Contractor to ensure that all flow meters provided as a part of the project are the same make and model.

#### M. Filtration System Controls

1. The filtration system shall be controlled via the Main Control Panel. Refer to Division 13 – Special Construction and the Contract Drawings. The Fe/Mn Filter Manufacturer shall work and provide support to the Application Engineer for the filtration system controls and programming.
2. Electrical Filed-Sub Bid to supply and install all Division 16 devices, equipment, components, and ancillary items associated with power and signal wiring for instrumentation and control devices associated with the filtration system.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. All materials and equipment specified herein and shown on the Contract Drawings for the iron and manganese removal system shall be purchased, furnished, and installed by the Contractor in accordance with the Filter Manufacturer's recommendations and the Contract Documents.
- B. Install all items with care, and in accordance with printed recommendations of Manufacturer.
- C. Install identifying labels permanently attached to equipment.
- D. Energize no equipment except by Filter Manufacturer's serviceman, until authorized in writing.
- E. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.

#### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.

- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 AIR SCOUR BLOWER FACTORY TEST REQUIREMENTS

- A. Refer to Section 11377 – Rotary Positive Displacement Blower requirements.

### 3.4 AIR SCOUR BLOWER FIELD TEST AND QUALITY CONTROL

- A. Refer to Section 11377 – Rotary Positive Displacement Blower requirements.

### 3.5 VALVE FIELD TESTING

- A. Field test each valve and electric valve actuator. Refer to Section 11200 – Interior Process Piping and Valves for requirements.

### 3.6 STARTUP & FUNCTIONAL TESTING AND INSPECTION

- A. Refer to Section 01650 – Facility Start-up/Commissioning requirements.

### 3.7 PERFORMANCE/DEMONSTRATION TESTING

- A. Refer to Section 01650 – Facility Start-up/Commissioning requirements.
- B. After the complete installation of all the materials and equipment specified herein and after completion of the services of the Filter Manufacturer’s representative as describe herein, the Contractor shall test all three filters of the iron and manganese removal system that shall perform in accordance with Part 2 Section 2.3.B and Section 01650.
- C. The proposed detailed performance testing procedure to test the integrated complete iron and manganese removal system shall be submitted to the Engineer for review prior to any authorized testing in accordance with Section 01650 – Facility Start-up/Commissioning.
- D. The Fe/Mn Filter Manufacturer’s Service Engineer, Licensed Treatment Facility Operator (per requirements of Section 01650 – Facility Start-up/Commissioning), and the Contractor shall operate each filter unit in the forward flow and backwash mode per the requirements of Section 01650 – Facility Start-up/Commissioning, exercising all equipment and operating systems covered under the Specifications. The Contractor and the Owner’s operating personnel will assist the Fe/Mn Filter Manufacturer’s Service Engineer and Licensed Treatment Facility Operator in the performance test. The Fe/Mn Filter Manufacturer’s Service Engineer shall perform the tests, record the data (every two hours during the operation of each filter), make the required calculations, and prepare a report on the results. Representatives of the Owner will observe the tests and collect a copy of the recorded data and laboratory data. The information collected will be used as a basis for determining acceptability of the filtration system. In case of conflict, interpretations and calculations made by the Engineer/Owner will govern.

- E. The Fe/Mn Filter Manufacturer's Service Engineer and Contractor shall demonstrate each item of equipment and operating systems' ability to operate continuously without vibrations, jamming and overheating and perform its specified functions satisfactorily. The Fe/Mn Filter Manufacturer's Service Engineer, Licensed Treatment Facility Operator, and Contractor shall demonstrate a water only backwash and air/water backwash for each filter – no exceptions, in the presence of the Engineer/Owner.
- F. Should any piece of equipment or operating system fail to operate as specified or as intended, the Fe/Mn Filter Manufacturer and Contractor shall promptly repair or replace all defective material equipment and work without any additional cost to the Owner.
- G. Field performance test shall be conducted using the filtration system under the service and design conditions specified to demonstrate the systems' ability to consistently perform at the performance and design requirements specified herein. The Fe/Mn Filter Manufacturer, Contractor, and the Engineer/Owner shall mutually agree in writing when the system is ready for the performance test. During performance testing, the Fe/Mn Filter Manufacturer's Service Engineer and Licensed Treatment Facility Operator (per requirements of Section 01650 – Facility Start-up/Commissioning) shall be allowed to adjust the chemical dosages in order to optimize the performance of the filter system. The performance requirements of the process shall be considered to be fully met when the overall system produces an effluent within the specified limits at 100% of its design capacity for at least 95% of the Full System Demonstration Test specified time. If more than the specified test period is required to achieve this objective, then the test will be extended until the limit is achieved, at no additional cost to the Owner. It is understood that the performance requirements include equipment and materials.
- H. Submit field test results and certification of successfully conducted field tests. All field testing to be witnessed by the Engineer in the field.

### 3.8 ADJUSTING AND CLEANING

- A. Adjust equipment settings, controls, and safety and alarm devices.
- B. Clean dirt and debris from equipment, valves, and piping.
- C. Prior to placing into service, equipment shall be disinfected. Refer to Section 13201 – Disinfection of Water Systems.

### 3.9 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible

as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.10 PAINT

- A. Equipment shall be painted in accordance with Division 9 – Finishes.
- B. Pressure filters and filter face and interconnecting piping shall be stenciled as specified in Division 9 – Finishes.

### 3.11 SPARE PARTS

- A. All lubricants required for the first year of operation shall be provided for the system.
- B. One (1) differential pressure transmitter.
- C. One (1) pressure gauge.
- D. Four (4) manway gaskets for the pressure filter tanks.
- E. One (1) replacement butterfly valve of each size provided.

### 3.12 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11201



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## SECTION 11202

### PFAS REMOVAL SYSTEM

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.
- B. Granular activated carbon media is specified under Section 11203.
- C. Ion exchange resin is specified under Section 11204.

##### 1.2 SUMMARY OF WORK

- A. Furnish all labor, equipment, appliances, materials, and performing all operations in connection with furnishing and delivering a complete vertical pressure-type PFAS removal system for operation in series as shown on the Contract Drawings and as specified herein. The filtration system shall be designed and constructed using materials suitable for potable water use meeting the standards of AWWA, ANSI, and NSF. The vertical filtration system shall meet the approval of the Engineer and all requirements of the Massachusetts Department of Environmental Protection.
- B. The PFAS Removal Filter Manufacturer (PFAS Filter Manufacturer) shall be responsible for the design, fabrication, delivering, furnishing, testing, and start-up of all process mechanical components including, but not limited to: pressure vessels, vessel underdrain and appurtenances, vessel internals, pipe and valve manifold, pressure vessel piping, and appurtenances. The PFAS Filter Manufacturer shall also be responsible for factory testing, field testing, and start-up activities required. The PFAS Filter Manufacturer shall be responsible for media loading.
- C. The following items in this Section generally include, but are not limited to:
  - 1. PFAS removal media pilot study;
  - 2. Pressure Vessels with internals for media retention;
  - 3. Pipe and valve manifold;
  - 4. Influent and effluent piping;
  - 5. Media fill and discharge piping with valves;
  - 6. Vent and pressure relief piping;

7. Bag filter housings;
8. Accessories as listed herein and in Section 11200;
9. Start-up, Training and Testing;
10. Operation and Maintenance Manuals; and
11. Ancillary accessories and appurtenances required to complete the work.

D. Related Sections include the following:

1. Division 1 – General Requirements
2. Division 9 – Finishes
3. Division 11 – Equipment
4. Division 13 – Special Construction

### 1.3 SUBMITTALS

A. In order to ensure that the PFAS removal system shall be effective in meeting the effluent requirements for a safe drinking water supply, the PFAS Filter Manufacturer shall provide the following information in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein. This data shall demonstrate the PFAS Filter Manufacturer's ability to design, manufacture, deliver, and start-up the filtration system in a timely manner and provide on-going technical support.

1. PFAS Filter Manufacturer Experience Qualifications: The PFAS Filter Manufacturer shall submit the following information for a minimum of three (3) projects in New England where the PFAS Filter Manufacturer has furnished similar water treatment equipment of equal or larger size. At least one (1) project shall be within the Massachusetts Department of Environmental Protection Southeast Region. This information shall demonstrate the ability to design and furnish an effective filtration system.
  - i. The name and locations of the previously supplied filtration systems, including vessel size, design flow rates, and water quality goals.
  - ii. The full name and telephone number of the individual who is knowledgeable in the operation and maintenance of the previously supplied equipment.
  - iii. PFAS Filter Manufacturer's technical support qualifications: The PFAS Filter Manufacturer shall list the key individuals and their supervisors who can provide technical support in the engineering, laboratory, and service departments to exhibit the PFAS Filter Manufacturer's ability to provide on-going support to the Engineer and Owner to ensure an effective operation of the filtration system.

2. In the event that it is impossible to conform to certain details of the specifications due to manufacturing techniques or supplier component changes, describe completely all non-conforming aspects. Failure to explain any deviation(s) may be grounds for rejection.
3. All submitted details and drawings shall clearly show the relations of the various parts to the main members and lines of the equipment and shall also show where correct fabrication of the work depends upon field measurements.
4. Information considered confidential in nature must be clearly marked and so designated.
5. Approval submittal: No work shall proceed, nor shall any material be delivered to the construction site until the PFAS Filter Manufacturer has submitted shop drawings to the Engineer, and the Engineer has reviewed, approved, and returned same. No payment shall be made for any Work not approved by the Engineer. Within four (4) weeks after receipt of the Notice to Proceed, the following data shall be submitted to the Engineer in the form of a searchable and indexed PDF (on CD, USB drive, or via electronic file transfer service):
  - i. Project schedule indicating submittals and equipment delivery
  - ii. Process flow diagram indicating line sizes, valves, and connections.
  - iii. Pressure vessel detail drawings and vessel interior detail drawings of the pressure vessel and distributors.
  - iv. Equipment shipping and operating weights.
  - v. Detailed data sheets on all equipment to be provided.
  - vi. Detailed layout drawings showing all piping details (not schematics) and all connection locations.
  - vii. Valve and equipment list detailing all major components with reference tag numbers and a detailed description of each item.
  - viii. Pressure losses through the system at the design flow rates.
6. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
  - i. If deviations and clarifications from the specifications are indicated, therefore requested by the PFAS Filter Manufacturer, provide a detailed written justification for each deviation and clarification.
  - ii. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.
7. Submit a pilot study proposal for the proposed GAC and IX resin media. The pilot study shall be performed for a minimum of three (3) months using raw water from Well Station 4.

- i. The PFAS Filter Vendor shall provide the following equipment, at a minimum, to facilitate the pilot study:
    - (a) Three (3) 6-inch diameter,  $\frac{1}{4}$  of the proposed full scale column height, pilot scale filter columns, each containing one of the following media:
      - (i) Proposed GAC media. Refer to Section 11203 - Granular Activated Carbon for requirements.
      - (ii) Proposed IX resin media. Refer to Section 11204 - Ion Exchange Resin for requirements.
      - (iii) Purolite Purofine PFA694EBF for comparison. This media is currently in use at Well Station 4 as part of a temporary PFAS treatment system.
      - (iv) Each filter column shall include a sample tap at 50% of the corresponding media bed height.
    - (b) One (1) 5 micron filter per pilot filter column.
    - (c) One (1) volumetric flow meter per pilot filter column.
    - (d) Sample piping/tubing from the existing Well Station 4 raw water sample tap to the pilot filter columns.
    - (e) Provisions for stopping flow when Well 4 is off and resuming flow when Well 4 is running.
  - ii. The PFAS Filter Manufacturer or third party testing agency shall collect PFAS samples once per week to be tested by a MassDEP accredited laboratory in accordance with EPA method 537.1. The samples shall be taken from the following locations for each sample period:
    - (a) Combined Well 4 Raw Water
    - (b) Proposed GAC media 50% bed depth sample port and filter effluent.
    - (c) Proposed IX resin media 50% bed depth sample port and filter effluent.
    - (d) Purolite Purofine PFA694EBF media 50% bed depth sample port and filter effluent.
  - iii. The PFAS Filter Manufacturer or third party testing agency shall collect iron, manganese, total organic carbon, chloride (IX columns only), sulfate (IX columns only), pH, and arsenic (GAC column only) samples once per week and tested by a MassDEP accredited laboratory. The samples shall be taken from the following locations for each sample period:
    - (a) Combined Well 4 Raw Water
    - (b) Proposed GAC media filter effluent.
    - (c) Proposed IX resin media filter effluent.
    - (d) Purofine PFA694EBF media filter effluent.
8. The PFAS Filter Manufacturer shall submit a memorandum following the completion of the pilot study summarizing the results for the Engineer's review. The memorandum shall recommend volumes of GAC and IX resin per filter vessel to achieve the bed volume life required in Section 11203 - Granular Activated Carbon and Section 11204 - Ion Exchange Resin. If the proposed resin is not Purolite Purofine PFA694EBF, the memorandum shall compare the performance of the proposed IX resin to the Purolite resin.

9. Equipment warranty. Refer to Section 01740 – Warranties and Bonds for additional requirements.
10. Process guarantee as described herein.

#### 1.4 DEFINITIONS

- A. PFAS: per- and polyfluoroalkyl substances.
- B. PFAS6: the sum of the concentration of six PFAS compounds regulated by the Massachusetts Department of Environmental Protection:
  1. PFOS: Perfluorooctane Sulfonic Acid
  2. PFOA: Perfluorooctanoic Acid
  3. PFHxS: Perfluorohexane Sulfonic Acid
  4. PFNA: Perfluorononanoic Acid
  5. PFHpA: Perfluoroheptanoic Acid
  6. PFDA: Perfluorodecanoic Acid
- C. GAC: Granular Activated Carbon
- D. IX: Ion Exchange Resin
- E. EBCT: Empty Bed Contact Time

#### 1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- B. The pressure vessel system and equipment specified shall be standard equipment and totally suited for the application as detailed herein. The equipment to be furnished shall be satisfactory and safely designed, in accordance with the design parameters as detailed in these Contract Documents.
- C. When two or more units of a specific type of equipment are to be provided, they shall be the product of a single manufacturer. Multiple units and their parts shall be identical and interchangeable to the greatest extent possible.
- D. All items shall be designed and constructed in full accordance with all applicable state and local codes and regulations. Labor, materials, and costs required to meet state codes shall be the responsibility of the PFAS Filter Manufacturer.
- E. The PFAS Treatment System shall be NSF 61 certified and free of PFAS.

- F. Pressure Vessel Manufacturer must provide the pressure vessel system components, including but not limited to, piping, valves, valve actuators, vessel interior systems, and media, regardless of manufacturer, as a complete and integrated package to ensure proper coordination and compatibility of equipment.
- G. Services of Manufacturer's technical service representative as specified herein.
- H. Provide services of factory-trained technical service representative, specifically trained on pressure vessel systems for PFAS removal:
  - 1. Man-day requirements listed exclusive of travel time, and do not relieve PFAS Filter Manufacturer of obligation to provide sufficient service to place equipment in satisfactory operation.
  - 2. Pilot Study Setup/Teardown: Sufficient time to assemble, install, initiate, and demobilize the pilot study equipment and system but not less than:
    - i. 4 days
  - 3. Installation: Sufficient time to assist in location of anchor bolts; setting, leveling, alignment, field erection, etc.; coordination of piping, electrical, miscellaneous utility connections, leak testing, and media commissioning but not less than:
    - i. 5 days
    - ii. Performance/Demonstration testing cannot proceed until media has been commissioned.
  - 4. Instruction and training on pressure vessel system for PFAS removal: Sufficient time for classroom and field operation and maintenance instruction, but not less than:
    - i. 1 day
    - ii. Instruction shall be scheduled separately from other start-up and testing activities, unless approved by the Engineer.
  - 5. Full System Performance Testing: Sufficient time for field performance testing, but not less than:
    - i. 1 day per lead-lag pair (3 days total)
    - ii. Refer to Section 01650 – Facility Start-up/Commissioning for additional Performance Testing requirements.
  - 6. Full System Demonstration Testing: Sufficient time for field performance testing, but not less than:
    - i. 2 days
    - ii. Refer to Section 01650 – Facility Start-up/Commissioning for additional Demonstration Testing requirements.

7. Instruction shall be scheduled separately from installation checkout and field testing, unless approved by the Engineer.
8. Credit to the Owner unused service man-days specified above, at the manufacturer's published field service rate plus travel costs.

## 1.6 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain the pressure vessel system.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Instructions relevant to all modes of equipment operation.
  2. Service and trouble-shooting instructions as may be available from select manufacturers of equipment supplied.
  3. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  4. A complete list of materials furnished.
  5. All applicable Safety Data Sheets.
  6. Names, functional titles, addresses, and phone numbers of technical personnel available for on-going technical support.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components. Complete shall mean vessels are delivered with internals and underdrains fully assembled, and pipe and valve manifolds are delivered fully assembled.
- B. Pressure vessel systems and appurtenant equipment shall be delivered to the site, in coordination with the Contractor.



- C. Contractor shall be responsible for unloading equipment and material from the delivery vehicle and placing in the final installation location on site. The PFAS Filter Manufacturer shall coordinate delivery of equipment and installation of media with the Contractor to ensure an orderly and successful delivery. At a minimum, the PFAS Filter Manufacturer shall provide the following:
1. Provide an estimated week of delivery to the Engineer/Contractor in writing at least one month prior to delivery.
  2. Provide an estimated three-day window for delivery to the Engineer/Contractor in writing at least two weeks prior to delivery.
  3. Provide an estimated delivery date to the Engineer/Contractor at least one week prior to delivery.
  4. Confirm delivery day at least two business days or 48 hours, whichever is greater, prior to delivery.
  5. Provide guaranteed four-hour window for delivery at least one business day or 24 hours, whichever is greater, prior to delivery. If the delivery is made after the guaranteed four-hour window, the PFAS Filter Manufacturer shall be responsible for the Contractor's additional costs caused by the delay. Costs may include, but are not limited to, labor, materials, rental equipment, markups, insurance, overhead and profit, and bonds.
  6. If the PFAS Filter Manufacturer's equipment delivery date changes to be outside of previous estimates, the Contractor shall have 24 hours or one business day, whichever is greater, to decline the new delivery date. If the Contractor declines the new delivery date, the Engineer, PFAS Filter Manufacturer, and Contractor shall mutually agree upon a new estimated delivery date.
- D. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which the parts are intended.
- E. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- F. Contractor shall store and safeguard equipment, material, and spare parts.
- G. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## 1.8 COORDINATION

- A. Coordinate with the Contractor to the fullest extent possible, particularly with respect to the delivery, media installation, start-up, and testing.
- B. Contractor shall coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.

- C. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.
- D. PFAS Removal pressure filter vendor shall coordinate with Contractor to assure all pipe and pipe fittings are the product of the same manufacturer. Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- E. PFAS Removal pressure filter vendor shall coordinate with Contractor to assure all valves are the product of the same manufacturer. Refer to Section 11200 – Interior Process Piping and Valves for requirements.
- F. PFAS Removal Pressure filter vendor shall coordinate with Contractor to assure all process gauges are the product of the same manufacturer. Refer to Section 11501 – Process Gauges for requirements.
- G. PFAS Removal pressure filter vendor shall coordinate with Contractor to assure all instrumentation are the product of the same manufacturer. Refer to Section 13325 – Process and Instrumentation Controls Products for requirements.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. The following describes equipment, materials, and services necessary to provide three (3) complete vertical pressure filtration systems. Each system shall include two 10-foot diameter vertical pressure vessels and all other appurtenances mentioned in this Section for a complete and operational system.

### 2.2 EQUIPMENT SUPPLIER

- A. The equipment covered by these specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.
- B. Available Suppliers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
  1. Calgon Carbon, Moon Township, PA (<https://www.calgoncarbon.com/>)
  2. Evoqua Water Technologies, Pittsburgh, PA (<https://www.evoqua.com/en/>)
  3. TetraSolv Filtration, Anderson, IN (<https://tetrasolv.com/>)
  4. Tigg by Newterra, Oakdale, PA (<https://tigg.com/>)

Note: The PFAS filter contract drawings are based upon Calgon Carbon’s filter system. Any proposed “OR EQUAL” PFAS filter suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional cost to the Owner.

## 2.3 DESIGN REQUIREMENTS

- A. The filtration system shall be specifically designed to provide filtration and treatment for PFAS removal and shall operate in a lead-lag configuration. The vessel media shall consist of granular activated carbon in the lead vessel and ion exchange resin in the lag vessel. Potassium hydroxide for pH adjustment and sodium bisulfite for dechlorination shall be fed ahead of the filtration system.
- B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- C. The specifications below are for a lead-lag system of two total vessels, unless noted otherwise.
- D. There will be three (3) identical systems. Each system shall include two (2) pressure vessels, (1) piping and valve manifold, and interconnecting piping as specified herein. Each system shall meet the following requirements:
  - 1. Vessel Diameter: 10-feet
  - 2. Maximum System Flow Rate: 520 gpm
  - 3. Minimum System Flow Rate: 390 gpm
  - 4. Lead Vessel Media: GAC (refer to Section 11203 for more information)
    - i. GAC Minimum EBCT: 10 minutes
  - 5. Lag Vessel Media: IX (refer to Section 11204 for more information)
    - i. IX Minimum EBCT: 3 minutes
- E. Influent Water Characteristics: the pressure vessel systems shall be designed to treat the raw water with the following typical characteristics. Additional raw water quality information for each site is included in Appendix C.

<b>Parameter</b>	<b>Influent</b>
pH	8.0-8.2
Temperature	50-55°F
PFAS6 (ppt)	43.2 – 81.4

- F. Effluent Water Quality Requirements:

<b>Parameter</b>	<b>Effluent</b>
PFAS6	ND
PFOA	ND
PFOS	ND
PFHxS	ND

Parameter	Effluent
PFNA	ND
GAC Minimum Bed Volumes Treated*	40,000
IX Minimum Bed Volumes Treated *	120,000
pH	8.0-8.2

\*Minimum bed volumes treated per vessel, per batch of Media.

G. The design requirements are as follows:

1. The pressure vessel equipment shall be designed based on the following requirements:
  - i. Maximum clean bed headloss at maximum system flow rate through the pressure vessel system: 20 psi
  - ii. Maximum system operating pressure: 75 psi
  - iii. Maximum height of pressure vessel and influent piping: 22'-6"
  - iv. Maximum footprint of pressure vessel system: 31'-4" long by 12'-9" wide
2. The pressure vessel system, underdrain, internals, piping, and valves shall be fully compatible with both granular activated carbon and ion exchange resin. No equipment modifications or replacements shall be required to utilize either media – **NO EXCEPTIONS.**
3. The piping and valve manifold provided for each system shall allow operation of each train of vessels in the following configurations:
  - i. Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) lead, Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) lag;
  - ii. Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) lead, Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) lag;
  - iii. Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) in backwash, Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) offline;
  - iv. Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) in backwash, Pressure Vessel #1 offline;
  - v. Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) rinse to backwash waste line, Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) offline;
  - vi. Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) rinse to backwash waste line, Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) offline;
  - vii. Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) online only, Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) offline;
  - viii. Pressure Vessel #2 (PF-301A, PF-301B, PF-301C) online only, Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) offline; and,
  - ix. Pressure Vessel #1 (PF-300A, PF-300B, PF-300C) and #2 (PF-301A, PF-301B, PF-301C) operating in parallel.
4. Process guarantee: The PFAS Filter Manufacturer shall review the vessel influent raw water quality and the specific requirements of these specifications, and shall guarantee in writing that the equipment supplied hereunder shall consistently produce a plant effluent having PFAS (PFAS6, PFOA, PFOS,

PFHxS, and PFNA) concentrations and treated water volumes per batch of media per vessel as noted below, as long as the raw water quality remains generally consistent:

- i. GAC Media: Non-detect PFAS concentration for a minimum of 40,000 bed volumes.
- ii. IX Resin Media: Non-detect PFAS concentration for a minimum of 120,000 bed volumes.

## 2.4 EQUIPMENT DESCRIPTION

### A. Pressure Vessels

1. The pressure vessels shall be fabricated of carbon steel, conforming to ASTM A516 grade 70, approximately 10' diameter with elliptical top and bottom heads. The straight side height of each vessel shall be sized to contain:
  - i. Approximately 700 cubic feet of GAC (as specified in Section 11203) and to accommodate approximately 30% bed expansion at 50°F with one foot of freeboard within the straight side of the vessel using GAC (as specified in Section 11203).
2. The vessels shall be designed, constructed, and stamped in accordance with ASME Section VIII, Division 1 and registered with the National Board for a design pressure rating of 100 psig at 140°F. Each vessel shall be provided with three (3) manways: one located on the lower straight side portion of the vessel, one on the top head, and one on the bottom head. The vessels shall be free standing utilizing four (4) structural steel support legs installed atop four (4) concrete pedestals provided by the Contractor.
3. The structural aspects of the vessels shall be sufficient to meet the International Building Code – Latest Edition.
4. Each vessel shall be designed and furnished with an underdrain system that provides uniform distribution of the treated water, facilitates GAC removal without the need to open a manway, and allows the replacement of the underdrain without the need to remove external piping. The underdrain system shall be designed to contain the media within the vessel and be constructed of stainless steel. The underdrain system provided shall be compatible with both GAC media and ion exchange resin.
5. Each vessel shall include the following features:
  - i. Two (2) 14" x 18" elliptical diameter manways with a spare gasket
  - ii. One (1) 20" diameter manway with a spare gasket (with a davit)
  - iii. Flange pad or nozzle type connections as shown on the Contract Drawings
  - iv. Four (4) lifting lugs
  - v. Four (4) structural steel I-beam type support legs
  - vi. Four (4) sample ports

6. Refer to Section 09900 – Shop Primers for additional priming and painting requirements.
7. The sample ports shall be located above the underdrain system to provide water level indication during initial water fill before media loading and to provide tracking of PFAS breakthrough through the vessel bed during normal operations. Each of the sample ports shall be connected to a ½” diameter vertical stainless steel pipe with a stainless steel ball valve and smooth nose end, installed approximately five (5) feet above ground level.

#### B. Pressure Vessel Valves

1. Each pressure vessel system shall be equipped with 8” diameter butterfly valves to accommodate the process and backwash functions.
  - i. Lead filter influent isolation valve: BFV-330A, BFV-330B, BFV-330C;
  - ii. Lag filter influent isolation valve: BFV-331A, BFV-331B, BFV-331C;
  - iii. Lead filter isolation valve: BFV-332A, BFV-332B, BFV-332B;
  - iv. Lag filter isolation valve: BFV-333A, BFV-333B, BFV-333C;
  - v. Lead filter effluent: BFV-334A, BFV-334B, BFV-334C;
  - vi. Lag filter effluent isolation valve: BFV-335A, BFV-335B, BFV-335C;
  - vii. Lead filter backwash supply: BFV-336A, BFV-336B, BFV-336C;
  - viii. Lag filter backwash supply isolation valve: BFV-337A, BFV-337B, BFV-337C;
  - ix. Lead filter backwash waste isolation valve: BFV-338A, BFV-338B, BFV-338C;
  - x. Lag filter backwash waste isolation valve: BFV-339A, BFV-339B, BFV-339C).
2. Media fill and discharge valves shall be full port ball valves.
3. Air release valves (AVV-341A, AVV-341B, AVV-341C, AVV-344A, AVV-344B, AVV-344C) shall be installed at the highest point of the pressure vessels or piping system, and shall be sized by the pressure vessel manufacturer.
4. Pressure relief shall be provided by two (2) 3” surge relief valves per system (lead filter surge relief valve: SRV-340A, SRV-340B, SRV-340C; lag filter surge relief valve: SRV-343A, SRV-343B, SRV-343C). Pressure relief valves shall be mounted at a height that allows for maintenance/adjustment from the ground.
5. Refer to Section 11200 – Interior Process Piping and Valves for valve specifications.

#### C. Pressure Vessel Piping

1. The process piping provided with the pressure vessel systems shall include raw water (influent), filtered water (effluent), backwash supply water, backwash waste, vent lines, and media fill and discharge piping.

2. The influent and effluent pipe network shall allow series (lead/lag) and parallel operating modes. Lead/lag operation shall allow either: (a) flow from the influent flange to Pressure Vessel #1 (PF-300A, PF-300B, PF-300C), to the pipe and valve manifold, to Pressure Vessel #2 (PF-301A, PF-301B, PF-301C), then to the effluent flange or (b) flow from the influent flange to Pressure Vessel #2 (PF-301A, PF-301B, PF-301C), to the pipe and valve manifold, to Pressure Vessel #1 (PF-300A, PF-300B, PF-300C), then to the effluent flange. A change in flow pattern shall be accomplished with a change of valve positions.
3. The pipe and valve manifold shall be provided with a structural steel support frame.
4. Refer to Section 11200 – Interior Process Piping and Valves for piping specifications.

#### D. System Accessories

1. Media fill and discharge lines shall be fitted with hose connections, such that media transfer to and from the vessels can be facilitated using media transfer hoses. These connectors shall be 4” Quick Disconnect Adapters constructed of aluminum as manufactured by Dover Corp. as Kamlock connectors, or Engineer approved equal.
2. Two (2) flush connections shall be provided on each media fill line, one upstream and one downstream of the fill valve. One (1) flush connection shall be provided on each media discharge line, downstream of the discharge valve. The connections shall be welded into the pipe or screwed into solid propylene “spacers” for the lined pipe. Flush connections shall consist of a short section of ¾” pipe, a ¾” full port ball valve, and a ¾” quick disconnect adapter to match with water hose fittings.
3. The influent and effluent pipe for each vessel shall be provided with an NSF-61 approved reinforced rubber expansion joint that allows 4-way movement and 30° angular misalignment. Refer to Section 11200 – Interior Process Piping and Valves for additional expansion joint requirements.
4. Each IX resin vessel shall be provided with 100 cf of anthracite to form a supporting base for the IX resin. The anthracite shall meet the following criteria:
  - i. Specific Gravity: approximately 1.6;
  - ii. Effective Size: 0.6 to 0.8 mm; and
  - iii. Uniformity Coefficient: less than 1.6.

#### E. Bag Filter Housing

1. Bag filter housings shall meet the following minimum design criteria:
  - i. Maximum design flow (per vessel): 700 gpm
  - ii. Maximum clean filter headloss (with bag filters installed): 2 psi

- iii. Inlet/Outlet arrangement: stacked (refer to Contract Drawings for more information)
- iv. Davit type: mechanical with handwheel
- v. Closure seal type: O-ring
- vi. Materials of construction:
  - (a) Shell: ASME SA240 316L stainless steel
  - (b) Heads: ASME SA240 316 stainless steel
  - (c) Flanges: ASME SA182 F316 stainless steel
  - (d) Pipe: ASME SA312 TP316 stainless steel
  - (e) Couplings/Fittings: ASME SA182 F216 B16.11 stainless steel
  - (f) Internal Supports: 316 stainless steel
  - (g) Fasteners: ASME SA193 B7 YZP
  - (h) Davit: 304 stainless steel
  - (i) Closure Seal: NSF61 EPDM
- vii. Certified for potable water use
- viii. Bag filter housing shall be Model S6LP24-712-6F-DA-150 as manufactured by FIL-TREK or engineer approved equal.

F. Bag filters:

- 1. Rating: 5 micron
- 2. Materials of construction: polypropylene
- 3. Certified for potable water use
- 4. Bag filters shall be Model MF61-PO-5-2-PS as manufactured by FIL-TREK or Engineer approved equal.

## PART 3 – EXECUTION

### 3.1 LEAK TESTING

- A. The Contractor shall be responsible for leak testing the pressure vessels along with the associated piping in accordance with Section 11200 – Interior Process Piping and Valves. If the Engineer determines a leak test fails due to a defect in any equipment furnished by the PFAS Filter Manufacturer under this Contract, the PFAS Filter Manufacturer shall be responsible for repairing and/or replacing the leaking equipment.

### 3.2 INSTALLATION

- A. All materials and equipment specified herein and shown on the Contract Drawings for the pressure vessel systems for PFAS removal shall be purchased, furnished, and delivered by the PFAS Filter Manufacturer in accordance with the Contract Documents. Delivery of the equipment shall be coordinated with the Contractor.



- B. Furnish identifying labels permanently attached to equipment for installation by the Contractor.
- C. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.
- D. The PFAS Filter Manufacturer shall be responsible for filling the vessels with media and for testing, start-up, and training.
- E. The Contractor shall coordinate disposal of all required backwash and rinse flows required to bring the PFAS treatment system online. Flow to waste shall not be allowed, unless expressly permitted by MassDEP in writing.
- F. The PFAS Filter Manufacturer shall furnish a letter to the Owner, stating that the installation is complete and acceptable. This indicates to the Owner/Engineer that failure of the filter system to provide the specified pressure vessel performance is not due to faulty installation.

### 3.3 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The PFAS Filter Manufacturer shall provide all materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the PFAS Filter Manufacturer, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.4 VALVE FIELD TESTING

- A. Field test each valve. Refer to Section 11200 – Interior Process Piping and Valves for requirements.

### 3.5 MEDIA COMMISSIONING

- A. Refer to Section 11203 – Granular Activated Carbon and Section 11204 – Ion Exchange Resin for requirements.

### 3.6 STARTUP & FUNCTIONAL TESTING AND INSPECTION

- B. Refer to Section 01650 – Facility Start-up/Commissioning requirements.

### 3.7 PERFORMANCE/DEMONSTRATION TESTING

- A. Refer to Section 01650 – Facility Start-up/Commissioning requirements.
- B. After the complete installation of all the materials and equipment specified herein and after completion of the services of the technical service representative as describe herein, the PFAS Filter Manufacturer shall test all three pressure vessel systems of the PFAS removal system that shall perform in accordance with Section 01650.
- C. The proposed detailed performance testing procedure to test the integrated complete PFAS removal system shall be submitted to the Engineer for review prior to any authorized testing in accordance with Section 01650 – Facility Start-up/Commissioning.
- D. The technical service representative and the Contractor shall operate each pressure vessel system in the forward flow per the requirements of Section 01650 – Facility Start-up/Commissioning exercising all items of equipment and operating systems covered under the Specifications. The Contractor and the Owner’s operating personnel will assist the technical service representative in the performance test. The technical service representative shall perform the tests, record the data (every two hours during the operation of each pressure vessel), make the required calculations, and prepare a report on the results. Representatives of the Owner will observe the tests and collect a copy of the recorded data and laboratory data. The information collected will be used as a basis for determining acceptability of the filtration system. In case of conflict, interpretations and calculations made by the Engineer/Owner will govern.
- E. The technical service representative and the Contractor shall demonstrate each item of equipment and operating systems ability to operate continuously without vibrations, jamming and overheating and perform its specified functions satisfactorily.
- F. Should any piece of equipment or operating system fail to operate as specified or as intended, the technical service representative and the Contractor shall promptly repair or replace all defective material equipment and work without any additional cost to the Owner.
- G. Field performance test shall be conducted using the filtration system under the service and design conditions specified to demonstrate the systems’ ability to consistently perform at the performance and design requirements specified herein. The technical service representative, the Contractor, and the Engineer/Owner shall mutually agree in writing when the system is ready for the performance test. The performance requirements of the process shall be considered to be fully met when the overall system produces an effluent within the specified limits at 100% of its design capacity for at least 95% of the Full System Demonstration Test specified time. If more than the specified test period is required to achieve this objective, then the test will be extended until the limit is achieved, at no additional cost to the Owner. It is understood that the performance requirements include equipment and materials.
- H. Submit field test results and certification of successfully conducted field tests. All field testing to be witnessed by the Engineer in the field.

### 3.8 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. PFAS Filter Manufacturer shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.9 SPARE PARTS

- A. Three (3) manway gaskets of each type for each pressure vessel.
- B. One (1) spare 8-inch butterfly valve for each pressure vessel system.

### 3.10 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11202

## SECTION 11203

### GRANULAR ACTIVATED CARBON (GAC) MEDIA

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. This Specification describes the GAC products for use as media in pressure vessels for treatment of potable water. The GAC shall be capable of removing per- and polyfluoroalkyl (PFAS) compounds in water treatment processes. The GAC shall be made from selected grades of bituminous or sub-bituminous coal capable of withstanding repeated backwash procedures without significant change in physical sizes and shall be suitable for reactivation and re-use. **Only coal-based GAC with MassDEP New Technology Approval for PFAS removal will be acceptable.**
- B. The PFAS Removal Filter Manufacturer (PFAS Filter Manufacturer) shall furnish GAC products as specified herein. Refer to Specification Section 11202 – PFAS Removal Pressure Vessels for more information.

##### 1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  - 1. American Water Works Association (AWWA):
    - i. B100, Granular Filter Material.
    - ii. B604, Granular Activated Carbon (GAC).

##### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein.
- B. PFAS Filter Manufacturer shall coordinate installation of media with the Contractor to ensure an orderly and successful installation. At a minimum, the PFAS Filter Manufacturer shall provide the following:
  - 1. Provide an estimated week of media installation to the Engineer/Contractor in writing at least one month prior to installation.
  - 2. Provide an estimated three-day window for media installation to the Engineer/Contractor in writing at least two weeks prior to delivery.
  - 3. Provide an estimated media installation date to the Engineer/Contractor at least one week prior to installation.
  - 4. Confirm installation day at least two business days or 48 hours, whichever is greater, prior to delivery.

5. Provide guaranteed four-hour window for start of media installation at least one business day or 24 hours, whichever is greater, prior to installation. If the media installation is started after the guaranteed four-hour window, the PFAS Filter Manufacturer shall be responsible for the Contractor's additional costs caused by the delay. Costs may include, but are not limited to, labor, materials, rental equipment, markups, insurance, overhead and profit, and bonds.
6. If the PFAS Filter Manufacturer's media installation date changes to be outside of previous estimates, the Contractor shall have 24 hours or one business day, whichever is greater, to decline the new installation date. If the Contractor declines the new installation date, the Engineer, PFAS Filter Manufacturer, and Contractor shall mutually agree upon a new estimated delivery date.

#### 1.4 SUBMITTALS

- A. In accordance with Section 01300 - Submittal Procedures.
- B. Action Submittals:
  1. Shop Drawings: Submit manufacturer's product information, including grain size ranges for the GAC media layer specified, total ash percent, and iodine number. Media sizes shall be in millimeters and include Effective Size and Uniformity Coefficient. Data on clean bed headloss and flow rate versus expansion of the media during fluidization backwashing at two different temperatures shall also be included.
- C. Informational Submittals:
  1. Submit gradation test results of GAC media, including sieve analysis prior to loading and shipment.
  2. Submit data showing successful application of the GAC in municipal water treatment plants including PFAS removal, along with references.
  3. Submit ICP metals SW-846 test results for each batch of GAC provided for this project.
  4. PFAS Filter Manufacturer shall supply signed Affidavit of Compliance stating that GAC they supply is 100% virgin, with no reactivated carbon content whatsoever and that it is 100% bituminous or sub-bituminous coal-based material.
  5. Submit detailed carbon installation and carbon exchange procedure.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS OF GRANULAR ACTIVATED CARBON

- A. Filtrasorb® 400 AR+ PH as manufactured by Calgon Carbon Corporation.

- B. Westates Ultracarb® 1240AWLD as manufactured by Evoqua Water Technologies.
- C. Norit® GAC 400 acid washed as manufactured by Cabot Norit Activated Carbon.
- D. Or Engineer approved equal.
- E. The manufacturer shall have a minimum of 5 years' experience in supplying GAC to water treatment plants. The manufacturer must be able to meet the performance criteria of this specification.

## 2.2 DESIGN CRITERIA

### A. GAC Media

1. The GAC shall be NSF Standard 61; certified virgin material; manufactured from select grades of bituminous or sub-bituminous coal; suitable for use in the treatment of potable water; having the following properties:
  - i. Particle Size Distribution: 12 by 40 carbon with maximum of 5 percent by weight larger than No. 12 mesh sieve and maximum of 5 percent by weight smaller than No. 40 mesh sieve.
  - ii. Effective size between 0.55 mm and 0.75 mm.
  - iii. Granular activated carbon with Uniformity Coefficient of no greater than 1.9.
  - iv. Minimum abrasion number of 75 (75 percent as determined by either the stirring abrasion test or the Ro-Tap abrasion test).
  - v. Adsorptive capacity as measured by a minimum iodine number of 900 mg iodine/g carbon.
  - vi. Maximum total ash content of 12 percent by weight.
  - vii. Maximum moisture as packed of 2.0 percent by weight.
  - viii. Minimum apparent density of 0.39 g/cm<sup>3</sup>.
2. The GAC shall be approved for use in Massachusetts in accordance with 310 CMR 22.04(8). The GAC shall not require additional New Technology approval.
3. The following materials shall not be blended into a mix with the required bituminous or sub-bituminous coal-based product:
  - i. Broken pellets, regardless of base material;
  - ii. Lignite-based GAC;
  - iii. Peat-based GAC;
  - iv. Wood-based GAC;
  - v. Coconut-based GAC; or,
  - vi. Anthracite-based GAC.

4. GAC media shall be treated with the following methods:
  - i. Acid-washed to reduce metals leaching during start-up.
  - ii. pH stabilized to reduce pH spike during start-up.
5. GAC shall be able to meet or exceed the following criteria, per vessel, assuming comparable influent water quality (Appendix U):
  - i. Non-detect PFAS (PFAS6, PFOA, PFOS, PFHxS, and PFNA) concentrations for a minimum of 40,000 bed volumes.
6. 700 cubic feet of GAC media shall be provided per lead pressure vessel.

## 2.3 SOURCE QUALITY CONTROL

- A. The GAC supplier will test samples in accordance with procedures specified in AWWA B100 and AWWA B604.
- B. Media shall only be furnished from suppliers of bituminous or sub-bituminous coal based activated carbon.
- C. The coal shall be mined and the corresponding GAC manufactured in the United States of America.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: GAC media shall be installed in strict accordance with the manufacturer's printed recommendations and as specified.
- B. GAC depletes oxygen from air and can be hazardous in a confined situation. PFAS Filter Manufacturer shall be responsible for worker's safety and follow all local, State, and Federal guidelines pertaining to confined space entry procedures. Obtain necessary permits for work in confined areas.
- C. The GAC shall be installed as a wet slurry to minimize abrasion and dust.
- D. Do not permit workers to walk or stand directly on media. Use boards that will sustain workers' weight without displacing media or gravel if specified.
- E. Before GAC media is placed, mark top of GAC layer on side of vessel.
- F. The PFAS Filter Manufacturer shall provide all required hoses, connections, air supply, and appurtenant equipment required to complete the initial installations of GAC.
- G. GAC Media:
  1. Transport and place media carefully to prevent contamination of any sort.

2. Any media which becomes contaminated or dirty (i.e., contains more than 0.5 percent of foreign material by weight), either before or after it has been placed in the vessels, shall be removed and replaced with clean media.
- H. Following installation, GAC media shall be soaked in water to displace air from the carbon's pore structure. Media shall be allowed to soak at ambient temperature for a minimum of 24 hours.
- I. Once the soaking process is complete, the GAC media shall be backwashed to cause bed expansion and remove remaining air bubbles. Backwashing shall be continued until clear water is observed exiting the carbon bed. Backwashing shall be conducted at a flow rate that will generate 20% - 30% bed expansion, as recommended by the media manufacturer. PFAS Filter Manufacturer shall have a manufacturer's technical service representative present on site during the backwash process.
- J. Following the backwashing process, GAC media shall be rinsed until the inlet pH is equal to the outlet pH.

### 3.2 DISINFECTION

- A. Prior to installation of GAC media, the pressure vessels and pipe and valve manifold shall be disinfected by the Contractor in accordance with AWWA C653 and manufacturer's recommendations. Refer to Section 13201 – Disinfection of Water Systems for additional requirements.

### 3.3 MANUFACTURER'S SERVICES

- A. A manufacturer's technical service representative for the GAC media specified shall be present at the sites continuously during placement of media for installation supervision, inspection, and certification of the installation. The representative shall be a full-time, direct employee of the media supplier and shall have a minimum of 2 years' experience during the past 5 years in media installation. Maximum time onsite, excluding travel, is 2 days per vessel.
- B. Provide a manufacturer's certificate of proper installation in accordance with Division 1, General Requirements.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11203



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## SECTION 11204

### ION EXCHANGE (IX) RESIN

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. This Specification describes the ion exchange resin (IX) products for use as media in pressure vessels for treatment of potable water. The IX shall be styrene-based polymer resin capable of removing per- and polyfluoroalkyl (PFAS) compounds in water treatment processes. **Only buffered type IX with MassDEP New Technology Approval for PFAS removal will be acceptable.**
- B. The PFAS Removal Filter Manufacturer (PFAS Filter Manufacturer) shall furnish IX products as specified herein. Refer to Specification Section 11202 – PFAS Removal Pressure Vessels for more information.

##### 1.2 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein.
- B. PFAS Filter Manufacturer shall coordinate installation of media with the Contractor to ensure an orderly and successful installation. At a minimum, the PFAS Filter Manufacturer shall provide the following:
  - 1. Provide an estimated week of media installation to the Engineer in writing at least one month prior to installation.
  - 2. Provide an estimated three-day window for media installation to the Engineer/Contractor in writing at least two weeks prior to delivery.
  - 3. Provide an estimated media installation date to the Engineer/GC at least one week prior to installation.
  - 4. Confirm installation day at least two business days or 48 hours, whichever is greater, prior to delivery.
  - 5. Provide guaranteed four-hour window for start of media installation at least one business day or 24 hours, whichever is greater, prior to installation. If the media installation is started after the guaranteed four-hour window, the PFAS Filter Manufacturer shall be responsible for the GC's additional costs caused by the delay. Costs may include, but are not limited to, labor, materials, rental equipment, markups, insurance, overhead and profit, and bonds.
  - 6. If the Contractor's media installation date changes to be outside of previous estimates, the GC shall have 24 hours or one business day, whichever is greater, to decline the new installation date. If the GC declines the new installation date,

the Engineer, Contractor, and GC shall mutually agree upon a new estimated delivery date.

### 1.3 SUBMITTALS

- A. In accordance with Section 01300 - Submittal Procedures.
- B. Action Submittals:
  - 1. Shop Drawings: Submit manufacturer's product information, including grain size ranges for the IX media layer specified. Media sizes shall be in millimeters and include Effective Size and Uniformity Coefficient. Data on clean bed headloss shall also be included.
- C. Informational Submittals:
  - 1. Submit gradation test results of IX media, including sieve analysis prior to loading and shipment.
  - 2. Submit data showing successful application of the IX in municipal water treatment plants including PFAS removal, along with references. References shall include a minimum of one (1) municipal water treatment plant in the Massachusetts Department of Environmental Protection's Southeast Region.
  - 3. Submit detailed resin installation and resin exchange procedure.
  - 4. Submit detailed resin commissioning requirements and procedure.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS OF ION EXCHANGE RESIN

- A. Purolite® PFA694EBF as manufactured by Purolite Corporation.
- B. CALRES™ 2301 (buffered option) as manufactured by Calgon Carbon Corporation.
- C. DOWEX PSR-2 Plus as manufactured by DOW Chemical Company.
- D. Or Engineer approved equal.
- E. The manufacturer shall have a minimum of 5 years' experience in supplying IX to water treatment plants. The manufacturer must be able to meet the performance criteria of this specification.
- F. The PFAS Filter Manufacturer shall conduct a small-scale pilot study at Well Station 4 using shortened IX media beds to confirm it can meet or exceed the bed life (number of treated water bed volumes) required herein. Refer to Section 11202 – PFAS Treatment System, Paragraphs 1.3.7 & 8 for requirements.

## 2.2 DESIGN CRITERIA

### A. IX Resin

1. The IX shall be NSF/ANSI/CAN 61; certified virgin material; manufactured from select grades of polymer resin; suitable for use in the treatment of potable water; having the following properties:
  - i. Particle Size: 16 by 50 US MESH.
  - ii. Effective size between 0.625 mm and 0.775 mm.
  - iii. Maximum Uniformity Coefficient: 1.3.
  - iv. Minimum exchange capacity: 0.51 eq/L.
2. The IX shall be buffered type.
3. The IX shall be approved for use in Massachusetts in accordance with 310 CMR 22.04(8). The IX shall not require additional New Technology approval.
4. IX shall be able to meet or exceed the following criteria, per vessel, assuming comparable influent water quality (Appendix U):
  - i. Non-detect PFAS (PFAS6, PFOA, PFOS, PFHxS, and PFNA) concentrations for a minimum of 120,000 bed volumes.
5. 240 cubic feet of IX media shall be provided per lag pressure vessel.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: IX media shall be installed in strict accordance with the manufacturer's printed recommendations and as specified.
- B. Contractor shall be responsible for worker's safety and follow all local, State, and Federal guidelines pertaining to confined space entry procedures. Obtain necessary permits for work in confined areas.
- C. The IX shall be installed as a wet slurry to minimize abrasion and dust.
- D. Do not permit workers to walk or stand directly on media. Use boards that will sustain workers' weight without displacing media or gravel if specified.
- E. Before IX media is placed, mark top of IX layer on side of vessel.
- F. The PFAS Filter Manufacturer shall provide all required hoses, connections, air supply, and appurtenant equipment required to complete the initial installations of GAC.
- G. IX Media:

1. Transport and place media carefully to prevent contamination of any sort.
  2. Any media which becomes contaminated or dirty (i.e., contains more than 0.5 percent of foreign material by weight), either before or after it has been placed in the vessels, shall be removed and replaced with clean media.
- H. Following installation, the IX media shall be backwashed at a low flow rate to redistribute the IX media into a uniform bed. Backwashing rate and duration shall be in accordance with the media manufacturer's instructions. Contractor shall have a manufacturer's technical service representative present on site during the backwash process.
- I. Following the backwashing process, IX media shall be rinsed until the inlet and effluent pH, chlorides, and sulfates are equivalent.

### 3.2 DISINFECTION

- A. Prior to installation of IX media, the pressure vessels and pipe and valve manifold shall be disinfected by the Contractor in accordance with AWWA C653 and manufacturer's recommendations. Refer to Section 13201 – Disinfection of Water Systems for additional requirements.

### 3.3 MANUFACTURER'S SERVICES

- A. A manufacturer's technical service representative for the IX media specified shall be present at the sites continuously during placement of media for installation supervision, inspection, and certification of the installation. The representative shall be a full-time, direct employee of the media supplier and shall have a minimum of 2 years experience during the past 5 years in media installation. Maximum time onsite, excluding travel, is 2 days per vessel.
- B. Provide a manufacturer's certificate of proper installation in accordance with Division 1, General Requirements.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11208

## SECTION 11241

### CHEMICAL METERING PUMPS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Electric Solenoid Diaphragm Chemical Metering Pumps
- 2. Other associated equipment for the chemical metering pumps.

- B. Related Sections include the following:

- 1. Division 1 – General Requirements
- 2. Division 6 – Wood and Plastics
- 3. Division 11 – Equipment
- 4. Division 13 – Special Construction
- 5. Division 16 – Electrical

##### 1.3 SYSTEM DESCRIPTION

- A. The Contractor shall furnish and install the chemical metering pumps as shown on the Contract Drawings. The chemical metering pumps shall be positive displacement type metering pumps including all appurtenances and accessories as described herein. The pumps shall be fully compatible with the chemicals being pumped.
- B. The pump manufacturer is responsible for ensuring that all equipment and systems required for a complete operating system are provided, and compatible and suitable for the project conditions.
- C. The equipment covered by these Specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.

##### 1.4 SUBMITTALS

- A. The shop drawing submittals for chemical metering pump shall contain pump curves, plans, and sections showing dimensions, materials of construction, details, design data,

test reports showing rated flow and steady state accuracy at 100 percent setting, certification of factory testing, operation and maintenance manuals, warranty, and installation instructions.

- B. Shop drawings shall be submitted for all appurtenances, including calibration columns, four-function valves, electrical and instrumentation wiring diagrams, safety valves, flow indicators, mounting system, and all other associated equipment. A chemical area layout plan indicating pumps, tanks, and equipment pad locations shall be provided by Contractor for Engineer/Town approval prior to installation.
- C. Operation and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Section 01730 – Operation and Maintenance Data.

#### 1.5 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals (O&M Manuals): Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish O&M Manuals prior to start-up.
- C. O&M Manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain all chemical feed equipment and systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  - 1. Description and operating instruction for all mechanical components.
  - 2. Instructions relevant to all modes of equipment operation.
  - 3. Service and trouble-shooting instructions of equipment supplied.
  - 4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  - 5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  - 6. Detailed operating instructions for normal and emergency operation conditions.
  - 7. As-Built Mechanical drawings and dimensional information showing the actual layout and location of equipment components within the structures.

## 1.6 SPARE PARTS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one set of spare parts for each individual unit furnished and installed.
- B. For each solenoid driven diaphragm chemical metering pump, provide one spare parts kit for pump repair.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material, and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## 1.8 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## PART 2 – PRODUCTS

### 2.1 DIAPHRAGM CHEMICAL METERING PUMPS

- A. One (one duty) or two (one duty and one standby) positive displacement chemical metering pumps shall be supplied for each chemical feed system, as specified herein. The chemical feed systems include potassium hydroxide, sodium hypochlorite (pre-filtration and post-filtration), sodium bisulfite, and sodium fluoride.
- B. Drawings and specifications indicate general arrangement and layout based on pumping equipment supplied by hereinafter specified manufacturers. If equipment accepted requires arrangement, dimensions, or design that differs from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.



- C. Electrical equipment and materials shall be listed by Underwriters' Laboratories, Inc. wherever standards have been established by that agency.
- D. All components of the equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- E. The pumps shall be capable, without a hydraulically backed diaphragm, of injecting solutions against pressures as described in Paragraph 2.1.J, 2.1.K, 2.1.L, and 2.1.M, herein. The pumps shall have a clear liquid crystal display. Control shall be selectable between internal and external pulsing by means of a tactile keypad. Internal stroke frequency shall be adjustable from 1 stroke per hour to 100 strokes per minute. Pressure capacity shall be keypad adjustable to reduce noise, vibration, and wear. Metering pump shall be capable of dividing or multiplying pulse inputs from 1 to 999 or responding directly or inversely to a 4-20mA input signal.
- F. The pump drive shall be totally enclosed with no exposed moving parts. Solid state electronic pulser shall be encapsulated and supplied with quick connect terminals at least 3/16" wide. Electronics shall be housed in a chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage. Electrical power consumption shall not exceed 65 watts under full speed and maximum pressure conditions.
- G. For overpressure conditions, pump shall automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.
- H. Chemical metering pump housing shall be of chemically resistant glass fiber reinforced thermoplastic with a glass fiber reinforced polypropylene EPU carrier. All wetted parts shall be compatible with pumped chemical. Chemical metering pump valves shall be ball type, with ceramic balls. Valve seat and seal ring shall be renewable by replacing the combination seat seal ring or cartridge valve assembly. Pump head shall be of transparent PVC material compatible with the chemical being pumped. Fittings and connections at the pump head shall be PVC.
- I. The power supply shall be 120 VAC 60 Hz, single phase with a 3-prong plug. Plug shall be 15 amp, 125 Volt, NEMA Type L5-15P, twistlock. The microprocessor is to compensate for supply voltage variations automatically within 10% of the rated voltage such that the frequency of the pump remains constant.
- J. Potassium Hydroxide Pump Design Criteria (also refer to mechanical schedule in Contract Drawings):

FEED SYSTEM	NUMBER OF PUMPS	MAX. FEED RATE (GPH)	MIN. FEED RATE (GPH)	MAX. INJECTION PRESSURE (PSI)	LIQUID END CONST
KOH (MP-502, MP-504)	2	5.37	1.67	65	316 S.S.

1. Chemical Being Pumped: Potassium Hydroxide (45% as KOH)
2. Note: The KOH chemical metering pump design is based upon LMI, Model Series C771-27. Any proposed “OR EQUAL” pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

K. Sodium Hypochlorite Pump Design Criteria (also refer to mechanical schedule in Contract Drawings):

FEED SYSTEM	NUMBER OF PUMPS	MAX. FEED RATE (GPH)	MIN. FEED RATE (GPH)	MAX. INJECTION PRESSURE (PSI)	LIQUID END CONST
Pre-Filtration NaOCl (MP-404, MP-405)	2	1.32	0.30	75	PVC
Post-Filtration NaOCl (MP-407, MP-408)	2	1.23	0.40	25	PVC

1. Chemical Being Pumped: Sodium Hypochlorite (6.25% as NaOCl)
2. Note: The Pre-Filtration NaOCl chemical metering pump design is based upon LMI, Model Series C911-D60HI. The Post-Filtration NaOCl chemical metering pump design is based upon LMI, Model Series C911-D60HI. Any proposed “OR EQUAL” pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

L. Sodium Bisulfite Pump Design Criteria (also refer to mechanical schedule in Contract Drawings):

FEED SYSTEM	NUMBER OF PUMPS	MAX. FEED RATE (GPH)	MIN. FEED RATE (GPH)	MAX. INJECTION PRESSURE (PSI)	LIQUID END CONST
NaHSO <sub>3</sub> (MP-603, MP-604)	2	0.38	0.008	65	PVC

1. Chemical Being Pumped: Sodium Bisulfite (38% as NaHSO<sub>3</sub>)
2. Note: The NaHSO<sub>3</sub> chemical metering pump design is based upon LMI, Model Series C901-498SP. Any proposed “OR EQUAL” pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

M. Sodium Fluoride Pump Design Criteria (also refer to mechanical schedule in Contract Drawings):

FEED SYSTEM	NUMBER OF PUMPS	MAX. FEED RATE (GPH)	MIN. FEED RATE (GPH)	MAX. INJECTION PRESSURE (PSI)	LIQUID END CONST
NaF (MP-651)	1	3.72	1.16	64	PVC

1. Chemical Being Pumped: Sodium Fluoride (4% as NaF)
2. Note: The NaF chemical metering pump design is based upon LMI, Model Series C921-D68HI. Any proposed "OR EQUAL" pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.2 DIAPHRAGM CHEMICAL METERING PUMP APPURTENANCES AND ACCESSORIES

- A. Four Function Valve: Metering pumps shall be supplied with a four-function valve capable of providing positive anti-siphon, back pressure, priming aid – line pressure release, and pressure relief. Sodium Hypochlorite metering pumps shall be supplied with a four-function valve with automatic priming to allow for constant removal of gas and vapors in the line. Valves shall be compatible with the metering pump and installed on the discharge as shown on the Contract drawings. All wetted materials shall be compatible with the chemical being pumped. The four-function valve shall be provided by the chemical metering pump manufacturer.
- B. Calibration Column: There shall be one calibration column per chemical feed system, as shown on the Contract Drawings. Calibration column shall be sized as shown on the Contract Drawings and shall be constructed of a material compatible with chemical being pumped.
- C. Backpressure valves (provided loose) shall be of the in-line diaphragm design and installed just prior to the injection point. Backpressure valve shall be set at 40 psig from the factory and provided with union connections. Once in the field the backpressure valve shall be set by the Contractor at 10-20 psig above injection pressure.
- D. Tubing Connectors: Tubing connectors shall be provided at all tubing connection points.
  1. Tubing connectors shall be Heavy Duty Connector (HDC) Series connectors as manufactured by Maltz Sales Company, or approved equal.
- E. Each metering pump shall be supplied with external cables for start/stop control and 4-20 mA control. If required, an analog to digital converter shall be provided. Cables shall be coordinated with metering pump control station requirements, refer to Section 13325 – Process and Instrumentation Control Products and Contract Drawings.

- F. Pressure Gauges: Each chemical feed system shall be supplied with a pressure gauge for reading discharge pressure as shown on the Contract Drawings. Refer to Section 11501 – Process Gauges.
- G. Free Standing Table and Mounting System: Metering pumps shall be provided with a freestanding mounting system consisting of a FRP framing system and mounting board. The freestanding mounting system shall have a minimum of four support legs. Freestanding mounting system shall be designed by a qualified engineer retained by the Contractor and installed according to the design and per framing system manufacturer's recommended procedure. The framing system shall be designed to support the weight of the metering pumps and forces exerted from pump operation. The mounting board shall be sized to extend a minimum of six inches beyond the limits of the metering pumps. Refer to the Contract Drawings are additional requirements.
  - 1. All framing system components shall be rigid PVC finished FRP, as manufactured by Uni-strut or Engineer approved equal.
  - 2. All mounting system components shall be chemical/corrosion resistant to the chemical being pumped.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install chemical metering pumps and related appurtenances according to the manufacturer's printed instructions, as indicated and specified.
- B. All equipment shall be field tested in accordance with this Section of the Specifications.
- C. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- D. Install identifying labels permanently to equipment.
- E. Energize no equipment except by manufacturer's service representative, until authorized in writing.

### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.

- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 TRAINING

- A. The Contractor shall provide operation and maintenance training for the chemical feed systems conducted by a qualified manufacturer's service representative. The training shall total no less than two (2) hours for each chemical feed system (not including travel time). Training shall be scheduled separately from installation checkout and testing, unless approved by Engineer.

### 3.4 FIELD QUALITY CONTROL

- A. The Contractor shall include the coordination of field testing with a representative of the chemical feed system manufacturer to insure a complete and functioning system as part of the work. All chemical feed systems shall be calibrated prior to start-up.
- B. After field testing, the manufacturer's field representative will provide instructions for the use and care of the equipment to the Owner's representative.
- C. The chemical pumps shall be tested and calibrated in the presence of the Engineer.
  - 1. The pump manufacturer's service representative shall generate calibration curves for each chemical feed pump.
  - 2. Diaphragm Metering Pumps: The calibration curves shall graphically represent the pump displacement at 25, 50, 75 and 100 percent of the stroke frequency and 25, 50, 75 and 100 percent of the maximum stroke position. The pumping period, volume of liquid pumped and the suction and discharge pressure shall be recorded
  - 3. Pump operation shall be verified using the actual chemical being pumped.
  - 4. If the pump output varies excessively, it is possible the pump is air bound. Operate pump for five minutes at a backpressure of 50 psig. Pumps unable to relieve themselves of air within a five-minute period are not acceptable.
- D. During field testing, the manufacturer's field representative shall inspect, test, and start-up the complete chemical feed systems. Equipment failing to meet specific conditions described herein shall be removed and replaced at no cost to the Owner.
- E. Submit field test results and certification of successfully conducted field tests.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 - Contract Closeout.

END OF SECTION 11241

## SECTION 11310

### VERTICAL TURBINE PUMPS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SCOPE OF WORK

- A. Furnish, install, and field test vertical turbine type pump, variable speed with all required appurtenances necessary for a complete installation as indicated on the drawings and herein specified.
- B. The term “pumping unit” or “unit” shall be defined as a complete pumping assembly, including intake suction bell, bowl assembly, column pipe, discharge head, base and sole plate, coupling, coupling guard, motor, controls, and any associated accessories and appurtenances specified herein or required for proper operation.
- C. All items herein specified shall be provided by the pump manufacturer. Pump manufacturer is responsible for insuring that all equipment required is provided, and that it is compatible and suitable for the application.
- D. The specifications and drawings adequately describe the system, but do not purport to cover all required details. Provide all appurtenances required, whether specifically noted herein or not, at no additional cost to the owner.
- E. Pumps shall be constructed with appropriate materials for continuous service suitable for drinking water.
- F. The pump manufacturer shall be responsible for supplying the complete pumping unit as defined above and shall assume complete pumping-unit responsibility.
- G. The pumping unit shall be designed to operate at the proposed design conditions described herein and in the Contract Documents. The pump and motor shall be capable of operating at the proposed and future pump design conditions. The addition of one or more bowl will be required to meet the future design conditions.

##### 1.3 SUMMARY OF WORK

- A. Related Sections include the following:
  - 1. Division 1 – General Requirements
  - 2. Division 9 – Finishes

3. Division 11 – Equipment
4. Division 13 – Special Construction
5. Division 16 – Electrical

B. Work not included:

1. Variable frequency drives (VFDs) shall be provided under Division 16.

#### 1.4 DESCRIPTION

A. General

1. Items under this Section include, but are not limited to, those components and appurtenances listed below for each pumping unit.
  - i. Pump Casing/ Pump Bowl Assembly
  - ii. Impeller
  - iii. Column Pipe
  - iv. Wearing Rings
  - v. Stuffing Box or Packing/ Sealing Housing
  - vi. Pump Shaft and Shaft Sleeve
  - vii. Bearing Housing and Bearing System
  - viii. Pump and Motor Supports
  - ix. Coupling
  - x. Coupling Guard
  - xi. Motor
  - xii. Anchor Bolts

B. Provisions

1. Drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by hereinafter specified manufacturers. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
2. Drawings and specifications direct attention to certain features of equipment, but do not purport to cover all details entering into design and construction of the equipment, controls, or appurtenances.
3. Conduit, wire, and connections for electrical power are shown on electrical drawings. In the event that the system proposed requires additional power, wiring or starters other than what is shown on electrical drawings, Contractor is fully responsible for any additional electrical costs.
4. Electrical equipment and materials shall be listed by UL wherever standards have been established by that agency.

C. Conditions of Service

1. All pumps will be in contact with drinking water.
2. Pertinent elevations, dimensions, and design conditions are indicated on the Contract Drawings and in the Mechanical Schedule of the Contract Drawings.
3. Finished water pump column and bowl assembly shall be equal to or less than 12-inch in diameter.

1.5 SUBMITTALS

A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein:

B. Additional submittals hereinafter specified, for Engineer's approval.

1. Shop test results
2. Field test results
3. Alignment procedure, and equipment certification

C. Additional Submittals

1. Complete pump/motor support loads and reactions, for the Engineer's information.
2. Pump/coupling/motor torsional analysis and lateral critical calculations for review.
3. Certified head/capacity rating curves for proposed and future pump design conditions. Plot the following as ordinates versus flow rate as the abscissa for 100 percent pump speed, and for variable speed applications 90 percent, 80 percent, and 70 percent speed:
  - i. Total Dynamic Head
  - ii. Pump Efficiency
  - iii. Brake Horsepower
  - iv. Required NPSH
4. The following information:
  - i. Maximum allowable speed
  - ii. Maximum allowable flow
  - iii. Preferred operating range
  - iv. Allowable operating range
  - v. Maximum allowable impeller diameter
  - vi. Maximum allowable horsepower (torque)



5. Complete start-up instructions. Followed by certified Start-up Report.
6. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field installed wiring.
7. Operation and Maintenance Manuals: Submit materials for inclusion in Operating and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.

## 1.6 QUALITY ASSURANCE

- A. Consideration given only to products of manufacturers who demonstrate successful experience in manufacture, operation, and servicing equipment of type, size, and performance equal to that specified.
- B. To ensure unity of responsibility, the pumping units shall be supplied, tested, inspected, certified, started-up and warranted by the pump manufacturer.
- C. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- D. The pumping units specified under this section are to be standard pumping equipment (for use in the specified Conditions of Service) manufactured by a company with no less than fifteen years' experience in the manufacture of referenced pumping equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, descriptive and annotated catalog cuts describing the equipment systems being proposed, etc.
- E. Manufacturing and testing shall comply with “Hydraulic Institute Standards for Centrifugal, Rotary & Reciprocating Pumps”.
- F. Pump rotating assemblies shall be balanced in accordance with the requirements of ANSI Designation S2.19, G6.3.
- G. Workmanship and Design
  1. All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be inter-changeable.
  2. All materials used in construction of equipment shall be of best quality and entirely suitable in every respect for the required service and duty requirements.
  3. Except as otherwise specified or approved, steel plates and shapes shall have a minimum thickness of 1/4-in., and bolts a minimum diameter of 1/2-in.

## H. Shop Testing

### 1. General

- i. Shop test new pumps and motors. Motor shop test data shall be provided. Approval of pump and motor test results by the Engineer must be granted prior to shipping – NO EXCEPTIONS.
- ii. The motors being furnished may be shop tested at the motor manufacturer's facility.
- iii. Pump tests need not be performed with the actual VFDs being furnished. However, shop testing of the pumps at various speeds is required; the pump manufacturer must provide a Variable Frequency Drive for the tests. If desired, the actual VFDs being furnished (under Division 16 – Electrical) may be used for the pump tests. The Contractor shall note that the pumps, motors, and VFDs furnished must perform satisfactorily as a complete system when installed at the project site. Shop testing the pump/motor assemblies without the actual VFDs does not relieve the Contractor of any responsibility for providing a satisfactory system.
- iv. In the event that a pump or motor fails to perform as specified during the test, make all modifications required to place the unit in conformance with the specifications, and retest, at no additional cost to the Owner.
- v. In the event that a pump or motor unit fails a second test, the unit will be rejected without recourse, and must be replaced with a unit equal to that specified, which passes the required tests.
- vi. All tests shall be performed in accordance with the Hydraulic Institute Test Standard for Centrifugal Pumps – 14.6 Latest Edition.

### 2. Hydrostatic Testing

- i. Test pump casing assemblies individually at the greater of: 1.5 times shut off head at the maximum allowable speed with the maximum allowable impeller diameter, or two times the design head.
- ii. Conduct hydrostatic testing prior to performance testing.
- iii. Provide written certification that the tests were successfully conducted.

### 3. Performance Testing

- i. Individually test each pump/motor unit on water, with a Variable Frequency Drive, (if applicable), in conformance with the Hydraulic Institute Standards.
- ii. The pumps shall be tested at 70 percent, 90 percent, and 100 percent speed. (If the pump is a constant speed pump without a VFD, test the pump only at 100 percent speed.) At each of the speeds, shut-off head plus seven head/capacity points shall be measured at equally spaced flows over the full range of the head/capacity curves for the respective speeds. For each test, the following data shall be collected and reported:
  - (a) Total dynamic head/Rate of flow
  - (b) Power draw
  - (c) Efficiency

- iii. Certify that the pump is free from overheating, cavitation, and excessive vibration.
- iv. Bearing Temperatures
  - (a) Motor bearing temperatures shall be determined by electronic measurement in an approved manner in a well bored in the bearing housings or by other approved means. If bearing temperature sensors are not called for in the specifications, there likely will be no bearing wells for test temperature measurements. Surface contact sensors should be satisfactory for bearing temperature measurement during the tests.
  - (b) Temperatures in excess of the specified limit less 80 °C rise will indicate excessive temperature. Measurements will be adjusted linearly with ambient temperature.
  - (c) Unless Contractor submits conclusive evidence that the bearing internal temperature does not exceed that specified temperatures above those limits specified above will result in rejection of the pump motor.

#### 4. Submission of Test Results

- i. All data shall be submitted on 8-1/2 x 11 inch sheets at as large a scale as is practical.
- ii. Plot curves for all performance data, corrected to standard conditions.

#### I. Field Testing

- 1. Field tests shall be performed by the Contractor on all pumping systems under the instruction of the field service engineer. All field testing to be witnessed by the Owner/Engineer in the field.
- 2. Ensure that all components perform as specified.
  - i. Test each pump at 70 percent, 90 percent, and 100 percent speed. (If the pump is a constant speed pump without a VFD, test the pump only at 100 percent speed.) At each speed collect and report the following data at shut off head and at three equally spaced points over the full range of the head/capacity curve for the respective speed:
    - (a) Rate of flow/total dynamic head;
    - (b) Amperage, voltage and power factor (at the input to the VFD);
    - (c) Wire to water efficiency;
    - (d) Vibration frequencies and amplitudes;
    - (e) Power consumption (at input to the VFD); and
    - (f) Motor temperature rise.
  - ii. Operate each pumping unit at each rated condition for not less than thirty (30) minutes. After ten (10) minute intervals record flow and head, and amperage, voltage, and power factor (at the input to the VFD or motor starter). Report wire to water efficiency. Pumping unit shall not be operated at shut-off head beyond manufacturer's recommendations (one minute minimum).
  - iii. Motor nameplate current and power not to exceed the nameplate data. (adjusted for operating voltage as field measured).

3. Perform vibration testing, utilizing a qualified independent testing company.
  - i. Vibrations measured in conformance with the appropriate HIS standards.
  - ii. Vibration velocities in excess of those specified are not acceptable.
  - iii. Vibration, when measured at the motor bearing housing shall not exceed the limitations specified by the Hydraulic Institute Standards “Acceptable Field Vibration Limits for Vertical Turbine Pumps”.
4. In the event that a pumping unit fails to pass a test, make all modifications (at no cost to the owner) required to place the unit in proper working order, and retest.
5. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the owner.
6. All tests shall be in conformance with the applicable Hydraulic Institute Standards.
7. Submit all scheduling and procedures to the Engineer for approval.
8. The Contractor shall provide all necessary instrumentation (with calibration certificates), equipment, devices and appurtenances, as well as any temporary wiring or piping, required to perform required field tests.
9. Provide written test procedures which describe the proposed means and methods to be used in conducting necessary field tests. Field testing shall not be completed without written test procedures. Engineer to witness all field testing.
10. Submit certification of successfully conducted field tests and results, including vibration test results, to Engineer.

#### 1.7 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner’s personnel to operate and maintain the pumping equipment and systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for all mechanical components.

2. Instructions relevant to all modes of equipment operation.
3. Service and trouble-shooting instructions of equipment supplied.
4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
6. Detailed operating instructions for normal and emergency operation conditions.
7. As-Built Mechanical drawings and dimensional information.

#### 1.8 EXTRA MATERIALS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one (1) set of spare parts for each individual unit furnished and installed.

#### 1.9 REFERENCES

- A. Where herein specified or applicable.

AFBMA	Anti-Friction Bearing Manufacturers Association
API	American Petroleum Institute
HIS	Hydraulic Institute Standards
NBS	National Bureau of Standards
SAE	Society of Automotive Engineers

#### 1.10 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

#### 1.11 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Pump manufacturer acts as single source for all components. The pump manufacturer shall furnish the pumps and motors and shall accept complete product responsibility.
- B. Manufacturers:
  - 1. Sulzer (<https://www.sulzer.com/>)  
Switzerland
  - 2. Franklin Electric Company (<https://franklinwater.com/>)  
Fort Wayne, IN
  - 3. Peerless Pump Co. ([www.peerlesspump.com](http://www.peerlesspump.com))  
Montebello, California
- C. Pump performance parameters (at discharge head) shall be as indicated on the Contract Drawings. The bowl efficiency shall be greater than 70% for all listed duty/rating points (excluding shut-off head). Pump design shall meet minimum continuous flow requirements for all listed duty/rating points (excluding shut-off head).
- D. Well Station 3 well pump drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by Sulzer Model CST-8L (11 Stages) with a 6.5-inch impeller. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- E. All pump components shall be of sufficient strength and design to withstand operation at shut-off head for a minimum of two (2) minutes without damage or reduced component life.
- F. Provide anchor bolts under this section in conformance with the requirements specified elsewhere. Anchor bolts shall be sized for a minimum base slab embedment (not including equipment pad) of 6”.
- G. Structural steel components where required shall be in conformance with ASTM Designation A36 and A53.

- H. Shop painting, field painting, and protective coatings are required as specified in Division 9 – Finishes.
- I. All major pump components shall be furnished with lifting lugs or eye bolts to facilitate handling and/or equipment removal for maintenance. The lugs or bolts shall be designed or arranged to allow safe handling of the pump components singly or collectively as required during shipping, installation, and maintenance.
- J. Unless otherwise specified, each piece of the new pump shall be assembled in the Pump Manufacturers facility to ensure the correctness of the fabrication and matching of the component parts. Shop assembly shall be marked to assure the same position when assembled in the field.

## 2.2 PUMP COLUMN AND DISCHARGE HEAD

### A. General

1. Pump discharge head shall be fabricated steel complete with integral discharge flange.
2. Smooth fluid passages of sufficient size at all points to pass any solids which can pass through the impeller shall be provided.
3. Discharge head design shall permit the drive shaft to be coupled above the mechanical seal box to facilitate easy removal and replacement of the driver. The mechanical seal shall be cartridge type seal with independent sleeve to allow seal adjustments after impeller clearances are set.
4. A fabricated steel base and sole plate shall be provided for mounting. Fabricated steel discharge head shall support the driver. A sole plate shall mount the discharge head to the foundation.
5. As appropriate, all weldments shall be heat-treated and stress relieved before final machining.
6. Pump shall be of the open line shaft design. All wetted parts shall be appropriate for use in the specified environments.
7. The pump shall be furnished complete with discharge head and sole plates designed to support the weight of the pumping unit and other loads to which the unit may be subjected during operations. Sole plate shall be 1-inch thickness (minimum).
8. Flanges shall be machined and bolt holes shall be drilled on a bolt circle concentric with the pump shaft vertical centerline. They shall be parallel machined when provided on each end of the same component and mounted parallel to a plane that is normal to the pump shaft centerline. The mating surface on all flanges shall be machined to a 125 RMS finish or better. All internal pump flanges shall be machined with registered fits.

9. To accommodate pump removal, pump column shall be fabricated in uniform interchangeable sections (10-feet long, maximum) and shall be connected by flanged and standard mounting hardware. Proper column sizing shall be the responsibility of the manufacturer. Refer to paragraph 1.4 for additional requirements.
- B. Provide discharge head with two lifting eyes to facilitate handling.
- C. Provide 1/2-inch NPT connections for head vents, head seal plate drains and a 1/2-inch connection on the discharge nozzle for a pressure gauge.
- D. Materials
1. Material shall be sufficient strength and thickness to insure long life, accurate alignment, minimal deflection, and, above all, reliable operation.
  2. Minimum wall thickness: 0.28 inch.
  3. Column Pipe constructed of carbon steel, in conformance with ASTM Designation A53 Gr. B and epoxy coated as specified in Division 9 - Finishes.
  4. Mechanical seal housing shall be constructed of cast iron and shall be provided with a cartridge-style mechanical seal.
  5. The line shafts and couplings shall be of ample size for continuous pumping, and shall be made of 416 stainless steel. Lineshafts shall be supplied in interchangeable lengths, not to exceed 10 ft., and shall be coupled by threaded couplings. Headshaft shall be coupled to the driver shaft by a threaded type coupling of ample size and strength to transfer all axial and torque loads from the driver to the pump. The coupling shall permit removal of the mechanical seal without removal or disassembly of the pump driver from its mounting base. All hardware, nuts, and bolts shall be 316 stainless steel.
  6. Open lineshaft bearing material shall be rubber, with 120-inch maximum lineshaft bearing spacing.
  7. Discharge flanges shall be flat faced, ANSI Designation B16.1, Class 150, of size equal to that indicated on the drawings, with drilled bolt holes.

## 2.3 PUMP BOWL ASSEMBLY

### A. General

1. The bowl assembly shall consist of two sections, the diffuser, and the suction bell. Each section shall be flanged.
2. Bowl bearings shall be encased in an easily removable and replaceable cartridge or shall be press fit. The discharge bowl shall be constructed of cast iron in accordance with ASTM Designation A48, Class 30. Bowls shall be free from blow holes or other imperfections. The diffuser vanes shall be designed with



ample clearance and rounded contours to allow passage of solids. Bowl bearings shall be bronze. The suction bell shall be cast iron and designed to mate with the impeller wear ring.

3. Upper and lower bronze (C89835) bearings shall maintain alignment of the shaft through the bowl.

## 2.4 IMPELLER

- A. The impeller shall have more than three vanes and be single suction enclosed type. The impeller shall be a one piece design, statically and dynamically balanced to ANSI Designation S2. 19-1975 (ASA 2-1975) G 6.3 standards.
- B. Provide smooth water passages with maximum sphere size as specified herein.
- C. Construction
  1. Material to be 410 stainless steel.
  2. Impeller formed with accurately set cores to ensure uniform thickness and spacing, and accurately machined.
  3. Statically and dynamically balance impellers prior to assembly, such that vibration of complete pumping unit does not exceed Hydraulic Institute limits.
  4. Impeller securely keyed and fastened to shaft with stainless steel fasteners. Attachment arranged such that impeller cannot be loosened by torque from either forward or reverse rotation, and will not interfere with stringy solids passing through impeller.

## 2.5 WEARING RINGS

- A. Provide wear rings on bowl assembly, to provide for a minimum of 1/4-inch of wear each.
- B. Wear rings arranged such that wear can be compensated for by adjusting the axial clearance between the bowl and the impeller.
- C. Materials:
  1. Impeller wear rings shall be fabricated from aluminum bronze (C95400).
  2. Bowl wear rings shall be fabricated from nickel aluminum bronze (C95500).
- D. Attach wear rings securely and provide an approved positive means of prohibiting rotation or misalignment.

## 2.6 PUMP SHAFT

- A. Provide pump shaft accurately machined, along its entire length, from 416 stainless steel, ASTM Designation A582, Type 416 bowl shaft.
- B. Shaft sized to transmit the maximum torque required when the pump is operating at the maximum allowable speed, with the largest possible impeller, to allow for a future change of capacity.
- C. Shaft must adequately support the impeller and operate with the minimum vibration possible at all operating speeds.
- D. Shaft first natural torsional or lateral critical speed must be not less than 120 percent of the maximum allowable operating speed of the pump.

## 2.7 LINE SHAFT

- A. Line shaft shall be of 416 stainless steel of a size which conforms to the requirements of ANSI standard specifications.
- B. Line shaft shall be furnished in interchangeable sections having a minimal length of not over 10-ft. The butt faces shall be machined square to the axis of the shaft. Shafts shall have threaded type couplings which tighten during pump operation.
- C. The shaft shall be provided with stainless steel line shaft sleeves. Open line shaft bearing material shall be constructed of rubber material.

## 2.8 COUPLING

- A. Provide a threaded coupling.
- B. Coupling rated for not less than the maximum torque output of the motor, including service factors, anywhere on the motor speed torque curve.

## 2.9 COUPLING GUARD

- A. Provide coupling guard of size and type required to meet OSHA standards.
- B. Fabricate coupling guard from carbon steel. Guard to be perforated and to meet OSHA standards.

## 2.10 PUMP AND DRIVE SYSTEM SUPPORTS

- A. Both pump and drive system shall be properly supported.
- B. The pump/motor assembly preferably shall be supported by the discharge head. The discharge head shall be of fabricated steel construction or approved equivalent material.

1. Discharge head and sole plate support system shall be designed for all imposed loads:
  - i. Pump and motor deadweight
  - ii. Weight of water in pump
  - iii. Maximum motor torque
  - iv. Fluid dynamic and pressure thrust (account for inside diameter of the discharge expansion joint)
2. Submit design calculations for review and approval.

#### C. Motor Support

1. If motor is supported by the bearing frame, design bearing frame and casing accordingly.
2. Provide ample access to the sealing housing and coupling, subject to Engineer's approval.

### 2.11 ACCESSORIES

- A. All major pump components shall be furnished with lifting lugs or eye bolts to facilitate handling. The lugs or bolts shall be designed or arranged to allow safe handling of the pump components singly or collectively as required during shipping, installation, and maintenance.
- B. Pump sole plate shall be factory modified for well level element, well vent, and similar, refer to the Contract Drawings for requirements, sizes, and locations.

### 2.12 MOTORS

- A. Pump motors shall be provided under this Section. They shall be in conformance with Division 16 – Electrical, with additional requirements specified herein and as indicated on the Contract Drawings. If required, motors shall be inverter duty suitable for operation with Variable Frequency Drives.
- B. Provide all motors with service factor of 1.15 over nameplate rating, of sufficient rated horsepower to provide non-overloading operation throughout the operating range indicated on the drawings.
- C. Starting characteristics required:
  1. NEC Code Letter F.
  2. Accelerate pump to full speed against a closed valve in 15 seconds or less.
- D. Temperature Rise Allowable: Maximum of 80°C at nameplate horsepower, as measured by imbedded motor stator thermostats, at an ambient temperature of 40 °C.
- E. Noise Level Allowable: Maximum of 85 dBA measured five feet from motor.

- F. Each motor shall be designed for the highest efficiency standard available in the marketplace.
- G. Motor Voltage: as indicated on the Contract Drawings.
- H. Motor starting current shall not exceed 650 percent of the motor full load current. Motors shall be Premium Efficiency type in accordance with NEMA specifications for premium efficiency motors.
- I. Stator windings shall be fully processed steel. Each lamination surface shall be given the necessary treatment to have core plate Type C-5 insulation.
- J. Aluminum wire shall not be acceptable. Individual coils shall be insulated with mica bearing tape prior to insertion. Coil extensions shall be blocked and braced sufficiently to minimize movement during normal starting and running conditions at full rated voltage and load.
- K. Stator winding protection shall be provided and shall consist of three bimetallic thermostatic automatic reset switches with normally closed (open on high temperature) contacts, mounted one per phase. Each thermostat shall be furnished with leads run to a terminal box where they shall be connected and wired to the motor controllers control circuits. Pump motor high winding temperature shall shut down the pump and initiate an alarm.
- L. Insulation systems shall receive a minimum of two vacuum pressure impregnation treatments using powder epoxy.
- M. Guide bearings shall be located at the bottom of the motor. Bearing assemblies shall be provided with sufficient means for preventing leakage of lubricant or entrance of foreign matter along the shaft. Bearings shall be oil lubricated and contained in an oil reservoir with an oil sight level gauge and oil fill and drain openings with plugs.
- N. Motors shall be commercially balanced.
- O. Motor Bearings
  - 1. Provide heavy duty ball bearings
    - i. Vacuum degassed, either grease or oil lubricated type.
    - ii. Designed for maximum radial and thrust loads that will occur.
    - iii. Minimum B-10 life: 100,000 hours.
    - iv. Provide large oil reservoir with sight gauge for each bearing assembly.
  - 2. Insulate bearings against flow of shaft currents.
- P. Accessories required
  - 1. The finished water pump motor manufacturer shall provide the motor with bearing and winding temperature detectors.

2. Motor nameplates shall be bronze or stainless steel and shall be securely fastened to the motor frame with pins of like material. The nameplate shall contain, as a minimum, the following information:
  - i. Rated horsepower
  - ii. Full Load Amps
  - iii. Full Load Speed
  - iv. Frequency
  - v. NEMA kVA code and design letter
  - vi. Rated voltage
  - vii. Manufacturer's serial number
  - viii. Service Factor
  - ix. Insulation Class
  - x. Maximum ambient temperature
  - xi. Maximum temperature rise
  - xii. Full load current at nameplate voltage
  - xiii. Frame designation
  - xiv. Hydraulic rating point (GPM @ Ft. TDH)
- Q. Terminal boxes shall be fabricated steel or cast-iron construction to be compatible with the motor enclosure specified herein and, when possible, shall be diagonally split and capable of rotation in 90 degree increments. Boxes not suitable for rotation shall be capable of top entry. The area where the main terminal box is connected with the motor frame shall be fully gasketed in order to prevent entrance of foreign matter into the motor and to provide support for the stator leads where they pass through the motor frame.
- R. A properly sized grounding terminal shall be mounted in the main terminal box. The main terminal box shall be sufficiently oversized to allow stress cone terminations of shielded power cables and to allow mounting of any required accessories.
- S. Main motor leads shall have EPDM or equivalent type jackets and shall be permanently tagged for identification. The relationship between the lead markings and the direction of the rotation shall be indicated on a separate motor nameplate.

## 2.13 SPECIAL TOOLS AND SPARE PARTS

- A. Provide one complete set of all special tools required for maintenance of the pumping units.
- B. Provide the following spare parts for each pump:
  1. One spare mechanical seal and shaft bushing.
  2. One complete set of gaskets, O-Rings, and lubrication seals with labyrinth
  3. One set of bowl wearing rings
  4. One set of thrust bearings

5. One impeller nut, locking screw, and key
6. One pump shaft sleeve and key

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install all items with care, and in accordance with printed recommendations of manufacturer.
- B. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.
- C. Energize no equipment, except by manufacturer's service representative, until authorized in writing.
- D. Installation conducted in accordance with applicable Hydraulic Institute Standards. Dynamically balance the pump shaft/impeller assembly to ensure a maximum vibration velocity, after installation, of 0.2 inches per second, as measured according to the Hydraulic Institute Standards.
- E. Alignment
  1. Maintain alignment using shouldered fits, or dowels or turned bolts placed in reamed holes. Unless otherwise approved, alignment methods depending upon friction between mating parts are not acceptable.
  2. Establish proper alignment using dial indicators. Submit alignment procedure for review and approval, in the event that field alignment is required.
  3. Alignment shall be in conformance with manufacturer's written tolerance limits.
  4. A qualified, Factory Service Representative shall confirm proper alignment of all components. Submit Factory Service Representative's certified statement verifying proper alignment.
- F. Install identifying labels permanently to equipment.

### 3.2 WARRANTY

- A. The equipment manufacturer shall warrant all parts free from defective material and workmanship for a period of one (1) year after final acceptance, and shall furnish to the Owner replacement for any such items found to be defective by the Manufacturer.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.

- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 FACTORY TEST, FIELD TEST, AND QUALITY CONTROL

- A. Contractor shall have the Pump Manufacturer provide a Factory Service Representative who has complete knowledge of the operation of the pumping system, including mechanical, electrical, control, and alarm components as necessary to perform field testing and initial start-up to assure and demonstrate the proper performance of all equipment and pump components.
- B. The Contractor shall have the Pump Manufacturer's Factory Service Representative present during field installation. It shall be the Contractor's responsibility to obtain the recommended installation procedures directly from the Manufacturer, and comply with the Manufacturer's procedures during installation.
- C. Field tests shall be performed by the Contractor under the instruction of the Factory Service Representative. All field testing to be witnessed by the Engineer in the field. Provide advanced notice of field testing in accordance with 01650 – Facility Start-up/Commissioning. Submit certification of successfully conducted field tests.
- D. Field tests and training shall meet the requirements specified in this section.

### 3.4 TRAINING

- A. The Contractor shall provide operation and maintenance training for the pumping units performed by qualified manufacturer's service representatives as specified in Division 1. The training shall total no less than four (4) hours (not including travel time) for each pumping unit after all pumps have been field tested and certified. Training shall be scheduled separately from installation checkout and testing, unless approved by the Engineer.

### 3.5 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.6 PAINT

- A. Equipment shall be painted and stenciled in accordance with Division 9 – Finishes.

3.7 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 - Contract Closeout.

END OF SECTION 11310



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## SECTION 11311

### END SUCTION PUMPS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Sludge Pumps

- B. Related Sections include the following:

- 1. Division 1 – General Requirements

- 2. Division 9 – Finishes

- 3. Division 11 – Equipment

- 4. Division 13 – Special Construction

- 5. Division 16 – Electrical

##### 1.3 SYSTEM DESCRIPTION

- A. The Contractor shall furnish and install the end suction pumps as shown on the Contract Drawings. The end suction pumps shall be centrifugal pumps including all accessories as described herein.

- B. The pump manufacturer is responsible for ensuring that all equipment and systems required for a complete operating system are provided, and compatible and suitable for the project conditions.

- C. The equipment covered by these Specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.

##### 1.4 SUBMITTALS

- A. The shop drawing submittals for each end suction pump shall contain performance curves, showing that they meet requirements for head, capacity, horsepower, efficiency, and related design conditions; plans and sections showing dimensions;

materials of construction; details; design data; test reports; operation and maintenance manuals; warranty; and installation instructions.

- B. Shop drawings shall be submitted for all appurtenances, including electrical and instrumentation wiring diagrams, and all other associated equipment.
- C. Operation and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Section 01730 – Operation and Maintenance Data.

#### 1.5 QUALITY ASSURANCE:

- A. Comply with applicable parts of Section 01400 – Quality Assurance.
- B. Consideration given only to products of manufacturers who demonstrate successful experience in manufacture, operation, and servicing equipment of type, size, and performance equal to that specified.
- C. Workmanship and Design
  - 1. All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be inter-changeable.
  - 2. The design and proportioning of all parts shall provide liberal strength, stability, and stiffness, and be especially adapted for the application. Ample room and facility for inspection, repairs, and adjustments shall be provided.
  - 3. All materials used in construction of equipment shall be of the best quality and shall be entirely suitable in every respect for the required service.
- D. Field Testing of End Suction Pumps
  - 1. Field tests shall be performed by the Contractor under the instruction of the field service engineer.
  - 2. Ensure that all components perform as specified.
    - i. Run a test on each pump at 100% speed. Collect and report the following data at shut-off head and at three equally spaced points over the full range of the head capacity curve:
      - (a) Flow/head
      - (b) Amperage, voltage, and power factor
    - ii. Motor current and power not to exceed the nameplate data (adjusted for operating voltage as field measured).
  - 3. In the event that a pumping unit fails to pass a test, make all modifications required to place the unit in proper working order, and retest.

4. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the owner.
5. All tests shall be in conformance with the applicable Hydraulic Institute Standards.
6. Submit all scheduling and procedures to the Engineer for approval.
7. Provide all instrumentation, equipment, and appurtenances, as well as any temporary wiring or piping, required to perform the tests.
8. Submit certification of successfully conducted field tests, including test results.

#### 1.6 OPERATIONS AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain all end suction pump systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for all mechanical components.
  2. Instructions relevant to all modes of equipment operation.
  3. Service and trouble-shooting instructions of equipment supplied.
  4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  6. Detailed operating instructions for normal and emergency operation conditions.
  7. As-Built Mechanical drawings and dimensional information showing the actual layout and location of equipment components within the structures.

## 1.7 EXTRA MATERIALS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one set of spare parts for each individual unit furnished and installed.

## 1.8 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 END SUCTION PUMPS

- A. Two (2) centrifugal end suction sludge pumps (P-801A, P-801B) shall be provided
- B. Drawings and specifications indicate general arrangement and layout based on pumping equipment supplied by hereinafter specified manufacturers. If equipment accepted requires arrangement, dimensions, or design that differs from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- C. Electrical equipment and materials shall be listed by Underwriters' Laboratories, Inc. wherever standards have been established by that agency.
- D. The equipment covered by these specifications is intended to be of proven ability as manufactured by reputable concerns having long experience in the production of such

equipment. The equipment furnished shall be designed and constructed in accordance with the best practice and methods.

- E. All components of the equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- F. Harnessed flexible pipe couplings or their approved equivalent shall be installed on the inlet and discharge piping of each pump in a manner that the pump will be free of forces of consequential magnitude transmitted thereto by the piping. Such provisions for eliminating pipe strain shall be furnished and installed whether shown or not.

2.2 SLUDGE PUMP (P-801A, P-801B) REQUIREMENTS

- A. Construction: Volute shall be either ductile iron or cast iron. Impellers shall be semi-open design and shall be constructed of 316 SS.
- B. Mechanical seal shall have carbon/ceramic seal faces with 316 SS spring and Viton elastomers.
- C. Drive:
  - 1. Horizontal, heavy-duty, TEFC electric motor, suitable for 460-volt, 3-phase, 60-Hz AC power supply.
- D. All motors shall be designed for 1.15 service factor.
- E. Pump and motor shall be installed on a cast iron baseplate.
- F. Refer to Division 13 - Special Construction and the Contract Drawings for additional requirements.
- G. General: End suction pumps shall be suitable in all parts and materials for the specified pumped fluid and they shall conform to the following requirements:

- 1. Number of pumps (2)
- 2. Location Pipe Gallery
- 3. Service Settled Backwash Sludge
- 4. Operation (hours per day) <1

H. Operating Conditions:

- 1. Design capacity (gpm) 50 GPM
- 2. Pump design head (TDH-ft) 17 ft
- 3. Shut-Off Head (ft) 20 ft

- |                     |         |
|---------------------|---------|
| 4. Percent Solids   | 1% - 2% |
| 5. Pump speed (rpm) | 870     |
| 6. Motor size (hp)  | 1.5     |
- I. Pump Dimensions:
- |                                   |        |
|-----------------------------------|--------|
| 1. Min size suction flange (in)   | 3"     |
| 2. Min size discharge flange (in) | 1-1/2" |
- J. End suction pumps shall be manufactured by Peerless Pumps, Pentair, Goulds Pumps, or Engineer approved equal.
- K. The sludge pump design is based upon Peerless Pumps, Model 1.5X3-10 with 10-inch impeller. Any proposed "OR EQUAL" pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.3 SPECIAL TOOLS AND SPARE PARTS

- A. Refer to Section 01730 – Operation and Maintenance Data.
- B. Provide one complete set of all special tools required for maintenance of the pumping units.
- C. Provide the following spare parts for each pump:
1. One mechanical seal.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install end suction pumps and related appurtenances according to the manufacturer's printed instructions, as indicated and specified.
- B. Disinfect or flush pumps in accordance with manufacturer's printed instructions, as indicated and specified.
- C. All equipment shall be field tested in accordance with this Section of the Specifications.
- D. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- E. Install identifying labels permanently to equipment.
- F. Energize no equipment except by manufacturer's factory service representative, until authorized in writing.

### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 CLEANING

- A. After installation is complete and piping connections made, clean transfer pumps in accordance with manufacturer's recommendations. Remove all debris from piping systems prior to cleaning transfer pumps.

### 3.4 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.5 PAINT

- A. Equipment shall be painted and stenciled in accordance with Division 9.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11313



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## SECTION 11312

### MULTI-STAGE IN-LINE VERTICAL PUMPS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

##### 1.2 SCOPE OF WORK

- A. Furnish, install, and field test variable speed, in-line vertical centrifugal type pump, with all required appurtenances necessary for a complete installation as indicated on the drawings and herein specified.
- B. The term “pumping unit” or “units” shall be defined as a complete pumping assembly, including pump body, casing, impeller, base, coupling, mechanical seal, motor, controls, and any associated accessories and appurtenances specified herein or required for proper operation.
- C. All items herein specified shall be provided by the pump manufacturer. Pump manufacturer is responsible for insuring that all equipment required is provided, and that it is compatible and suitable for the application.
- D. The specifications and drawings adequately describe the system, but do not purport to cover all required details. Provide all appurtenances required, whether specifically noted herein or not, at no additional cost to the owner.
- E. Pumps shall be constructed with appropriate materials for continuous service suitable for drinking water.
- F. The pump manufacturer shall be responsible for supplying the complete pumping unit as defined above and shall assume complete pumping-unit responsibility.

##### 1.3 SUMMARY OF WORK

- A. Related Sections include the following:
  - 1. Division 1 – General Requirements
  - 2. Division 9 – Finishes
  - 3. Division 11 – Equipment
  - 4. Division 13 – Special Construction

5. Division 16 – Electrical

B. Work not included:

1. Variable frequency drives (VFDs) shall be provided under Division 16.

1.4 DESCRIPTION

A. General

1. Items under this Section include, but are not limited to, components including pump base, pump wet end, coupling, coupling guards, and motor.

B. Provisions

1. Drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by hereinafter specified manufacturers. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
2. Drawings and specifications direct attention to certain features of equipment, but do not purport to cover all details entering into design and construction of the equipment, controls, or appurtenances.
3. Conduit, wire, and connections for electrical power are shown on electrical drawings. In the event that the system proposed requires additional power, wiring or starters other than what is shown on electrical drawings, Contractor is fully responsible for any additional electrical costs.
4. Electrical equipment and materials shall be listed by UL wherever standards have been established by that agency.

C. Conditions of Service

1. Well Station #2 pumps will handle groundwater with minimal solids content.
2. Finished water pumps will handle finished water with minimal solids content.
3. Recycle pumps will handle settled backwash supernatant water with some solids content.
4. Pertinent elevations, dimensions, and design conditions are indicated on the Contract Drawings and in the Mechanical Schedule of the Contract Drawings.

1.5 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein:

B. Additional submittals hereinafter specified, for Engineer's approval.

1. Shop test results
2. Field test results
3. Equipment certification

C. Additional Submittals

1. Certified head/capacity rating curves for each required pump. Plot the following as ordinates versus flow rate as the abscissa for 100 percent pump speed, and for 90 percent, 80 percent, and 70 percent speed:
  - a. Total Dynamic Head
  - b. Pump Efficiency
  - c. Brake Horsepower
  - d. Required NPSH
2. The following information:
  - a. Maximum allowable speed
  - b. Maximum allowable flow
  - c. Maximum allowable impeller diameter
  - d. Maximum allowable horsepower (torque)
3. Certification the pump will not exhibit cavitation.
4. Complete start-up instructions. Followed by certified Start-up Report.
5. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field installed wiring.
6. Operation and Maintenance Manuals: Submit materials for inclusion in Operating and Maintenance Manuals specified in Division 1.

## 1.6 QUALITY ASSURANCE

- A. Consideration given only to products of manufacturers who demonstrate successful experience in manufacture, operation, and servicing equipment of type, size, and performance equal to that specified.
- B. To ensure unity of responsibility, the pumping units shall be supplied, tested, inspected, certified, started-up and warranted by the pump manufacturer.

- C. Provide in accordance with Section 01400 - Quality Assurance and as specified.
- D. The pumping units specified under this section are to be standard pumping equipment (for use in the specified Conditions of Service) manufactured by a company with no less than fifteen years experience in the manufacture of referenced pumping equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, descriptive and annotated catalog cuts describing the equipment systems being proposed, etc.
- E. Manufacturing and testing shall comply with “Hydraulic Institute Standards for Centrifugal, Rotary & Reciprocating Pumps”.
- F. Workmanship and Design
  - 1. All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be inter-changeable.
  - 2. All materials used in construction of equipment shall be of best quality and entirely suitable in every respect for the required service and duty requirements.
- G. Shop Testing
  - 1. General
    - a. Shop test new pumps and motors. Motor shop test data shall be provided. Approval of pump and motor test results by the Engineer must be granted prior to shipping – NO EXCEPTIONS.
    - b. The motors being furnished may be shop tested at the motor manufacturer's facility. Motor routine test shall include winding resistance, locked rotor, no load, high potential, and insulation resistance.
    - c. In the event that a pump or motor fails to perform as specified during the test, make all modifications required to place the unit in conformance with the specifications, and retest, at no additional cost to the Owner.
    - d. In the event that a pump or motor unit fails a second test, the unit will be rejected without recourse, and must be replaced with a unit equal to that specified, which passes the required tests.
    - e. All tests shall be performed in accordance with the Hydraulic Institute Test Standard 14.6 - Latest Edition.
  - 2. Performance Testing
    - a. Individually performance test each pump/motor unit on water in conformance with the Hydraulic Institute Standards.

- b. The pumps shall be tested at 100 percent speed. Acceptance criteria shall be HI Grade 3B. Shut-off head plus four head/capacity points shall be measured. For each test, the following data shall be collected and reported:
  1. Rate of Flow
  2. Total Head
  3. Power Draw

### 3. Submission of Test Results

- a. All data shall be submitted on 8-1/2 x 11 inch sheets at as large a scale as is practical.
- b. Plot curves for all performance data, corrected to standard conditions.

## H. Field Testing

1. Field tests shall be performed by the Contractor on all pumping systems under the instruction of the field service engineer. All field testing to be witnessed by the Owner/Engineer in the field.
2. Ensure that all components perform as specified.
  - a. Test each pump at 70 percent, 90 percent, and 100 percent speed. At each speed collect and report the following data at shut off head and head/capacity data three equally spaced points over the full range of the curve:
  - b. Confirm current draw does not exceed nameplate FLA
  - c. Perform field vibration testing to confirm vibration is within allowable limits as specified in HI 9.6.4.
3. In the event that a pumping unit fails to pass a test, make all modifications (at no cost to the owner) required to place the unit in proper working order, and retest.
4. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the owner.
5. Submit all scheduling and procedures to the Engineer for approval.
6. The Contractor shall provide all necessary instrumentation (with calibration certificates), equipment, devices and appurtenances, as well as any temporary wiring or piping, required to perform required field tests.

7. Provide written test procedures which describe the proposed means and methods to be used in conducting necessary field tests. Field testing shall not be completed without written test procedures. Engineer to witness all field testing.
8. Submit certification of successfully conducted field tests and results to Engineer.

#### 1.7 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operating and Maintenance Manuals specified in Division 1.
- B. Furnish six (6) complete sets of Operations and Maintenance Instruction Manuals (O&M Manuals) prior to start-up. Furnish one (1) electronic Adobe PDF searchable version on thumb drive or CD-ROM.
- C. O&M manuals shall be prepared with clear instructions which will enable the Owner's personnel to operate and maintain the pumping equipment and systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for all mechanical components.
  2. Instructions relevant to all modes of equipment operation.
  3. Service and trouble-shooting instructions of equipment supplied.
  4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  6. Detailed operating instructions for normal and emergency operation conditions.

#### 1.8 REFERENCES

- A. Where herein specified or applicable.

AFBMA	Anti-Friction Bearing Manufacturers Association
API	American Petroleum Institute
HIS	Hydraulic Institute Standards
NBS	National Bureau of Standards
SAE	Society of Automotive Engineers

## 1.9 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.10 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 - Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Vertical multistage pumps as manufactured by Grundfos are the basis of design. Contract documents were developed based on the Grundfos pump models specified. Should the Contractor propose to furnish another named manufacturer, any changes to structures, pipe, fittings, cabling, conduit, etc. required to accommodate the other manufacturers shall be provided at no additional cost.
- B. Pump performance parameters shall be as indicated on the Contract Drawings.
- C. Well Station 2 raw water pump drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by Grundfos Model CRN 64-3 with a 5.59-inch impeller. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- D. Finished water pump drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by Grundfos Model CRN 125-2 with a 6.38-inch impeller. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.



- E. Recycle water pump drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by Grundfos Model CRN 5-11-3ph with a 2.88-inch impeller. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- F. All pump components shall be of sufficient strength and design to withstand operation at shut-off head for a minimum of ten (10) minutes without damage or reduced component life.
- G. Provide anchor bolts under this section in conformance with the requirements specified elsewhere.
- H. Structural steel components where required shall be in conformance with ASTM Designation A36.
- I. Shop painting, field painting, and protective coatings are required as specified in Division 9 - Finishes.
- J. All major pump components shall be furnished with lifting lugs or eye bolts to facilitate handling and/or equipment removal for maintenance. The lugs or bolts shall be designed or arranged to allow safe handling of the pump components singly or collectively as required during shipping, installation, and maintenance.
- K. Unless otherwise specified, each piece of the new pump shall be assembled in the Pump Manufacturers facility to ensure the correctness of the fabrication and matching of the component parts. Shop assembly shall be marked to assure the same position when assembled in the field.

## 2.2 MULTI-STAGE IN-LINE VERTICAL PUMP

- A. The pump end shall be of the vertical multi-stage design with the motor mounted directly to the top of the pump. The pump models shall be furnished as shown on the Drawings and installed in accordance with the recommendations of the manufacturer.
- B. The pump shall be compatible for potable water applications and/or NSF 61 approved.
- C. Net Positive Suction Head Allowed (NPSHa) and Net Positive Suction Head Required (NPSHr) for each pump shall be as follows:
  - 1. Well 2 Raw Water Pumps: The maximum NPSHa shall be 23 ft. The NPSHr shall be 18 feet or less.
  - 2. Finished Water Pumps: The maximum NPSHa shall be 29 ft. The NPSHr shall be 24 feet or less.
  - 3. Recycle Water Pumps: The maximum NPSHa shall be 33 ft. The NPSHr shall be 28 feet or less.

## 2.3 MATERIALS OF CONTRUCTION

A. For Well 2 Raw Water Pumps, materials of construction shall be:

Base plate:	Cast Iron, ASTM 88-55-06
Pump head cover/base:	CF 8MStainless Steel
Motor stool:	Cast Iron, ASTM Class 25B
Impellers:	316 stainless steel
Diffuser chambers:	316 stainless steel
Outer sleeve:	316 Stainless Steel
Shaft:	Duplex stainless steel
Bearing rings:	Silicon Carbide
O-rings:	EPDM

A. For Finished Water Pumps, materials of construction shall be:

Base:	CF8M stainless steel
Base Plate:	Ductile iron, ASTM A536-84 70-50-05
Motor stool:	Ductile iron, ASTM A536-84 70-50-05
Shaft:	AISI 318 LN stainless steel
Pump Head:	CF8M stainless steel
Impellers:	AISI 316 stainless steel
Chamber:	AISI 316 stainless steel
Sleeve:	AISI 304 or AISI 316 L stainless steel
Bearing Ring:	Tungsten carbide
O-rings:	EPDM

B. For Recycle Water Pumps, materials of construction shall be:

Pump head/base plate:	Cast iron, ASTM Class 30
Pump head cover/base:	CF 8M stainless steel
Impellers:	316 stainless steel
Diffuser chambers:	316 stainless steel
Outer sleeve:	316 stainless steel or 329 stainless steel
Shaft:	Duplex stainless Steel
Bearing rings:	Silicon Carbide
O-rings:	EPDM

## 2.4 ACCESSORIES

A. Motors larger than 20 HP shall be furnished with lifting lugs or eye bolts to facilitate handling. The lugs or bolts shall be designed or arranged to allow safe handling of the pump components singly or collectively as required during shipping, installation, and maintenance.

## 2.5 VACUUM PRIMING SYSTEM

A. A vacuum priming system shall be provided for the Well Station 2 Raw Water Pumps in accordance with Section 11371.

B. Both the finished water pumps and recycle pumps will be flooded suction.

## 2.6 MOTORS

- A. Pump motors shall be provided under this Section. They shall be in conformance with Division 16 - Electrical, with additional requirements specified herein and as indicated on the Contract Drawings. If required, motors shall be inverter duty suitable for operation with Variable Frequency Drives.
- B. Provide all motors with service factor of 1.15 over nameplate rating, of sufficient rated horsepower to provide non-overloading operation throughout the operating range indicated on the drawings.
- C. Starting characteristics required:
  - 1. NEC Code Letter F.
  - 2. Accelerate pump to full speed against a closed valve in 15 seconds or less.
- D. Temperature Rise Allowable: Maximum of 80 °C at nameplate horsepower, as measured by imbedded motor stator thermostats, at an ambient temperature of 40 °C.
- E. Noise Level Allowable: Maximum of 85 dBA measured five feet from motor.
- F. Each motor shall be designed for the highest efficiency standard available in the marketplace.
- G. Motor Voltage: as indicated on drawings.
- H. Motor starting current shall not exceed 650 percent of the motor full load current. Motors shall be Premium Efficiency type in accordance with NEMA specifications for premium efficiency motors.
- I. Motors shall be commercially balanced.
- J. Motor Bearings and Shaft Grounding Ring
  - 1. Provide heavy duty ball bearings
    - a. Grease lubricated type.
    - b. Designed for maximum radial and thrust loads which will occur.
    - c. Minimum L10 bearing life of 17,500 hours.
  - 2. Provide shaft grounding ring to protect bearings from damage caused by shaft currents.

K. Accessories required

1. The pump motor manufacturer shall provide motors with winding temperature detectors. The winding temperature detectors shall be motor overstats (bi-metallic switches).
2. Motor nameplates shall be bronze or stainless steel and shall be securely fastened to the motor frame with pins of like material. The nameplate shall contain, as a minimum, the following information:
  - a. Rated horsepower
  - b. Full Load Amps
  - c. Full Load Speed
  - d. Frequency
  - e. NEMA kVA code and design letter
  - f. Rated voltage
  - g. Manufacturer's serial number
  - h. Service Factor
  - i. Insulation Class
  - j. Maximum ambient temperature
  - k. Maximum temperature rise
  - l. Full load current at nameplate voltage
  - m. Frame designation
  - n. Hydraulic rating point (GPM @ Ft. TDH)

L. Motor shall be provided with TEFC enclosure.

2.7 SPECIAL TOOLS AND SPARE PARTS

- A. Provide one complete set of all special tools required for maintenance of the pumping units.
- B. Provide the following spare parts for each pump:
  1. One seal kit.
  2. One gasket kit.

3. One impeller stack kit.
4. One bearing kit.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install all items with care, and in accordance with printed recommendations of manufacturer.
- B. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.
- C. Energize no equipment, except by manufacturer's serviceman, until authorized in writing.
- D. Installation conducted in accordance with applicable Hydraulic Institute Standards. Dynamically balance the pump shaft/impeller assembly to insure a maximum vibration velocity, after installation, of 0.2 inches per second, as measured according to the Hydraulic Institute Standards.
- E. Well 2 Raw Water Pump installation shall be coordinated with the Vacuum Priming System, Section 11310.
- F. Alignment
  1. Maintain alignment through the use of shouldered fits, or dowels or turned bolts placed in reamed holes. Unless otherwise approved, alignment methods depending upon friction between mating parts are not acceptable.
  2. Establish proper alignment through the use of dial indicators. Submit alignment procedure for review and approval, in the event that field alignment is required.
  3. Alignment shall be in conformance with manufacturer's written tolerance limits.
  4. Proper alignment of all components shall be confirmed by qualified, factory engineer. Submit factory engineer's certified statement verifying proper alignment.
- G. The Well 2 Raw Water Pumps shall be suitable and compatible with the Vacuum Priming System. The Well 2 Raw Water Pumps shall not be energized until the Vacuum Priming System is installed and tested.
- H. Install identifying labels permanently to equipment.

### 3.2 WARRANTY

- A. The equipment manufacturer shall warrant all parts to be free from defective material and workmanship for a period of twenty four (24) months from startup, not to exceed 30 months from shipment.

- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 FACTORY TEST, FIELD TEST, AND QUALITY CONTROL

- A. The Contractor shall have the Pump Manufacturer factory representative present during field installation. It shall be the Contractor's responsibility to obtain the recommended installation procedures directly from the Manufacturer, and comply with same.
- B. Contractor shall have the Pump Manufacturer provide a factory service representative who has complete knowledge of the operation of the pumping system, including mechanical, electrical, control, and alarm components as necessary to perform field testing and initial start-up to assure and demonstrate the proper performance of all equipment and pump components.
- C. Field tests shall be performed by the Contractor under the instruction of the field service engineer. All field testing to be witnessed by the Engineer in the field. Provide advanced notice of field testing in accordance with 01650 – Facility Start-up/Commissioning. Submit certification of successfully conducted field tests.
- D. Field tests and training shall meet the requirements specified in this section.

### 3.4 TRAINING

- A. The Contractor shall provide operation and maintenance training for the pumping units performed by qualified manufacturer's service representatives as specified in Division 1. The training shall total no less than four (4) hours (not including travel time) for each pumping unit after all pumps have been field tested and certified. Training shall be scheduled separately from installation checkout and testing, unless approved by the Engineer.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 - Contract Closeout.

END OF SECTION 11312

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## SECTION 11313

### CHEMICAL TRANSFER PUMPS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Centrifugal Chemical Transfer Pumps

- B. Related Sections include the following:

- 1. Division 1 – General Requirements

- 2. Division 9 – Finishes

- 3. Division 11 – Equipment

- 4. Division 13 – Special Construction

- 5. Division 16 – Electrical

##### 1.3 SYSTEM DESCRIPTION

- A. The Contractor shall furnish and install the chemical transfer pumps as shown on the Contract Drawings. The chemical transfer pumps shall be magnetic drive centrifugal transfer pumps including all accessories as described herein. The pumps shall be fully compatible with the chemicals being pumped.

- B. The pump manufacturer is responsible for ensuring that all equipment and systems required for a complete operating system are provided, and compatible and suitable for the project conditions.

- C. The equipment covered by these Specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.

##### 1.4 SUBMITTALS

- A. The shop drawing submittals for each chemical transfer pump shall contain performance curves, showing that they meet requirements for head, capacity,



horsepower, efficiency, and related design conditions; plans and sections showing dimensions; materials of construction; details; design data; test reports; operation and maintenance manuals; warranty; and installation instructions.

- B. Shop drawings shall be submitted for all appurtenances, including electrical and instrumentation wiring diagrams, and all other associated equipment. A chemical area layout plan indicating pumps, tanks, and equipment pad locations shall be provided by the Contractor for Engineer/Town approval prior to installation.
- C. Operation and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Section 01730 – Operation and Maintenance Data.

#### 1.5 QUALITY ASSURANCE:

- A. Comply with applicable parts of Section 01400 – Quality Assurance.
- B. Consideration given only to products of manufacturers who demonstrate successful experience in manufacture, operation, and servicing equipment of type, size, and performance equal to that specified.
- C. Workmanship and Design
  - 1. All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be inter-changeable.
  - 2. The design and proportioning of all parts shall provide liberal strength, stability, and stiffness, and be especially adapted for the application. Ample room and facility for inspection, repairs, and adjustments shall be provided.
  - 3. All materials used in construction of equipment shall be of the best quality and shall be entirely suitable in every respect for the required service.
- D. Field Testing of Chemical Transfer Pumps
  - 1. Field tests shall be performed by the Contractor under the instruction of the field service engineer.
  - 2. Ensure that all components perform as specified.
    - i. Run a test on each pump at 100% speed. Collect and report the following data at shut-off head and at three equally spaced points over the full range of the head capacity curve:
      - (a) Flow/head
      - (b) Amperage, voltage, and power factor
    - ii. Motor current and power not to exceed the nameplate data (adjusted for operating voltage as field measured).

3. In the event that a pumping unit fails to pass a test, make all modifications required to place the unit in proper working order, and retest.
4. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the owner.
5. All tests shall be in conformance with the applicable Hydraulic Institute Standards.
6. Submit all scheduling and procedures to the Engineer for approval.
7. Provide all instrumentation, equipment, and appurtenances, as well as any temporary wiring or piping, required to perform the tests.
8. Submit certification of successfully conducted field tests, including test results.

#### 1.6 OPERATIONS AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain all chemical transfer pump systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for all mechanical components.
  2. Instructions relevant to all modes of equipment operation.
  3. Service and trouble-shooting instructions of equipment supplied.
  4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  6. Detailed operating instructions for normal and emergency operation conditions.
  7. As-Built Mechanical drawings and dimensional information showing the actual layout and location of equipment components within the structures.

## 1.7 EXTRA MATERIALS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one set of spare parts for each individual unit furnished and installed.

## 1.8 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 CHEMICAL TRANSFER PUMPS

- A. One (1) magnetic drive centrifugal transfer pump shall be supplied for the following chemical feed systems:
  - 1. Potassium Hydroxide
  - 2. Pre-Filtration Sodium Hypochlorite
  - 3. Post-Filtration Sodium Hypochlorite
  - 4. Sodium Bisulfite
- B. Drawings and specifications indicate general arrangement and layout based on pumping equipment supplied by hereinafter specified manufacturers. If equipment accepted requires arrangement, dimensions, or design that differs from that indicated

or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.

- C. Electrical equipment and materials shall be listed by Underwriters' Laboratories, Inc. wherever standards have been established by that agency.
- D. The equipment covered by these specifications is intended to be of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed and constructed in accordance with the best practice and methods.
- E. All components of the equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- F. Harnessed flexible pipe couplings or their approved equivalent shall be installed on the inlet and discharge piping of each pump in a manner that the pump will be free of forces of consequential magnitude transmitted thereto by the piping. Such provisions for eliminating pipe strain shall be furnished and installed whether shown or not.

## 2.2 CHEMICAL TRANSFER PUMP REQUIREMENTS

- A. Construction: All transfer pump wetted materials shall be chemically compatible with pumped chemical.
- B. Drive:
  - 1. The plastic body chemical pumps 3 HP or less shall have horizontal, heavy-duty, TEFC electric motor, suitable for 460-volt, 3-phase, 60-Hz AC power supply. Motors shall be chemical mill duty rated with corrosion resistance.
- C. All motors shall be designed for 1.15 service factor.
- D. Refer to Division 13 - Special Construction and the Contract Drawings for additional requirements.
- E. Chemical transfer pumps shall be manufactured by Finish Thompson, March Pumps, Goulds Pumps, or Engineer approved equal.

## 2.3 PUMP NAME: Potassium Hydroxide Transfer Pump (TP-502)

- A. General: Plastic body chemical pumps shall be suitable in all parts and materials for the type of chemical involved and they shall conform to the following requirements:
  - 1. Number of pumps (1)
  - 2. Location Potassium Hydroxide Storage Area
  - 3. Service Transfer Pump

4. Operation (hours per day) <1

B. Operating Conditions:

- 1. Design capacity (gpm) 50 GPM
- 2. Pump design head (TDH-ft) 25 ft
- 3. Shut-Off Head (ft) 33 ft
- 4. Liquid to be pumped Potassium Hydroxide 45%
- 5. Specific gravity of liquid 1.45
- 6. Max pump speed (rpm) 3450
- 7. Min motor size (hp) 1
- 8. Max motor speed (rpm) 3450

C. Pump Dimensions:

- 1. Min size suction flange (in) 2"
- 2. Min size discharge flange (in) 1-1/2"

D. The chemical transfer pump design is based upon Finish Thompson Inc., Model DB7 with 3.18-inch impeller. Any proposed "OR EQUAL" chemical transfer pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

2.4 PUMP NAME: Pre-Filtration Sodium Hypochlorite Transfer Pump (TP-403)

A. General: Plastic body chemical pumps shall be suitable in all parts and materials for the type of chemical involved and they shall conform to the following requirements:

- 1. Number of pumps (1)
- 2. Location Sodium Hypochlorite Storage Area
- 3. Service Transfer Pump
- 4. Operation (hours per day) <1

B. Operating Conditions:

- 1. Design capacity (gpm) 27 GPM
- 2. Pump design head (TDH-ft) 13.8 ft
- 3. Shut-Off Head (ft) 26 ft

- |                               |                           |
|-------------------------------|---------------------------|
| 4. Liquid to be pumped        | Sodium Hypochlorite 12.5% |
| 5. Specific gravity of liquid | 1.20                      |
| 6. Max pump speed (rpm)       | 3450                      |
| 7. Min motor size (hp)        | 1/2                       |
| 8. Max motor speed (rpm)      | 3450                      |

C. Pump Dimensions:

- |                                   |    |
|-----------------------------------|----|
| 1. Min size suction flange (in)   | 1” |
| 2. Min size discharge flange (in) | 1” |

D. The chemical transfer pump design is based upon Finish Thompson Inc., Model DB6 with 2.75-inch impeller. Any proposed “OR EQUAL” chemical transfer pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

2.5 PUMP NAME: Post-Filtration Sodium Hypochlorite Transfer Pump (TP-406)

E. General: Plastic body chemical pumps shall be suitable in all parts and materials for the type of chemical involved and they shall conform to the following requirements:

- |                              |                                  |
|------------------------------|----------------------------------|
| 1. Number of pumps           | (1)                              |
| 2. Location                  | Sodium Hypochlorite Storage Area |
| 3. Service                   | Transfer Pump                    |
| 4. Operation (hours per day) | <1                               |

F. Operating Conditions:

- |                               |                           |
|-------------------------------|---------------------------|
| 1. Design capacity (gpm)      | 23 GPM                    |
| 2. Pump design head (TDH-ft)  | 11 ft                     |
| 3. Shut-Off Head (ft)         | 21 ft                     |
| 4. Liquid to be pumped        | Sodium Hypochlorite 12.5% |
| 5. Specific gravity of liquid | 1.20                      |
| 6. Max pump speed (rpm)       | 3450                      |
| 7. Min motor size (hp)        | 1/2                       |
| 8. Max motor speed (rpm)      | 3450                      |

G. Pump Dimensions:

1. Min size suction flange (in) 1”
2. Min size discharge flange (in) 1”

H. The chemical transfer pump design is based upon Finish Thompson Inc., Model DB6 with 2.5-inch impeller. Any proposed “OR EQUAL” chemical transfer pump suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

2.6 PUMP NAME: Sodium Bisulfite Transfer Pump (TP-402)

I. General: Plastic body chemical pumps shall be suitable in all parts and materials for the type of chemical involved and they shall conform to the following requirements:

1. Number of pumps (1)
2. Location Sodium Bisulfite Storage Area
3. Service Transfer Pump
4. Operation (hours per day) <1

J. Operating Conditions:

1. Design capacity (gpm) 23 GPM
2. Pump design head (TDH-ft) 11 ft
3. Shut-Off Head (ft) 21 ft
4. Liquid to be pumped Sodium Bisulfite 38%
5. Specific gravity of liquid 1.30-1.37
6. Max pump speed (rpm) 3450
7. Min motor size (hp) 1/2
8. Max motor speed (rpm) 3450

K. Pump Dimensions:

1. Min size suction flange (in) 1”
2. Min size discharge flange (in) 1”

L. The chemical transfer pump design is based upon Finish Thompson Inc., Model DB6 with 2.5-inch impeller. Any proposed “OR EQUAL” chemical transfer pump

suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.7 CHEMICAL TRANSFER PUMP CONTROLS

- A. Provide spring loaded switch for chemical transfer pump operation. When switch is turned clockwise, the pump shall energize and shall return left to the OFF position once the switch is released.
- B. Each transfer pump control switch shall be mounted on a unistrut support within sight of the corresponding transfer pump and day tank.
- C. Refer to Division 13 – Special Construction, Division 16 – Electrical, and the Contract Drawings for additional requirements.

## 2.8 SPECIAL TOOLS AND SPARE PARTS

- A. Refer to Section 01730 – Operation and Maintenance Data.
- B. Provide one complete set of all special tools required for maintenance of the pumping units.
- C. Provide the following spare parts for each chemical transfer pump:
  - 1. One set of impeller and suction cover wearing rings and shims.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install chemical transfer pumps and related appurtenances according to the manufacturer's printed instructions, as indicated and specified.
- B. Disinfect or flush chemical transfer pumps in accordance with manufacturer's printed instructions, as indicated and specified.
- C. All equipment shall be field tested in accordance with this Section of the Specifications.
- D. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- E. Install identifying labels permanently to equipment.
- F. Energize no equipment except by manufacturer's factory service representative, until authorized in writing.



### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 CLEANING

- A. After installation is complete and piping connections made, clean transfer pumps in accordance with manufacturer's recommendations. Remove all debris from piping systems prior to cleaning transfer pumps.

### 3.4 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.5 PAINT

- A. Equipment shall be painted and stenciled in accordance with Division 9.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11313

## SECTION 11371

### VACUUM PRIMING SYSTEM

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Furnish all labor, equipment, appliances, materials and performing all operations in connection with providing and installing a complete vacuum priming system as shown on the Contract Drawings and as specified herein. The vacuum priming system shall meet the approval of the Engineer.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 9 – Painting
  - 4. Division 11 – Process Mechanical
  - 5. Division 13 – Special Construction
  - 6. Division 16 – Electrical
- C. Work included:
  - 1. The work covered under this Section of the Specifications includes the furnishing of all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the furnishing, installation, and testing of vacuum priming systems, including compressors, control panels, PLC system, air receiver, vacuum pumps, piping, valves, and appurtenant work, at the locations and to the general arrangements and details as indicated and/or as directed, complete in place, in accordance with the Contract Drawings and Specifications.

##### 1.3 SUBMITTALS

- A. The shop drawing submittals for the vacuum priming system shall contain vacuum pump curves, plans, and sections showing dimensions, materials of construction, details, design data, test reports showing rated flow and steady state accuracy at 100 percent setting, certification of factory testing, operation and maintenance manuals,

warranty, and installation instructions. Provide sequence of operations and points list for integration purposes.

- B. Shop drawings shall be submitted for all appurtenances, including water traps, priming valves, electrical and instrumentation wiring diagrams, control panels, and all other associated equipment. A vacuum priming system layout plan indicating pumps, tanks, and equipment pad locations shall be provided by Contractor for Engineer/Town approval prior to installation.
- C. Submit a legal copy of the programming software for the PLC licensed to the Town of Sharon.
- D. Certification that the Vacuum Priming System is suitable and compatible for use with the Collection Well 2 Pumps (P-100A, P-100B).
- E. Operating and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. The materials and equipment covered in this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and these Specifications. The Specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- B. The Contractor's attention is directed to the fact that the vacuum priming system is an integrated system and, as such, it shall be furnished by one manufacturer which shall provide all materials, equipment and controls and accept all responsibility for the satisfactory installation and operation and control of the process. All controls for electrically operated or motor driven equipment shall be complete including all necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit. All necessary fuses and switches required by the Vacuum Priming System Manufacturer shall be provided with the equipment.
- C. Provide in accordance with Section 01400 - Quality Assurance and as specified.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 - Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.

## 1.6 EXTRA MATERIALS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one set of spare parts for each individual unit furnished and installed.

## 1.7 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.
- C. Manufacturer shall provide technical assistance and guidance to the Application Engineer for SCADA programming of the equipment. Equipment PLC shall be programmed per Paragraph 2.6.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Vacuum priming system shall be an Automatic Duplex Vacuum Priming System as manufactured by Q-VAC Automatic Priming Systems, CompreVac, Inc., Premier Fluid Systems, or Engineer approved equal. System shall be a pre-packaged system that is piped and wired to the fullest extent possible prior to shipment.
- B. The drawings and specifications indicate general arrangement and description of what is required, but do not purport to cover all details entering into design and construction of the equipment, controls, and appurtenances. Drawings and specifications are, however, intended to cover furnishing, shop testing, delivering, supervision of installation, certifying and field testing all materials, equipment and appurtenances for the complete pneumatic mixing system as specified herein, whether specifically mentioned in these specifications or not.
- C. The vacuum priming system shall include two oil-lubricated rotary vane vacuum pumps, air receiver tank, control panel, isolation valves, water trap, and appurtenances.
- D. Vacuum priming system shall be compatible with the Well Station 2 Raw Water Pumps (P-100A, P-100B) and designed to vacuum prime the pump.
- E. The vacuum priming system design is based upon Q-VAC QVD-11RV-60HG-AP automatic duplex vacuum priming system. Any proposed “OR EQUAL” vacuum priming system supplier’s work and Contractor’s work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.2 ROTARY VANE VACUUM PUMPS

- A. The vacuum priming system shall be equipped with two (2) rotary vane vacuum pumps.
- B. Drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by QVAC Duplex Vacuum Priming System. If equipment accepted requires arrangement, dimensions, or designs which differ from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- C. The vacuum pump shall be of oil-lubricated rotary vane design with a minimum ultimate vacuum rating of 29 mmHg.
- D. The maximum noise level of each pump shall be 62 dB(A) or less.
- E. The vacuum pump shall be integrally flanged to a 0.6 horsepower TEFC motor wired for operation.
- F. Belt drives shall not be permitted.
- G. The vacuum pump shall be constructed primarily of cast iron.
- H. Vacuum pump shall be equipped with three non-metallic, non-asbestos vanes. Multiple stages of liquid and aerosol oil separation shall be integral to the pump to ensure clean discharge air. A gas ballast valve must be included to improve moisture handling. An oil drain valve shall be piped to the edge of priming system for ease of maintenance. The vacuum pump assembly shall be supplied with the following equipment connected to the inlet: a 5-micron inlet filter; secondary inlet check valve; vacuum release valve with silencer, pump isolation valve; and a flexible connector for a vibration free attachment.
- I. Each vacuum pump shall be filled with vacuum pump oil. Oil shall be NSF 61 approved.

## 2.3 AIR RECEIVER

- A. The air receiver tank shall be a galvanized 60 gallon horizontal air receiver functioning as a vacuum storage vessel.
- B. The air receiver shall be coded to ASME Section VIII, Div. I, and be rated for 200 psi working pressure at 450 degrees F.
- C. The receiver shall include a sight gauge for visual inspection of water accumulation within the receiver; a protective high water level switch to shut down the system and provide an alarm if the receiver begins to flood; a vacuum release valve with silencer to facilitate draining; a manual drain valve for draining accumulated water; and an inlet ball valve to isolate the priming system from the process vacuum line.

## 2.4 WATER TRAP

- A. An inline water trap shall be furnished by the priming system manufacturer to help protect the system from slugs of water due to a priming valve leak or failure.
- B. The water trap shall include 3/4" FNPT isolation valves, a corrosion resistant aluminum head, clear polycarbonate housing, internal baffle, stainless steel separator screen and float ball, elastomer seat, vacuum release valve with silencer, drain valve, and liquid filled vacuum gauge.

## 2.5 VACUUM PRIMING VALVE

- A. A priming valve shall be furnished for each pump serviced by the priming system.
- B. The priming valve shall be constructed of cast iron with 316 stainless steel trim.
- C. The internal and external valve body shall include a fusion bonded epoxy coating for abrasion and chemical resistance.
- D. A SPDT water level switch with weatherproof enclosure shall be provided with brass installation fittings to provide a prime verification signal or interlock with each pump.

## 2.6 CONTROL PANEL

- A. Automatic controls shall be utilized for maintaining preset vacuum levels and to ensure peak system operation and safety.
- B. Controls shall be housed in NEMA 4 enclosure with UL508 panel shop rating and shall include:
  - 1. Main disconnect switch with lockable handle
  - 2. Motor starters with UL Class 10 motor overload relays
  - 3. Control voltage transformer
  - 4. Green LED pump running lights
  - 5. H-O-A selector switches
  - 6. Local-Remote selector switch
  - 7. Remote Start-Stop contact for a 115VAC remote start signal
  - 8. Vacuum transducer, 0.5% FS accuracy, 4-20 mA
  - 9. Alarm horn
  - 10. Alarm silence push button

11. Red LED Alarm light

12. PLC controller with 4.3” color LCD touchscreen. The Town of Sharon has standardized their PLC system on Allen-Bradley PLC Micrologix 1400 (**No substitutions shall be allowed**). PLC shall be programmed and tested prior to shipment, and shall be re-programmed in the field as required to provide a complete, functional system.

13. Dry contacts for SCADA monitoring as shown on I drawings and as specified in Division 13.

## 2.7 ACCESSORIES

A. Refer to Section 11200 for piping and valve requirements.

## 2.8 SHOP/FACTORY FINISHING

A. Furnish manufacturer’s standard enamel finish, color as selected. All external ferrous surfaces shall be uniformly primed and painted by the manufacturer to provide a high quality protective finish and uniform color.

B. Different coatings on the receiver and other major components shall not be permitted.

C. All ferrous surfaces must be sound, dry, clean and free of oil, grease, dirt, mildew, release agents, curing compounds, efflorescence, loose and flaking paint and other foreign substances.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

A. General: Install equipment on vibration isolators in accordance with manufacturer’s instructions.

B. Piping: Each pump shall be equipped with full-size flexible discharge connection, check valves, and PVC isolation ball valve.

C. Install all items with care, and in accordance with printed recommendations of manufacturer.

D. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.

E. Alignment

1. Maintain alignment through the use of shouldered fits, or dowels or turned bolts placed in reamed holes. Unless otherwise approved, alignment methods depending upon friction between mating parts are not acceptable.

2. Submit alignment procedure for review and approval, in the event that field alignment is required.
  3. Alignment shall be in conformance with manufacturer's written tolerance limits.
  4. Proper alignment of all components shall be confirmed by qualified, factory engineer. Submit factory engineer's certified statement verifying proper alignment.
- F. Install identifying labels permanently to equipment.
- G. Energize no equipment, except by manufacturer's serviceman, until authorized in writing.

### 3.2 WARRANTY

- A. The equipment manufacturer shall warrant all parts to be free from defective material and workmanship for a period of one (1) year after final acceptance, and shall furnish to the Owner replacement for any such items found to be defective by the Manufacturer.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on each piece of equipment in the system.
1. Vibration Test: System shall not develop amplitudes of vibration in excess of manufacturer's recommendations. Test with units installed and in normal operation.
- B. Performance Test: Conduct on each unit assisted by manufacturer's representative.
1. Perform under actual or approved simulated operating conditions.
  2. Test for without malfunction and in accordance with Section 01650.
  3. Perform with Engineer present.
  4. Adjust, realign, or modify units and retest.

### 3.4 MANUFACTURER'S SERVICES

- A. In accordance with Section 01730, Operation and Maintenance Data.



- B. Manufacturer's Representative: Present at Site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:
  - 1. 1 person-day for installation assistance and inspection, or as required.
  - 2. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation, or as required.
  - 3. 1 person-day for facility startup, or as required.
  - 4. 1 person-day for training of Owner's personnel.

### 3.5 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.6 PAINT

- A. Equipment shall be painted and stenciled in accordance with Division 9 – Finishes.

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11371

## SECTION 11373

### FLOATING DECANTER

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Backwash Waste Tank Recycle Decanters

- B. Related Sections include the following:

- 1. Division 1 – General Requirements

- 2. Division 9 – Finishes

- 3. Division 11 – Equipment

- 4. Division 13 – Special Construction

- 5. Division 16 – Electrical

##### 1.3 SYSTEM DESCRIPTION

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals and install three (3) floating decanters and support systems to extract the supernatant from the backwash waste tanks.

- B. The pump manufacturer is responsible for ensuring that all equipment and systems required for a complete operating system are provided, and compatible and suitable for the project conditions.

- C. The equipment covered by these Specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.

- D. Decanters are located in confined spaces, the backwash waste tanks.

#### 1.4 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections.
  - 1. Submit shop drawing submittals for floating decanters shall contain valves, valve operators, strainers, hangers and supports, wall seals and sleeves, flexible connections, and other like manufactured items.
- B. Operation and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Section 01730 – Operation and Maintenance Data.

#### 1.5 QUALITY ASSURANCE:

- A. Comply with applicable parts of Section 01400 – Quality Assurance.
- B. Consideration given only to products of manufacturers who demonstrate successful experience in manufacture, operation, and servicing equipment of type, size, and performance equal to that specified.
- C. Workmanship and Design
  - 1. All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be inter-changeable.
  - 2. The design and proportioning of all parts shall provide liberal strength, stability, and stiffness, and be especially adapted for the application. Ample room and facility for inspection, repairs, and adjustments shall be provided.
  - 3. All materials used in the construction of equipment shall be of the best quality and shall be entirely suitable in every respect for the required service.
- D. Field Testing of Floating Decanters
  - 1. Field tests shall be performed by the Contractor under the instruction of the field service engineer.
  - 2. Ensure that all components perform as specified. The field tests shall be completed in coordination with the recycle pump tests.
  - 3. In the event that a decanter unit fails to pass a test, make all modifications required to place the unit in proper working order, and retest.
  - 4. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the owner.
  - 5. Submit all scheduling and procedures to the Engineer for approval.

6. Provide all instrumentation, equipment, and appurtenances, as well as any temporary wiring or piping, required to perform the tests.
7. Submit certification of successfully conducted field tests, including test results.

#### 1.6 OPERATIONS AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain all end suction pump systems.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for all mechanical components.
  2. Instructions relevant to all modes of equipment operation.
  3. Service and trouble-shooting instructions of equipment supplied.
  4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  6. Detailed operating instructions for normal and emergency operation conditions.
  7. As-Built Mechanical drawings and dimensional information showing the actual layout and location of equipment components within the structures.

#### 1.7 EXTRA MATERIALS

- A. Furnish items expected to require replacement or to be consumed during normal operation within the first year of operation. Furnish one set of spare parts for each individual unit furnished and installed.

#### 1.8 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.

- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Three (3) floating decanters (DF-835A, DF-835B, DF-835C) shall be provided.
- B. Decanter manufacturer acts as a single source for all components and shall accept complete product responsibility.
- C. Manufacturers
  - 1. Pureflow (<https://waterbypureflow.com/>) Whittier, CA
  - 2. Fluidyne (<http://www.fluidynecorp.com/>) Cedar Falls, IA
  - 3. Engineer Approved Equal.
- D. Drawings and specifications indicate general arrangement and layout based on decanter equipment supplied by Pureflow Model PFD-18G-8.5-4. If the equipment accepted requires arrangement, dimensions, or design that differs from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.
- E. The equipment covered by these specifications is intended to be of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed and constructed in accordance with the best practice and methods.

- F. All components of the equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- G. Provide anchor bolts under this section in conformance with requirements specified elsewhere. Anchor bolts shall be sized for a minimum base slab embedment of 6”.
- H. Structural steel components where requires shall be in conformance with ASTM Designation A36 and A53.
- I. Shop painting, field painting, and protective coatings are required as specified in Division 9 – Finishes.

## 2.2 FLOATING DECANTER (DF-835A, DF-835B, DF-835C) REQUIREMENTS

- A. The floating decanter system shall be suitable for potable water use.
- B. The floating suction assembly shall be designed and constructed so that the hose connection can swivel through 180 degrees without causing the float to overturn. During operation, the unit shall be self-righting if turned over, and capable of functioning as constructed without the addition of field attached weights.
- C. If the water is above the recycle pump shut-off point, the floating suction assembly shall be constructed in such a manner that regardless of water level, or hose position, the suction inlet will not break suction, either by turning on its side, pulsating, or vortexing at the suction inlet.
- D. The suction pipe assembly shall vent air when the suction pipe is above the horizontal on the floating suction assembly end.
- E. The floating suction assembly shall be a welded PVC enclosure, foam-filled, sized to pass through a 24” hatchway. The suction invert tee shall have 180-degree travel. There shall be two suction locations to provide reduced invert suction velocity. Each suction invert shall have a stainless-steel vortex breaker.
- F. The floating suction assembly shall have 316 stainless steel legs with non-metallic caps to prevent damage to the tank floor.
- G. If a tethering is a sight requirement, a top-mounted eyebolt shall be included on the floating suction assembly to allow for tethering or for float retrieval without draining the reclaim tank.
- H. The suction pipe shall be schedule 80 PVC connected at the tank end with a metal helix reinforced flexible PVC hose-joint of sufficient length to allow for a ninety-degree bend radius from horizontal to a vertical position, change of direction, without the reinforcement being unduly stressed or distorted.
- I. The suction assembly shall have a pipe size of 4”.
- J. Basic components supplied:

1. Float
  2. Stainless steel vortex breakers
  3. Dual suction invert
  4. Suction pipe schedule 80 NSF/ANSI 61
  5. Suction flex hose joint
  6. Tank connection Schedule 80 PVC flange adapter with 125# pattern
  7. Four power-clamps to make up hose connections.
- K. All floating suction parts in contact with the water shall be constructed from NSF / ANSI 61 compliant components.

### 2.3 SPECIAL TOOLS AND SPARE PARTS

- A. Refer to Section 01730 – Operation and Maintenance Data.
- B. Provide one complete set of all special tools required for maintenance of the decanting units.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install floating decanters and related appurtenances according to the manufacturer's printed instructions, as indicated and specified.
- B. Disinfect or flush decanters in accordance with manufacturer's printed instructions, as indicated and specified.
- C. All equipment shall be field tested in accordance with this Section of the Specifications.
- D. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- E. Energize no equipment except by manufacturer's factory service representative, until authorized in writing.

### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.

- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 CLEANING

- A. After installation is complete and piping connections made, clean decanters in accordance with manufacturer's recommendations. Remove all debris from piping systems prior to cleaning decanters.

### 3.4 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.5 FIELD PAINTING

- A. Equipment shall be painted and stenciled in accordance with Division 9.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11373



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## SECTION 11377

### ROTARY POSITIVE DISPLACEMENT BLOWER

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Furnish, install, and field test package blower system, including, but not limited to, blowers, motors, noise enclosure, drives, guards, drive couplings, baseplates, vibration isolators, supports, silencers, relief valves, flexible connectors, spare parts, outside air filter, and miscellaneous appurtenances as necessary for a complete installation as indicated on the drawings and herein specified.
- B. All items herein specified and related items shall be provided by the blower manufacturer as selected by the Filter Manufacturer in accordance with Section 11201 – Iron and Manganese Removal System. The Blower Manufacturer is responsible for ensuring that all equipment required is provided, and that it is compatible and suitable for the application.
- C. The specifications and drawings adequately describe the system, but do not purport to cover all required details. Provide all appurtenances required, whether specifically noted herein or not, at no additional cost to the owner.
- D. Blowers shall be constructed with appropriate materials for continuous service suitable for drinking water. The Blower Manufacturer shall be responsible for supplying the complete unit as defined and shall assume complete unit responsibility.
- E. Related Sections include the following:
  - 1. Division 1 – General Requirements
  - 2. Division 9 – Finishes
  - 3. Division 11 – Equipment
  - 4. Division 13 – Special Construction
  - 5. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein:

1. Complete list of system components to be provided.
2. Make, model, weight, and horsepower of each equipment assembly.
3. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
4. Standard and specialized equipment assembly cuts.
5. System layout, installation, and placing drawings for equipment, drivers, and bases.
6. Performance data for each type of equipment that will show compliance with specification requirements stated herein.
7. Horsepower demand over the operating range of the blower.
8. Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work.
9. Sound Enclosure: Complete description of sound enclosure and accessories, and calculated noise attenuation.
10. Routine maintenance requirements prior to plant startup.
11. Test Reports: Factory test reports for blower and motor. Field test procedures and inspection reports. Test report for slip test and noise certified readings.
12. Shop drawing data for accessory items.
13. Operating and maintenance instructions and parts lists.
14. Shop Manuals.
15. Motor shop test results.
16. Recommendations for short- and long-term storage.
17. Samples: Color samples for finish coating. If paint manufacturer of finish coat differs from manufacturer of prime coat, provide both manufacturers' written confirmation that materials are compatible.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- B. To be considered “or equal”, the blower shall be a standard product in regular production by a single blower manufacturer who shall have five years minimum, successful experience in the production of equipment specified herein. The

manufacturer shall have also satisfactorily furnished ten units of the type described herein within the last five years.

- C. The blower and equipment specified shall be standard equipment and totally suited for the application as detailed herein. The equipment to be furnished shall be satisfactory and safely designed, in accordance with the design parameters as detailed in these contract documents. It shall be constructed for continuous, automatic operation, for extended periods.
- D. When two or more units of a specific type of equipment are to be provided, they shall be the product of a single manufacturer. Multiple units and their parts shall be identical and interchangeable to the greatest extent possible.
- E. All items shall be designed and constructed in full accordance with all applicable state and local codes and regulations. Labor, materials, and costs required to meet state codes shall be the responsibility of the Contractor and the equipment supplier.
- F. Blower manufacturer must provide the blowers and motors, regardless of manufacturer, as a complete and integrated package to ensure proper coordination and compatibility of equipment.
- G. Shop tests as hereinafter specified.
- H. Services of Manufacturer's Representative as specified herein.
- I. Provide services of factory-trained Service Engineer, specifically trained on type of equipment specified:
  - 1. Submit qualifications of Service Engineer for approval.
  - 2. Person-day requirements listed exclusive of travel time, and do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.
  - 3. Installation: Sufficient time to assist in location of anchor bolts; setting, leveling, alignment, field erection, etc.; coordination of piping, electrical, miscellaneous utility connections, but not less than:
    - i. 1 day
  - 4. Start-up: Sufficient time for calibration, testing, and start-up, but not less than:
    - i. 1 day
  - 5. Instruction: Sufficient time for classroom and/or field operation and maintenance instruction, but not less than:
    - i. ½ day

6. Instruction shall be scheduled separately from installation checkout and acceptance testing, unless approved by the Engineer.
7. Performance Testing: Sufficient time for field performance testing, but not less than:
  - i. ½ day
8. Credit to the Owner unused service person-days specified above, at the manufacturer's published field service rate plus travel costs.

## 1.5 OPERATION AND MAINTENANCE INSTRUCTION MANUALS

- A. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Section 01730 – Operation and Maintenance Data.
- B. Furnish Operation and Maintenance Instruction Manuals (O&M Manuals) prior to start-up for each blower supplied.
- C. O&M manuals shall be prepared with clear instructions that will enable the Owner's personnel to operate and maintain the blowers and all equipment associated with each blower.
- D. The manuals shall be prepared specifically for each installation. General literature from the equipment manufacturer that is not specifically applicable to the operation and maintenance of the installed items shall not be acceptable.
- E. The manuals shall be comprehensive and as a minimum contain:
  1. Description and operating instruction for each blower.
  2. Instructions relevant to all modes of equipment operation.
  3. Service and trouble-shooting instructions as may be available from select manufacturers of equipment supplied.
  4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
  5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
  6. As-Built Mechanical drawings and dimensional information showing the actual layout and location of blower equipment components within the structures.

## 1.6 SPARE PARTS

- A. Furnish, tag, and box for shipment and storage the following spare parts:

<u>Item</u>	<u>Quantity</u>
Oil, synthetic	Enough for one year of service
Intake Filters	Three filters
Flexible Coupling	One complete set per unit
Drive V-Belts	One complete set per unit
Special tools required to maintain or dismantle	One complete set for each unit

## 1.7 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to instrumentation, electrical, and concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- D. Store and safeguard equipment, material and spare parts.
- E. Grease coat all exposed ferrous surface prior to shipping, to prevent corrosion during on site storage.

## PART 2 – PRODUCTS

### 2.1 EQUIPMENT SUPPLIER

- A. The Blower Manufacturer shall act as a single source for all components and shall accept entire system responsibility.
- B. The equipment covered by these specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.
- C. Available Suppliers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Dresser Roots (<http://www.rootsblower.com/>)
2. Kaeser Compressors, Inc. (<http://us.kaeser.com/>)
3. Gardner-Denver, Inc. (<http://www.gardnerdenver.com/>)

Note: The blower contract drawings are based upon Roots 22 URAI Universal blower package unit. Any proposed “OR EQUAL” blower suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

## 2.2 DESIGN REQUIREMENTS

### A. General.

1. Design equipment with due regard to safety of operation, accessibility, and durability of parts, and complying with applicable OSHA, state, and local safety regulations.
2. The blower will receive outside air from a dedicated filter and discharge into a separate discharge line.
3. Intermittent and continuous operation in an indoor environment.
4. Maximum Sound Pressure Level: 80 dBA, factory calculated, with inlet and discharge silencers, measured with a sound enclosure.

B. Performance requirements are listed in the Mechanical Schedule of the Drawings. Additional design requirements are listed in the table below:

Design Capacity, scfm	31
Design Capacity, acfm @ 100 degrees F and 100% RH	40
Altitude, mean sea level	162
Barometric pressure, psia	14.6
Inlet pressure at compressor inlet flange, psia	13.9
Inlet air temperature range, degrees F	-10 to 110
Relative humidity, %	0 to 100
Discharge pressure at compressor discharge flange, psia	19.9
Blower pressure rise required, psig	5
Pressure relief valve setting, psig	6

## 2.3 BLOWER

- A. Rotary positive displacement type, belt driven by horizontal electric motor.
- B. Casing: One-piece construction, ASTM A48, Class 30B close-grain cast iron strongly ribbed to prevent distortion at the specified operating conditions. Separate headplates of cast iron.
- C. Bearings: Each shaft and impeller assembly shall be supported by bearings sized for a minimum L10 rating of 100,000 hours. Drive end bearings shall be fixed to control axial location of impeller assembly. Bearings and gears shall be lubricated by a splash type lubrication system on both ends of the rotors. Provide each bearing with a positive lip type oil seal designed to prevent lubricant from entering air stream and a labyrinth seal on each shaft designed to reduce air leakage at point where shaft extends through headplate of blower casing. Make further provision to vent area between the two sealing systems to atmosphere to relieve excessive pressure on seals.
- D. Impellers: Each impeller/shaft assembly integrally cast from high-strength ASTM A395 Type 60-45-15 ductile iron. Straight, two-lobe involute type, rotating in opposite directions in a common casing without rubbing, liquid seals, or lubrication. Positioned by timing gears to maintain proper clearances. Impellers and timing gears shall be mounted on shafts supported by antifriction bearings, fixed to control the axial location of impeller/shaft in the casing.
- E. Shafts: The blower shafts shall be ASTM A322, Class B, Grade SAE 1144 or equal. The shafts shall be pressed through the impeller body with an interference fit, and pinned in place.
- F. Belt Drive: V-belt drive with automatic belt tension device. Minimum service factor of 1.4. Designed not to exceed allowable overhung load limits of blower and motor. Provide belt guard with acoustical treatment.

## 2.4 MOTOR

- A. The motor shall be sized for appropriate horsepower, RPM, and other electrical characteristics as determined for the application. The brake horsepower requirement with relief valve fully open shall not exceed the motor nameplate horsepower rating with service factor. Motors to be horizontal foot mounted, ball bearings, heavy-duty steel or cast iron frame, gasketed conduit boxes, and manufactured to NEMA or IP standards.
- B. Motor shall be squirrel-cage induction type with TEFC enclosure, and motor shall be premium efficiency with a 1.15 service factor.
- C. Factory mount blower and motor as a package.

## 2.5 ACCESSORIES

- A. Provide vibration isolators to limit transmission of vibration to anchor points at floor.



- B. Baseplate: Cast iron or fabricated steel mounted on concrete equipment pad as shown on Drawings.
- C. Support Stand: Designed by manufacturer and shall be reinforced to withstand anticipated loadings and vibration of blower, motor, inlet silencers, and associated piping.
- D. The drive guard shall be the manufacturer's standard sheet metal with provision for ventilation. The installed guard shall be fully enclosed, easily removable, and designed to meet current OSHA recommendations and CE standards.
- E. Intake filters shall be the type suitable for exterior service and direct mounting at the end of the air piping. The filter element shall be the cartridge type fabricated from a pleated paper media with an efficiency of 99 percent on 10 micron particles. The housing shall be designed to withstand a full vacuum of 15 psig. The rated capacity of the filter shall be a minimum of 150 scfm with a clean maximum pressure drop of 2 inches of water column (WC). End connections shall be 125-pound steel flanges.
- F. The silencers shall be of the absorptive type, directly connected to the inlet/outlet ports of the blower, and shall be mounted horizontally. Silencers shall be designed to reduce pulsation from rotary lobe blowers at blower operating timing gear speed. Silencer shall be designed for anticipated operating temperatures. Pressure loss shall not exceed 6 inches of WC maximum, through each silencer at the design flow rate. Provide drain coupling and plug.
- G. Check Valve: Wafer type for each blower; installed in blower discharge piping downstream of relief valve. Cast iron body, stainless steel pin and spring, and two semicircular cast iron or aluminum plates. Seat shall be Viton or Silicone for high temperature operation. Elastomeric hinges will not be allowed. The blower manufacturer must ensure the valve is suitable for the application.
- H. Safety Relief Valve: Flanged, spring type. Cast iron weighted nonvibrating type with flanged connection. Sized to relieve entire discharge flow without overloading blower. Rated at operating temperatures of 300 degrees F. Furnish one for each blower on discharge piping. Design pressure for relief shall be 7 psig. Safety Relief Valve shall be as manufactured by: TEC, Inc. Model: SWL1199 or Engineer Approved Equal.
- I. Noise Enclosure: Total noise enclosure to provide 80 dBA average noise level at one meter. Material shall be at least 2 inches thick of galvanized material. Noise enclosure shall have removable panels for blower access and inspection. The sound enclosure shall be sheet steel construction with powder coat finish.
- J. The blower package shall be capable of being installed directly adjacent to another blower package of similar design and shall be capable of mounting next to the wall without maintenance interference.

- K. The blower package shall include pressure/vacuum gauges, each with a throttle plug on both the suction and discharge of the blower. Gauges shall be mounted on the noise enclosure.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install package blower systems and related appurtenances according to the manufacturer's printed instructions, as indicated and specified.
- B. All equipment shall be field tested in accordance with this Section of the Specifications.
- C. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.
- D. Install identifying labels permanently to equipment.
- E. Energize no equipment except by blower manufacturer's service representative, until authorized in writing.
- F. Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.
- G. Install blower package on vibration isolators in strict accordance with manufacturer's written instructions.

### 3.2 WARRANTY

- A. The complete system shall be warranted free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 FACTORY TEST REQUIREMENTS

- A. The rotating parts of each blower provided by the manufacturer shall be statically and dynamically balanced before final assembly. The blower alone shall operate without excessive vibration. Removal of material from the face of the rotors for balancing purposes is not allowed.

- B. Each blower provided by the manufacturer shall be slip tested. A 1 PSI slip test shall be performed on each blower to verify flow and horsepower. The slip RPM shall be documented. A document certifying that the supplied blowers conform to the design specifications shall be provided.
- C. On completion of final assembly of the packaged blower and prior to shipment, each packaged blower shall be mechanically run for a minimum of fifteen (15) minutes. A document certifying that the supplied blowers conform to the design specifications shall be provided.
- D. Provide package noise certified readings which includes the mechanical run test and calculated to a free field environment. Test to be measured to CAGI-PNEUROP test code with +/- 3 dBA tolerance. Blower manufacture's certification shall be provided.
- E. Motor Tests:
  - 1. Give each motor the standard commercial tests in the shop of the motor manufacturer, and submit certified copies of the test results to the Engineer for review prior to installation of the motors.
- F. In the event that the blower package fails to perform as specified during the test, make all modifications required to place the unit in conformance with the specifications, and retest, at no additional cost to the Owner.
- G. In the event that the blower package fails a second test, the unit will be rejected without recourse, and must be replaced with a unit equal to that specified, which passes the required tests.
- H. Submission of Test Results: All data shall be submitted on 8-1/2 x 11 inch sheets at as large a scale as is practical.

### 3.4 FIELD TEST AND QUALITY CONTROL

- A. Each blower package shall be completely assembled in the Blower Manufacturer's facility and the blowers shall be subjected to a complete operational performance test. Individually test each blower package. Certify that the blower package is free from overheating and excessive vibration. Plot curves for all performance data. A copy of the test report will be submitted to the Engineer prior to startup. Additional requirements specified herein.
- B. The Contractor shall have the Blower Manufacturer factory service representative present during field installation. It shall be the Contractor's responsibility to obtain the recommended installation procedures directly from the Manufacturer, and comply with same.
- C. Contractor shall have the Blower Manufacturer provide a factory service representative who has complete knowledge of the operation of the packaged blower system, including mechanical, electrical, control, and alarm components as necessary to perform field testing and initial start-up to assure and demonstrate the proper performance of all equipment and blower components.

- D. Field tests shall be performed by the Contractor under the instruction of the Blower Manufacturer's field service engineer. All field testing to be witnessed by the Engineer in the field. Provide notice of field testing in accordance with 01650 – Facility Start-up/Commissioning. Submit all scheduling and procedures to the Engineer for approval. Provide written test procedures which describe the proposed means and methods to be used in conducting necessary field tests. Submit certification of successfully conducted field tests.
- E. Check on each blower system, assisted by manufacturer's service representative, for correct rotation, proper alignment and connection, quiet operation, vibration, and satisfactory specified performance in meeting design requirements. Complete mechanical and flow test, record the following data: Inlet and outlet air pressure, inlet and outlet air temperature, discharge flow, motor voltage and amperage for each phase, horsepower. Measure power consumption using a calibrated wattmeter.
- F. In the event that a unit fails to pass a test, make all modifications required to place the unit in proper working order.
- G. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the Owner.
- H. The Contractor shall provide all necessary instrumentation, equipment, devices, and appurtenances, as well as temporary wiring or piping, required to perform field tests.

### 3.5 SHOP PAINTING

- A. Both the inside and outside surfaces of all ferrous materials, equipment, and devices shall be thoroughly cleaned at the shop.
- B. All ferrous parts/components, except machine surfaces and others obviously not to be painted, and as otherwise specified hereinbefore (including referenced AWWA Standards), shall be furnished with primer coats of rust inhibitive primer compatible as specified in Division 9 – Finishes. Where applicable, surface preparation and primer coating shall be as specified in Division 9 – Finishes. All machined surfaces subject to corrosion shall be coated with a rust preventer/inhibitor prior to shipment. Contractor shall follow Manufacturer's recommendations for preventing corrosion prior to installation and operation.

### 3.6 PAINT

- A. Equipment shall be painted and stenciled in accordance with Division 9 – Finishes

### 3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 - Contract Closeout.

END OF SECTION 11377

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SECTION 11501  
PROCESS GAUGES

PART 1 – GENERAL

1.1 SUMMARY OF WORK

- A. The Contractor shall furnish process gauges where shown on the Contract Drawings and as specified herein.
- B. The Contractor shall be responsible for delivery and unloading of the process gauges system as noted below.
- C. All required labor, materials, and equipment shall be included.
- D. Related Sections include the following:
  - 1. Division 1 – General Requirements
  - 2. Division 11 – Equipment
  - 3. Division 13 – Special Construction

1.2 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- B. Each component shall be designed for the environmental conditions of the space in which the component is located.
- C. Indoor areas will be climate controlled. Temperatures in the equipment areas will be between 75 and 55 degrees F, and a relative humidity may be as high as 60 percent.

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings for all components of the pressure gauges in accordance Division 1.

1.4 COORDINATION

- A. Contractor shall coordinate with PFAS Removal and Iron and Manganese Removal pressure filter vendors to assure all process gauges are the product of the same manufacturer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. The available manufacturers are:

1. AMETEK, Inc.; U.S. Gauge Div. (<https://webshop.ametekusg.com/>).
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div. (<http://www.ashcroft.com/>).
3. H. O. Trerice Co. (<http://www.trerice.com/>).
4. WIKA Instrument Corporation (<https://www.wika.us/>).
5. Engineer Approved Equal.

## 2.2 DIRECT MOUNTING, DIAL TYPE PRESSURE GAUGES

- A. All pressure gauges shall be of the indicating-dial type in accordance with ASME Designation B40.100.
1. The case shall be of the liquid-filled type, drawn steel or cast aluminum, 4-1/2 inches in diameter.
  2. The pressure-element assembly shall be of the Bourdon tube, unless otherwise indicated.
  3. The pressure connection shall be brass, NPS 1/4, bottom-outlet type unless the back-outlet type is indicated.
  4. The movement shall be mechanical with a link to the pressure element and connection to pointer.
  5. The dial shall be satin-faced, non-reflective aluminum with permanently etched scale markings.
  6. The pointer shall be red metal.
  7. The window shall be glass.
  8. The ring shall be metal.
  9. The accuracy shall be Grade A, plus or minus one (1) percent of middle half scale.
  10. The vacuum-pressure range shall be 30-inches of mercury of vacuum to 15 psig of pressure.
  11. The range for fluids under pressure shall be two (2) times the operating pressure.
  12. Provide diaphragm seals for liquid piping to prevent the gauge from being clogged or corroded by process materials.

## 2.3 REMOTE MOUNTING, DIAL TYPE PRESSURE GAUGES

- A. All pressure gauges shall be of the indicating-dial type in accordance with ASME Designation B40.100.
1. The case shall be of the dry type, drawn steel or cast aluminum, 4-1/2 inches in diameter, with holes or something else for panel mounting.
  2. The pressure-element assembly shall be of the Bourdon tube, unless otherwise indicated.
  3. The pressure connection shall be brass, NPS 1/4, bottom-outlet type unless the back-outlet type is indicated.
  4. The movement shall be mechanical with a link to the pressure element and connection to pointer.
  5. The dial shall be satin-faced, non-reflective aluminum with permanently etched scale markings.
  6. The pointer shall be red metal.
  7. The window shall be glass.
  8. The ring shall be metal.
  9. The accuracy shall be Grade A, plus or minus one (1) percent of middle half scale.
  10. The vacuum-pressure range shall be 30-inches of mercury of vacuum to 15 psig of pressure.
  11. The range for fluids under pressure shall be two (2) times the operating pressure.
  12. Provide diaphragm seals for liquid piping to prevent the gauge from being clogged or corroded by process materials.

## 2.4 PRESSURE-GAUGE FITTINGS

- A. The valves shall be NPS 1/2" or 1/4" brass or stainless steel ball valve.
- B. The snubbers shall be in accordance with ASME Designation B40.5, NPS 1/4 brass bushing with corrosion resistant, porous metal disc of material suitable for system fluid and working pressure.

## PART 3 – EXECUTION

### 3.1 GAUGE APPLICATIONS

- A. The Contractor shall furnish pressure gauges for discharge of each blower.
- B. The Contractor shall furnish and install pressure gauges at the suction and discharge of each pump.



- C. The Contractor shall furnish and install pressure gauges where noted on the Contract Drawings and as specified in other sections.

### 3.2 INSTALLATION

- A. The Contractor shall furnish ball valves and snubber fitting in the piping for each pressure gauge in accordance with the Manufacturer's written instructions, Drawings, and as specified herein.
- B. The Contractor shall provide diaphragm protection seal protection for all chemical feed system and residuals/backwash waste applications.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 11501

DIVISION 12 – FURNISHINGS

12350	.....	Laboratory Casework
12500	.....	Window Treatments

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## SECTION 12350

### LABORATORY CASEWORK

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Laboratory casework standing base cabinet.
2. Laboratory casework standing base cabinet with drawers.
3. Molded epoxy resin laboratory base cabinet worktop, backsplash, sink and sink outlet.
4. Wall mounted, glass fronted laboratory casework storage cabinet.
5. Accessories and appurtenances as required for complete installation of laboratory casework.

- B. Related Sections:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 07920 “Joint Sealants”, for sealing joint between laboratory casework and adjacent wall.
4. Division 15 Sections for plumbing work at laboratory casework sinks.
5. Division 15 Sections for fume hood.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.

- B. Product Data: Full information on all laboratory casework items, including materials of construction, dimensions, hardware and all other features, together with a complete schedule of laboratory casework to be provided.

- C. Samples: 12 in. x 12 in. sample of laboratory casework wood cabinet material and 6 in. x 6 in. sample of 1 in thick worktop.
- D. Cleaning and Maintenance Information: Manufacturer's laboratory casework cleaning and maintenance instructions.

#### 1.4 QUALITY ASSURANCE

- A. Obtain all laboratory casework from a single supplier and single manufacturer.
- B. The materials, products, devices, methods, systems, design and installation of any and all aspects of the plumbing systems, including the laboratory casework sink and appurtenances, shall be in conformance with 248 CMR 3.00 through 10.00, including the provision that all products used in any plumbing system shall be Product-Approved by the Plumbing Board.

#### 1.5 WARRANTY

- A. Provide manufacturer's standard warranty for all laboratory casework items, including defects such as hardware failures, delamination or warping of wood cabinets, deterioration of molded epoxy resin and other material failures.
- B. Warranty to include repair or replacement, as appropriate, of failed or defective laboratory casework materials and items at no cost to the Owner for the full length of warranty period.

#### 1.6 COORDINATION

- A. Coordinate laboratory casework with Plumbing work and HVAC work (fume hood).

### PART 2 - PRODUCTS

#### 2.1 LABORATORY CASEWORK

- A. Cabinets, Worktop, Sink and Other Items:
  - 1. Wood base cabinets and wall cabinets with doors, drawers and shelves as shown and listed on the Drawings.
  - 2. Worktop: 1 in. thick molded epoxy resin countertop with sink cutout, epoxy resin backsplash, tub sink and sink outlet. [Note: Worktop shall be compatible with potassium hydroxide (45%), sodium hypochlorite (12.5%), and polyaluminum chloride (33%).]
  - 3. Wall mounted, glass fronted laboratory casework storage cabinet.
  - 4. Accessories and appurtenances as required for complete installation of laboratory casework.

- B. Wood Cabinet Finish: Golden Oak.
- C. Acceptable Manufacturers:
  - 1. Kewaunee Scientific Corporation.
  - 2. Fisher Scientific.
  - 3. Labconco Corporation.
  - 4. Or approved equal.
- D. Casework Listing: Casework identified on the Drawings is based on Kewaunee Scientific Corporation catalog numbers. Listing on the Drawings is solely to establish the sizes, features and other characteristics of the laboratory casework items. Casework items by other manufacturers with the same size, features and other characteristics as the listed items will be acceptable.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine location for installation of laboratory casework for suitability to proper installation.
- B. If unsatisfactory conditions are found, notify Engineer and General Contractor for correction of unsatisfactory conditions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install all laboratory casework in strict accord with manufacturer's written recommendations.
- B. Install all casework level and true and securely mount wall-hung unit.
- C. Coordinate work at sink with Plumbing Contractor.
- D. Coordinate installation of casework with installation of joint sealants.

#### 3.3 PROTECTION AND CLEANING

- A. After completion of casework installation, provide protective covers for all casework to prevent damage from other construction work.
- B. Repair or replace, as needed, any casework damaged by other construction work at no cost to the Owner.
- C. Clean all casework as part of Closeout work.

3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Project Closeout.

END OF SECTION 12350

## SECTION 12500

### WINDOW TREATMENTS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. Horizontal louver blinds for windows indicated.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements.
  - 2. Division 1 – General Requirements.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.
- D. Samples for Initial Selection: For each type and color of horizontal louver blind indicated.
  - 1. Include similar Samples of accessories involving color selection.
- E. Samples for Verification: For each type and color of horizontal louver blind indicated.
  - 1. Slat: Not less than 12 inches long.
  - 2. Blind: One full functional unit, 16-inches wide by 24-inches long.
- F. Product Certificates: For each type of horizontal louver blind, signed by product manufacturer.



G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of horizontal louver blind.

H. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Flame-Resistance Ratings: Passes NFPA 701.

C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

#### 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Engineer of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## PART 2 - PRODUCTS

### 2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

- A. Basis of Design Product: Subject to compliance with requirements, provide **SWFContract; Classics 1” Mini Blinds** or one of the following:
1. Hunter Douglas; Lightlines.
  2. Levolor; Riviera.
- B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile.
1. Width: 1 inch (0.991- inch actual).
    - i. Spacing: Not less than 0.85 inch (21.5 mm).
  2. Thickness: Not less than 0.008 inch.
  3. Finish: One color.
    - i. Ionized Coating: Antistatic, dust-repellent, baked polyester finish.
- C. Headrail: Formed steel channel, “U”-shaped; long edges returned or rolled; fully enclosing operating mechanisms on three sides and the following:
1. Capacity: One blind per headrail.
  2. Size: 1-inch high by 1-1/2- inch deep, 0.025 inch thick.
  3. Provide steel end stiffeners at each end of headrail with a lateral adjustment tab to eliminate lateral movement and the center the blind in the window.
  4. Hardware: Acetal low friction thermoplastic, mechanically locked into head channel by means of snap-in fittings with no mechanical cleats visible from underside of headrail.
  5. Finish: Prime coat of vinyl primer with finish coat of polyester baked enamel, to match bottom rail and end support brackets.
- D. Bottom Rail: Formed-steel tube 0.025-inch-thick, with plastic or metal capped ends, top contoured to match crowned shape of slat; with enclosed ladders and tapes to prevent contact with sill; and locking groove to receive dust cover.
1. Finish: Prime coat of vinyl primer with finish coat of polyester baked enamel.

- E. Ladders: Braided string; 100% high tenacity polyester yarn, not less than 0.045- inch diameter or greater than 0.066- inch diameter.
  - 1. Spacing: Distance between end ladder and end of slats not to exceed 6-1/2 inches; distance between ladders not to exceed 24 inches.
  - 2. Ladder drum: Injection molded thermoplastic with smooth hole edges to position ladder. Secure ladder with a snap down top, eliminating the need for braided ladder clips.
- F. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod, and the following:
  - 1. Tilt Operation: Manual.
  - 2. Wand: Detachable, clear polycarbonate hollow rod with a hexagonal shape measuring approximately 1/4- inch across.
  - 3. Length of Tilt Control: Length required to make operation convenient from floor level.
  - 4. Tilt: Full.
  - 5. Tilt Rod: Electro-zinc coated solid steel, hexagonal in shape, 1/4-inch at its widest point. Tilt rod to limit torsional deflection to 6 degrees in a 30-inch test length with a torque application of one-foot pound.
  - 6. Tilt Rod Support: Acetal low friction thermoplastic, to provide smooth bearing and center the ladder drum over ladder hole. Incorporate a grommet guide to guide lift cord and braided ladder through bottom of headrail. Provide acetal grommet with beveled edges to prevent cord and braided ladder wear and discoloration.
- G. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
  - 1. Cord Lock: Snap-in design which incorporates a stainless steel wear guard over which cords pass, and a floating shaft-type locking pin. Locking pin shall be free of abrasive teeth and offer minimum wear to cord. Incorporate a crash-proof safety feature which will lock blind automatically upon release of cord.
  - 2. Cord Guide: Nickel steel plated.
- H. Tilt-Control and Cord-Lock Position: Right and left side of headrail, respectively.
- I. Mounting: Wall or ceiling mounting as required, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind, but not more than 48-inches.
- J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard; provide at locations indicated.
- K. Colors, Textures, Patterns, and Gloss: As selected by Owner from manufacturer's full range.

## 2.2 HORIZONTAL LOUVER BLIND FABRICATION

- A. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
  1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
  1. Blind Units Installed between (inside) Jamb: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.
  2. Blind Units Installed outside Jamb: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, and operating hardware, and for hardware position and blind mounting method indicated.
  1. Fabricate from steel, marked left and right to facilitate installation, with 1-1/4-inch extra wide top to accommodate power screwdriver.
  2. Finish: Prime coat of vinyl primer with finish coat of polyester baked enamel, to match headrail.
- D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- E. Color-Coated Finish:
  1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

- F. Component Color: Provide rails, cords, ladders, and exposed-to-view metal, and plastic matching or coordinating with slat color, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.

- B. Flush Mounted: Install horizontal louver blinds with slat edges flush with finish face of opening if slats are tilted open.

- C. Jamb Mounted: Install headrail flush with face of opening jamb and head.

- D. Head Mounted: Install headrail on face of opening head.

#### 3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

#### 3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by Engineer, before time of Substantial Completion.

#### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

3.6 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 12500

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DIVISION 13 – SPECIAL CONSTRUCTION

13100	.....	Computers and Miscellaneous Equipment
13120	.....	Metal Building Systems
13200	.....	Programmable Logic Controllers
13201	.....	Disinfection of Water Systems
13215	.....	Chemical Storage Tanks
13320	.....	Instrumentation and Controls
13325	.....	Process Instrumentation and Control Products
13400	.....	Supervisory Control and Data Acquisition (SCADA) System
13400.1	.....	Alarm Schedule
13420	.....	Control System Equipment Panels and Racks
13465	.....	Sequence of Operations



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## SECTION 13100

### COMPUTERS AND MISCELLANEOUS EQUIPMENT

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Work required by this section is indicated on the Contract Drawings and by the requirements of this section.
2. The components as required to provide a complete supervisory control and data acquisition (SCADA) servers at the Town of Sharon Wells 2, 3, and 4 Water Treatment Plant (WTP) in accordance with the Specifications and Drawings, by the control systems integrator/ supplier (Integrator) as specified in Section 13320.
3. Installation and start-up of computer system.
4. Testing of the computer system.
5. Coordination with work to be completed by the Application Engineer.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Division 13 – Special Construction
4. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Submit in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein.
- B. Provide complete equipment specifications, details of all connections, wiring diagrams, and component dimensions.
- C. Submittals consisting of only general sales literature will not be acceptable.

- D. Submit detailed information for each product listed below clearly indicating compliance with each of the specifications. Indicate any deviations from that specified and the reason for deviation.
- E. Submit all software licenses to the Owner. Licenses shall be made out in Owner's name.
- F. Submit O&M information as specified in Paragraph 1.5.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – Quality Assurance and as specified. Installer's Qualifications - Firms regularly engaged in the installation, programming, and testing of computer and network systems, with a minimum of five years of experience or a minimum of ten (10) fully installed system, have functioned satisfactorily in similar service for a minimum of two (2) years and have demonstrated proficiency and extensive experience with current technology.

#### 1.5 OPERATIONS AND MAINTENANCE MANUALS

- A. Furnish six (6) complete sets of Operations and Maintenance Instruction Manuals (O&M Manuals) prior to start-up. Furnish one (1) electronic Adobe PDF searchable version on thumb drive or CD-ROM.
- B. Provide O&M manuals for each software package supplied.
- C. O&M manuals for the servers and all components inside shall be include. Manuals should include:
  - 1. Processor;
  - 2. Modems;
  - 3. Optical Drive;
  - 4. Sound Card;
  - 5. Video Card (if provided);
  - 6. DVD Drive
  - 7. Internal Hard Drive
  - 8. Network Interface Card
  - 9. Motherboard; and
  - 10. Ethernet Card.
- D. Provide O&M manual for the mouse.

- E. Provide O&M manual for the monitor.
- F. Provide O&M manual for the printer.
- G. Provide O&M manual for the server tower.
- H. Refer to Specification Section 01730 – Operation and Maintenance Data for additional requirements.

## 1.6 SPARE PARTS

- A. Spare parts shall include the following:
  - 1. One connecting cable for each type used;
  - 2. One matching power supply;
  - 3. One mouse – same type as provided;
  - 4. One keyboard – same type as provided;
  - 5. 500 writable CDs;
  - 6. 10 – 16 GB USB 3.0 Thumb Drives; and
  - 7. Printer accessories/supplies as specified below.
- B. Spare parts shall be packaged so as to prevent damage during long storage at the WTP. All packages shall be legibly and properly identified with indelible markings on the exterior as to contents.
- C. Complete ordering information including manufacturer, part number, part name, and equipment for which the part is to be used shall be provided.
- D. All spare parts/accessories provided under this section shall be turned over to the Owner at the same time accompanied by a written transmittal listing each specific item and quantity.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Control, delivery, storage, and handling of equipment in accordance with Sections 01600 and 01610.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Type

1. All computer hardware and software supplied shall be of the manufacturer's latest version.
2. All equipment furnished shall be suitable for operation on 120 VAC, 60-hertz electrical power.
3. Hardware and software products required for communications between the Programmable Logic Controllers (PLCs) and the SCADA servers shall consist of standard products offered by either the computer software publisher or the PLC manufacturer.

B. Lightning/Surge Protection

1. General - Lightning/surge protection shall be provided to protect the system from inducted surges and shall be separate from the Uninterruptible Power Supply (UPS) specified below and shall be installed such that it protects the UPS as well.

2.2 SERVERS (PC)

A. The two SCADA Servers shall run the SCADA software, function as an operator interface (OI)/Human Machine Interface (HMI) and, serve as a control/alarm monitoring system for the WTP and the Well Stations 2, 3, and 4. The SCADA Servers shall be located at the Wells 2, 3, and 4 Water Treatment Plant (WTP). The SCADA Servers shall meet these minimum requirements and achieve the performance goals in the control system software specification.

B. General Requirements

1. Provide servers to meet requirements for the Process Control System SCADA and all other SCADA support functions.
2. Provide tower-mount server, with all necessary items for installation, including interconnecting cables, mounting hardware, and appurtenances.
3. Provide all documentation, manuals, and licenses.

C. Features:

1. Tower form factor.
2. Processor: Intel Xeon Processor or Engineer approved equal. 4 cores or more, minimum 3.4 GHz, and minimum 8 MB cache.
3. RAM (Random-Access Memory): 16 GB UDIMM, 3200 MT/s, ECC, minimum.
4. Support 1920 x 1080 at 75 Hz monitor resolution.
5. Internal Hard Drive Configuration:

- a. Provide two (2) separate internal hard drives.
  - b. Type: 7.2k RPM SATA, 3.5", 6 Gbps
  - c. Capacity: 2.0 TB, minimum, each
  - d. RAID: 1
6. Removable Media Drive: DVD Dual-layer Drive with both Read and Write Capability.
7. Network Interface Cards (NIC):
- a. Provide two (2) separate NIC cards.
  - b. Network cards shall be of the same type and manufacturer.
  - c. All network ports shall at minimum support 1 Gbps transmission rate.
8. Power Supply: 125 VAC, 60 Hz
9. Warranty (parts & labor): 1 year
10. Acceptable Manufacturers
- a. Dell PowerEdge T150 (basis of design)
  - b. Hewlett-Packard ProLiant
  - c. Cisco UCS
  - d. Or approved equal.

### 2.3 OPERATING SYSTEM AND SOFTWARE

- A. 64-bit Windows Operating System Compatibility Requirement:
  - 1. SCADA Servers: Windows Server 2022 Standard, 16CORE
  - 2. PC Workstation: Windows 10 Pro
- B. Microsoft Office Professional 2021
- C. Adobe Acrobat Reader, latest edition
- D. Web Browser: Microsoft Edge, latest edition
- E. All software licenses shall be registered by the Contractor in the Owner's name.

- F. All software shall be licensed to the Owner; end user license agreements and proof of purchase to be submitted to Owner.

## 2.4 MONITORS

- A. Each SCADA Server shall be provided with a monitor that meets the below specifications.
- B. Features:
  - 1. Screen Size: 27-inch
  - 2. Screen Type: IPS panel with antiglare coating
  - 3. Native Resolution: 1920 x 1080 at 75 Hz
  - 4. Input Connectors:
    - a. (1) HDMI Port (v. 1.4)
    - b. (1) Display Port 1.2
    - c. (1) Audio line-out port
  - 5. Acceptable Manufacturers:
    - a. Dell
    - b. Asus
    - c. HP
    - d. Or approved equal.

## 2.5 PRINTER

- A. Type: Laser
- B. Printer to be located adjacent to SCADA Servers
- C. Interface: Wired Ethernet
- D. Paper weight: 24 Lbs
- E. Print resolution: 4800 x 2400 dpi color
- F. Rated speed: 25 ISO ppm Black/White, 12 ISO ppm Full Color
- G. Compatible with Windows Server 2022 Operating System
- H. Warranty (parts & labor): 1 year
- I. Accessories/supplies:

1. Scanning capability
2. Connecting cable
3. One spare toner cartridge for each type used, in addition to ones installed in the printer originally
4. 500 sheets, 24 LB, A size printing paper
5. Support software with all necessary drivers

J. Acceptable Manufacturers

1. Epson WorkForce Pro WF-C4810 Color Multifunction Printer (basis of design)
  2. Canon
  3. Hewlett Packard
- Or approved equal.

2.6 Accessories:

A. Mouse

1. USB Wireless connectivity
2. Combination set with keyboard
3. Optical
4. Compatible with Windows Server 2022
5. Manufacturers:
  - a. Logitech Signature M550 L
  - b. Dell
  - c. Microsoft
  - d. Or approved equal.

B. Keyboard

1. USB Wireless connectivity
2. Combination set with keyboard
3. Standard 104 key configuration
4. Cushioned palm rest
5. Compatible with Windows Server 2022
6. Manufacturers:
  - a. Logitech Wave Keys MK67
  - b. Dell
  - c. Microsoft
  - d. Or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The Integrator shall furnish the servers, software, and ancillary equipment to the Application Engineer for servers set up, configuration, and programming. The



Contractor shall be responsible for coordinating this work with the Application Engineer.

- B. The Application Engineer shall deliver the configured and programmed servers to the Contractor for installation. The SCADA servers, peripherals, and accessory equipment shall be installed by the Integrator in accordance with the manufacturer's instructions and located as shown on the contract drawings or as approved by the Owner.
- C. The Integrator shall coordinate the installation, the placing and location of system components, and connections to the process components, panels, cabinets and devices. The Integrator shall be responsible to ensure that all field wiring for power and signal circuits between existing devices and PLCs are correctly done in accordance with best industry practice to ensure a satisfactory functioning installation and a high degree of lightning surge protection at both ends of all systems/connectors.

### 3.2 TESTS AND ACCEPTANCE

- A. The Integrator shall perform onsite operability tests and system acceptance tests.
- B. The Integrator shall train Owner's personnel in the operation of the SCADA servers. This training is considered formal and may not coincide with the system acceptance test.
- C. Provide four (4) hours of training on the SCADA servers system, not including travel time.

### 3.3 SOFTWARE VERSIONS, UPDATES, AND LICENSING

- A. The Integrator shall provide the latest version of each software package being provided with all update service packs that may apply.
- B. The software provided by the Integrator shall be compatible with the specified servers operating system.
- C. The Integrator shall include all necessary licensing for operation of the software on the computer system provided.
- D. The Integrator shall provide to the Owner a software update service as part of the warranty and/or maintenance contract for this project for a minimum of 1 year.

### 3.4 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.

- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 001700 – Contract Closeout.

END OF SECTION 13100

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## SECTION 13120

### METAL BUILDING SYSTEMS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes following:

1. Structural steel main building framing.
2. Secondary framing including purlins; girts; sag rods; and bracings and supports for canopies, door, window, mechanical and process openings, and mechanical components.
3. Insulated roof panels and insulated wall panels.
4. Gutters and downspouts.
5. Snow guards.
6. Anchor bolts.
7. Accessories, trim, flashing, sealants, and all other appurtenances required for a complete, weathertight metal building system.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements.
2. Division 1 – General Requirements.
3. Section 03300 “Cast-In-Place Concrete” for concrete work.
5. Section 05400 “Cold-Formed Metal Framing” for framing associated with dormers to be installed in the metal building system.
6. Section 07620 “Sheet Metal Flashing and Trim” for stainless steel counter-flashing to be installed as part of the work of this Section.
7. Section 07920 “Joint Sealants” for sealants between the metal building system components and items installed under other sections.

8. Section 08331 “Overhead Coiling Doors” for overhead doors to be installed in the metal building system.
9. Section 08413 “Aluminum-Framed Entrances” for aluminum frames to be installed in the metal building system.
10. Section 08513 “Aluminum Windows” for aluminum windows to be installed in the metal building system.
11. Section 08950 “Fiberglass-Sandwich-Panel Assemblies” for fiberglass-sandwich-panel assemblies to be installed in the metal building system.
12. Section 10200 “Fixed Louvers” for louvers to be installed in the metal building system.
13. Division 11 “EQUIPMENT” for mechanical work to be installed in the metal building system.
14. Division 15 “MECHANICAL” for plumbing, HVAC, and fire protection work to be installed in the metal building system.
15. Division 16 “ELECTRICAL” for electrical work to be installed in the metal building system.

### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein.
  - A. Product Data: Submit product data for all components of the metal building system, including material descriptions, dimensions and profiles of components, construction details and finishes.
  - B. Shop Drawings: Submit shop drawings for entire metal building system, including plans, elevations, wall sections, details and all other drawings required for full review of building system compliance with Contract Drawing and Specification requirements.
  - C. Drawings to show the shapes of all members, design and erection drawings, and an isometric view of the roof showing the design wind uplift pressure and dimensions of edge and corner zones. Shop painting and finishing specifications. Anchor bolt placement plan and column reactions.
  - D. Color Selector: Selectors for full range of colors available for interior and exterior of insulated roof panels and insulated wall panels.
  - E. Design Certification: Letter signed and sealed by a structural engineer registered in the Commonwealth of Massachusetts certifying metal building system complies with all applicable Massachusetts Codes and Regulations.

F. Structural Calculations: Calculations for structural design of the metal building system signed and sealed by a structural engineer registered in the Commonwealth of Massachusetts showing design's compliance with all structural requirements of the applicable Massachusetts Codes and Regulations, including dead loads, wind loads, snow loads, lateral loads and foundation reactions for all load combinations.

G. Samples

1. Accessories: One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.
2. Roofing and Siding: One piece of each type and finish (exterior and interior) to be used, 9 inches long, full width. The sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish.
3. Fasteners: Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.
4. Gaskets and Insulating Compounds: Two samples of each type to be used and descriptive data.
5. Sealant: One sample, approximately 1 pound, and descriptive data.

H. On-Site Sample Coordination Meeting: The General Contractor, metal building manufacturer and erector, Owner, and Engineer shall meet on site to coordinate and confirm all finish selections.

I. Mockups: Construct on-site mockup of exterior wall components, including trim and flashing. Coordinate with Section 04001 for masonry veneer installed over insulated metal backup wall panel system.

J. Welding Certificates: Copies of certificates for welding procedures and personnel.

K. AISC Certifications: Copies of certifications of Manufacturer and Erector.

L. Signed Warranties for building system, roof panel and wall panels and weathertightness.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Metal building system design in accordance with AISC 360-10, "Specification for Structural Steel Buildings," and Mass. State Building Code, current edition.
- B. Construction shall comply with AISC 303-10, "Code of Standard Practice for Steel Buildings and Bridges."
- C. Welding shall comply with AWS D1.1, "Structural Welding Code - Steel" and AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Cold-formed steel shall comply with AISI SG-671, "Specification for Design of Cold- Formed Steel Structural Members."
- E. Bolted connections shall comply with Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using ASTM A325 and A490 Bolts."
- F. The metal building system covered under this specification shall be provided by a single manufacturer and shall include all components and assemblies that form a building. Structural Standing Seam Metal Roofing System shall be furnished as part of a single manufacturer's system.
- G. Primary frame shall be solid-member, clear span, rigid frame with pinned column bases; and, in accord with AISC recommendations: Column base plates and anchor bolts shall be designed and detailed to transfer shear load to the foundation.
- H. Secondary framing girts shall be inset type as shown on drawings. Purlins shall be supported on top flange of the frame girders and shall be braced at quarter spans. Purlin bracing shall be full depth bracing.
- I. Thermal Movements: Provide metal building roof and wall panels systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg. F ambient; 180 deg. F material surfaces.
- J. Building envelope shall be designed with a continuous air barrier to control air leakage into and out of conditioned space. Air permeability barrier shall not exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 inches of water.

- K. Water Penetration for Roof Panels: Provide roof panel system with no water penetration when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 pounds per square foot and not more than 12 pounds per square foot.
- L. Water Penetration for Wall Panels: Provide wall panel system with no water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 pounds per square foot and not more than 12 pounds per square foot.

## 1.5 QUALITY ASSURANCE

- A. Metal building shall be the product of a recognized steel building systems manufacturer who has been in the practice of manufacturing steel building systems for a period of not less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating steel building systems. The manufacturer shall be certified under the Metal Building Systems (MB) Certification Program, AISC FCD. Structural framing and covering shall be designed by a licensed Professional Engineer registered in the Commonwealth of Massachusetts and experienced in design of this work.
- B. Erector shall have specialized experience in the erection of steel building systems for a period of at least 5 years. Framing shall be erected in accordance with MBMA Low Rise Manual, common industry practices and erection instructions describing the basic sequence of assembly, temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads acting on the exposed framing, such as wind loads and seismic forces, as well as loads due to erection equipment and erection operation. Bracing furnished by the manufacturer for the metal building system shall not be assumed to be adequate during erection. Structural members shall not be field cut or altered without approval of the metal building manufacturer. Welds, abrasions, and surfaces not galvanized shall be primed after erection.
- C. Erector shall investigate and be familiar with the site to prevent causing damage to existing adjacent structures and utilities, above or below grade, during the erection of the structure. Erector shall be fully liable for any damage caused to existing adjacent structures and utilities above or below grade.
- D. A representative designated by the building manufacturer, who is familiar with the design of the building supplied and experienced in the erection of metal buildings similar in size to the one required under this contract, shall be present at the job site during construction, from the start of the structural



framing erection until completion of the installation of the exterior covering, to assure that the building is erected properly.

- E. At the conclusion of construction, the building manufacturer will provide written certification that the building was erected in accordance with the design and all applicable codes and standards.

## 1.6 DESIGN REQUIREMENTS

- A. Criteria and definitions shall be in accordance with MBMA Low Rise Manual, except criteria for seismic loads shall be in accordance 780 CMR State Building Code of the Commonwealth of Massachusetts, with TI 809-04, the design loads as shown on structural drawings and all other loads and load combinations in accordance with ASCE 7, whichever is more stringent.
- B. The dead load shall consist of the weight of all permanent construction such as roof, framing, covering members and all other materials of the building system.
- C. Collateral loads shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, and process piping. This allowance does not include the weight of hung equipment weighing 50 pounds or more. Equipment loads of 50 pounds or more shall be shown on the shop drawings and the structural members shall be strengthened as required. The Contractor is responsible for providing the building manufacturer the magnitude and approximate location of all concentrated loads greater than 50 pounds before design of the building commences.
- D. Additional localized dead loads such as supports for mechanical components shall be accounted for in the design of the building. The Contractor is responsible for providing the Building Manufacturer the magnitude and location of all additional loads.
- E. Uniform roof live loads, including maintenance traffic and construction loads, shall be determined and applied in accordance with 780 CMR State Building Code of the Commonwealth of Massachusetts or ASCE 7, whichever is more stringent.
- F. In addition to prescribed roof live loads, a minimum design concentrated load of 300 pounds shall be used to simulate a construction load on roof panels. The concentrated load shall be applied at the panel midspan and shall be resisted by a single standing seam metal roof panel, or a 24 inches wide corrugated metal panel, assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.
- G. The design roof snow loads, including effects of drifting, shall be determined and applied in accordance with 780 CMR State Building Code of the

Commonwealth of Massachusetts or as indicated on the Construction Drawings, whichever is more stringent.

- H. Wind pressures shall be computed and applied in accordance with 780 CMR State Building Code of the Commonwealth of Massachusetts or as indicated on the Construction Drawings, whichever is more stringent.
- I. Seismic loads shall be computed in accordance with 780 CMR State Building Code of the Commonwealth of Massachusetts or as indicated on the Construction Drawings, whichever is more stringent.
- J. Structural steel members and their connections shall be designed in accordance with AISC 360. Structural cold-formed steel framing members and their connections shall be designed in accordance with TI 809-07. Maximum live load deflection under applied live load, snow, or wind load shall not exceed 1/180th of the span length, including deflection of the roof and wall diaphragm. Members with openings in their webs shall be designed with consideration of the additional stresses which will result due to the openings. Deflections of the steel framing above and along the side of commercially framed door and window openings shall be limited to a maximum allowable deflection of 1/360 of the opening width to ensure proper operation. The contractor shall include the loads that the doors and windows transfer to the building frame in the design. All openings shall be framed all around and shall be designed to structurally replace the covering and framing displaced. The subpurlin and/or purlin spacing shall not exceed 30 inches on centers at the corner, edge and ridge zones, and 5 foot maximum on centers for the remainder of the roof. Provide solid blocking between roof purlins.
- K. Except as otherwise specified, steel roofing and siding shall be designed in accordance with AISI Cold-Formed design manual. Maximum deflection for wall and roof panels under applied live load, snow or wind loads shall not exceed 1/180th of the span length. The design analysis shall establish that the roof, when deflected under loading combinations, shall not result in ponding. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. The calculated deflection from the concentrated load shall not exceed 1/180 of the span length. The methods for resisting lateral loads shall be cross-bracing, rigid frames, or wind columns.

## 1.7 DESIGN ANALYSIS

- A. The design analysis shall be done by a registered Professional Engineer, registered in the Commonwealth of Massachusetts, experienced in design of this work and shall include complete calculations for the building, its components, and the foundations. Foundations shown on the drawings are based on loads derived from a representative set of similar building types. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross-referencing shall be clear. Wind forces on

various parts of the structure, both positive and negative pressure, shall be calculated with the controlling pressure summarized. Lateral forces due to seismic loading shall be calculated and tabulated for the various parts and portions of the building. Computer programmed designs shall be accompanied by stress values and a letter of certification, signed by a Professional Structural Engineer registered in the Commonwealth of Massachusetts, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design. A narrative of the computer program delineating the basic methodology shall be included. Computer program output shall be annotated and supplemented with sketches to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer, who shall function as a point of contact to answer questions during the detail drawing review.

- B. Submit design calculations, including reactions to foundation to the Engineer for review and use.

## 1.8 WARRANTIES

- A. Material Warranty: Manufacturers standard form in which manufacturer agrees to repair or replace metal building system wall and roof panels that fail in workmanship or materials within specified warranty period. Failures include, but are not limited to:
  - 1. Structural failures including rupture, buckling or perforation.
  - 2. Weathertightness failures including roof leaks or wall drafts.
  - 3. Deterioration of metals, finishes and other materials beyond normal weathering and use, including rusting.
- B. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
- C. Period of Warranties: Twenty (20) years from date of Substantial Completion.

## 1.9 PRODUCT HANDLING

- A. Deliver components, sheets, panels and other items undamaged, undeformed and in all conditions fully suited for use in construction of the metal building system.
- B. Unload, store and erect roof and wall panels to prevent bending, warping, twisting and any surface damage.
- C. Stack delivered materials on platforms or pallets, covered with tarpaulins or other suitable weathertight, ventilated covering.

- D. Store roof and wall panels to ensure dryness; do not store panels in contact with other materials that might cause staining, denting or other surface damage.

#### 1.10 COORDINATION

- A. Coordinate location, number, size and placement of anchor bolts with concrete work.
- B. Coordinate metal building system work with the work of all trades affected by metal building system erection, panel installation and other related work.
- C. A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing/metal building system manufacturer, the roofing/metal building supplier, the erector, the designer, and the Owner's Representative. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

### PART 2 - PRODUCTS

#### 2.1 FRAMING

- A. Each piece or part of the assembly shall be clearly and legibly marked to correspond with the drawings.
- B. Hot-rolled Shapes: W-shapes shall conform to ASTM A992 (50 ksi minimum yield strength); channels shall conform to either ASTM A36 or ASTM A572 grade 50; other steel shapes shall conform to ASTM A36.
- C. Steel Plate, Bar or Strip: ASTM A572, 50 ksi minimum yield strength.
- D. Welding electrodes shall comply with AWS requirements, with a tensile strength level of 70 ksi.
- E. Anchor bolts shall be of sizes required by certified design, threaded, headed and made of ASTM F1554 Grade 36 steel.
- F. Bolts shall be ASTM A325 Type I, heavy-hex.
- G. Nuts shall be ASTM A563, heavy-hex.
- H. Washers shall be ASTM F436, hardened steel.
- I. Plate washers shall be ASTM A36.
- J. Tension-control bolts assemblies shall be ASTM F1852 Type I, heavy-hex.

K. Direct tension indicators shall be ASTM F959, Type 325, compressible washer type.

L. Threaded rods shall be ASTM A36.

## 2.2 INSULATED ROOF PANELS AND SUPPORTS

### A. Roof Construction:

1. UL construction (uplift) rating of not less than Class I-90 required.
2. Single panel from eave to ridge.
3. Deflection of roof panel shall not exceed 1/180 of its span when supporting applicable design loads.

### B. Standing Seam Roof Panels:

1. Exterior Facing: 22 gauge AZ-50 aluminum-zinc coated steel, 2 in. high lap lock or batten clip standing seam, with 1/8 in. nominal depth wave pattern, non-directional embossed, between seams.
2. Insulation: Foamed-in-place, non-CFC, zero ozone-depleting polyurethane, Factory Mutual Class 1 approval.
3. Interior Facing: 22 gauge AZ-50 aluminum-zinc coated steel, flat surface, with 1/16 in. nominal depth wave pattern, non-directional embossed.
4. Panel Width: 36 in. minimum.
5. Panel Length: As required for single panel coverage from eave to ridge
6. Panel Thickness: 5 in. minimum, with max. U-Factor of 0.027.
7. Finishes:
  - i. Exterior: Kynar 500/Hylar 5000.
  - ii. Interior: Silicone polyester.
8. Colors (including metal trim): As selected by Engineer from Basis-of-Design manufacturer's (Metl-Span) full range of 26 Standard Exterior and Premium I Exterior colors.

### C. Fasteners and Accessories:

1. Provide roof jacks and roof curbs as required by the roof penetrations in accord with metal building system manufacturer's design and construction standards for compatibility with standing seam roof, including visual appearance and weathertightness.

2. Concealed stainless steel or aluminum fasteners and/or clips with thermal break.
3. Metal flashing, closure panels and accessories to match panels in materials and finishes.

D. Acceptable Products:

1. Basis-of-Design: CFR Roof Panel, by Metl-Span, LLC, Lewisville, Texas.
2. Standing Seam (SR2) Roof Panel, by Nucor Building Systems.
3. Isoleren RL Roof Panel, by ATAS International, Inc.
4. Or approved equal.

## 2.3 INSULATED WALL PANELS AND SUPPORTS

A. Wall Construction:

1. Deflection of single wall panel shall not exceed 1/180 of its span when supporting applicable design loads.

B. Wall Panels:

1. Exterior Facing: 22 gauge AZ-50 aluminum-zinc coated steel, architectural surface, with 1" wide by nominal 3/8" deep reveals at approx. 8.4" on center, non-directional embossed.
2. Insulation: Foamed-in-place, non-CFC, zero ozone-depleting polyurethane, Factory Mutual Class 1 approval.
3. Interior Facing: 22 gauge AZ-50 aluminum-zinc coated steel, flat surface, with 1/16 in. nominal depth wave pattern, non-directional embossed.
4. Panel Width: 36 in. minimum.
5. Panel Thickness: 4 in. minimum, with max. U-Factor of 0.032.
6. Finishes:
  - i. Exterior: Kynar 500/Hylar 5000.
  - ii. Interior: Silicone polyester.
7. Colors (including metal trim): As selected by Engineer from Basis-of-Design manufacturer's (Metl-Span) full range of 26 Standard Exterior and Premium I Exterior colors.

C. Fasteners and Accessories:

1. Provide all trim, wall opening subframes and fastenings required to complete a finished, weathertight metal building.
2. Stainless steel fasteners and/or clips; fastening of wall panels to framing to be done with interlocking ribs toward the interior, eliminating fasteners exposed to exterior.
3. Metal flashing, closure panels and trim to match panels in materials and finishes.

D. Acceptable Products:

1. Basis-of-Design: CF Flute Wall Panel, by Metl-Span, LLC, Lewisville, Texas.
2. Isoleren SL Wall Panel, by ATAS International, Inc.
3. ShadowLine Wall Panel, by Green Span Profiles.
4. Or approved equal.

## 2.4 RAIL-TYPE SNOW GUARDS

A. Seam-Mounted, Rail-Type Snow Guards:

1. Basis-of-Design: Alpine SnowGuards (a division of Vermont Slate & Copper Services), Model ASG4025; or a comparable product by one of the following:
2. Rocky Mountain Snow Guards, Inc.
3. Sno Gem, Inc.

B. Description:

1. Units fabricated from metal baseplate anchored to fixed bracket and equipped with two bars.
2. Finish: Powder coat in custom color to match standing seam metal roof panels.
3. Bracket: 6000 Series aluminum.
4. Base Plate: 11 gauge, Type 304 stainless steel with two 5/16-inch Type 304 stainless steel machine screws welded into countersinks.
5. Tubing: 6000 Series extruded aluminum, 1 inch outside diameter and 0.120-inch wall thickness.

6. Couplings: 6000 Series aluminum; internal and concealed couplings 3 inches long.
7. End Caps: Type 304 stainless steel.
8. End Collars: 6000 Series aluminum.
9. Ice Flags: 6000 Series aluminum, 3 inches wide by length required.

## 2.5 STRUCTURAL STEEL PRIMER

- A. All uncoated structural steel shall be given one (1) shop coat of rust-inhibitive (primer) paint; surface preparation shall conform to SP-6, commercial blast, unless otherwise required.

## 2.6 SEALANT

- A. Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubber like consistency.

## 2.7 GASKETS AND INSULATING COMPOUNDS

- A. Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

## PART 3 - EXECUTION

### 3.1 ERECTION

#### A. General:

1. Erect metal building system in strict accord with manufacturer's written instruction and erection drawings.
2. Set structural framing in location and to elevations indicated and in accord with AISC specifications referenced above; maintain structural stability of frame during erection.
3. Do not field cut, drill or alter structural members without written approval from metal building system manufacturer's Mass. registered structural engineer.
4. Erect framing true to line, level, plumb, rigid and secure.

#### B. Leveling Plates, Baseplates and Bearing Plates:



1. Clean bearing surfaces of bond-reducing materials and roughen surfaces before setting baseplates and bearing plates; clean bottom surface of baseplates and bearing plates.
  2. Set baseplates and bearing plates for structural members on wedges, shims or setting nuts.
  3. Level baseplates to a true even plane with full bearing to supporting structures; set baseplates with double-nutted bolts.
  4. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; if protruding, cut-off flush with edge of baseplate or bearing plate before packing with grout.
  5. Pack grout solidly between bearing surface and plates so no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. Comply with manufacturer's written instructions for grout materials.
  6. Moist cure grout for not less than seven days after placement.
- C. Align and adjust framing members before permanently fastening; before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignments.
1. Level and plumb individual members of structure.
  2. Establish required leveling and plumbing measurement on mean operating temperature of structure; make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
  3. Make field connections using high-strength bolts; tighten bolts by turn-of-the-nut method.
- D. Secondary Framing:
1. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts; hold rigidly to straight line by sag rods.
  2. Provide rake and gable purlins with tight-fitting closure channels and fascias.
  3. Locate and space girts and purling to suit:
    - i. Openings for doors, louvers, windows, vents, curbs and any other wall or roof penetrations.
    - ii. Canopy projections.

4. Provide supplemental framing at entire perimeter of openings and penetrations of roof and walls.

E. Bracing:

1. Install bracing in roof and walls where shown on erection drawings and as otherwise required.
2. Tighten rod and cable bracing to avoid sag.
3. Locate interior end bay bracing only where indicated.

F. Framing for Openings:

1. Provide shapes of proper design and size to reinforce openings and to carry load and vibrations imposed for all equipment furnished under mechanical and electrical work or otherwise included in the project work.
2. Securely attach framing for openings to building structural frame.

G. Roof, Wall and Canopy Panels:

1. Securely fasten panels to structure and secondary framing in strict accord with manufacturer's written instructions.
2. Use concealed fasteners unless otherwise required by manufacturer's building and panel system.

H. Trim and Accessories: Securely fasten all trim and accessories to supporting structure or panels, as recommended by manufacturer.

### 3.2 CORRECTING, TOUCH-UP AND CLEANING

- A. Check all connections, materials and surfaces of completed metal building; correct any defects found, including but not limited to installing missing screws and fasteners, sealing openings, repairing dents, grinding uneven surfaces.
- B. Touch-up abrasions in primer on structural steel framing with coating compatible with, and matching in color and gloss, factory-applied primer.
- C. Touch-up minor abrasions in finishes on panels with air-dried coating compatible with, and matching in color and gloss, factory-applied finish coating.
- D. Replace any roof or wall panels that are dented, deeply scratched or otherwise not suitable for touch-up, as determined by the Engineer, with new panels at no additional cost to the Owner – no exceptions.

E. Clean all exposed surfaces of completed metal building system.

3.3 EXTRA MATERIALS

A. Provide six complete, full-width insulated metal wall panels. Panel length to match longest length provided for the project but not less than 30 feet. Provide a complete set of clips, anchors, and fasteners as may be required to install extra wall panels.

3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 13120

## SECTION 13200

### PROGRAMMABLE LOGIC CONTROLLERS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Provide Programmable logic controllers (PLCs) and operator interface terminals in accordance with this Section.
2. This specification has been developed to establish minimum requirements for a solid-state PLC designed to provide high reliability in industrial applications. All controllers provided under this Contract shall meet the requirements of this Specification. All controllers are to be of the same manufacturer.
3. The internal wiring of each controller is to be fixed, with the logic functions each must perform in a given application to be programmed into its memory. Each controller shall be supplied with the central processing unit (CPU), input/output scanner, inputs, outputs, memory, power supply, and all power and interface cables necessary to function as a complete and operable programmable controller system.
4. The Integrator shall use the equipment, instrument, and loop numbering scheme that has been developed and shown on the Drawings in the development of all submittals.
5. The Integrator shall coordinate with equipment manufacturers (provided under other Specifications Divisions) prior to programming to review equipment operations, functions, interlocks, and ancillary requirements to provide a complete, functional controls system.
6. Furnishing of all labor, equipment, appliances, and materials, and in performing all operations in connection with furnishing, installation, testing, and training of a programmable controller system complete and in place, in accordance with the Contract Drawings and Specifications.
7. The Integrator shall coordinate with the Application Engineer.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements

2. Division 1 – General Requirements
3. Division 11 – Equipment
4. Division 13 – Special Construction
5. Division 15 – Mechanical
6. Division 16 – Electrical

C. Work not included:

1. Programming and configuration of Programmable Logic Controllers and Operator Interface Terminals (OITs).
2. Electrical conduit relays, raceways, starters, motor control centers, etc., required for operation, control, and monitoring of equipment shall be furnished and installed under Division 16 of these specifications.
3. The exterior power connections to all electrical devices furnished under this Section shall be performed under Division 16.
4. PLC programming; PLC I/O addressing; testing of PLC logic and computer based control system SCADA; OIT programming including graphics development; OIT software configuration; database development; and report development activities associated with the software portions of the SCADA and PLC systems shall be provided by the Application Engineer.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300- Submittals.
- B. Closeout and Maintenance Material Submittals: per Division 1 General Requirements.
- C. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.
- E. Submit Manufacturer's programming manuals.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Division 01 General Requirements, Section 01400 – Quality Assurance and as specified.

- B. Provide PLCs and OITs supplied from manufacturers regularly engaged in the production of such products, shall be standard products wherever possible, and shall be of the manufacturer's latest design.
- C. All PLC system components shall be new, free from defects, and produced by manufacturers regularly engaged in the manufacture of these products.
- D. Only communication modules for communication or network media functions that are not provided by the PLC manufacturer may be produced by third-party sources.
- E. Only PLC manufacturer-approved hardware, including cables, mounting hardware, connectors, enclosures, racks, communication cables, splitters, terminators and taps, may be used.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 1 General Requirements.

B. Acceptance at Site

1. Check equipment, instruments, and materials for damage or defects within 7 days of delivery. Repair or replace to satisfaction of Engineer.
2. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment.
3. Each package shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.
4. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his own expense.

#### 1.6 COORDINATION

A. Coordination, Sequencing, and Scheduling: in accordance with Section 13320 Instrumentation and Controls.

### PART 2 – PRODUCTS

#### 2.1 PROGRAMMABLE LOGIC CONTROLLERS

D. Manufacturers

1. The Town of Sharon has standardized their PLC system on Allen-Bradley CompactLogix™ 5380 Programmable Logic Controllers (**No substitutions shall be allowed**).
- E. PLC hardware and programming software: by same manufacturer.
  - F. House PLCs in new or existing control panel as specified in Section 13420 Control System Equipment Panels and Racks. Provide 120VAC, 60 Hz, single phase power to control panel.
  - G. Minimum PLC input/output (I/O) requirements as indicated on Drawings. Provide additional 25 percent active spare I/O wired to terminal blocks; relay outputs, wired to interposing relays.
  - H. Provide PLC rack or mounting space to accommodate additional 25 percent minimum spare slots for future expansion.
  - I. Provide microprocessor-based PLC devices with power supplies, processors, process input and output modules, communication cards and chassis, mounted in control panel.
  - J. Size power supplies to accommodate analog signals, including spares, and card's entire I/O capacity.
  - K. Provide PLC capable of stand-alone operation in the event of SCADA network or SCADA computer failure.
  - L. The PLC shall be capable of performing the following basic math functions:
    1. Addition
    2. Subtraction
    3. Multiplication
    4. Division
    5. Square root
  - M. The PLC shall be capable of performing PID algorithms and control processes utilizing the PID output.
  - N. Provide UL listed PLC system using modular, field expandable design.
  - O. Module design shall prohibit upside down insertion or connection of modules and be compatible with processor type specified.
  - P. Operate programmable controller hardware at ambient temperature of 32-140 degrees F.  
F. Ambient temperature rating for storage: minus 40-185 degrees F.

- Q. Provide PLC hardware to function continuously in relative humidity range of 5 to 95%, non-condensing.
- R. Provide PLC system designed and tested to operate in the high electrical noise environment of an industrial plant.
- S. Module-expandable PLCs and associated modules shall meet the following acceptable level of quality:
  - A. Processor: Allen Bradley CompactLogix 5380 L3 series, 5069 L306ER.
  - B. Discrete input modules: Allen Bradley 5069-IQ16.
  - C. Discrete output modules: Allen Bradley 5069-OW16.
  - D. Analog input modules: Allen Bradley 5069-IF8.
  - E. Analog output modules: Allen Bradley 5069-OF8.
  - F. Memory module: Allen Bradley 1784-SD1.
- T. Chassis-based PLCs and associated modules shall meet the following acceptable level of quality:
  - A. Processor: Allen Bradley ControlLogix 1756-L81E series.
  - B. Discrete input modules: Allen Bradley 1756-IQ16 or 1756-IQ32.
  - C. Discrete output modules: Allen Bradley 1756-OW16.
  - D. Analog input modules: Allen Bradley 1756-IF8 or 1756-IF16.
  - E. Analog output modules: Allen Bradley 1756-OF8.

## 2.2 OPERATOR INTERFACE TERMINALS

- A. House OITs in new or existing control panel as specified in Section 13420 Control System Equipment Panels and Racks.
- B. Operator interface terminal: color graphic display connecting directly to PLC communication port or a communication module, allowing viewing and changing of PLC parameters, rated NEMA 4/4X, powered by 24VDC with integrated real time clock and battery backup.
- C. The OIT shall have a minimum resolution of 800 x 600 VGA (10.4 inch) and 1024 x 768 XGA (15 inch) with 18-bit color graphics.
- D. Provide OIT with 80MB internal project memory with compact flash port. Provide one (1) GB SD flash card for each operator terminal.



- E. Provide OIT with ability to display a selectable screen based on specific alarm bits.
- F. Provide OIT with ability to communicate to more than one PLC.
- G. Provide all communication modules and cables for OIT - PLC communications. PLC interface: Ethernet/IP.
- H. Provide and coordinate communications protocol drivers to establish reliable communications between PLC and OIT.
- I. Furnish licensed copy of OIT software to be installed by the Engineer.
- J. OITs shall be Allen-Bradley PanelView Plus 7 Performance 10.4-inch or 15-inch Color active matrix TFT Touch Panel as shown on the Drawings, or approved equivalent.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Programmable controller shall be installed per manufacturer's recommendations.
- B. Programmable controllers shall be located within the MCP. The PLC, processor racks and power supplies shall be grounded to meet the manufacturer's specifications and installation recommendations.
- C. All field wiring shall terminate at terminal blocks within the PLC enclosure.
- D. All terminals and wires shall be uniquely numbered and labeled for easy identification. Numbers shall match those identified in wiring diagrams.
- E. All panel construction shall meet the requirements of Section 13420- Control System Equipment Panels and Racks.

#### 3.2 TESTING

- A. All testing shall be completed in accordance with Specification Section 13320 – Instrumentation and Controls.
- B. The Contractor shall perform onsite operability tests and system acceptance tests; and coordinate this work with the Application Engineer.

#### 3.3 TRAINING

- A. Provide eight (8) hours of training on PLC, power supply, and I/O module maintenance, replacement, and troubleshooting.

#### 3.4 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after

startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.

- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents
- C. Warranties: Submit a written warranty, executed by the manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 13200

## SECTION 13201

### DISINFECTION OF WATER SYSTEMS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0, and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 2 – Site Construction
  - 4. Division 11 – Equipment
  - 5. Division 13 – Special Construction

##### 1.3 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
  - 1. American Water Works Association (AWWA):
    - i. B300, Hypochlorites.
    - ii. B301, Liquid Chlorine.
    - iii. B302, Ammonium Sulfate.
    - iv. B303, Sodium Chlorite.
    - v. C651, Disinfecting Water Mains.
    - vi. C652, Disinfection of Water Storage Facilities.
    - vii. C653, Disinfection of Water Treatment Plants.
    - viii. C654, Disinfection of Wells.
  - 2. Standard Methods for the Examination of Water and Wastewater, as published by American Public Health Association, American Water Works Association, and the Water Environment Federation.

##### 1.4 SUBMITTALS

- A. Submit in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein.

B. Submittals:

1. Plan describing and illustrating conformance to appropriate AWWA standards and this Specification.
2. Procedure and plan for cleaning systems.
3. Procedures and plans for disinfection and testing.
4. Proposed locations within system where samples will be taken.
5. Type of disinfecting solution and method of preparation.
6. Certification that employees working with concentrated chlorine solutions or gas have received appropriate safety training.
7. Method of disposal for highly chlorinated disinfecting water.
8. Independent Test Agency: Certification that testing agency is qualified to perform chlorine concentration testing and bacteriological testing in accordance with AWWA standards, agency requirements, and this Specification.

1.5 QUALIFICATIONS

- A. Independent Testing Agency: Certified in the State of Massachusetts, with 10 years' experience in field of water sampling and testing. Agency shall use calibrated testing instruments and equipment, and documented standard procedures for performing specified testing.

PART 2 – PRODUCTS

2.1 WATER FOR DISINFECTION AND TESTING

- A. Clean, uncontaminated, and potable.
- B. The Contractor shall coordinate with the Owner before any public water is used. The Contractor will be responsible for all associated fees and charges for water use and compliance with conditions and/or restrictions associated with the use of public water from the Owner. Contractor shall convey in disinfected pipelines or containers to site.

2.2 CONTRACTOR'S EQUIPMENT

- A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
- B. Water used to fill pipeline may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connections as required by AWWA C651.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Conform to AWWA C651 for pipes and pipelines, C652 for tanks and reservoirs, C653 for water treatment plants and filters, and C654 for wells, except as modified in these Specifications.
- B. Disinfect the following items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
  - 1. Pumps:
    - i. Well Station 2 Raw Water Pumps (P-100A, P-100B)
    - ii. Well Station 3 Raw Water Pump (P-141)
    - iii. WTP Finished Water Pumps (P-700A, P-700B, P-700C)
    - iv. WTP Recycle Pumps (P-800A, P-800B)
    - v. WTP Sludge Pumps (P-801A, P-801B)
  - 2. Tanks:
    - i. Finished Water Wet Well
    - ii. Backwash Waste Tanks (3 compartments)
  - 3. Pressure Filters
  - 4. Wells:
    - i. Eight production wells at Well Station 2
    - ii. Well 3
  - 5. Pipelines: Disinfect new pipelines that connect to existing pipelines up to point of connection.
  - 6. Disinfect surfaces of materials that will contact finished water, both during and following construction, using one of the methods described in AWWA C652 and C653. Disinfect prior to contact with finished water. Take care to avoid recontamination following disinfection.
- C. Prior to application of disinfectants, clean pumps, tanks, filters, and pipelines of loosed and suspended materials.
- D. Allow freshwater and disinfectant solution to flow into pipe or vessel at a measured rate so chlorine-water solution is at specified strength. Do not place concentrated liquid commercial disinfectant in pipeline or other facilities to be disinfected before it is filled with water.

### 3.2 SEQUENCING AND SCHEDULING

- A. Commence initial disinfection after completion of following:

1. Completion and acceptance of internal painting of system(s).
2. Hydrostatic and pneumatic testing, pressure testing, functional and performance testing and acceptance of pipelines, pumping systems, structures, and equipment.
3. Disinfection of:
  - i. Pumps and associated system piping.
  - ii. Treatment plant basins and processes used to supply water to system.

### 3.3 PIPING AND PIPELINES

- A. Piping, valves, and those items contacting process water shall be disinfected as specified under AWWA Standards C651 – Disinfecting Water Mains, latest version. Refer to Section 02615 – Ductile Iron Pipe and Fittings.
  1. Before disinfecting, clean all foreign matter from pipe in accordance with AWWA C651.

### 3.4 WELLS

- A. Wells shall be disinfected as specified under AWWA Standards C654 – Disinfection of Wells, latest version.
  1. Contractor shall complete all requirements of AWWA Standard C654, Section 4.5 Chlorination of Well after permanent equipment is installed.
  2. Refer to Contract Drawings for additional requirements.

### 3.5 PUMPS

- A. Disinfecting Solutions: Minimum free chlorine concentration of 100 ppm.
- B. Application:
  1. Inject disinfecting solution into pump and associated piping and circulate for a minimum 3-hour period of time. At end of 3-hour period, solution shall have a strength of at least 50 ppm free chlorine.
  2. Operate valves and pump appurtenances during disinfection to ensure that disinfecting solution is dispersed into all parts of pump and lines.
  3. Disinfecting solution contained in pump has a residual free chlorine concentration less than 50 ppm after the 3-hour retention period, re-clean pump, reapply disinfecting solution, and retest until a satisfactory test result is obtained.
  4. After chlorination, flush water from pump until water through the unit chemically and bacteriologically equal to permanent source of supply.

### 3.6 TANKS AND RESERVOIRS

A. Cleaning:

1. Clean interior surfaces using water under pressure before sterilizing. Isolate tanks from system to prevent contaminating materials from entering the distribution system. Cleaning shall:
    - i. Remove all deposits of foreign nature.
    - ii. Remove all biological growths.
    - iii. Clean the slopes, walls, top, and bottom.
    - iv. Avoid damage to the structure.
    - v. Avoid pollution or oil deposits by workers and equipment.
  2. Dispose of water used in cleaning in accordance with applicable regulations before adding disinfecting solution to tanks.
- B. Disinfecting Procedure: In accordance with AWWA C652, unless herein modified. Parts of structures, such as ceilings or overflows that cannot be immersed, shall be spray or brush disinfected.

3.7 FILTERS

- A. Prior to disinfection, remove foreign material from filtration structures. Clean using fire hoses and tools suitable for adequate scrubbing and cleaning. Pump or drain scrub water from structures.
- B. Disinfection Procedure: In accordance with AWWA C653, unless herein modified.
- C. Disinfect the underdrain. Do not disinfect GreensandPlus™, Granular Activated Carbon, or Ion Exchange media.
- D. Clean other new facilities designed to hold or transport process water prior to disinfection of filter system including filter influent piping, and filter effluent piping.

3.8 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. Do not allow flow into a waterway without neutralizing disinfectant residual.
- B. See the appendix of AWWA C651 for acceptable neutralization methods.

3.9 TESTING

- A. Collection of Samples:
1. Coordinate activities to allow samples to be taken in accordance with this Specification and Contract Drawings.
  2. Provide valves at sampling points.
  3. Provide access to sampling points.

B. Test Equipment:

1. Clean containers and equipment used in sampling and make sure they are free of contamination.
2. Obtain sampling bottles with instructions for handling from an independent testing laboratory.

C. Chlorine Concentration Sampling and Analysis:

1. Collect and analyze samples in accordance with AWWA C651.
2. Sampling Frequency for Disinfecting Solution: 2 samples per hour.
3. Residual Free Chlorine Samples: 2 samples per hour.
4. Dechlorinated Disinfecting Wastewater Residual Samples: 1 sample.
5. Sampling Locations: As required to meet this Specification and accepted by Engineer.
6. Analysis to be performed by an independent test laboratory. Samples will be analyzed using amperometric titration method for free chlorine as described in latest edition of Standard methods for Examination of Water and Wastewater.

D. After tanks, filters, pumps, and pipelines have been cleaned, disinfected, and refilled with potable water, an independent laboratory will take water samples and have them analyzed for conformance to bacterial limitations for public drinking water supplies.

1. Samples shall be collected in accordance with applicable AWWA Standard.
2. Samples shall be analyzed for coliform concentrations in accordance with latest edition of Standard Methods for the Examination of Water and Wastewater.
3. A minimum of two samples on each of 2 consecutive days from each separable structure and every 1,000 feet of pipeline shall be obtained and analyzed by standard procedures outlined by state and local regulatory agencies.
4. Sampling points shall be representative and accepted by Engineer.

E. If minimum samples required above are bacterially positive, disinfecting procedures and bacteriological testing shall be repeated until bacterial limits are met.

### 3.10 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 13201



## SECTION 13215

### CHEMICAL STORAGE TANKS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0, and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this section of the Specifications includes the following:
  - 1. The Contractor shall furnish all labor, materials, equipment, and incidentals required to install, field test, certify, complete, and make ready for service chemical storage tanks as shown on the Contract Drawings as specified herein.
- B. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 11 – Equipment
  - 4. Division 13 – Special Construction

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections and as specified herein:
  - 1. The Contractor shall submit shop drawings to the Engineer showing details of construction and erection for each tank as follows:
    - i. Dimensions of tank, fittings and attachments, with bolt and gasket material.
    - ii. Wall thicknesses.
    - iii. Wall thickness calculations for each tank (bulk tanks and day tanks over 50 gallons only).
    - iv. Locations of fittings and attachments and size of manway and instrument openings.
    - v. Resin used.
    - vi. Weight of tank and any auxiliary equipment.
    - vii. Installation list of tanks with similar applications.
    - viii. Instructions for handling, storage, and installation of tanks.
    - ix. Statement that the high density cross-linked PE tanks are designed and manufactured in accordance with ASTM Designation D1998, Type I.

- x. Corrosion data for all materials in contact with the chemicals.
  - xi. Certificate of Compliance from the tank manufacturer for each tank stating:
    - a. All dome fittings and manway covers are vapor tight.
    - b. All fittings and appurtenances have been installed by the tank manufacturer.
    - c. H2O tests have been performed by the manufacturer and all fittings were installed prior to H2O tests.
    - d. The tank materials of construction are suitable for the intended chemical storage application.
- B. Operating and Maintenance Manuals: Equipment manuals shall be supplied with all tanks and shall give detailed, descriptive instruction on external piping procedures, accessory installation and use, and general tank use guidelines. Tank Installation and Use Instructions booklet shall be supplied. Refer to Section 01730 – Operation and Maintenance Data for additional requirements.

#### 1.4 QUALITY ASSURANCE

- A. The materials and equipment covered in this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and these Specifications. The Specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- B. Provide in accordance with Section 01400 – Quality Assurance and as specified.
- C. Consideration shall be given to only those manufacturers regularly engaged in the successful design, manufacture, and installation of storage tanks of the size and character herein specified for a period of not less than ten (10) years in similar applications. These locations must be provided where the tank can be visibly inspected. All tanks and appurtenances shall be supplied by one tank manufacturer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling.

#### 1.6 COORDINATION

- A. Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.
- B. Provide an efficient, well-coordinated arrangement without conflict or sacrifice of design.

## 1.7 SYSTEM DESCRIPTION

- A. Potassium Hydroxide Bulk Storage Tank: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 45% potassium hydroxide. The HDXLPE tank shall be vertical, cylindrical, flat bottom, dome top. Bulk storage tank shall have a flanged outlet to achieve full drain. Tank shall be graduated for visual measurement of tank volume.
- B. Sodium Hypochlorite Bulk Storage Tank: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 12.5% sodium hypochlorite. The HDXLPE tank shall be vertical, cylindrical, flat bottom, dome top. Bulk storage tank shall have a flanged outlet to achieve full drain. Tank shall be graduated for visual measurement of tank volume. Tanks shall be molded with an oxidation resistant barrier with 4x the anti-oxidant.
- C. Sodium Bisulfite Bulk Storage Tank: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 38% sodium bisulfite. The HDXLPE tank shall be vertical, cylindrical, flat bottom, dome top. Bulk storage tank shall have a flanged outlet to achieve full drain. Tank shall be graduated for visual measurement of tank volume. Tank shall be molded with an oxidation resistant barrier with 4x the anti-oxidant.
- D. Potassium Hydroxide Day Tanks: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 45% potassium hydroxide. The tanks shall be flat bottom, cylindrical with a tight fitting cover. A threaded inspection hatch shall be provided on the cover. Tank shall be graduated for visual measurement of tank volume.
- E. Sodium Hypochlorite Day Tanks: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 6.25% sodium hypochlorite. The tanks shall be flat bottom, cylindrical with a tight fitting cover. A threaded inspection hatch shall be provided on the cover. Tank shall be graduated for visual measurement of tank volume.
- F. Sodium Bisulfite Day Tanks: High-density cross-linked polyethylene (HDXLPE) shall be used for storage of 38% sodium bisulfite. The tanks shall be flat bottom, cylindrical with a tight fitting cover. A threaded inspection hatch shall be provided on the cover. Tank shall be graduated for visual measurement of tank volume.
- G. Fluoride Saturator and Overflow Assembly: Rugged polyethylene (PE) shall be used for storage of 4% fluoride and backup overflow assembly. The tanks shall be open top, flat bottom, cylindrical tanks. The saturator shall have a tight fitting, hinged opening cover. The overflow tank shall have a tight fitting cover. Tanks shall be graduated for visual measurement of tank volume. The fluoride saturator and overflow system shall be provided with a disc water meter, 6 vane distributor assembly, cover mounted flow switch, remote mounted solenoid valve, control box, float shutoff valve, and siphon breaker. The fluoride saturator and overflow system shall be a 55 gallon Fluoro-HD Saturator with associated Overflow Assembly as manufactured by JP Plastics, Inc. or Engineer approved equal.

- H. Items under this Section include, but are not limited to, the following components and appurtenances: tanks, manways, ladders, fittings, supports, tank pads, tank stands, and associated appurtenances.

## PART 2 – PRODUCTS

### 2.1 EQUIPMENT SUPPLIER

- A. Storage Tank Manufacturer shall act as a single source for all components and shall accept entire system responsibility.
- B. The equipment covered by these specifications shall be standard equipment of proven ability as supplied by reputable suppliers having a long experience in the production of such equipment.
- C. Available Suppliers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
1. Bulk Storage Tanks:
    - i. Poly Processing Company (<http://www.polyprocessing.com/>)
    - ii. Assmann Corporation (<http://www.assmann-usa.com/>)
    - iii. Terracon Corporation (<http://www.terracontanks.com/>)
    - iv. or Engineer approved equal
  2. Day Tanks:
    - i. Poly Processing Company: (<http://www.polyprocessing.com/>)
    - ii. Chem-Tainer Industries (<http://www.chemtainer.com/>)
    - iii. LMI Milton Roy (<https://www.lmi-pumps.com/>)
    - iv. Northeast Fluid Control, Inc (<http://www.nefluid.com>)
    - v. or Engineer approved equal
  3. Fluoride Saturator and Overflow Assembly:
    - i. JP Plastics Inc. (<http://www.maltzsales.com/>)
    - ii. Northeast Pump and Instrument Co. (<http://www.npipump.com>)
    - iii. LMI Milton Roy (<https://www.lmi-pumps.com/>)
    - iv. or Engineer approved equal
  4. Note: The chemical tank drawings are based upon Poly Processing Company and JP Plastics, Inc tank designs. Any proposed “OR EQUAL” chemical storage tank suppliers work includes any necessary re-design, revised piping/equipment/wiring, etc., at no additional costs to the Owner.

### 2.2 DESCRIPTION OF EQUIPMENT

- A. The Manufacturer shall be responsible for design and supply of tank supports and anchors, additional requirements described herein.

B. All tanks shall be provided with labels per MassDEP requirements.

C. Chemical storage tank schedule:

CHEMICAL STORAGE TANK SCHEDULE

<i>Equipment Description</i>	<i>Tag</i>	<i>Chemical Specific Gravity</i>	<i>Capacity (gal)</i>	<i>Dimensions *</i>	<i>Material</i>
Potassium Hydroxide Bulk Storage Tank	BT-500	1.30	3,000	7'-1" dia. 11'-11 3/4" height	HDXLPE
Sodium Hypochlorite Bulk Storage Tank	BT-400	1.20	905	64'-0" dia. 66'-0" height	HDXLPE
Sodium Bisulfite Bulk Storage Tank	BT-600	1.30-1.37	1,150	5'-4" dia. 8'-6" height	HDXLPE
Potassium Hydroxide Day Tank	DT-501	1.30	230	3'-2" dia. 4'-10 3/4" height	HDXLPE
Sodium Hypochlorite Day Tank (Pre-Filtration)	DT-401	1.20	70	1'-11" dia. 4'-1" height	HDXLPE
Sodium Hypochlorite Day Tank (Post-Filtration)	DT-402	1.20	30	1'-11" dia. 2'-1 1/4" height	HDXLPE
Sodium Bisulfite Day Tank	DT-601	1.30-1.37	30	1'-11" dia. 2'-1 1/4" height	HDXLPE
Fluoride Saturator	SAT-650		55		PE

\* Dimensions for reference only. Prior to submittal all dimensions shall be verified with available room, door, and building clearances.

2.3 BULK STORAGE TANKS

- A. Plastic: The tanks shall be molded from Grade I cross-linked polyethylene. The molding powder used shall be Paxon 7004, as manufactured by Exxon/Mobil Chemical, or powders of equal physical and chemical properties. The tank shall be suitable for each chemical application. Sodium hypochlorite bulk storage tank shall be molded with an oxidation resistant barrier with 4x the anti-oxidant.
- B. Fillers and Pigments: The plastic shall not contain any fillers. All plastic shall contain a long term U.V. stabilizer. Pigments may be added as desired by customer or as designated by tank manufacturer, not to exceed 0.5% of dry blended or 2 percent if melt compound of the total weight of the tank.

- C. The high density cross-linked polyethylene storage tanks shall be as manufactured in accordance with the definitions given in ASTM Designation D-1998 Type I. The tanks shall be manufactured by the rotational molding process.
- D. The minimum for the properties of the material shall be as follows, based on molded parts:

<b>Test Procedure</b>	<b>Units</b>	<b>Value</b>
Density /ASTM D-1505	g/cc	0.943-0.946
Tensile Strength at Yield/ASTM D-638	MPa (psi)	22.7 (3,290)
Elongation at Break (%)/ASTM D-638	%	> 640
Environmental Stress Crack Resistance/ASTM D-1693	hrs.	F <sub>0</sub> > 2,000
Impact Strength (-40 °C)/ARM	joules (ft-lb)	96 (71)
Heat Deflection Temperature, 66 psi/ ASTM D-648	°C (°F)	69 (157)

- E. The tanks shall be designed with a hoop stress value of no greater than 600 psi at 100 °F, with a safety factor of no less than two (2), using the Barlow Formula for calculating wall thickness. Wall thickness shall be designed for 1.90 Specific Gravity.
- F. All edges cut out for manway or other openings shall be trimmed to have smooth edges.
- G. The finished surface shall be as free as commercially practical from visual defects such as foreign inclusions, air bubbles, pinholes and craters.
- H. The tank diameter shall be measured externally (the reason for this variance in wall thickness to handle different weight materials). Tolerance on the outside diameter, including out of roundness, shall be +/- 1 percent. Measurement shall be taken in a vertical position. The knuckle radius at bottom to wall shall be a minimum of one (1) inch.
- I. At a minimum, the tank shall be rated for the specific gravity of the chemical intended for storage.
- J. Accessories:
1. Ladders:
    - i. Rigid ladders shall be provided on each bulk chemical tank as shown on the Contract Drawings.
    - ii. Ladders conform to the requirements of OSHA 29 CFR Part 1910.27, Fixed Ladder.

- iii. Ladder rungs to be nonskid fiberglass on one-foot centers and a minimum of two feet wide.
2. Refer to Contract Drawings for the location and sizes of fittings. Contractor and Manufacturer shall coordinate location and size of fittings with Engineer approved piping layouts. All tank fittings shall be shop installed prior to shipment.
3. Dome Fittings: All dome fittings shall be two-flanged Universal Ball Dome style. The flange attached to the tank wall shall be 150 Lb. ANSI and constructed of PVC. Bolts shall be chemically compatible. Each bolt shall have a ¼-inch EPDM gasket which is on the inside of the tank, and each flange shall have a ¼-inch EPDM gasket on the outside of the tank. All dome fittings shall be fume tight. All dome fittings shall have PVC flange adapters and be 150 Lb. ANSI. All pipe connections shall have a union fitting within one foot of the connection point.
4. Sidewall Overflows: All sidewall outlets shall be bolted flanged fittings. The flange attached to the tank wall shall be 150 Lb. ANSI and constructed of PVC. Bolts shall be chemically compatible. Each bolt shall have a ¼-inch EPDM gasket which is on the inside of the tank, and each flange shall have a ¼-inch EPDM gasket on the outside of the tank. All fittings shall be liquid tight. Overflow pipe shall provide for full volume of tank using interior overflow piping.
5. Flexible Connections/Expansion Joints: Flexible connections shall be provided for each lower sidewall fitting, as show on the Contract Drawings. Flex connections shall be true union PVC design with EPDM tube bellows and EPDM O-ring seals. Flex connections shall be designed to allow for expansion and contraction of tank without applying stress to the piping system. Joint shall be installed after the tank shut-off valve prior to the first pipe support.
6. Integrally Molded Flanged Outlet (IMFO): The bulk storage tank shall include an IMFO. The IMFO shall be located at the bottom of the sidewall and allow the tank to be fully drained. The IMFO shall be integrally molded into the tank during the molding process. The IMFO shall be seamless, flanged, and manufactured from the same material as the tank. Inserts are not acceptable. A PVC companion flange assembly with a split back-up ring, bolts, and gasket shall be provided.
7. Tank Pads: All bulk storage tanks shall be supplied with the associated IMFO tank pad or a custom tank pad with a footprint equivalent to the tank diameter. The pads shall be a minimum of 4” thick and shall be constructed of grade I high-density cross-linked polyethylene (HDXLPE) suitable for each chemical application.

## 2.4 DAY TANKS

- A. All day tanks shall be vertical, cylindrical, and flat bottom tanks. The tanks shall be molded from High Density Polyethylene and all tank materials shall be chemically compatible with the service. Tanks shall have a threaded inspection hatch.
- B. At a minimum, the tank shall be rated for the specific gravity of the chemical intended for storage.

### C. Accessories

1. Refer to Contract Drawings for the location and sizes of fittings. All piping connections to the tank shall have a union fitting within one foot of the connection point. Contractor and Manufacturer shall coordinate location and size of fittings with Engineer approved piping layouts.
2. Connections on the top of the tank shall be welded half couplings for fill, vent, level, and as required. Connections on the side and bottom tank shall be welded-gusseted flanged. Bolts shall be PVC. All fittings shall be liquid tight. Gussets shall extend to the outside edge of the ANSI flange and give full support to the pipe stub and flange.
3. Inspection Hatch: All chemical day tanks shall include a threaded inspection hatch.
4. All day tanks shall be provided with external, visible graduations.
5. All day tanks shall be provided with a freestanding polyethylene tank stand suitable of supporting the combined weight of the tank and chemical. Tank stands shall be provided with minimum of four (4) tie down tabs. Tank stands shall be provided by the tank manufacturer or shall be poured concrete. Day tank stands shall be 4-inches tall.

## 2.5 INSPECTION AND TEST PROCEDURES

- A. Test samples shall be taken from the manway cut out area or where fittings are inserted in each tank.
- B. Impact Test: Shall be performed (bulk tank only) in accordance with ASTM Designation D746.
  - 1/8" < test sample < 1/4" shall not shatter at  $-20^{\circ}\text{F}$  at 90 ft. lbs.
  - 1/4" < test sample < 1/2" shall not shatter at  $-20^{\circ}\text{F}$  at 100 ft. lbs.
  - 1/2" < test sample < 3/4" shall not shatter at  $-20^{\circ}\text{F}$  at 150 ft. lbs.
  - 3/4" < test sample shall not shatter at  $-20^{\circ}\text{F}$  at 200 ft. lbs.
- C. Degree of Cross-linking Test: ASTM Designation D2765 as modified by Phillips PTC Report 193 shall be used in this test. A minimum of 60 percent gel must be obtained.
- D. Hydrostatic Test: Each tank shall be filled with water and checked for leaks.
- E. Spark test the day tank connections.
- F. A certified certificate of compliance must be provided by the Manufacturer for impact tests, degree of cross-linking, hydrostatic tests, and spark tests prior to installation of the tanks.



## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. The Contractor shall furnish and install the tanks in accordance with the Contract Drawings and the manufacturer's instructions.
- B. The Contractor shall furnish and install the process piping in such a manner that allows the tank to expand and contract when filled and drained. Rigid piping must not be used. All piping must be supported.
- C. Upon successful completion of the field test, tanks and support members shall be anchored in their final position according to the Manufacturer's recommendations.

### 3.2 WARRANTY

- A. The complete system shall be warranted to be free from defects in material and workmanship under normal and proper use and service, for a period of one (1) year after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made under the requirements of the Contract Documents.
- C. Warranties: Submit a written warranty, executed by the Manufacturer of the equipment and the Contractor, agreeing to repair or replace components of the equipment that fail in materials or workmanship within the specified warranty period.

### 3.3 FIELD TESTING

- A. After installation, each tank shall be field tested by filling with water. The tank and fittings shall hold water without loss, evidence of weeping or capillary action for a period of 24 hours prior to acceptance. Dispose of water in accordance with requirements of the Contract Documents.
- B. Submit field test results and certification of successfully conducted field tests.
- C. All field testing to be witnessed by the Engineer in the field.

### 3.4 CLEANING

- A. After installation is complete and piping connections made, remove all debris from tank and piping systems.

### 3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION 13215

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## SECTION 13320

### INSTRUMENTATION AND CONTROLS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:
  - 1. It is the intent and requirement of this project to have an instrumentation and control system integrator/supplier (ICSI/S or Integrator) responsible to the Contractor and an instrumentation and control system integrator (Application Engineer) responsible to the Town of Sharon (Owner) and Engineer.
  - 2. The Integrator shall complete all the work covered under this Section of the Specifications, including: furnishing all plant, labor, equipment, instruments, devices, appliances, hardware, software, accessories, incidentals and materials, and in performing all operations in connection with the furnishing, installation, calibration, testing, certification, and training of all instruments, equipment, devices associated with the process instrumentation and control systems, complete in place, in accordance with the Specifications and Drawings.
  - 3. Integrator responsibilities: The Integrator shall be responsible to the Contractor for satisfactory design detail of a complete coordinated system; and calibration services.
  - 4. Application Engineer responsibilities: The Application Engineer shall be responsible to the Owner and Engineer for integration with the Owner's existing drinking water system facilities; SCADA and PLC programming; start-up; testing; ongoing operation of the Owner's existing drinking water facilities; training; and on-site quality assurance.
  - 5. All work provided by the Integrator shall be done in harmony with the Contractor, Contractor's sub-contractors, Engineer, Owner, Application Engineer, and Owner's existing SCADA system.
  - 6. The Owner's existing SCADA system may not be interrupted under any circumstances – NO EXCEPTIONS.

7. All work shall be done in accordance with the National Electric Code, National Electric Safety Code, Occupational Safety and Health Administration, Underwriters Laboratories, Inc., International Society of Measurement and Control, National Electric Manufacturers Association, and all other state and local codes.

B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Division 11 – Equipment
4. Division 13 – Special Construction
5. Division 15 – Mechanical
6. Division 16 – Electrical

C. Work included:

1. The Contractor shall be responsible for the following:
  - i. Providing the services of an instrumentation and control system integrator/supplier (ICSI/S or Integrator) who shall furnish and install all of the equipment, instruments, devices, and materials described and specified in this Section.
  - ii. Furnishing a complete and fully operational system. The Drawings and Specifications are intended to include all details of a complete equipment installation, but do not purport to cover all details entered into the design of the complete system. The Contractor shall be responsible for all details which may be necessary to properly install, adjust, and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations or substitutions from the specifications and all requirements necessary to integrate the new systems with the Owner's existing system. An inspection of the Owner's existing SCADA and I&C systems is strongly encouraged during the bid phase.
  - iii. Installation of all mechanical instrumentation furnished under this Contract.
  - iv. The Contractor shall not furnish separate equipment and attempt to assemble a system. This work is to be performed by a qualified control systems company as approved by the Engineer.
2. The Integrator shall be responsible for the following:
  - i. Well Stations 2, 3, and 4  
Furnishing and installing all appurtenant materials, including specialty cables, connectors, tubing, and necessary mounting and accessory equipment

to provide a complete operating system. All equipment shall be furnished as indicated on the Contract Drawings and specified herein, or as required to ensure proper system functioning;

Furnishing all panels and panel components specified herein and in Division 13 specifications. Prefabrication of all panel assemblies;

Integration of all equipment and instrumentation meant for SCADA control and monitoring as specified under this Contract;

Connection of fiber cables to the network switch at Well Station 4;

Integration of the new fiber telemetry and existing radio telemetry at Well Station 4;

Integration of existing radio telemetry at Well Stations 2 and 3;

All selective demolition and salvage work as shown in the Contract Drawings; and

Coordination with the Application Engineer for programming and control.

ii. Wells 2, 3, and 4 Water Treatment Plant

Furnishing and installing all appurtenant materials, including specialty cables, connectors, tubing, and necessary mounting and accessory equipment to provide a complete operating system. All equipment shall be furnished as indicated on the Drawings and specified herein, or as required to ensure proper system functioning;

Furnish all panels and panel components specified herein and in Division 13 specifications. Prefabrication of all panel assemblies;

Integration of all equipment and instrumentation meant for SCADA control and monitoring as specified under this Contract;

Connection of fiber cables to the network switch;

Integration of the new fiber telemetry and existing radio telemetry;

Coordination with the Application Engineer for programming and control; and

Coordination with the Iron and Manganese Filter Manufacturer for the filtration system controls.

iii. Remote Site Radios

Furnish 14 radios, lightning protection, and appurtenances to the Owner for installation by the Application Engineer at the Town's water system facilities.

- iv. The Integrator shall be available for consultation and provide direction during mechanical installation of instrumentation furnished under this Contract and during installation of conduit, raceways, power supplies, wiring, and terminations associated with instrumentation furnished under this Contract but installed by others.

D. Work not included:

1. Integration with the Owner's existing drinking water system facilities; programming; ongoing operation of the Owner's existing drinking water facilities shall be covered under the Application Engineer's scope of work.
2. Installation of radio modems and lightning protection devices at each of the Owner's existing water system facilities shall be covered under the Application Engineer's scope of work.
3. Installation of process equipment, pumps, piping, valves, fittings, and appurtenances shall be covered under Division 11.
4. Providing control panels to be provided under Division 11.
5. Electrical conduit, wiring, raceways, relays, starters, motor control centers, and variable speed drives, etc., required for operation of the equipment shall be furnished and installed by the Electrical Contractor under Division 16 of these specifications.
6. Power connections for all electrical devices and panels furnished under this Section, including connections or disconnections to power supplies, shall be furnished and installed by the Electrical Contractor under Division 16. Electrical terminations of signal wiring from applicable field devices/equipment furnished under Division 11, Division 13, Division 15, and Division 16 within the cabinets furnished and installed in this Section shall be made by the Electrical Contractor as directed by the Integrator. Fiber connections for all fiber-Ethernet network switches provided under this Section shall be furnished and installed by the Electrical Contractor under Division 16 as directed by the Integrator.

### 1.3 REFERENCE STANDARDS

- A. Publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for a reference standard, the latest edition in effect at the time of bidding shall apply.
- B. American Petroleum Institute (API)
- C. International Society of Measurement and Control (formerly Instrument Society of America)
  1. ISA S5.4, Instrument Loop Diagrams

2. ISA S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
  3. ISA RP60.3, Human Engineering for Control Centers
  4. ISA RP60.6, Nameplates, Labels, and Tags for Control Centers
- D. National Electric Manufactures Association (NEMA)
- E. National Fire Protection Agency (NFPA)
- F. Underwriters Laboratories, Inc. (UL)
- G. American Society for Testing and Materials (ASTM)

#### 1.4 QUALIFICATIONS OF INSTRUMENTATION & CONTROL SYSTEM INTEGRATOR

- A. The evaluation of qualifications of each Instrumentation and Control System Integrator will be in accordance with the following requirements, as determined by the Engineer:
1. Responsiveness to each of the specific requirements, both technical and contractual.
  2. Documentation that demonstrates the Instrumentation and Control System Integrator is both financially and technically capable of providing and implementing the instrumentation and control system, as specified.
  3. The Instrumentation and Control System Integrator shall have a staffed field service department with full-time service technicians. Service technicians shall be in the direct employ of the Instrumentation and Control System Integrator, not a sub-contractor, capable of performing detailed engineering, coordination, drafting, procurement, scheduling, inspection, programming, calibration, and testing of equipment supplied. Qualification summaries and resumes of staff shall be submitted upon request.
  4. The Instrumentation and Control System Integrator shall provide a list of at least seven (7) currently operating installations that use communications, and control systems similar to the one specified for this project.
  5. The Instrumentation and Control System Integrator shall provide documentation that they have built and placed into service at least 5 systems of similar scope within the past 60 months.
  6. The final decision regarding the acceptance of the qualifications for the Instrumentation and Control System Integrator shall be that of the Engineer. Therefore, it is imperative that the Bidder understand the Contractor qualifications for the Instrumentation and Control System Integrator set forth herein, prior to submitting a Bid for this project.

7. The following Instrumentation and Control System Integrators have been pre-qualified for this project:
  - i. R. E. Erickson, Co., Inc.  
591-A Providence Highway  
Walpole, MA 02081  
508-668-9330
  - ii. Elm Electrical, Inc.  
68 Union Street  
Westfield, MA 01085  
413-562-0905
  - iii. Harbor Controls Inc.  
85 Commerce Park Rd  
North Kingstown, RI, 02852  
401-667-0930

## 1.5 SUBMITTALS

A. The Integrator shall submit the following in accordance with Section 01300.

1. Qualifications Submittal: Within 15 days of the Contract Award the Contractor shall submit detailed information associated with the Integrator to be subcontracted for the project. The information shall include project references from five (5) water/wastewater projects of similar complexity (including contact information for prior projects, resumes of staff to be participating in this project, and location of staff responsible for responding to the site within four hours to resolve start-up issues). The project descriptions and references shall include an approximate value of the project and contact information (Engineer and Owner). The information shall clearly demonstrate compliance with paragraph 1.4 of this Section. The Qualifications submittal shall be submitted to the Engineer, reviewed, and approved before any further Instrumentation, Control, or SCADA system submittals will be accepted by the Engineer. Failure to meet the minimum requirements of this Section shall be grounds for rejection as an acceptable Integrator. If the Contractor's proposed Integrator is rejected, a new Integrator shall be proposed by the Contract until the Integrator is deemed to be qualified by the Engineer.
2. Project Plan and Schedule: a Project Plan and Schedule submittal shall be submitted within 60 calendar days of the Contract Award. This submittal must be reviewed and approved by the Engineer before any further Instrumentation, Control, or SCADA system submittals will be accepted by the Engineer, and shall, as a minimum, contain the following:
  - i. Overview of the proposed system.
  - ii. A summary of conformance of the equipment supplied with the specifications and identification of any substitutions or deviations.



- iii. Summary of Integrators approach to the work, including integration with existing SCADA system.
  - iv. Plan and approach to installation, testing, calibrating, and training.
  - v. Implementation schedule that includes: equipment purchase, manufacturing, delivery, installation, testing, start-up, calibration, training, and certificate of installation.
  - vi. Project personnel and organization chart for each task to be completed: design, installation, testing, calibration, and training.
  - vii. Proposed list of submittals including specific contents of each submittal.
  - viii. Project milestones and anticipated meeting dates with Filter Manufacturer for filter programming.
3. Hardware, Panel Drawings, and Loop Drawings: the Integrator shall submit a single all-inclusive package as detailed herein. The submittal shall contain a job index sheet for all equipment, materials, and devices to be furnished, and a detailed table of contents for the submittal package. At a minimum, the submittal shall include the following.
- i. A complete system architecture diagram showing in schematic form, the interconnections between major hardware components including control centers, panels, power supplies, consoles, computer and peripheral devices, network equipment, PLCs, PLC I/O modules, OIT, and like equipment. The system architecture diagram shall be complete and shall depict all required cables, details on connection requirements, network modules, switches, communication modules, port numbers, and rack slot numbers. The intent of this submittal is for the Integrator to develop a diagram that is complete in every aspect to allow purchase of all required equipment by part number, and to allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature. The system architecture diagram shall be provided on 11 x 17 inch paper and may be shown on multiple sheets.
  - ii. Component specifications, manufacturer's descriptive literature, shop drawings, and ISA-S20 data sheets for all devices/equipment being furnished. The information shall clearly indicate all pertinent design data for the Engineer to evaluate conformance with the specifications. Devices shall reference the tagging convention used in the Design Documents.
  - iii. Submit certified calibration data for all flow metering devices.
  - iv. Submit UPS system sizing calculations listing all connected and anticipated loads, battery backup times, and spare capacity.
  - v. Component drawings showing dimensions, mounting and external connection details including external piping and/or wiring for all field and pipeline mounted equipment.
  - vi. Panel Drawings: Where panels are furnished, provide: bill of materials drawings listing each panel component; fabrication and nameplate legend drawings; internal wiring and piping schematic drawings clearly showing all equipment, terminal, and bulkhead numbers; conduit access locations; panel construction details; fabrication and painting specifications (including color); panel layout drawing showing the location of each

device/component; panel wiring diagram showing all signal and power connections. Wiring diagrams to show all wire sizes, numbers, wire colors, and terminal block numbers. The drawings shall be drawn to scale and detail all equipment in and on the panel.

Loop Drawings: The Integrator shall submit detailed loop diagrams for each analog and digital loop in compliance with ISA-S5.4 format. Loop drawings shall include the location of each device using a minimum of three areas (field, back of panel, front of panel), and shall show all intermediate wiring locations such as junction boxes or field termination panels. Drawings shall reflect actual wire numbers, terminal block numbers, and equipment/device tag IDs. Loop drawings shall be submitted on 11 x 17 inch paper folded to 8.5 x 11 inches.

4. Testing Plan: The Integrator shall submit a detailed testing plan describing the method and procedure for testing each loop. The procedure shall include checkoff/signoff sheets/forms for each component/device for: tag identification, installation, wiring, tubing, calibration, adjustments, and space for comments. The procedure shall include checkoff/signoff sheets/forms for each loop including panel interface terminations, I/O interface terminations, I/O signal operation, total loop operation, and space for comments. For each analog device, calibration and testing sheets shall be provided to document calibration and testing results including: scale ranges, functions, modes, interlocks, required and actual I/O signals at 25%, 50%, 75%, and 100%, and space for comments. After completion of the system installation and testing, submit a written certification that the system installation has been completed as specified, and to the satisfaction of the Integrator. The testing plan shall meet the requirements of Part 3 of this Section.
5. Training Plan: The Integrator shall submit an outline of the proposed training to be provided to the Owner's personnel. Training shall be directed to the different needs of various users of the system. At a minimum, training programs shall be developed for the following areas: basic hardware and equipment operation; system maintenance; system calibration; and basic troubleshooting. The training plan shall meet the requirements of Part 3 of this Section.
6. Final System Documentation: After approval of the system, submit six complete bound sets of final documentation manuals. The manuals shall be submitted in 3-ring binders, maximum size of 3-inches, with drawings reduced to 11 x 17 inch, then folded to 8.5 x 11 inch for inclusion. Each section shall be uniquely numbered and separated by a binder tab. At a minimum, the submittal shall contain the following:
  - i. Table of Contents
  - ii. An instrument and equipment list for all devices supplied including tag numbers, manufacturer's model number, range, span, set points, manufacturer, manufacturer's telephone number, local supplier name and telephone number.
  - iii. An ISA S20 data sheet for every type of device and equipment supplied.
  - iv. Detailed service, maintenance, and operation instructions for each

- device/instrument supplied.
- v. Complete as-built panel drawings, wiring diagrams, loop diagrams, and system architecture schematic.
- vi. The cover and edge of each volume shall contain the Owner's name, project name, Integrator name, date, volume number, and number of volumes.

## 1.6 QUALITY ASSURANCE

- A. The materials and equipment covered in this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. The control and monitoring system shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and these Specifications. The Specifications call attention to certain features but do not purport to cover all details entering into the design and installation of the Instrumentation and Control system. The Contractor shall be responsible for furnishing and installing any necessary peripheral devices required to achieve a fully functioning Instrumentation and Control system as described herein.

## 1.7 WARRANTY

- A. Contractor shall provide an equipment manufacturer's guarantee that the materials and/or workmanship of the equipment be free from defects for a period of one year from date of the Engineer's Letter of Substantial Completion.
- B. The Contractor shall provide, at the time of start-up, a letter certifying that the equipment has been installed properly, calibrated and is in working order suitable for operation.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Control, delivery, storage, and handling of equipment in accordance with Sections 01600 and 01610.

## 1.9 COORDINATION

- A. The Contractor's attention is directed to the fact that the instrumentation is an integrated system which shall be furnished by one supplier who shall provide all of the equipment and appurtenances regardless of manufacturer. Substitutions of functions specified will be unacceptable.
- B. The final I&C system shall be fully compatible and functional with existing and new systems.
- C. Coordination with Iron and Manganese Filter Manufacturer for the filtration system controls.
- D. Coordination with the Application Engineer for PLC and HMI programming and configuration.

## 1.10 OPERATION AND MAINTENANCE DATA

- A. Furnish Operations and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- B. Submit under provisions of this Section.
- C. Operation Data: Description of operating procedures.
- D. Maintenance Data: Description of servicing procedures; list of major components, recommended remedial and preventive maintenance procedures; and recommended spare parts list for each product furnished under this section.
- E. Manuals shall be published by the Manufacturer and shall be of the most recent publication date.
- F. Refer to Specification Section 01730 –Operations and Maintenance Data for additional requirements.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. All of the equipment shall be of the manufacturer's latest, most modern proven design and shall, as far as practical, be of one manufacturer. Overall system and component accuracy shall be as guaranteed by the specific manufacturer.
- B. All instrumentation and electronic equipment shall be UL approved and of the manufacturer's latest proven design, utilizing printed circuitry and epoxy coating (or equal) to prevent contamination by dust, moisture, and fungus. First generation equipment with less than three years general use shall have documentation on construction, operation, field testing, and user list.
- C. All equipment shall be suitable for operation in the environment of the project. Solid state components shall be conservatively rated for their purpose, to provide reliable (>90%) performance over ambient atmospheric temperature between 0 to 140 degrees Fahrenheit and 0 to 95 percent relative humidity. All indoor control panel- located electronics shall be suitable for operation in ambient temperatures of 40 degrees F to 120 degrees F. All field electronics and outdoor panel equipment shall be suitable for operation in ambient temperatures of -40 degrees F to 140 degrees F.
- D. All electronic instrumentation shall be of the solid state type and shall utilize linear transmission signals (to and from) of isolated 4 to 20 mA DC (milliampere direct current); however, distribution within a panel or cabinet may use variable voltage (1-5 VDC – volts direct current).
- E. Outputs of equipment that are not of the standard signals outlines above shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals shall be allowed.
- F. All electronic/digital equipment shall be provided with radio frequency interference protection.

- G. All transmitter output signals shall include signal and power source isolation boosting (as required).
- H. All receiving devices and field instruments when operating in a loop shall be of a design such that a failure of an individual device shall not affect the operation and integrity of the remaining functions or devices. All instruments and devices, either remote or panel mounted, shall have an individual, internal on-off switch.
- I. All signal converters, isolation transformers, power regulators, power converters, fuses, switches, relays, integrators, computing devices, alarm trips, and related equipment required by the instrument manufacturers and necessary to complete the functional requirements described in the loop descriptions and shown on the drawings shall be furnished and installed by the Integrator. All instruments and devices requiring an external power supply shall have an internal on-off switch.
- J. All electronic transmitting equipment shall provide loop power. True 2-wire transmitters may have loop power supplied in the receiving instrument if available or by a plug-in power supply mounted in the receiving instrument panel. A separate and isolated power supply for each device within a loop shall be supplied.
- K. All instruments and equipment shall be provided with suitable mounting hardware, floor stands, wall brackets, and instrumentation racks.
- L. All instrument air and fluid fittings and valves necessary for the operation of instruments shall be suitable and compatible for the process fluids being contacted.
- M. Nameplates (equipment tags) shall be provided on all field-mounted instruments. Nameplates shall be constructed of stainless steel. Nameplates shall be a minimum of 1.5" long times 0.75" high with 3/16" stamped letter height. Wording shall be the equipment tag id. Nameplates shall be attached to the instruments using stainless steel screws or a stainless steel wire/band passing through a hole in the tag and secured to the instrument.
- N. The INSTRUMENT LOOP DESCRIPTIONS (SECTION 13465), PROCESS & INSTRUMENTATION DRAWINGS, CONTROL SYSTEM EQUIPMENT PANELS AND RACKS (SECTION 13420), AND PROCESS AND INSTRUMENTATION CONTROL PRODUCTS (SECTION 13325) indicate the intent of the process and interconnection between EQUIPMENT, INSTRUMENTATION & CONTROL PRODUCTS, INSTRUMENTS, AND DEVICES. EQUIPMENT specified in Division 11 and Division 13 does not purport to cover all equipment which may be required to complete the process intent. The equipment specified herein does not include all of the required equipment and devices necessary for a completely operational system. The Integrator shall provide all necessary equipment required to perform the function for the system.

## 2.2 ELECTRICAL

- A. Equipment shall operate on the 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10%, except where specifically noted. Where possible, all field instruments shall be 24 VDC loop powered. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- B. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified elsewhere.
- C. All materials shall be UL listed and approved.
- D. Equipment shall be constructed (or configured) so that when a power interruption occurs, the equipment, instrument, and/or device resumes normal operation without manual resetting when power is restored, unless otherwise noted.
- E. All conductors running from the field to control panels shall be of a single, continuous length, without splices, except at approved junction boxes. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance. Multi-conductor cable may be used between junction boxes and control panels.
- F. All shielded cable shall be grounded at the control panel end only. Shields shall be carried through junction boxes with the least possible resistance and kept isolated from ground at these points. The field end of the shield shall be insulated to prevent grounding.
- G. All external connection points shall be made at terminal blocks with No 6-32 or larger screws.

## 2.3 EQUIPMENT

- A. Refer to Computers and Miscellaneous Equipment (13100), Programmable Logic Controllers (13200), Control System Equipment Panels and Racks (Section 13420), and Instrumentation Control Products (Section 13325).
- B. Radio Modems
  - 1. Radio modems shall be Viper SC+100 IP Router or approved equal. The radio modem shall operate with a 10 to 30 VDC power supply. All radio modems shall be configurable as the master station, repeater, or remote radio. All radios shall be capable of redundancy, be robust and designed for data transmission, FCC approved, and UL listed. All radios shall have a 1-year Manufacturer's warranty.
  - 2. The radio modem shall be configurable for operation between 150 to 174 MHz. The radio modem will include an Ethernet 10/100 Base RJ45 connector, serial connector, and antenna connector. The radio modem will

include an LED light to indicate Power, Status, Ethernet Activity, Ethernet Link, and Receive/Transmit

3. Each radio modem shall be provided with a mounting shelf, connectors, and jumper cables.

#### C. Lightning Protection

1. Radio system surge protection shall be rated for 100-700 MHz service and shall be manufactured by Polyphaser, or approved equal.

### 2.1 CONTROL PANELS, ENCLOSURES, CABINETS

- A. Refer to Control System Equipment Panels and Racks (Section 13420).

### 2.2 MISCELLANEOUS EQUIPMENT

#### A. Spare Parts

1. Spare parts shall be provided as a part of the start-up services during the initial start-up and phase-in period. These items shall include accessories such as fuses, electrodes, membranes, fluids, charts, ink, lights, etc. required to start-up and operate the system for a period of 60 days. These items shall be packaged in separate containers and shipped to the job site with the instruments and shall be tagged "INSTRUMENT START-UP EQUIPMENT."
2. Spare parts and accessories above and beyond those being provided for start-up services shall be provided under this Section. All spare parts shall be packaged and shipped at one time. Separate shipment of spare parts shall not be acceptable. The Engineer shall be notified of the shipment release in writing indicating that all items have been shipped. Each item shall be checked by the Engineer as being received and that all components have been provided as specified.
3. A one year supply of consumables and replacement parts required for all instruments and devices being furnished for the system. A list of spare part to be included in the one year supply of consumables and replacement parts shall be provided to the engineer during the shop drawing approval stage. Consumables and replacement parts shall be those over and above that which have been specifically identified in this section.
4. At a minimum, spare parts shall consist of the following:
  - i. Six (6) of each type of fuse (per panel)
  - ii. Two (2) of each type of relay (per panel)
  - iii. Six (6) of each type of replaceable indicator lamp (per panel)
  - iv. One (1) of each type of UPS
  - v. One (1) of each type of power supply (per panel)

## PART 3 – EXECUTION

### 3.1 PRODUCT HANDLING

- A. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment.
- B. Each package shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.
- C. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.
- D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry, heated, permanent shelters and, including in-line equipment, shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Contractor at his/her own cost and expense. If any apparatus has been subject to possible exposure or injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his/her own expense.

### 3.2 INSTALLATION

- A. Instrumentation and accessory equipment shall be installed in accordance with the best field and shop practices.
- B. The workmanship shall be in accordance with the best field and shop practices for the instrument and control systems.
- C. All workmen shall be skilled in the work to which they are assigned, and all work shall be performed under an instrumentation foreman. The instrumentation foreman shall be identified to the Engineer prior to construction and installation.
- D. All wiring and piping shall be constructed perfectly plumb, square, level, and true to lines and surfaces indicated, in a neat, substantial and workmanlike manner, and in such a way as to properly serve for the purpose intended. All members and parts, upon installation, shall be properly framed, secured together, and anchored in place. All cuts shall be deburred and immediately cleaned from the opposite end before connecting.
- E. All instruments shall be mounted, piped and connected in strict accordance with the manufacturer's instructions. All wall mounted panels shall be mounted 5 feet above the floor, as measured to the center of the panel, or as directed by the Engineer.
- F. All internal wiring of the panels shall be done by the panel manufacturer in accordance with the drawings, and instrument manufacturer's instructions.



- G. The instrument specifications indicate the intent of the interconnections between process equipment and the type of individual instrument. The proposed equipment shall be complete with all mounting hardware and accessories to satisfy the functional requirements.
- H. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising there from.
- I. All piping to and from field instrumentation shall be provided with necessary unions, test tees, and shut-offs.
- J. Interfacing fixtures shall be compatible with the equipment to which they are attached and shall comply with the applicable specifications.
- K. Coordination with the process and equipment in addition to standard quoted fixtures required to conform the instrumentation to the process shall be the responsibility of the Contractor. The instrument and control system supplier shall provide detailed information on the fixtures being supplied and the extent of the field installation required.
- L. Brackets and hangers required for mounting of equipment shall be provided as noted and/or as required. The brackets and hangers shall be installed in a workmanlike manner and shall not interfere with any other equipment. Devices shall be resistant to corrosion from acids, bases, and oxidants, and applicable to the environment for which they are being installed.
- M. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his/her material in sections sized to permit passing through such restricted areas in the building.
- N. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment, but in no case shall more than one ground be employed for each shield.
- O. Maximum practical separation shall be maintained between signal (analog alarm, and status) conduits and power feeders and AC systems.
- P. All field conductors shall terminate at the panel terminal board. Millivolt signal wires (i.e., thermocouple) may be connected direct to the input terminals of the receiving instrument if so specified.
- Q. All signal wire terminations to field equipment and panel terminal strips shall be covered under Division 16, with coordination from the Integrator. Power feed terminations shall be covered under Division 16, with coordination from the Integrator. All fiber terminations at fiber-Ethernet network switches shall be covered under Division 16, with coordination from the Integrator.

- R. All wire ends shall be terminated with hook fork type non-split compression lugs.
- S. All wire ends shall be identified at both ends with wire markers.
- T. Installation of fiber optic cable within control panels and console assemblies shall refer to cable manufacturer's specifications for bend radius. Use cable breakout assembly as recommended by the cable manufacturer. Provide basket, strain relief as required to meet manufacturer's strain requirements.
- U. Clean and prepare surfaces on which signs and tags will be mounted prior to installation.
- V. Entry to field enclosures shall be through the back, side, or bottom (not top) with weatherproof hubs. Wiring shall enter near the terminal point and not obstruct access to removal of components.
- W. Lifting rings shall be removed from cabinets/assemblies. Hole plugs of the same color as the cabinet shall be provided and installed for the holes.

### 3.3 FACTORY TESTS

- A. The Integrator shall test all equipment at the factory prior to shipment. Unless otherwise specified, all equipment provided by the Integrator shall be tested at the factory as a single fully integrated system.
- B. At a minimum, the testing shall include the following:
  - 1. Unwitnessed Factory Test (UFT)
  - 2. Witnessed Factory Tests (WFT)
  - 3. Application Software Test (AST)
- C. Each test shall be in the cause and effect format. The person(s) conducting the tests shall initiate an input (cause) and upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- D. All tests shall be conducted in accordance with prior Engineer approved procedures, forms, and checklists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.
- E. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.
- F. The Integrator shall provide all special testing materials and equipment, including all interconnecting wires and cables between equipment to be tested, required to conduct testing in accordance with these specifications. Wherever possible, perform tests

using actual process variables, equipment, and data. Provide a suitable means of simulation when it is not practical to test with real process variables, equipment, and data. Simulation tests and techniques must be clearly identified and described in the test procedures.

- G. The Integrator shall coordinate all testing with the Contractor, Application Engineer, and Engineer.
- H. The Engineer reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved Test Procedures without additional cost.
- I. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.
- J. No equipment shall be shipped until the Engineer has received all test results and approved that the system is ready for shipment.
- K. Unwitnessed Factory Tests (UFT)
  - 1. The entire system except for primary elements and final control elements shall be interconnected and tested to ensure the system will operate as specified. All analog and discrete input/output points not interconnected at this time shall be simulated to ensure proper operation of monitoring devices/functions and control devices/functions. The intent is for the Integrator to verify functionality of all components (e g., 100 percent I/O check to the interface terminal blocks) prior to the Application Engineer loading the PLC and OIT software.
  - 2. All panels, consoles and assemblies shall be inspected and tested to verify that they are in conformance with related submittals, specifications and drawings. During the tests all digital system hardware shall be operated for at least five days continuously trouble free to verify the system is capable of continuous operation
  - 3. Provide all temporary cables including fiber optic, Ethernet, CAT5e, and CAT6e necessary to connect all control system components including network and PLC control system communication modules and cables for use during factory testing.
  - 4. Provide test documentation as specified herein.
- L. Witnessed Factory Test (WFT)
  - 1. The Integrator shall notify the Engineer in writing that the system is ready for the WFT and allow the Engineer to schedule a test date within 21 days of receipt of the "Ready To Test" letter. At the time of notification, the Integrator shall submit any revisions to the detailed test procedure previously approved by the Engineer in the project system plan.
  - 2. Prior to start of the WFT, all previous unwitnessed test results shall have been submitted and approved by the Engineer.

3. Implicit in the scheduling of the WFT is the assumption that the Integrator has determined through prior, unwitnessed tests and quality assurance programs that the equipment is ready for shipment.
4. The following documentation shall be made available to the Engineer at the test site both before and during the WFT:
  - i. All drawings and specifications addenda and change orders.
  - ii. Master copy of the test procedure.
  - iii. List of the equipment to be tested including make, model, and serial number.
  - iv. Design related hardware and non-Owner supplied software submittal applicable to the equipment being tested.
5. All system tests specified for the UFT shall be repeated. All temporary cabling provided during the UFT shall be provided for the WFT.
  - i. Perform a 100 percent check of all I/O to the interface terminal blocks and verification of all communications networks. I/O verification includes testing each analog signal at zero, ten, fifty, ninety, and one hundred percent, and each digital signal at zero and one hundred percent of range.
  - ii. Test the functionality of each selector switch and push button.
  - iii. Test the functionality of each indicator light and annunciator point.
  - iv. Confirm accurate signaling at each analog indicator, recorder, and controller at zero, ten, fifty, ninety, and one hundred percent of range.
  - v. Test each computer to ensure system boots correctly, allows access to all system components including hard drives, disk drives, CD ROM drives, and communications networks.
  - vi. The Integrator and Engineer shall jointly test each communications network link using an Engineer approved Integrator test configuration to verify successful completion of required communications paths including: sending data to and receiving data from a PLC (PC to PLC communications and OIT to PLC communications), sending data to and receiving data from another PLC (PLC to PLC communications), sending data to and receiving data from another PC (PC to PC communications and PC to OIT communications), and sending data to all printers.
  - vii. Test the UPS systems to verify ability to carry the associated load during a power failure for a minimum of 15 minutes.
6. All control panels shall be included in these tests.
7. All deficiencies identified during these tests shall be corrected and retested prior to completion of the WFT as determined by the Engineer.
8. All test data and procedure followed during testing shall be logged, and certified copies of the logs shall be provided to the Engineer.
9. All "punch list" items or deficiencies identified during the WFT shall be corrected by the Integrator prior to starting the AST.

M. Application Software Test (AST).

1. After completion of the WFT, the Engineer shall have unrestricted access to the entire PLC system to verify the functionality of the PLC programs and OIT application software.
2. Normal access to the system shall be from 7:00 a.m. to 4:00 p.m., Monday through Friday. The Application Engineer shall provide additional access time to the system when the Engineer provides 48 hours' notice.
3. The Engineer agrees to complete their required testing "as rapidly as possible" to minimize the disruption of the Integrator's installation schedule and other day to day activities. The Contractor, Integrator, and Application Engineer shall include a minimum of two (2) weeks for the Engineer to complete the AST. The Integrator shall include in their schedule sufficient time to accommodate this extended staging time.
4. The Integrator shall provide and reinstall all necessary power, cables, communications equipment, etc., to interconnect all the PLC and OIT system components as shown on the Contract Drawings. This requirement includes all necessary communications hardware, software, PLC cables and connectors, Ethernet, fiber optic, and CAT6e cables, telephone lines, etc.
5. During the entire AST all panels and OIT equipment shall be powered fully and interconnected per the approved Integrator system architecture drawing and ready for testing. Additionally, all equipment shall be arranged to allow convenient and safe access by the Engineer.
6. During the entire AST, the Engineer shall have reasonable access to Integrator facilities including a minimum of free parking, restrooms, drinking water, telephone, and internet service. The Engineer shall be responsible for all of their long distance telephone charges, refreshments, and meals.
7. The Integrator shall provide copies of all shop drawings, PLC and OIT manufacturer's literature, one large table (approximately 4 foot by 8 foot for staging the OIT equipment and for Engineer working space), and two padded office style chairs. In addition, the Integrator shall supply access to a minimum of two 120 VAC, 20 amp, single phase power outlets.

3.4 FIELD TESTS

- A. Prior to final field connections to any of the instrument panels, the Contractor shall clean all work completed including the interior of all panels; and remove all dirt, trash, wire clippings, and foreign material. The outside of all instrument panelboards are to be cleaned, and damaged painted surfaces touched up as required to leave the equipment in an acceptable condition. This shall include all nameplates, tags, and identification of equipment and devices within or on the front of the panels.
- B. No form of energy shall be turned on to any part of the instrumentation system prior

to receipt by the Engineer of a certified statement of approval of the installation from the Contractor containing his/her supplier's authorization for turning on energy to the system.

- C. It shall be the responsibility of the Integrator to provide a factory trained and qualified service person from the manufacturers' of the equipment to TEST AND CALIBRATE ALL EQUIPMENT and to INSTRUCT the Contractor on EQUIPMENT INSTALLATION and the ENGINEER and OWNER on operation of the equipment.
- D. No other instrumentation system manufacturer's personnel other than those persons directly from the service department of the manufacturer of the equipment and identified in the approved Project Plan shall be acceptable to perform field testing.
- E. All tests shall be conducted in accordance with prior Engineer approved procedures, forms and checklist. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after the satisfactory completion.
- F. Signed copies of the test procedures, forms and check lists will constitute the required test documentation.
- G. Provide all special testing materials, equipment, and devices. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of simulation. Define these simulations techniques in the test procedures.
- H. At a minimum, field testing shall include the following:
  - 1. Operational Readiness Test (ORT)
  - 2. Application Software Operational Readiness Test (ASORT)
  - 3. Functional Acceptance Test (FAT).
- I. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied. Implicit in these testing requirements is extensive coordination between the Integrator, Application Engineer, and Engineer. The Integrator is responsible for proving that the system functions in a manual mode without the aid of the PLC/OIT software. The Integrator is also responsible for verifying all I/O is connected correctly and providing valid readings at the PLC system. The Integrator and Application Engineer are also responsible for proving the automatic/remote functions that require PLC/OIT software.
- J. The Integrator and Application Engineer shall coordinate all testing with the Engineer.
- K. The Engineer reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved Test Procedures with no additional cost.

- L. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.
- M. The Integrator shall furnish the services of field service engineers, all special calibration and test equipment and labor to perform the field tests.
- N. Operational Readiness Test (ORT)
  - 1. General: Prior to the Operational Readiness Test, the entire system shall be certified (inspected, tested, and documented) that it is ready for operation.
  - 2. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated and adjusted on a loop-by-loop and component-by-component basis by the Integrator following field installation to demonstrate and document that the system is in conformance with related submittals and these specifications.
  - 3. The Integrator shall maintain the Loop Status Reports and Component Calibration sheets at the jobsite and make them available to the Engineer at any time.
  - 4. The Engineer reserves the right to witness and sign off on all tests conducted by the Integrator. The Engineer will review and initial all Loop Status Sheets and Component Calibration Sheets and spot check their entries periodically and upon completion of the tests. Any deficiencies found shall be corrected. Final versions of these test sheets shall be submitted to the Engineer.
- O. Application Software Operational Readiness Test (ASORT)
  - 1. After completion of the Integrator's ORT, the Engineer shall have unrestricted access to the entire PLC system to verify the functionality of the PLC programs and OIT application. During the ASORT, the Integrator and Application Engineer shall be on site or available within 4 hours to make any necessary repairs or equipment calibrations.
  - 2. The Integrator shall include in their schedule sufficient time (5 calendar days) to accommodate this extended on site testing time.
  - 3. Implicit in the scheduling of the ASORT is the assumption that the Contractor and Integrator have determined through prior quality assurance programs and successful completion of the ORT (and other tests) that all I&C equipment (furnished by the Integrator and equipment supplied under other Divisions), including control panel assemblies, networking equipment, PLC systems, networks, instruments, analyzers and other ancillary equipment is completely operational and ready for the Engineer's use.
  - 4. During the entire ASORT, all panels and OIT equipment shall be powered fully and interconnected per the approved Integrator system architecture drawing, and ready for testing.
  - 5. The Integrator shall provide, or coordinate with the Contractor to provide, copies

of all approved shop drawings; copies of all as built drawings; PLC and OIT manufacturers literature; one large table (approximately 4 foot by 8 foot) and three padded office style chairs in a temperature controlled area.

6. The Engineer agrees to complete their required testing as rapidly as possible to minimize the disruption of the Integrator's installation schedule and other day to day activities.

P. Functional Acceptance Test (FAT)

1. Prior to the FAT, the entire installed instrument and control system shall be certified by the Contractor, Integrator, Application Engineer and Engineer that it is ready for operation. All preliminary testing, inspection, and calibration shall be complete and defined in the ORT and ASORT. The intent of the FAT is for all responsible parties, working together, to prove the installed system operates in accordance with the Specifications. Each party is responsible for verifying the completeness of all system components furnished, installed, configured by their respective firms or subcontractors.
2. Once the facility has been started up (as defined in 01650) and is operating, a witnessed FAT shall be performed on the complete system to demonstrate that it is operating and in compliance with these specifications. Each specified function shall be demonstrated on a paragraph by paragraph, loop by loop, and site by site basis.
3. Loop-specific and non-loop-specific tests shall be the same as specified under factory testing, WFT, and AST for all Integrator activities, except that the entire installed system shall be tested and all functions demonstrated. During testing, the Integrator, applicable manufacturer's representatives, Application Engineer and Engineer shall be present.
4. In the event of rejection of any part or function of an Integrator furnished system or equipment supplier's system, the Integrator (or supplier as applicable) shall perform repairs or replacement within 10 days.
5. Updated versions of the documentation specified to be provided for during the FAT shall be made available to the Engineer at the job site both before and during the tests. In addition, one copy of all O&M manuals shall be made available to the Engineer at the job sites both before and during testing.

### 3.5 START-UP/COMMISSIONING

- A. During the start-up and commissioning the Contractor shall provide sufficient personnel to aid with the start-up of the instrumentation and controls equipment to be provided and installed under this Contract. This shall include services to correct any faults and to make the necessary adjustments for the proper operation of the equipment and installation. No other instrumentation system manufacturer's personnel other than those persons directly from the service department of the manufacturer of the equipment and identified in the approved Project Plan shall be acceptable to



perform this work.

- B. After completion of the FAT, the Instrumentation and Control System shall be tested as a component of, and extension of, the Full System Demonstration Test (refer to Section 01650). In addition, all furnished hardware and software shall operate for a period of 14 consecutive days, under conditions of full plant process operation, without a single non field repairable malfunction.
- C. During the Full System Demonstration Test and extended 14-day period, the Integrator and Contractor shall have available, within 4 hours of notification; personnel who have an intimate knowledge of the hardware and software furnished and installed under this Contract.
- D. While this test is proceeding, the Contractor shall have full use of the system. Only Contractor operating personnel shall be allowed to operate equipment associated with live plant processes.
- E. Any malfunction of hardware and/or software furnished under this Contract during the tests shall be analyzed and corrected by the Integrator or equipment supplier's service technician. Any malfunction of software furnished under this Contract during the tests shall be analyzed and corrected by the Application Engineer or equipment supplier's service technician. The Engineer will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.
- F. Any malfunction attributed to the Integrator during the Full System Demonstration Test (and 14-day period) which cannot be corrected within 24 hours of occurrence, or more than two similar failures of any duration, will be considered as a non-field repairable malfunction.

### 3.6 TRAINING

- A. The cost of training programs to be conducted with Town personnel shall be included in the Contract price. The training and instruction shall be directly related to the system being supplied. The Integrator is responsible for training associated with all hardware, including PLC system troubleshooting and repair. The Application Engineer is responsible for training associated with the PLC and OIT system software.
- B. The Integrator shall provide training in accordance with the approved training plans. The Integrator shall provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.
- C. The Integrator shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to Owner.
- D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system hardware.
- E. All training schedules shall be coordinated with, and at the convenience of, the

Owner.

- F. The Integrator shall schedule their training to allow sufficient time in the project schedule to provide training on the PLC and OIT systems software. The exact details of the Integrator training will be coordinated with the Engineer during the submittal process, and approved by the Engineer.
- G. On site (field) training shall be conducted at the Owner's designated location and shall provide detailed hands on instruction to personnel covering: system debugging, troubleshooting, maintenance procedures, calibration procedures and system operation. The training shall run at times chosen by the Owner.
- H. The Contractor shall provide organized instrumentation and control systems training to be conducted by qualified manufacturer's service representatives for operations staff totaling no less than twenty-four (24) hours. Training will include equipment startup, operation, calibration, preventative maintenance, corrective maintenance, and trouble shooting. Contractor will provide the Engineer with a proposed training schedule and outline at least 14 days prior to the proposed dates of training. Content and schedule to be approved by the Engineer. Training will only be conducted for equipment that has been completely installed, tested, calibrated, and is in acceptable working order. Training on installed equipment that has not been adequately tested and calibrated will not be acceptable.
- I. The training shall be conducted over a period of six months as follows:
  - 1. Two (2) eight-hour work days: immediately after successful completion of the Functional Acceptance Test.
  - 2. One (1) eight-hour work day: three months after successful completion of the Full Scale Demonstration Test.
- J. Training days (and hours) do not have to be consecutive, however the total training time shall equal twenty four total hours as specified above. Contractor shall provide written verification to the engineer that all equipment is properly calibrated and in good working order prior to the beginning of TRAINING.

### 3.7 MANUFACTURER'S SERVICES

- A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided for a period of not less than three (3) eight-hour days during construction to assist the Contractor in equipment installation; the location of sleeves; methods of installing conduit and special cable; mounting, piping, and wiring of one of each type of device; and the methods of protecting all of the equipment prior to placing it into service.
- B. Upon completion of the installation, the services of the above service engineer shall be provided for a period of not less than three (3) eight-hour days for calibration and testing as described in Section 3.4.

- C. Upon completion of the equipment calibration and testing, the services of the above service engineer shall be provided for a period of not less than twenty-four (24) hours for instruction and training as described in Section 3.6.

### 3.8 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 13320

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## SECTION 13325

### PROCESS INSTRUMENTATION AND CONTROL PRODUCTS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Process instrumentation and control products, instruments, devices, and accessories associated with Process Instrumentation and Control Systems.
2. The work covered under this Section of the Specifications includes furnishing all plant, labor, equipment, instruments, devices, appliances, hardware, software, accessories, incidentals and materials, and in performing all operations in connection with the furnishing, installation, calibration, testing, certification, and training of all instruments, equipment, devices associated with the process instrumentation and control systems, complete in place, in accordance with the Specifications and Drawings, by the instrumentation and control system integrator/supplier (Integrator) as specified in Section 13320.
3. All work provided by the Integrator shall be done in harmony with the Contractor, Contractor's sub-contractors, Application Engineer, Engineer, and Owner.
4. All work shall be done in accordance with the National Electric Code, National Electric Safety Code, Occupational Safety and Health Administration, Underwriters Laboratories, Inc., International Society of Measurement and Control, National Electric Manufacturers Association, and all other state and local codes.

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Division 11 – Equipment
4. Division 13 – Special Construction
5. Division 16 – Electrical

- C. Work not included:

1. Electrical conduit, relays, starters, motor control centers, and variable speed drives, etc., required for operation of the equipment shall be furnished and installed under Division 16 of these specifications.
2. All electrical devices furnished under this Section shall be installed under Division 16.
3. The power connections to all electrical devices furnished under this Section shall be performed under Division 16.
4. Installation of process equipment, pumps, piping, valves, fittings, and appurtenances shall be covered under Division 11.

### 1.3 SUBMITTALS

- A. Refer to Section 13320 – Instrumentation and Controls

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Control, delivery, storage, and handling of equipment in accordance with Sections 01600 and 01610.

### 1.5 OPERATION AND MAINTENANCE DATA

- A. Furnish Operations and Maintenance Instruction Manuals (O&M Manuals) prior to start-up.
- B. Submit under provisions of this Section.
- C. Operation Data: Description of operating procedures.
- D. Maintenance Data: Description of servicing procedures; list of major components, recommended remedial and preventive maintenance procedures; and recommended spare parts list for each product furnished under this section.
- E. Manuals shall be published by the Manufacturer and shall be of the most recent publication date.
- F. Refer to Specification Section 01730 – Operation and Maintenance Data for additional requirements.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. All instrumentation and electronic equipment shall be UL approved and of the manufacturer's latest proven design, utilizing printed circuitry and epoxy coating (or equal) to prevent contamination by dust, moisture and fungus. First generation equipment with less than three years general use shall have documentation on construction, operation, field test, and user list.

- B. All equipment and devices furnished hereunder shall be designed for continuous industrial service and shall be of modular construction capable of field expansion.
- C. All equipment shall be suitable for operation in the environment of the project. Solid state components shall be conservatively rated for their purpose, to provide reliable (>90%) performance over ambient atmospheric temperature between 0-140 degrees Fahrenheit and 0 to 95 percent relative humidity. All indoor control panel-located electronics shall be suitable for operation in ambient temperatures of 40 degrees F to 120 degrees F. All field electronics and outdoor panel equipment shall be suitable for operation in ambient temperatures of -40 degrees F to 140 degrees F.
- D. All electronic instrumentation shall utilize transmission signals (to and from) of isolated 4 to 20 mA DC, unless otherwise approved by the Engineer.
- E. All electronic/digital shall be provided with radio frequency interference protection.
- F. All transmitter output signals shall include signal and power source isolation and boosting (as required).
- G. Indicators, controllers, integrators, relays, and other receiving devices when operating in a loop shall be of a design such that a failure of an individual device shall not affect the operation and integrity of the remaining functions. All indicators, either remote or panel mounted, shall have an individual, internal on-off switch.
- H. Electronic transmitting equipment shall provide loop power. True 2-wire transmitter may have its loop power supplied in the receiving instrument if available or by a plug-in power supply mounted in the receiving instrument panel.
- I. All equipment necessary to complete the functional requirements shall be supplied by the systems supplier and shall be of the same manufacturer as the controllers, indicators, and recorders unless otherwise specified (e.g. signal converters, integrator, computing devices, alarm trips, etc.).
- J. All instruments and equipment shall be provided with suitable mounting hardware, floor stands, wall brackets, panel racks, and rails.
- K. All instrument air and fluid fittings and valves necessary for operations shall be suitable and compatible for the process fluids being contacted.
- L. All necessary fuses and switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an external power supply shall have an internal on/off switch.
- M. All conductors running from the field to control panels shall be of a single, continuous length, without splices, except at approved junction boxes. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.
- N. Metal nameplates shall be provided on all field-mounted elements, indicators and transmitters. Wording and sizing of nameplates shall be as described in Section 13320.

O. Instrument Summary List:

SECTION	INSTRUMENTATION	TYPE
2.2	Flow	Electromagnetic Flow Meter Flow Switch*
2.3	Pressure	Pressure Indicating Transmitter Differential Pressure Indicating Transmitter
2.4	Level	Ultrasonic Level Propane Tank Level Septic Tank Float Switch Flood/Float Switch Well Level Level Switch
2.5	Analytical	pH Chlorine Residual Water Temperature
2.6	Temperature	Room Temperature Transmitter
2.7	Control Station	Metering Pump
2.8	Laboratory	Spectrophotometer pH Meter

\* - Furnished and installed under Division 15.

2.2 FLOW INSTRUMENTS

A. Electromagnetic Flow Meters

1. Flow Element

- i. Type: Flow meters shall be a pulsed, direct current (DC) type volumetric liquid flow rate detector. The process transducing method shall be such that the characteristics of the water being measured shall be used to generate an induced voltage as water passes through a magnetic field. The amplitude of the voltage produced shall be directly proportional to the flow rate. The flow meter description, tag number, nominal size, and flow range are presented in the Contract Drawings.
- ii. Performance: Accuracy – within +/- 0.5% of actual flow rate with absolute zero stability, requiring no zero adjustment; Repeatability - 0.1% of full scale; Power Requirements – match to converter/transmitter; Temperature rating – minus 4 to plus 140 degrees F; Pressure rating – 150 psi; Provide RFI protection; One pipe diameter upstream maximum and zero pipe diameter downstream maximum of straight run required for flow meter operation; Meter shall be capable of running empty indefinitely without damage to any component.
- iii. Physical: ANSI 150# RF flanged end connections, hard rubber liner (NSF 61 approved), Hastelloy C electrodes, 304 stainless steel measuring tube, steel SAE, epoxy paint finished housing, 316 stainless steel grounding rings, and die-cast terminal box, and built-in ultrasonic electrode cleaning features.
- iv. Accessories/Options Required: Provide a certified flow curve for each meter; provide ground ring, ground wires and gaskets, as required or as otherwise noted. All materials shall be immune to chemical reaction with liquid being measured. Where



insulated or non-conductive pipe is used, only orifice plate grounding rings will be acceptable.

- v. Flow meters must be approved for use in drinking water applications.

## 2. Signal Converter/Transmitter

- i. Type: Instrument or remote mounted, microprocessor based electronics w/ LCD display, matched to flow element.
  - ii. Performance: Power requirements - 120 VAC, +/- 10%; power consumption no greater than 15 VA; Temperature - minus 4 to plus 140 degrees F.; Output – Isolated 4-20mA into 0 to 1000 ohms; output signal linear and proportional to flow velocity, without requirement for signal characterizing; LCD indicator, totalizer, 10 Hz scaled pulse, and integral electronics.
  - iii. Physical: Housing – NEMA 4X wall mount, or integral with the device as approved by the Engineer.
  - iv. Accessories/Options Required: Signal converters shall be interchangeable without recalibration for all meter sizes; a separate terminal strip for power connection shall be supplied; empty pipe zero stabilization option; separate junction box for terminal connections; attached to electronics housing.
  - v. Remote transmitters required for the Fe/Mn filter influent flow meters (FIT-213A, FIT-213B, FIT-213C) and PFAS Filter influent flow meters (FIT-319A, FIT-319B, FIT-319C). All other electromagnetic flow meters to have instrument mounted transmitters (FIT-110, FIT-148, FIT-178, FIT-212, FIT-218, FIT-311, FIT-312, FIT-714A, FIT-714B, FIT-714C, FIT-812, FIT-813, FIT-814).
3. Manufacturer: All electromagnetic flow meters shall be Badger, the Town of Sharon has standardized on this electromagnetic flow meter. No exceptions shall be allowed.

## B. Flow Switches (FS-420, FS-421)

- 1. One flow switch shall be installed on the feed line to each emergency showers located in the KOH/NaOCl Containment area, which shall be used to indicate emergency shower usage.

## 2.3 PRESSURE INSTRUMENTS

- A. Pressure Indicating Transmitters (PIT-107, PIT-108A, PIT-108B, PIT-147, PIT-177, PIT-211, PIT-316A, PIT-316B, PIT-316C, PIT-317A, PIT-317B, PIT-317C, PIT-318, PIT-713A, PIT-713B, PIT-713C, PIT-817A, PIT-817B)
- 1. Type: Turret mount case with digital liquid crystal display and ¼” NPT connection. The description, tag number, nominal size, and pressure range are presented in the Contract Drawings.
  - 2. Performance/Functional: Gauge pressure range of 0 to 300 psi and an operating temperature range of -20 to 185 degrees F; Span limits - 10 and 300 psi. Transmitter accuracy of +0.25% of calibrated span and +0.1% repeatability of maximum span. Range is to be fully adjustable using allowable span and range limits.

3. Physical: All wetted parts shall be 316 stainless steel. Transmitters shall be 2 wire providing a 4-20 mA DC output signal with non-interacting zero and span adjustments. Units shall provide local indication of measured pressure with on-board configuration pushbuttons. Electric terminations shall be in a NEMA 4X enclosure provided with a terminal strip.
  4. Power Requirements: 24 VDC
  5. Accessories/Options: Provide with diaphragm seal constructed of materials compatible with drinking water applications. All necessary accessories required for installation and mounting shall be included.
  6. Manufacturer: Foxboro (IGP10); Siemens; Rosemount; or Engineer approved equal.
- B. Differential Pressure Indicating Transmitters (DPIT-214A, DPIT-214B, DPIT-214C, DPIT-215, DPIT-313A, DPIT-313B, DPIT-313C, DPIT-315A, DPIT-315B, DPIT-315C)
1. Type: Electronic variable capacitance; two-wire transmitter; “smart electronics”. Includes indicating transmitter with digital liquid crystal display, and three-valve manifold. The description, tag number, nominal size, and pressure range are presented in the Contract Drawings.
  2. Performance: Range is -30 to 30 psia; Maximum adjustable range – noted range shall be between 40% and 80% of the maximum adjustable range. Accuracy – plus or minus 0.075 percent of span. Temperature – operating range -20 degrees F to 150 degrees F, minimum.
  3. Physical/Features: Materials – all wetted parts including process flanges and drain vents/valves shall be 316 SS unless otherwise noted. Wetted O-rings: Glass filled TFE, graphite filled PTFE, or Viton unless otherwise noted. Damping – Fluid or electronic type with adjustment. Indicator – Four-digit LCD indicating the noted range. Suppressed or elevated zero when noted. Signal Interface – 4 to 20 mA DC output for load impedance of 0 to 500 ohms minimum; Digital process variable signal superimposed on 4 to 20 mA signal; support HART protocol type device.
  4. Power Requirements: 24V DC supply.
  5. Enclosure: NEMA 4X; Mounting – Pipe or wall as noted. Provide stainless steel brackets with stainless steel bolts. Housing – Modular with separate compartments for electronics.
  6. Three-valve manifold: Type 316 SS.
  7. Manufacturers: Siemens (SITRANS P320); Rosemount; Foxboro; or Engineer approved equal.

## 2.4 LEVEL INSTRUMENTS

### A. Ultrasonic Level Transducers and Transmitters

1. Type: Ultrasonic type level transducers and integral transmitters

2. Performance/Functional: Level monitoring system shall have a range of up to 50 feet with a resolution of +/- 0.1% of range and repeatability of +/- 25% of range.
3. Bulk Chemical Storage Tank Transducers (LE-411, LE-511, LE-611): All level transducers shall be coordinated with the tank height and equipped with chemical isolation diaphragms suitable for the chemical in use. The wiring from the transducer to the transmitter shall be housed in conduit. One monitor transmitter shall be used per transducer. Transducer materials of construction shall be compatible with the chemical service. Transducers shall be installed according to manufacturer recommendations.
4. Backwash Waste Tank and Finished Water Wetwell Transducers (LE-711, LE-811A, LE-811B, LE-811C): Fully submersible, self-cleaning, and able to be mounted without flanges. The wiring from the transducer to the transmitter shall be housed in conduit. One monitor transmitter shall be used per transducer. Transducers shall be installed according to manufacturer recommendations.
5. Bulk Chemical Storage Tank Monitors/Transmitters (LIT-411, LIT-511, LIT-611): Shall include a 4 x 1.5" multi-block LCD display with backlighting. Input: 4 to 20 mA from alternate device, scalable; Output: 4 to 20 mA for display at the bulk chemical fill panel (sodium hypochlorite, potassium hydroxide, and sodium hydroxide) and as an input to the SCADA system. The monitor/transmitter shall have two Form C dry contacts for each tank monitored. Transmitters shall be installed according to manufacturer recommendations.
6. Backwash Waste Tank and Finished Water Wetwell Monitors/Transmitters (LIT-711, LIT-811A, LIT-811B, LIT-811C): Shall include a 4 x 1.5" multi-block LCD display with backlighting. Input: 4 to 20 mA from alternate device, scalable; Output: 4 to 20 mA as an input to the SCADA system. The monitor/transmitter shall have two Form C dry contacts for each clearwell monitored. Transmitters shall be installed according to manufacturer recommendations.
7. Power Required: 12-30V DC supply.
8. Manufacturer: All ultrasonic type level transmitters shall be of the same manufacturer.
  - i. Bulk Chemical Storage Tank Transducers: Siemens (ST-H); Flowline; Emerson or Engineer approved equal.
  - ii. Bulk Chemical Storage Tank Monitors/Transmitters: Siemens (HydroRanger200); Siemens; Flowline; Emerson or Engineer approved equal.
  - iii. Backwash Waste Tank and Finished Water Wetwell Transducers: Siemens (XPS-10); Flowline; Emerson or Engineer approved equal.
  - iv. Backwash Waste Tank and Finished Water Wetwell Monitors/Transmitters: Siemens (HydroRanger200); Flowline; Emerson or Engineer approved equal.

#### B. Flood/Float Switches

1. Sump Pits (LSH-113, LSH-151, LSH-181, LSH-419, LSH-614, LSH-996)

- i. Direct-acting, normally open, mercury-free type float switch with polypropylene housing, slosh guard, and PVC-jacketed type SO cable of sufficient length. Chemical feed area flood switch housing shall be compatible with the chemical(s) in use. Float switch shall have two (2) Form C dry contacts.
  - ii. Manufacturer: Madison; ACT; SJE-Rhombus; or Engineer approved equal.
- 2. Chemical Bulk Storage and Day Tanks (LSH-412, LSH-413, LSH-416, LSH-512, LSH-513, LSH-612, LSH-613)
  - i. Environmentally safe, containing no mercury. Switches shall be float type with DPDT mechanical switches and provide Form C dry contacts. Housing for switches shall be suitable for and compatible with the chemical in use. Switches shall be installed at a height of 2-inches below the tank overflow elevation and shall be adjustable within a range of +/- 2-feet of the set point.
  - ii. Chemical tank level switches shall be supplied with cable weights. The level switches shall have a narrow angle of operation to ensure quicker alarming.
  - iii. Manufacturer: Flowline Switch-Pak (AV16-4247-A) or Engineer approved equal.
- 3. Backwash Waste Tank and Finish Water Wetwell (LSH-712A, LSL-712B, LSH-815A, LSL-816A, LSH-815B, LSL-816B, LSH-815C, LSL-816C)
  - i. Direct-acting, normally open, mercury-free type float switch with 316 stainless steel housing and PVC-jacketed type SO cable of sufficient length. Float switch shall have two (2) Form C dry contacts.
  - ii. Manufacturer: Madison; ACT; SJE-Rhombus; or Engineer approved equal.
- 4. Tight Tank (LSH-971, LSH-972)
  - i. Direct-acting, normally open, mercury-free type float switch with 316 stainless steel housing and PVC-jacketed type SO cable of sufficient length. Float switch shall have two (2) Form C dry contacts.
  - ii. Manufacturer: Madison; ACT; SJE-Rhombus; or Engineer approved equal.

#### C. Level Transducer

- 1. Well Level Transducer (LE-146, LE-176)
  - i. Well level transducer shall be submersible type that measures level through hydro static head pressure. Transducer shall be suitable for groundwater well applications with a watertight integrity of up to 15000 psi.
  - ii. Transducer shall be provided with 200-foot cable.
  - iii. Transducer shall be less than 3/4" diameter and constructed of 316 stainless steel. Power and signal cable shall be encapsulated in polyurethane. Provide stainless steel transducer mounting attachment to pump sole plate.
  - iv. Power Requirements: Loop Powered.
  - v. Internal circuitry shall provide lightning protection and shall provide a 4-20 mA output signal.
  - vi. Transducer shall be physically compatible within 1" PVC conduit, as shown on the Contract drawings.

- vii. The well level transducer shall be manufactured by Esterline Technologies Corporation model KPSI Level Transducer, Flowline, Dwyer, or Engineer approved equal.

## 2.5 ANALYTICAL INSTRUMENTS

- A. Each sample stream shall have a single analyzer assembly shall be preassembled by the manufacturer/supplier on a fiberglass backer board as shown on the Contract Drawings.
- B. Analyzer Filters – All Sample Streams
  - 1. There shall be two 10” cartridge, wound filters included on each sample stream analyzer assembly: one 50 microns and one 10 microns.
- C. Sensor – pH/Temperature (AE-961A, AE-962A, AE-963A, AE-964A, AE-965A, AE-966A)
  - 1. Manufacturer: Walchem – WEL (Model: WEL-PHF-72), or Engineer approved equal.
    - i. PH Sensor Flat
    - ii. PH Housing with PT1000 Tee
- D. Sensor – Chlorine Residual (AE-962B, AE-963B, AE-964B, AE-965B, AE-966B)
  - 1. Manufacturer: Walchem (Model: 191445), or Engineer approved equal.
    - i. Free Chlorine /Bromine sensor
    - ii. 200PPM
    - iii. No cable
- E. Controller (AIT-962, AIT-963, AIT-964, AIT-965, AIT-966)
  - 1. Manufacturer: Walchem – W900 (Model: WEL-PHF-72) as manufactured by Walchem, or Engineer approved equal.
    - i. 6 powered relays, Hardwired
    - ii. One Sensor Card
    - iii. One Dual isolated output card
    - iv. No Ethernet
    - v. Single DIS flow cell/cable, no sensor
    - vi. Three analog outputs (min)

## 2.6 TEMPERATURE INSTRUMENTS

- A. Room Temperature Transmitters (TT-112, TT-150, TT-180, TT-921, TT-923, TT-926, TT-930)
  - 1. Room temperature monitoring shall be via a wall mounted temperature transmitter with local readout. The temperature range monitored shall be 20° to 120°F. The unit shall be two-wire, looped power with a 4-20mA output.

2. Manufacturer: Devar; Kele; ProSense; or Engineer approved equal.

## 2.7 METERING PUMP CONTROL PANEL

- A. The KOH, NaOCl, NaHSO<sub>3</sub>, and NaF metering pumps shall be supplied with a pre-designed chemical feed interlock receptacle which shall include an HOA switch, emergency stop pushbutton, twist lock plug receptacle, integral lock-out timer, and local indicator light during Hand Operation.
- B. The HOA switch shall provide local control of the connection between the pump and the automatic control system. In Hand Mode the pump shall run if power is available at the twist lock plug. In Auto mode the pump shall run if control signals are present and calling for chemical. Off removes power from pump. A green LED light shall illuminate when in Hand mode.
- C. The emergency stop pushbutton shall shut down the corresponding metering pumps.
- D. The twist lock plug shall be a 115V female twist lock socket (NEMA L5-15P).
- E. The receptacle shall be supplied with an integral user adjustable one-shot cycle timer which energizes the twist lock outlet for a preset time (10 min max) when the pump HOA switch is in Hand mode. At the end of the pre-set time, the outlet shall de-energize and an alarm buzzer shall sound.
- F. Input Voltage: 125 VAC, 50/60 Hz
- G. Enclosure: PVC
- H. Manufacturer: CMI Pumps, or Engineer Approved Equal.

## 2.8 LABORATORY INSTRUMENTS

### A. Spectrophotometer

1. Bench scale spectrophotometer shall meet the following specifications:

- i. Beam Height: 10 mm
- ii. 2000 measured values (result, date, time, sample ID, user ID)
- iii. Dimensions (H x W x D): 151 mm x 350 mm x 255 mm
- iv. Display: 7" thin film transistor
- v. Display Resolution: 800 x 480 pixels
- vi. Display Type: Colored touch screen
- vii. Enclosure Rating: IP30
- viii. Light Source: Gas-filled Tungsten (visible)
- ix. Operating Temperature: 10°C to 40°C
- x. Operating Mode: Transmittance (%), Absorbance & Concentration, Scanning
- xi. Photometric Accuracy: 5 mAbs @ 0.0 - 0.5 Abs, 1% @ 0.50 - 2.0 Abs
- xii. Photometric Linearity: <0.5% - 2 Abs, ≤0.01% @ >2 Abs with neutral glass @ 546 nm

- xiii. Photometric Measuring Range:  $\pm 3.0$  Abs (wavelength range 340-900 nm)
- xiv. Power Supply: desk power supply, 120 VAC, 60 Hz
- xv. Warranty: 12 months

2. Consumables:

- i. Provide glassware and chemical consumables required to conduct the following tests:
  - a) Total Chlorine
  - b) Free Chlorine
  - c) Total Iron
  - d) Total Manganese
  - e) Fluoride
  - f) Turbidity
  - g) UV254
- 3. Manufacturer: Hach DR3900 or Engineer approved equal.

B. pH Meter and Electrode

- 1. Bench scale pH meter shall meet the following specifications:
  - i. Power: 4 AA batteries (included)
  - ii. pH Accuracy:  $\pm 0.002$  pH
  - iii. pH Measurement: 0-14 pH
  - iv. pH Resolution: Selectable between 0.001 and 0.1 pH
  - v. Warranty: 3 years
  - vi. Water Resistance: IP54
- 2. pH meter and electrode shall compatible and of the same manufacturer.
- 3. pH Meter Manufacturer: Hach (HQ2200) or Engineer approved equal.
- 4. Electrode Manufacturer: Hach (IntelliCal PCH301) or Engineer approved equal.

2.9 MISCELLANEOUS EQUIPMENT

A. Spare Parts

- 1. Spare parts shall be provided as a part of the start-up services during the initial start-up and phase-in period. These items shall include accessories such as fuses, electrodes, membranes, fluids, charts, ink, lights, etc. required to start-up and operate the system for a period of 60 days. These items shall be packaged in separate containers and shipped to the job site with the instruments and shall be tagged "INSTRUMENTATION START-UP EQUIPMENT."
- 2. Spare parts and accessories above and beyond those being provided for start-up services shall be provided under this Section. All spare parts shall be packaged and shipped at one time. Separate shipment of spare parts shall not be acceptable. The Engineer shall be notified of the shipment release in writing indicating that all items have been shipped.

Each item shall be checked by the Engineer as being received and that all components have been provided as specified.

3. A one year supply of consumables and replacement parts required for all instruments, analyzers, and devices being furnished for the system. A list of spare parts to be included in the one year supply of consumables and replacement parts shall be provided to the engineer during the shop drawing approval stage. Consumables and replacement parts shall be those over and above that which have been specifically identified in this section.
4. Refer to Section 13320 for additional spare part requirements.

### PART 3 – EXECUTION

REFER TO SECTION 13320 – PROCESS INSTRUMENTATION AND CONTROL

END OF SECTION 13325



## SECTION 13400

### SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work associated with the supervisory control and data acquisition (SCADA) system including hardware are to be provided by the Integrator.
- B. The programming associated with the SCADA system including software and SCADA screen displays are to be provided by the Application Engineer.
- C. The work covered under this Section of the Specifications includes the following:
  - 1. This specification has been developed to establish minimum requirements for the SCADA software to be provided and programmed under this Section for the remote control, monitoring, and alarming of the Town of Sharon's Wells 2, 3, and 4 Water Treatment Plant (WTP)
  - 2. Integrator responsibilities: The Integrator shall be responsible to the Contractor for furnishing the SCADA software specified herein and providing the software to the Application Engineer for installation and programming. The Integrator shall be responsible for installing the programmed SCADA Servers on-site.
  - 3. Application Engineer responsibilities: The Application Engineer shall be responsible to the Owner and Engineer for installing the SCADA software specified herein on the SCADA Servers, programming the SCADA system controls and alarms, and developing SCADA Server and operator interface terminal (OIT) screens.
  - 4. The SCADA software to be furnished and installed for the WTP shall be integrated with and work in harmony with the Owner's existing SCADA systems associated with existing site facilities and off-site or remote facilities. A schematic diagram of existing and proposed SCADA systems is provided in the Contract Drawings.
  - 5. On-site coordination meeting with Owner; Engineer; Contractor; Integrator; Application Engineer; and equipment suppliers prior to start of work.

D. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements
3. Division 13 – Special Construction
4. Division 16 – Electrical

E. Work not included:

1. Integration with the Owner's existing drinking water system facilities; programming; SCADA screen development, ongoing operation of the Owner's existing drinking water facilities shall be covered under the Application Engineer's scope of work.
2. Electrical conduit relays, raceways, starters, etc., required for operation, control, and monitoring of equipment shall be furnished and installed under Division 16 of these specifications.
3. The power connections to all electrical devices furnished under this Section shall be performed under Division 16

### 1.3 SUBMITTALS

- A. Submit in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein.
- B. Product Data: Provide catalog sheets and technical data sheets to indicate all aspects of the software package and its capabilities.
- C. Submit licenses to the Owner for all software provided.
- D. Submit Manufacturer's programming manuals.
- E. Submit a legal copy of the SCADA software to be run on the SCADA Servers. All SCADA software and hardware or software keys shall be licensed to the Town of Sharon. The cost of the one-year Contract shall be included in the bid price for this construction Contract.
- F. Submit a two (2) year maintenance/upgrade Proposal to the Owner covering the purchase and installation of all upgrades to the SCADA software package during the maintenance period.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Control, delivery, storage, and handling of equipment in accordance with Sections 01600 and 01610.

## 1.5 OPERATION AND MAINTENANCE DATA

- A. Furnish six (6) complete sets of Operations and Maintenance Instruction Manuals (O&M Manuals) prior to start-up. Furnish one (1) electronic Adobe PDF searchable version on thumb drive or CD-ROM.
- B. Submit under provisions of this Section.
- C. Operation Data: Description of operating procedures.
- D. Maintenance Data: Description of servicing procedures; list of major components, recommended remedial and preventive maintenance procedures; and recommended spare parts list for each product furnished under this section.
- E. Manuals shall be published by the Manufacturer and shall be of the most recent publication date.
- F. Refer to Specification Section 01730 – Operation and Maintenance Data for additional requirements.

## PART 2 –PRODUCTS

### 2.1 GENERAL

- A. The SCADA software provided under this section shall be the most recent version of the SCADA software.

### 2.2 SCADA SOFTWARE

- A. The SCADA software (SS) shall be designed for use in the Microsoft Server 2022 operating system for PCs.
- B. The SS shall be of the manufacturer's latest shipping version.
- C. The SS shall be complete with all functions available to the Owner. The Owner shall not be required to purchase any software to provide the full functionality of the software.
- D. The SS shall be a combination development/runtime version and shall have an unlimited point count.
- E. The SS shall support the following communications protocols at a minimum and shall be standard with the software:
  - 1. Allen Bradley Ethernet/IP.
  - 2. Modbus RTU
  - 3. GE Ethernet

4. DirectNET

5. Modbus TCP

F. The SS shall be object-based and event-driven.

G. The SS shall be able to be programmed while on-line and shall provide uninterrupted monitoring and control when switching between programming mode and runtime mode.

H. The SS shall be compatible with any OPC server or OPC client.

I. The SS shall be capable of data logging.

J. The SS shall be capable of trending real-time and historical data.

K. The SS shall be capable of creating alarms based on set points and/or logical expressions.

L. The SS shall maintain an event file and an alarm file that can be printed at a later date.

M. The SS shall be capable to interface with spreadsheet programs such as Microsoft Excel.

N. The SS shall be supplied with a library of graphic displays for the creation of SCADA screens.

O. Manufacturers:

1. The Town of Sharon has standardized their HMI software on the latest version of iFix by General Electric (**No substitutions shall be allowed**).

(1) GE iFix Developer Unlimited Tags

(1) GE iFix Runtime Unlimited Tags

## 2.3 REPORTING SOFTWARE

A. Software shall be furnished by the Integrator and programmed by the Application Engineer to gather data from the SCADA system and to generate monthly, weekly, and daily reports that will be used by the Owner and for MADEP Chemical Addition reporting.

## 2.4 ALARMING SOFTWARE

A. The software shall be designed for use in the Microsoft Server 2022 operating system for PCs.

- B. Alarming software shall be Win-911 v3.1 as noted above, and shall be provided, installed, and programmed to allow remote access to acknowledge alarms and to provide remote alarming capabilities.
- C. The following software functions shall be provided as a minimum:
  - 1. Notification of personnel by phone – on or off site.
  - 2. Voice/sound over remote speakers at facility.
  - 3. Pop-up on-screen windows.
  - 4. Voice alarm messages.
  - 5. Interfaces with the SCADA software package provided.
  - 6. Multiple adjustable trip settings for analog signals.
  - 7. Priority calling sequence.
  - 8. Archival of alarm history.
  - 9. Pager formatting.
  - 10. Customized day & time settings for phone/pager numbers – according to availability of personnel.
  - 11. Custom recording of voice messages.
  - 12. Acknowledgement from SCADA software package.

## 2.5 OPERATOR INTERFACE

- A. SCADA Servers as specified in Section 13100.

## PART 3 – EXECUTION

### 3.1 I/O SIGNAL COUNT

- A. Refer to the Contract Drawings.

### 3.2 ALARM SCHEDULE

- A. Refer to the pages that follow.

### 3.3 INTERLOCK SCHEDULE

A. Refer to the Contract Drawings and the pages that follow.

END OF SECTION 13400

Well Station 2  
Alarm Schedule

<b>Well Station 2 Alarms</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
1	Well 2 Pump #1 VFD Fault (P-100A)	SCADA alarm
2	Well 2 Pump #1 High Temperature (P-100A)	SCADA alarm
3	Well 2 Pump #2 VFD Fault (P-100B)	SCADA alarm
4	Well 2 Pump #2 High Temperature (P-100B)	SCADA alarm
5	Well 2 Vacuum Priming Pump #1 Fault (P-101A)	SCADA alarm
6	Well 2 Vacuum Priming Pump #2 Fault (P-101B)	SCADA alarm
7	Well 2 Low Suction Pressure (PIT-107)	SCADA alarm, interlock 1
8	Well 2 Low-Low Suction Pressure (PIT-107)	SCADA alarm
9	Well 2 High Discharge Pressure (PIT-108A)	SCADA alarm
10	Well 2 High-High Discharge Pressure (PIT-108A)	SCADA alarm, interlock 4
11	Well 2 High Discharge Pressure (PIT-108B)	SCADA alarm
12	Well 2 High-High Discharge Pressure (PIT-108B)	SCADA alarm, interlock 5
13	Well 2 No Flow (Flow=0 gpm) (FIT-110)	SCADA alarm, interlock 6
14	Well 2 High Flow (>350 gpm) (FIT-110)	SCADA alarm
15	Well 2 Personnel Down (PB-111)	SCADA alarm
16	Well 2 Low Pump Room Temperature (TT-112)	SCADA alarm
17	Well 2 High Pump Room Temperature (TT-112)	SCADA alarm
18	Well 2 Flood (LSH-113)	SCADA alarm
19	Well 2 Vacuum Priming System High Water Level (LSH-114)	SCADA alarm
20	Well 2 Pump #1 Loss of Prime (LSL-115A)	SCADA alarm, interlock 2
21	Well 2 Pump #2 Loss of Prime (LSL-115B)	SCADA alarm, interlock 3
22	Well 2 Vacuum Priming System Low Vacuum Pressure (PIT-116)	SCADA alarm
23	Well 2 Vacuum Priming System Maintenance (VPS-FCP)	SCADA alarm
24	Well 2 MCP Emergency Stop (PB-117)	SCADA alarm, interlock 7
25	Well 2 Intrusion (Security Access Control Panel)	SCADA alarm

Well Station 3  
Alarm Schedule

<b>Well Station 3 Alarms</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
1	Well 3 Pump VFD Fault (P-141)	SCADA alarm
2	Well 3 Pump High Temperature (P-141)	SCADA alarm
3	Well 3 Low Well Level (LE-146)	SCADA alarm
4	Well 3 Low-Low Well Level (LE-146)	SCADA alarm, interlock 8
5	Well 3 High Discharge Pressure (PIT-147)	SCADA alarm
6	Well 3 High-High Discharge Pressure (PIT-147)	SCADA alarm, interlock 9
7	Well 3 No Flow (Flow=0 gpm) (FIT-148)	SCADA alarm, interlock 10
8	Well 3 High Flow (>350 gpm) (FIT-148)	SCADA alarm
9	Well 3 Personnel Down (PB-149)	SCADA alarm
10	Well 3 Low Pump Room Temperature (TT-150)	SCADA alarm
11	Well 3 High Pump Room Temperature (TT-150)	SCADA alarm
12	Well 3 Flood (LSH-151)	SCADA alarm
13	Well 3 MCP Emergency Stop (PB-152)	SCADA alarm, interlock 11
14	Well 3 Intrusion (Security Access Control Panel)	SCADA alarm



Well Station 4  
Alarm Schedule

<b>Well Station 4 Alarms</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
1	Well 4 Low Pump Room Temperature (TT-150)	SCADA alarm
2	Well 4 High Pump Room Temperature (TT-150)	SCADA alarm
3	Well 4 Pump VFD Fault (P-171)	SCADA alarm
4	Well 4 Pump High Temperature (P-171)	SCADA alarm
5	Well 4 Low Well Level (LE-176)	SCADA alarm
6	Well 4 Low-Low Well Level (LE-176)	SCADA alarm, interlock 12
7	Well 4 High Discharge Pressure (PIT-177)	SCADA alarm
8	Well 4 High-High Discharge Pressure (PIT-177)	SCADA alarm, interlock 13
9	Well 4 No Flow (Flow=0 gpm) (FIT-178)	SCADA alarm, interlock 14
10	Well 4 High Flow (>800 gpm) (FIT-178)	SCADA alarm
11	Well 4 Personnel Down (PB-179)	SCADA alarm
12	Well 4 Flood (LSH-181)	SCADA alarm
13	Well Station 4 MCP Emergency Stop (PB-183)	SCADA alarm, interlock 15
14	Well 4 Intrusion (Security Access Control Panel)	SCADA alarm

Wells 2, 3, and 4 WTP  
Alarm Schedule

<b>WTP Raw Water</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
1	WTP Influent Low Pressure (PIT-211)	SCADA alarm
2	WTP Influent High Pressure (PIT-211)	SCADA alarm
3	Combined Fe/Mn Treatment Influent No Flow (Flow=0 gpm) (FIT-212)	SCADA alarm, interlock 17
4	Combined Fe/Mn Treatment Influent High Flow (>650 gpm) (FIT-212)	SCADA alarm
<b>Fe/Mn Filters</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
5	Filter #1 High Flow (>500 gpm) (FIT-213A)	SCADA alarm
6	Filter #2 High Flow (>500 gpm) (FIT-213B)	SCADA alarm
7	Filter #3 High Flow (>500 gpm) (FIT-213C)	SCADA alarm
8	Filter #1 High Differential Pressure (10 psi) (DPIT-214A)	SCADA alarm
9	Filter #1 Low Differential Pressure (7-10 psi) (DPIT-214A)	SCADA alarm
10	Filter #2 High Differential Pressure (10 psi) (DPIT-214B)	SCADA alarm
11	Filter #2 Low Differential Pressure (7-10 psi) (DPIT-214B)	SCADA alarm
12	Filter #3 High Differential Pressure (10 psi) (DPIT-214C)	SCADA alarm
13	Filter #3 Low Differential Pressure (7-10 psi) (DPIT-214C)	SCADA alarm
14	Combined Fe/Mn Filter Effluent No-Flow (Flow=0 gpm) (FIT-218)	SCADA alarm, interlock 18
15	Combined Fe/Mn Filter Effluent High Flow (>650 gpm) (FIT-218)	SCADA alarm
16	Fe/Mn Backwash Control Valve General Fault (BFV-248)	SCADA alarm
17	Fe/Mn Backwash Control Valve Fail to Open (BFV-248)	SCADA alarm
18	Fe/Mn Backwash Control Valve Fail to Close (BFV-248)	SCADA alarm
<b>Fe/Mn Filter #1 Flow Control Valves</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
19	Filter #1 Influent Valve General Fault (BFV-236A)	SCADA alarm
20	Filter #1 Influent Valve Fail to Open (BFV-236A)	SCADA alarm
21	Filter #1 Influent Valve Fail to Close (BFV-236A)	SCADA alarm
22	Filter #1 Effluent Valve General Fault (BFV-238A)	SCADA alarm
23	Filter #1 Effluent Valve Fail to Open (BFV-238A)	SCADA alarm
24	Filter #1 Effluent Valve Fail to Close (BFV-238A)	SCADA alarm
25	Filter #1 Backwash Supply Valve General Fault (BFV-240A)	SCADA alarm
26	Filter #1 Backwash Supply Valve Fail to Open (BFV-240A)	SCADA alarm
27	Filter #1 Backwash Supply Valve Fail to Close (BFV-240A)	SCADA alarm
28	Filter #1 Backwash Waste Valve General Fault (BFV-241A)	SCADA alarm
29	Filter #1 Backwash Waste Valve Fail to Open (BFV-241A)	SCADA alarm
30	Filter #1 Backwash Waste Valve Fail to Close (BFV-241A)	SCADA alarm
31	Filter #1 Backwash Drain Valve General Fault (BFV-242A)	SCADA alarm
32	Filter #1 Backwash Drain Valve Fail to Open (BFV-242A)	SCADA alarm
33	Filter #1 Backwash Drain Valve Fail to Close (BFV-242A)	SCADA alarm
34	Filter #1 Air Scour Supply Valve General Fault (BFV-243A)	SCADA alarm
35	Filter #1 Air Scour Supply Valve Fail to Open (BFV-243A)	SCADA alarm
36	Filter #1 Air Scour Supply Valve Fail to Close (BFV-243A)	SCADA alarm
37	Filter #1 Air Draindown Valve General Fault (BFV-244A)	SCADA alarm
38	Filter #1 Air Draindown Valve Fail to Open (BFV-244A)	SCADA alarm
39	Filter #1 Air Draindown Valve Fail to Close (BFV-244A)	SCADA alarm

Wells 2, 3, and 4 WTP  
Alarm Schedule

<b>Fe/Mn Filter #2 Flow Control Valves</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
40	Filter #2 Influent Valve General Fault (BFV-236B)	SCADA alarm
41	Filter #2 Influent Valve Fail to Open (BFV-236B)	SCADA alarm
42	Filter #2 Influent Valve Fail to Close (BFV-236B)	SCADA alarm
43	Filter #2 Effluent Valve General Fault (BFV-238B)	SCADA alarm
44	Filter #2 Effluent Valve Fail to Open (BFV-238B)	SCADA alarm
45	Filter #2 Effluent Valve Fail to Close (BFV-238B)	SCADA alarm
46	Filter #2 Backwash Supply Valve General Fault (BFV-240B)	SCADA alarm
47	Filter #2 Backwash Supply Valve Fail to Open (BFV-240B)	SCADA alarm
48	Filter #2 Backwash Supply Valve Fail to Close (BFV-240B)	SCADA alarm
49	Filter #2 Backwash Waste Valve General Fault (BFV-241B)	SCADA alarm
50	Filter #2 Backwash Waste Valve Fail to Open (BFV-241B)	SCADA alarm
51	Filter #2 Backwash Waste Valve Fail to Close (BFV-241B)	SCADA alarm
52	Filter #2 Backwash Drain Valve General Fault (BFV-242B)	SCADA alarm
53	Filter #2 Backwash Drain Valve Fail to Open (BFV-242B)	SCADA alarm
54	Filter #2 Backwash Drain Valve Fail to Close (BFV-242B)	SCADA alarm
55	Filter #2 Air Scour Supply Valve General Fault (BFV-243B)	SCADA alarm
56	Filter #2 Air Scour Supply Valve Fail to Open (BFV-243B)	SCADA alarm
57	Filter #2 Air Scour Supply Valve Fail to Close (BFV-243B)	SCADA alarm
58	Filter #2 Air Draindown Valve General Fault (BFV-244B)	SCADA alarm
59	Filter #2 Air Draindown Valve Fail to Open (BFV-244B)	SCADA alarm
60	Filter #2 Air Draindown Valve Fail to Close (BFV-244B)	SCADA alarm
<b>Fe/Mn Filter #3 Flow Control Valves</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
61	Filter #3 Influent Valve General Fault (BFV-236C)	SCADA alarm
62	Filter #3 Influent Valve Fail to Open (BFV-236C)	SCADA alarm
63	Filter #3 Influent Valve Fail to Close (BFV-236C)	SCADA alarm
64	Filter #3 Effluent Valve General Fault (BFV-238C)	SCADA alarm
65	Filter #3 Effluent Valve Fail to Open (BFV-238C)	SCADA alarm
66	Filter #3 Effluent Valve Fail to Close (BFV-238C)	SCADA alarm
67	Filter #3 Backwash Supply Valve General Fault (BFV-240C)	SCADA alarm
68	Filter #3 Backwash Supply Valve Fail to Open (BFV-240C)	SCADA alarm
69	Filter #3 Backwash Supply Valve Fail to Close (BFV-240C)	SCADA alarm
70	Filter #3 Backwash Waste Valve General Fault (BFV-241C)	SCADA alarm
71	Filter #3 Backwash Waste Valve Fail to Open (BFV-241C)	SCADA alarm
72	Filter #3 Backwash Waste Valve Fail to Close (BFV-241C)	SCADA alarm
73	Filter #3 Backwash Drain Valve General Fault (BFV-242C)	SCADA alarm
74	Filter #3 Backwash Drain Valve Fail to Open (BFV-242C)	SCADA alarm
75	Filter #3 Backwash Drain Valve Fail to Close (BFV-242C)	SCADA alarm
76	Filter #3 Air Scour Supply Valve General Fault (BFV-243C)	SCADA alarm
77	Filter #3 Air Scour Supply Valve Fail to Open (BFV-243C)	SCADA alarm
78	Filter #3 Air Scour Supply Valve Fail to Close (BFV-243C)	SCADA alarm
79	Filter #3 Air Draindown Valve General Fault (BFV-244C)	SCADA alarm
80	Filter #3 Air Draindown Valve Fail to Open (BFV-244C)	SCADA alarm
81	Filter #3 Air Draindown Valve Fail to Close (BFV-244C)	SCADA alarm

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<b>PFAS Filters</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
82	Bag Filters High Differential Pressure (10 psi) (DPIT-215)	SCADA alarm
83	Combined PFAS Influent No-Flow (Flow=0 gpm) (FIT-311)	SCADA alarm, interlock 19
84	Combined PFAS Influent High Flow (>1400 gpm) (FIT-311)	SCADA alarm
85	Combined PFAS Effluent No-Flow (Flow=0 gpm) (FIT-312)	SCADA alarm, interlock 20
86	Combined PFAS Effluent High Flow (>1400 gpm) (FIT-312)	SCADA alarm
87	PFAS Lead Filter #1 Differential Low Pressure (-3 psi) (DPIT-313A)	SCADA alarm
88	PFAS Lead Filter #1 Differential High Pressure (10 psi) (DPIT-313A)	SCADA alarm
89	PFAS Lead Filter #2 Differential Low Pressure (-3 psi) (DPIT-313B)	SCADA alarm
90	PFAS Lead Filter #2 Differential High Pressure (10 psi) (DPIT-313B)	SCADA alarm
91	PFAS Lead Filter #3 Differential Low Pressure (-3 psi) (DPIT-313C)	SCADA alarm
92	PFAS Lead Filter #3 Differential High Pressure (10 psi) (DPIT-313C)	SCADA alarm
93	PFAS Lag Filter #1 Differential Low Pressure (-3 psi) (DPIT-315A)	SCADA alarm
94	PFAS Lag Filter #1 Differential High Pressure (10 psi) (DPIT-315A)	SCADA alarm
95	PFAS Lag Filter #2 Differential Low Pressure (-3 psi) (DPIT-315B)	SCADA alarm
96	PFAS Lag Filter #2 Differential High Pressure (10 psi) (DPIT-315B)	SCADA alarm
97	PFAS Lag Filter #3 Differential Low Pressure (-3 psi) (DPIT-315C)	SCADA alarm
98	PFAS Lag Filter #3 Differential High Pressure (10 psi) (DPIT-315C)	SCADA alarm
99	PFAS Lead Filter #1 Low Pressure (PIT-316A)	SCADA alarm
100	PFAS Lead Filter #1 High Pressure (PIT-316A)	SCADA alarm
101	PFAS Lead Filter #2 Low Pressure (PIT-316B)	SCADA alarm
102	PFAS Lead Filter #2 High Pressure (PIT-316B)	SCADA alarm
103	PFAS Lead Filter #3 Low Pressure (PIT-316C)	SCADA alarm
104	PFAS Lead Filter #3 High Pressure (PIT-316C)	SCADA alarm
105	PFAS Lag Filter #1 Low Pressure (PIT-317A)	SCADA alarm
106	PFAS Lag Filter #1 High Pressure (PIT-317A)	SCADA alarm
107	PFAS Lag Filter #2 Low Pressure (PIT-317B)	SCADA alarm
108	PFAS Lag Filter #2 High Pressure (PIT-317B)	SCADA alarm
109	PFAS Lag Filter #3 Low Pressure (PIT-317C)	SCADA alarm
110	PFAS Lag Filter #3 High Pressure (PIT-317C)	SCADA alarm
111	Filtered Water Low Pressure (PIT-318)	SCADA alarm
112	Filtered Water High Pressure (PIT-318)	SCADA alarm
<b>Finished Water System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
113	Finished Water Wet Well Low Level (LE/LIT-711)	SCADA alarm
114	Finished Water Wet Well High Level (LE/LIT-711)	SCADA alarm
115	Finished Water Wet Well High-High Level (LSH-712A)	SCADA alarm, interlock 21
116	Finished Water Wet Well Low-Low Level (LSH-712B)	SCADA alarm, interlock 22
117	Finished Water Pump #1 VFD Fault (VFD-700A)	SCADA alarm
118	Finished Water Pump #1 High Temperature (VFD-700A)	SCADA alarm
119	Finished Water Pump #2 VFD Fault (VFD-700B)	SCADA alarm
120	Finished Water Pump #2 High Temperature (VFD-700B)	SCADA alarm
121	Finished Water Pump #3 VFD Fault (VFD-700C)	SCADA alarm

Wells 2, 3, and 4 WTP  
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122	Finished Water Pump #3 High Temperature (VFD-700C)	SCADA alarm
123	Finished Water Pump #1 Low Pressure (PIT-713A)	SCADA alarm
124	Finished Water Pump #1 High Pressure (PIT-713A)	SCADA alarm
125	Finished Water Pump #1 High-High Pressure (PIT-713A)	SCADA alarm, interlock 23
126	Finished Water Pump #2 Low Pressure (PIT-713B)	SCADA alarm
127	Finished Water Pump #2 High Pressure (PIT-713B)	SCADA alarm
128	Finished Water Pump #2 High-High Pressure (PIT-713B)	SCADA alarm, interlock 24
129	Finished Water Pump #3 Low Pressure (PIT-713C)	SCADA alarm
130	Finished Water Pump #3 High Pressure (PIT-713C)	SCADA alarm
131	Finished Water Pump #3 High-High Pressure (PIT-713C)	SCADA alarm, interlock 25
132	Finished Water Pump #1 No-Flow (Flow=0 gpm) (FIT-714A)	SCADA alarm, interlock 26
133	Finished Water Pump #1 High Flow (>800 gpm) (FIT-714A)	SCADA alarm
134	Finished Water Pump #2 No-Flow (Flow=0 gpm) (FIT-714B)	SCADA alarm, interlock 27
135	Finished Water Pump #2 High Flow (>800 gpm) (FIT-714B)	SCADA alarm
136	Finished Water Pump #3 No-Flow (Flow=0 gpm) (FIT-714C)	SCADA alarm, interlock 28
137	Finished Water Pump #3 High Flow (>800 gpm) (FIT-714C)	SCADA alarm
<b>Backwash/Recycle/Sludge System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
138	Recycle Water Pump #1 VFD Fault (VFD-800A)	SCADA alarm
139	Recycle Water Pump #1 High Temperature (VFD-800A)	SCADA alarm
140	Recycle Water Pump #2 VFD Fault (VFD-800B)	SCADA alarm
141	Recycle Water Pump #2 High Temperature (VFD-800B)	SCADA alarm
142	Sludge Pump #1 Overload (P-801A)	SCADA alarm
143	Sludge Pump #1 Fault (P-801A)	SCADA alarm
144	Sludge Pump #2 Overload (P-801B)	SCADA alarm
145	Sludge Pump #2 Fault (P-801B)	SCADA alarm
146	Backwash Waste Tank #1 Low Level (LE/LIT-811A)	SCADA alarm
147	Backwash Waste Tank #1 High Level (LE/LIT-811A)	SCADA alarm
148	Backwash Waste Tank #2 Low Level (LE/LIT-811B)	SCADA alarm
149	Backwash Waste Tank #2 High Level (LE/LIT-811B)	SCADA alarm
150	Backwash Waste Tank #3 Low Level (LE/LIT-811C)	SCADA alarm
151	Backwash Waste Tank #3 High Level (LE/LIT-811C)	SCADA alarm
152	Backwash Supply High Flow (>1100 gpm) (FIT-812)	SCADA alarm
153	Backwash Supply Control Valve General Fault (BFV-832)	SCADA alarm
154	Backwash Supply Control Valve Fail to Open (BFV-832)	SCADA alarm
155	Backwash Supply Control Valve Fail to Close (BFV-832)	SCADA alarm
156	Backwash Supply Isolation Valve 1 General Fault (BFV-834A)	SCADA alarm
157	Backwash Supply Isolation Valve 1 Fail to Open (BFV-834A)	SCADA alarm
158	Backwash Supply Isolation Valve 1 Fail to Close (BFV-834A)	SCADA alarm
159	Backwash Supply Isolation Valve 2 General Fault (BFV-834B)	SCADA alarm
160	Backwash Supply Isolation Valve 2 Fail to Open (BFV-834B)	SCADA alarm
161	Backwash Supply Isolation Valve 2 Fail to Close (BFV-834B)	SCADA alarm
162	Backwash Supply Isolation Valve 3 General Fault (BFV-834C)	SCADA alarm
163	Backwash Supply Isolation Valve 3 Fail to Open (BFV-834C)	SCADA alarm
164	Backwash Supply Isolation Valve 3 Fail to Close (BFV-834C)	SCADA alarm

Wells 2, 3, and 4 WTP  
Alarm Schedule

165	Recycle Water No-Flow (Flow=0 gpm) (FIT-813)	SCADA alarm, interlock 29
166	Recycle Water High Flow (>10% FIT-212 Flow) (FIT-813)	SCADA alarm
167	Sludge High Flow (>100 gpm) (FIT-814)	SCADA alarm
168	Backwash Waste Tank #1 High-High Level (LSH-815A)	SCADA alarm
169	Backwash Waste Tank #1 Low-Low Level (LSL-816A)	SCADA alarm, interlock 32
170	Backwash Waste Tank #2 High-High Level (LSH-815B)	SCADA alarm
171	Backwash Waste Tank #2 Low-Low Level (LSL-816B)	SCADA alarm, interlock 33
172	Backwash Waste Tank #3 High-High Level (LSH-815C)	SCADA alarm
173	Backwash Waste Tank #3 Low-Low Level (LSL-816C)	SCADA alarm, interlock 34
174	Recycle Water Pump #1 High Discharge Pressure (PIT-817A)	SCADA alarm
175	Recycle Water Pump #1 High-High Discharge Pressure (PIT-817A)	SCADA alarm, interlock 30
176	Recycle Water Pump #2 High Discharge Pressure (PIT-817B)	SCADA alarm
177	Recycle Water Pump #2 High-High Discharge Pressure (PIT-817B)	SCADA alarm, interlock 31
178	Recycle Backwash Waste Tank Isolation Valve 1 General Fault (BFV-836A)	SCADA alarm
179	Recycle Backwash Waste Tank Isolation Valve 1 Fail to Open (BFV-836A)	SCADA alarm
180	Recycle Backwash Waste Tank Isolation Valve 1 Fail to Close (BFV-836A)	SCADA alarm
181	Recycle Backwash Waste Tank Isolation Valve 2 General Fault (BFV-836B)	SCADA alarm
182	Recycle Backwash Waste Tank Isolation Valve 2 Fail to Open (BFV-836B)	SCADA alarm
183	Recycle Backwash Waste Tank Isolation Valve 2 Fail to Close (BFV-836B)	SCADA alarm
184	Recycle Backwash Waste Tank Isolation Valve 3 General Fault (BFV-836C)	SCADA alarm
185	Recycle Backwash Waste Tank Isolation Valve 3 Fail to Open (BFV-836C)	SCADA alarm
186	Recycle Backwash Waste Tank Isolation Valve 3 Fail to Close (BFV-836C)	SCADA alarm
<b>Air Scour Blower System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
187	Air Blower System Overload (ASB-202)	SCADA alarm
<b>Potassium Hydroxide Feed System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
188	KOH Pump #1 Fault (MP-503)	SCADA alarm
189	KOH Pump #2 Fault (MP-504)	SCADA alarm
190	KOH Bulk Tank High Level (LE/LIT-511)	SCADA alarm
191	KOH Bulk Tank Low Level (LE/LIT-511)	SCADA alarm
192	KOH Bulk Tank Low-Low Level (LE/LIT-511)	SCADA alarm
193	KOH Bulk Tank High-High Level (LSH-512)	SCADA alarm
194	KOH Day Tank High Level (LSH-513)	SCADA alarm, interlock 41
195	KOH Bulk Chemical Fill Panel Emergency Alarm (PB-517)	SCADA alarm
<b>Sodium Hypochlorite Feed System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
196	Pre-Filtration NaOCl Metering Pump #1 Fault (MP-404)	SCADA alarm
197	Pre-Filtration NaOCl Pump #2 Fault (MP-405)	SCADA alarm
198	Post-Filtration NaOCl Pump #1 Fault (MP-407)	SCADA alarm
199	Post-Filtration NaOCl Pump #2 Fault (MP-408)	SCADA alarm
200	NaOCl Bulk Tank High Level (LE/LIT-411)	SCADA alarm
201	NaOCl Bulk Tank Low Level (LE/LIT-411)	SCADA alarm
202	NaOCl Bulk Tank Low-Low Level (LE/LIT-411)	SCADA alarm
203	NaOCl Bulk Tank High-High Level (LSH-412)	SCADA alarm

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204	Pre-Filtration NaOCl Day Tank High Level (LSH-413)	SCADA alarm, interlock 35
205	Post-Filtration NaOCl Day Tank High Level (LSH-416)	SCADA alarm, interlock 38
206	KOH & NaOCl Containment Area Flood (LSH-419)	SCADA alarm
207	NaOCl Area Chemical Emergency Shower Flow (FS-420)	SCADA alarm
208	KOH Area Chemical Emergency Shower Flow (FS-421)	SCADA alarm
209	NaOCl Bulk Chemical Fill Panel Emergency Alarm (PB-422)	SCADA alarm
210	NaOCl Area Personnel Down Switch (PB-985)	SCADA alarm
<b>Sodium Bisulfite Feed System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
211	NaHSO3 Pump #1 Fault (MP-603)	SCADA alarm
212	NaHSO3 Pump #2 Fault (MP-604)	SCADA alarm
213	NaHSO3 Bulk Tank High Level (LE/LIT-611)	SCADA alarm
214	NaHSO3 Bulk Tank Low Level (LE/LIT-611)	SCADA alarm
215	NaHSO3 Bulk Tank Low-Low Level (LE/LIT-611)	SCADA alarm
216	NaHSO3 Bulk Chemical Fill Panel Emergency Alarm (PB-612)	SCADA alarm
217	NaHSO3 Bulk Tank High-High Level (LSH-612)	SCADA alarm
218	NaHSO3 Day Tank High Level (LSH-613)	SCADA alarm, interlock 44
219	NaHSO3 Containment Area Flood (LSH-614)	SCADA alarm
220	NaHSO3 Area Personnel Down Switch (PB-984)	SCADA alarm
<b>Sodium Fluoride Feed System</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
221	NaF Pump #1 Fault (MP-651)	SCADA alarm
<b>Standby Power</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
222	Automatic Transfer Switch Loss of Utility	SCADA alarm
223	Stand-by Generator Running	SCADA alarm
224	Stand-by Generator Fault	SCADA alarm
<b>Instrumentation</b>		
<i>Alarm No.</i>	<i>Alarm Event</i>	<i>Action</i>
225	Nitrate Removal Area Low Temperature (TT-921)	SCADA alarm
226	Nitrate Removal Area High Temperature (TT-921)	SCADA alarm
227	Fe/Mn Removal Area Low Temperature (TT-923)	SCADA alarm
228	Fe/Mn Removal Area High Temperature (TT-923)	SCADA alarm
229	WTP Control Room Low Temperature (TT-926)	SCADA alarm
230	WTP Control Room High Temperature (TT-926)	SCADA alarm
231	Electrical Room Low Temperature (TT-930)	SCADA alarm
232	Electrical Room High Temperature (TT-930)	SCADA alarm
233	Low Raw Water pH (AIT-961)	SCADA alarm
234	High Raw Water pH (AIT-961)	SCADA alarm
235	Low Oxidized Water pH (AIT-962)	SCADA alarm
236	High Oxidized Water pH (AIT-962)	SCADA alarm
237	Low Oxidized Water Cl2 (AIT-962)	SCADA alarm
238	Low-Low Oxidized Water Cl2 (AIT-962)	SCADA alarm, interlock 48
239	High Oxidized Water Cl2 (AIT-962)	SCADA alarm
240	High-High Oxidized Water Cl2 (AIT-962)	SCADA alarm, interlock 49

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241	Low Fe/Mn Filtered Water pH (AIT-963)	SCADA alarm
242	High Fe/Mn Filtered Water pH (AIT-963)	SCADA alarm
243	Low Fe/Mn Filtered Water Cl2 (AIT-963)	SCADA alarm
244	High Fe/Mn Filtered Water Cl2 (AIT-963)	SCADA alarm
245	Low PFAS Influent pH (AIT-964)	SCADA alarm
246	Low-Low PFAS Influent pH (AIT-964)	SCADA alarm, interlock 50
247	High PFAS Influent pH (AIT-964)	SCADA alarm
248	High-High PFAS Influent pH (AIT-964)	SCADA alarm, interlock 51
249	High PFAS Influent Cl2 (AIT-964)	SCADA alarm
250	High-High PFAS Influent Cl2 (AIT-964)	SCADA alarm, interlock 52
251	Low Finished Water pH (AIT-965)	SCADA alarm
252	Low-Low Finished Water pH (AIT-965)	SCADA alarm, interlock 53
253	High Finished Water pH (AIT-965)	SCADA alarm
254	High-High Finished Water pH (AIT-965)	SCADA alarm, interlock 54
255	Low Finished Water Cl2 (AIT-965)	SCADA alarm
256	Low-Low Finished Water Cl2 (AIT-965)	SCADA alarm, interlock 55
257	High Finished Water Cl2 (AIT-965)	SCADA alarm
258	High-High Finished Water Cl2 (AIT-965)	SCADA alarm, interlock 56
259	Low 100-Foot Sample Tap pH (AIT-966)	SCADA alarm
260	Low-Low 100-Foot Sample Tap pH (AIT-966)	SCADA alarm
261	High 100-Foot Sample Tap pH (AIT-966)	SCADA alarm
262	High-High 100-Foot Sample Tap pH (AIT-966)	SCADA alarm
263	Low 100-Foot Sample Tap Cl2 (AIT-966)	SCADA alarm
264	Low-Low 100-Foot Sample Tap Cl2 (AIT-966)	SCADA alarm
265	High 100-Foot Sample Tap Cl2 (AIT-966)	SCADA alarm
266	High-High 100-Foot Sample Tap Cl2 (AIT-966)	SCADA alarm
267	Tight Tank High Level (LSH-971)	SCADA alarm
268	Tight Tank High-High Level (LSH-972)	SCADA alarm
269	Nitrate Removal Area Personnel Down (PB-981)	SCADA alarm
270	PFAS Removal Area Personnel Down (PB-982)	SCADA alarm
271	Fe/Mn Removal Area Personnel Down (PB-983)	SCADA alarm
272	WTP Control Room Personnel Down (PB-986)	SCADA alarm
273	Pipe Gallery West Personnel Down (PB-991)	SCADA alarm
274	Pipe Gallery East Personnel Down (PB-992)	SCADA alarm
275	WTP Control Panel Emergency Stop (PB-993)	SCADA alarm, interlock 57
276	Fe/Mn Removal Area Emergency Stop (PB-994)	SCADA alarm, interlock 58
277	Pipe Gallery Flood (LSH-996)	SCADA alarm
278	Nitrate Removal Area Dehumidifier #1 High Level (DHU-1)	SCADA alarm
279	Nitrate Removal Area Dehumidifier #2 High Level (DHU-2)	SCADA alarm
280	Fire (Fire Alarm Control Panel)	SCADA alarm
281	Supervisory (Fire Alarm Control Panel)	SCADA alarm
282	WTP Intrusion (Security Access Control Panel)	SCADA alarm
283	Chemical Alarm (Chemical Alarm System Control Panel)	SCADA alarm



## SECTION 13420

### CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. Provide all wiring, labor, tools, materials, and equipment to modify existing control panels, furnish new control panels, install, and test control panels, networking equipment, and enclosures in accordance with this Section and applicable reference standards listed in Section 13320 Instrumentation and Controls.

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements
- 3. Section 13200- Programmable Logic Controllers
- 4. Section 13320- Instrumentation and Controls

- C. Work included:

- 1. The Contractor shall be responsible for the following:
  - i. Installation of Control Panels.
  - ii. Installation of Intrinsic Safety Barrier Panels (ISBP).
  - iii. Termination, labeling, and testing of all cable and signal wiring to associated panels.

##### 1.3 SUBMITTALS

- A. Provide in accordance with Division 1 General Requirements.

- B. Product Data: as listed below unless letter regarding shop drawing level control panel drawings are submitted per Paragraph 1. 3.C.1. below.

- 1. Bill of materials (BOM) for each control panel, including panel tag name or number and component description, quantity, manufacturer name and model number for each component used in fabrication. BOM: keyed to easily correlate components

shown in bill of materials with components shown on control panel equipment layout Drawings.

2. Manufacturer's literature for each component identified on BOM. Clearly designate part number with highlights or arrows.
3. Equipment layout drawings for each control panel
4. Panel communication diagrams for each control panel
5. Power wiring diagrams for each control panel
6. Programmable logic controllers (PLC) input/output (I/O) wiring diagrams, on a module-by-module basis

C. Shop Drawings

1. A letter with copy of fabrication drawings confirming control panel fabricator will fabricate control panels as specified on shop drawing level control panel drawings may be provided in lieu of Shop Drawings.

D. Procurement of materials and manufacture of the control panels shall not begin until related submittals have been reviewed by the Engineer.

E. Closeout and Maintenance Material Submittals per Division 1 General Requirements.

1. As-Built Drawings

- i. After fabrication of control panels and factory acceptance testing is complete, panel shop shall provide drawings of control panels, representing as-built conditions. Submit panel drawings in AutoCAD DWG and Adobe PDF file formats, on USB drive media or cloud-based file sharing service.
- ii. Submit with panels at delivery.
- iii. Legible red-line markups of shop drawing level drawings from panel shop may be provided if used in lieu of Shop Drawings.

F. Operation and Maintenance (O&M) Information

1. Refer to Division 1 General Requirements for O&M material requirements. In addition to the requirements in Division 1, the control panel section of the O&M manuals shall include:
  - i. Record Drawings of the control panels, updated to reflect the panels after checkout and startup.
  - ii. Installation and operation manuals for all major control panel components, including the network switches, PLCs, I/O modules, communication equipment.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Division 1 General Requirements.
- B. Control panel fabricator, Panel Shop, shall hold a valid UL-508A certification for their panel fabrication facility, and shall have executed a minimum of 3 Projects of similar scope in the municipal water and wastewater markets in the past 5 years.
- C. Surge protection shall be provided by a recognized manufacturer with a minimum of 5 years' experience in the production of this equipment.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Division 1 General Requirements.
- B. Acceptance at Site
  - 1. Check equipment, instruments, and materials for damage or defects within 7 days of delivery. Repair or replace to satisfaction of Engineer.

#### 1.6 COORDINATION

- A. Provide in accordance with Division 1 General Requirements.
- B. Coordinate equipment, instrument, and material delivery to coincide with the Project schedule. If the delivery schedule of any equipment, instrument, or material shall affect the overall Project schedule, notify the Owner and Engineer in writing immediately. Include in the written notification, documentation from the equipment Supplier indicating the revised delivery schedule and reason for the change.
- C. When applicable, coordinate delivery equipment, instruments, or materials to be delivered directly to another trade or vendor for installation in a system or control panel provided under another Specification section.
- D. Exercise care while loading, unloading and transporting equipment, instruments and materials to avoid damage. Check all equipment, instruments, and materials for damage or defects within 7 days of delivery to the Project Site.
- E. Equipment, instruments, and materials required to be stored on Site prior to installation shall be stored in such a manner to avoid damage or exposure to water, dust, or construction debris.
- F. Repair or replace, at no additional cost to the Owner, all equipment, instruments and materials that are defective or damaged during installation.

### PART 2 – PRODUCTS

#### 2.1 CONTROL PANEL COMPONENTS

A. The following table contains control panel components and recommended manufacturers for each component.

<b>Control Panel Components</b>	<b>Manufacturer (or approved equivalent)</b>	<b>Comments</b>
Enclosures	Saginaw Hoffman Hammond	Shall be suitable for use in the environments that they will be located (NEMA, NFPA, etc.)
Enclosure Lighting	Saginaw Hoffman Hammond	LED strip light to provide interior lighting for enclosures
Programmable Logic Controllers (PLCs)		Refer to section 13200, Programmable Logic Controllers
Operator Interface Terminals (OITs)		Refer to section 13200, Programmable Logic Controllers
Wireway	Panduit Hoffman	
DIN Rail	Allen Bradley Phoenix Contact	
Terminal Blocks	Allen Bradley Phoenix Contact Entrelec	Utilize 2-tier terminal blocks wherever possible to conserve panel space.
Terminal Block Fuse Holders	Allen Bradley Phoenix Contact Entrelec	Specify fuse holders with blown fuse indicators.
Circuit Breakers	Square D Allen Bradley	
120VAC Surge Suppressors	Allen Bradley Phoenix Contact Square D	
Analog Surge Suppressors	Allen Bradley Phoenix Contact Citel	
Media Converters	N-Tron B&B Electronics L-Com	Furnish with DIN rail mount converters as required on the network architecture

<b>Control Panel Components</b>	<b>Manufacturer (or approved equivalent)</b>	<b>Comments</b>
Fuses	Bussman Mersen	All glass fuses in control panels shall be fast acting style. Motor circuit protection fuses shall be time delay style.
Control Relays	Allen Bradley Square D Omron	Include all required bases and hardware.
Power Supplies	Sola Phoenix Contact Allen Bradley	Furnish with power supplies sized as required for equipment contained within the enclosures and to supply field equipment connected to the enclosure.
Intrinsic Safety Barriers	Pepperl & Fuchs MTL Phoenix Contact	Discrete barriers shall be 2-channel barriers. Analog barriers shall be 2-wire barriers.
Ethernet Switches (Unmanaged)	N-Tron Allen Bradley B&B Electronics	Switches shall be furnished with direct-wired low voltage power source within the enclosure.
Ethernet Switches (Managed)	Cisco Allen Bradley N-TRON	All switches throughout the facility shall be furnished from the same manufacturer.
Emergency Power System	Sola Phoenix Contact Allen Bradley	Include uninterruptible power supply (UPS) in each control panel sized to furnish with at least 10 minutes of emergency power.
Panel Heaters	Hammond Hoffman Pfannenber	Furnish with panel heaters for outside control panels where temperature is a concern for electronic components.
Receptacles	Pass & Seymour Hubbel Leviton	Furnish with receptacle for UPS and convenience receptacle in each PLC control panel.
Pilot/Status Lights (Push to test)	Allen Bradley General Electric Square D	Color code as follows: Red-Fault, Green-Run
HOA, On/Off, L/R switches and push buttons	Allen Bradley General Electric Square D	Furnish switches and push buttons with matching nameplate

PART 3 – EXECUTION

3.1 CONTROL PANEL FABRICATION

B. General

1. Control panels shall include PLC, required I/O modules with chassis, if applicable, power supply, cables, and all appurtenances. Enclosures shall include switches, lights, annunciators and all appurtenances. Furnish panels and materials from one Supplier.
2. Provide electronic equipment utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture, and fungus. Solid-state components: rated to provide reliable performance over ambient atmosphere fluctuations between 0 – 140 degrees F and 0 – 95 percent relative humidity, non-condensing. Field mounted equipment and system components: designed for installation in dusty, humid, and slightly corrosive service conditions.
3. Equipment installed in a hazardous area shall meet Class, Group, and Division to comply with the NFPA 70.
4. Provide heavy duty equipment, cabinets, and devices designed for continuous industrial service using current production products.
5. Fabrication requirements of control panels, enclosures, consoles, and cabinets.
  - i. Size enclosures to fit all required equipment, accommodate all field wires and provide adequate working space.
  - ii. Size control panel enclosures to provide at least 20 percent spare space for future expansion.
  - iii. Provide PLC hardware to accommodate minimum 20 percent spare of each I/O type used in panel, wired to terminals and interposing relays during fabrication process.
  - iv. Provide panel door with flush type, 3-point locking latches with keys.
  - v. Provide drawing pocket to hold as-built and service documentation.
  - vi. Provide control panel assemblies in compliance with UL 508A Standards.

C. Control Panels

1. The name, Tag Identification, and NEMA enclosure rating for the control panels to be furnished under this section or under Division 11 shall be as follows:

<b>Name</b>	<b>Tag Id</b>	<b>Enclosure</b>
Well Station 2 Control Panel	(Well 2 CP)	Wall Mounted, NEMA-12
Well Station 3 Control Panel	(Well 3 CP)	Wall Mounted, NEMA-12
Well Station 4 Control Panel	(Well 4 CP)	Wall Mounted, NEMA-12
WTP Main Control Panel	(MCP)	Floor Mounted, NEMA-1
Well Station 4 Fiber-Patch Panel	(FPP)	Wall Mounted, NEMA-1
WTP Main Fiber-Patch Panel	(MFPP)	Wall Mounted, NEMA-1

Potassium Hydroxide Bulk Chemical Fill Panel (Interior and Exterior)	(KOH BCFP)	Wall Mounted, NEMA-4X
Sodium Hypochlorite Bulk Chemical Fill Panel (Interior and Exterior)	(NaOCl BCFP)	Wall Mounted, NEMA-4X
Sodium Bisulfite Bulk Chemical Fill Panel (Interior and Exterior)	(NaHSO3 BCFP)	Wall Mounted, NEMA-4X
Sludge Pump Field Control Panel	SP-FCP	Wall Mounted, NEMA-4X

2. Refer to the Contract Drawings for the location of each control panel/cabinet and panel layouts for specified panels.

3. Panel/Cabinet Components

I. The Well Station Control Panels shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:

- i. PLC and subsystem components as specified in Section 13200.
- ii. OIT as specified in Section 13200.
- iii. Managed Ethernet Switch as specified herein (Well Station 4 Control Panel only).
- iv. UPS as specified herein and shown on the Contract Drawings.
- v. Courtesy equipment as specified herein.
- vi. Electrical receptacles as specified in Division 16.
- vii. Panel Surge Suppression and Power Supplies as specified herein.
- viii. Indicator lights as shown on the Contract Drawings.
- ix. Emergency alarm pushbutton as specified herein and as shown on the Contract Drawings.
- x. Network and communication devices specified herein and shown on the Contract Drawings.
- xi. Programming port as specified herein.
- xii. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.

II. The Main Control Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:

- i. PLC and subsystem components as specified in Section 13200.
- ii. OIT as specified in Section 13200.
- iii. Managed Ethernet Switch as specified herein.
- iv. UPS as specified herein and shown on the Contract Drawings.
- v. Courtesy equipment as specified herein.

- vi. Electrical receptacles as specified in Division 16.
  - vii. Panel Surge Suppression and Power Supplies as specified herein.
  - viii. Indicator lights as shown on the Contract Drawings.
  - ix. Emergency alarm pushbutton as specified herein and as shown on the Contract Drawings.
  - x. Network and communication devices specified herein and shown on the Contract Drawings.
  - xi. Programming port as specified herein.
  - xii. Firewall as furnished by the Application Engineer.
  - xiii. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.
- III. The Well Station 4 Fiber-Patch Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. 6 port fiber connection
  - ii. Multimode 62.6 fiber compatibility
  - iii. Integrated 12 position slicing chip and adapter panel
  - iv. Cable entry tie down points
  - v. DIN-rail mounting system
- IV. The WTP Main Fiber-Patch Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. 6 port fiber connection
  - ii. Multimode 62.6 fiber compatibility
  - iii. Integrated 12 position slicing chip and adapter panel
  - iv. Cable entry tie down points
  - v. DIN-rail mounting system
- V. The Potassium Hydroxide Bulk Chemical Fill Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. Clear window vision panel.
  - ii. KOH bulk storage tank level digital display as specified herein.
  - iii. Indicator lights as shown on the Contract Drawings.
  - iv. Emergency alarm pushbutton as specified herein and as shown on the Contract Drawings.
  - v. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.
- VI. The Sodium Hypochlorite Bulk Chemical Fill Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. Clear window vision panel.
  - ii. NaOCl bulk storage tank level digital display as specified herein.
  - iii. Indicator lights as shown on the Contract Drawings.
  - iv. Emergency alarm pushbutton as specified herein and as shown on the



Contract Drawings.

- v. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.
- VII. The Sodium Bisulfite Bulk Chemical Fill Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. Clear window vision panel.
  - ii. NaHSO<sub>3</sub> bulk storage tank level digital display as specified herein.
  - iii. Indicator lights as shown on the Contract Drawings.
  - iv. Emergency alarm pushbutton as specified herein and as shown on the Contract Drawings.
  - v. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.
- VIII. The Sludge Pump Field Control Panel shall include, make provisions for, and provide sufficient space for the following, as indicated on the Contract Drawings and specified herein:
- i. Clear window vision panel.
  - ii. Three (3) Backwash Waste Tank level digital displays as specified herein.
  - iii. Selector switches as shown on the Contract Drawings.
  - iv. Indicator lights as shown on the Contract Drawings.
  - v. All other ancillary equipment required for a fully operational system as specified herein and shown on the Contract Drawings.
- IX. Digital displays shall be LED type 14 mm high numbers with display in engineering units coordinated with input signals. Displays shall be NEMA-4X rated. Displays shall be adjustable from one to three decimal points, as manufactured by Newport Electronics, Honeywell, General Electric, or approved equal.

#### D. Wiring

1. Interconnecting wiring: stranded and have 600-volt insulation.
2. Power distribution wiring on line side of fuses.
3. Power and low voltage direct current (DC) wiring systems: routed in separate wireways. Crossing of power distribution wiring and control wiring: at right angles. Different system wires routed parallel to each other: separated by at least six (6) inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs may not be filled to more than 60 percent visible fill.
4. All wiring shall terminate onto single-or-double tier terminal blocks, where each terminal is sequentially numbered with a unique identifier. Direct interlock wiring between equipment is not allowed. Control panel: fabricated with minimum 20 percent spare terminals. Terminal blocks: arranged in vertical rows and separated into groups;

power, alternating current (AC) control, DC signal. Terminal blocks: compression screw type. Spring-clamp style terminals will not be accepted.

- i. Discrete inputs (DI) and discrete outputs (DO) shall have 2 terminals per point with adjacent terminal assignments. Active and spare points: wired to terminal blocks.
- ii. Analog inputs (AI) and analog outputs (AO) shall have a minimum of three (3) terminals per shielded pair. Provide three (3) terminals for direct connection of powered, 4-wire loops. Provide four (4) terminals for direct connection of loop powered, 2-wire loops. Provide five (5) terminals for connection of analog loops incorporating a local indicator or recorder. One terminal is for shielded ground connections for cable pairs. Ground the shielded signal cable at the PLC cabinet. Wire active and spare points to terminal blocks.
- iii. Wire and tube markers in accordance with Division 16 requirements.
- iv. Only one (1) side of a terminal block row shall be used for internal wiring. Field wiring side of terminal shall not be within six (6) inches of side panel or adjacent terminal, or within eight (8) inches of bottom of panel.
- v. Locate terminals for field wiring to reduce amount of routing through wireway to carry wiring to termination point.

5. Provide wiring, internal to panel and field wiring, with service loop to allow for future adjustment of termination point. Service loop: no more than 4-5 inches, stored in associated wireway.

6. Identify live circuit wiring, independent of the panel's normal circuit breaker protection.

7. All wiring shall be clearly tagged and color-coded in accordance with NEC. All tag numbers and color-coding shall correspond to panel wiring diagrams prepared by Engineer. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. Utilize the following color-coding scheme.

- i. Incoming 120 VAC Hot – Black
- ii. 120 VAC Hot Wiring (control circuit wires downstream of panel circuit breaker) – Red
- iii. 120 VAC Neutral – White
- iv. Ground – Green with yellow stripe
- v. DC Wiring – Blue
- vi. DC Common – White with blue stripe
- vii. Intrinsically Safe Wiring - Light Blue
- viii. Foreign Voltage – Yellow

#### E. Control Panel Loss of Power

1. Each control panel containing a PLC shall have an input configured to alarm the operators upon loss of main control panel power. Display alarm on SCADA nodes to alert operators that attention is required.

#### F. Control Panel Overcurrent Protection

1. Overcurrent protection devices: properly sized to protect associated devices and loads.
2. Circuit breakers: sized to protect associated equipment and provide necessary power to operate.
3. Fuses
  - i. Glass fuses not associated with motor circuit protection or inductive loads: specified as fast-acting style. Fuses associated with motor circuit protection or inductive loads: specified as time delay style.

#### G. Lightning/Surge Suppression

1. Provide to protect control panel and associated equipment from surges on incoming power circuits, or those induced by lightning strikes and propagated along signal or power lines connected to control panels. Surge protection: sized properly for intended purpose.
2. 120 VAC Surge Suppression
  - i. Provide incoming 120 VAC power source for control panel with surge suppression located in the control panel. Surge protection device rated at a minimum of 10 kilo amperes (kA).
  - ii. Provide surge suppressors with auxiliary contact, connected to PLC to indicate surge suppressor failure. If there are multiple circuits within the same control panel, provide each incoming 120 VAC power sources with surge suppression.
3. Analog Signal Surge Suppression
  - i. Supply analog signals connected to equipment or instrumentation located outside the building where the control panel is installed with DIN rail mounted surge suppression in control panel. Provide surge protection at both ends of signal cable and mount surge protection as close to equipment, instrument, or termination point as possible. Provide minimum of 10 kA surge current suppression.
4. Ethernet Surge Suppression
  - i. Provide Ethernet cabling connected to control panel that leaves the building that houses the control panel with surge suppression in the control panel. Provide surge protection at both ends of telephone or Ethernet cabling and mount surge protection as close to termination point as possible.

#### H. Uninterruptible Power Supplies

1. Control panel mounted UPS shall be 24VDC and din-rail mountable. UPS shall have remote monitoring features with relay contact outputs, connected to the PLC to indicate UPS fault and UPS low battery conditions, at a minimum.
2. Size UPS to provide minimum of 10 minutes of power in event of main control power loss.

I. DC Power Supply

1. Din Rail mounted power supply shall be housed in a rugged metal case with large, accessible, multiple connection screw terminals.
2. Power supply shall be enclosed and finger safe. Open power supplies shall not be acceptable.
3. Power supply shall feature Auto selecting 115/230 VAC, 50/60 Hz single phase input, adjustable voltage, power factor correction, short circuit, overvoltage and over-temperature protection, 90% or greater efficiency, power supply shall be UL listed.

J. Managed Ethernet Switches

1. Ethernet switches sized to accept number of connections shown on Drawings.
2. Managed (Layer 3 and 2) ethernet switches shall have a minimum of eight (8) fast ethernet ports and two (2) Gigabit Ethernet Combo Ports. Provide SFP modules for each combo port used.
3. Provide ethernet switches with minimum of 20 percent spare RJ-45 ports available for future expansion.
4. Ethernet switch acceptable level of quality equal to: Cisco IE3300 and IE1000 series as shown on the drawings.

K. Unmanaged Ethernet Switches

1. Ethernet switches sized to accept number of connections shown on Drawings.
2. Provide ethernet switches with minimum of 20 percent spare RJ-45 ports available for future expansion.
3. Ethernet switch acceptable level of quality equal to: Allen Bradley Stratix 2000.

L. Interposing / Control Relays

1. DIN rail mounted Miniature plug-in style relays sealed, 10A resistive rating at 120VAC, double throw Form C contact outputs, UL Listed. Life expectancy shall be 50 million operations, minimum.

M. Courtesy Equipment

1. Provide in each panel:
  - i. LED light fixture powered from 120VAC and activated by switch or motion sensor when the enclosure door opens. Number of fixtures as required for sufficient lighting to perform maintenance and troubleshooting.
  - ii. Print storage pockets shall be provided on the inside of each panel and shall be of sufficient size to hold prints required to service the equipment.

#### N. Intrinsic Safety Barrier Panels

1. Mount intrinsic safety barriers required for interfacing with equipment and instruments located in a classified area, in a panel separate from control panels.
2. Panels housing intrinsic safety barriers: laid out to facilitate separation of hazardous and non-hazardous wiring. Wireway containing hazardous area wiring: clearly indicated.

#### O. Equipment Mounting/Arrangement

1. Mount components in a manner that permits servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Mount components on inside of panels on removable plates, not directly to enclosure. Mounting: rigid and stable unless shock mounting is required by manufacturer to protect from vibration. Identify components with plastic or metal engraved tags attached with drive pins adjacent to each component, identifying the component in accordance with the Drawings and Specifications.
2. Install exterior panel mounted equipment with suitable gaskets, faceplates, and other measures required to maintain NEMA rating of panel.
3. Provide minimum of 1½ inches between panel wireway and terminal blocks for easy access to wiring.
4. Maintain manufacturer recommended spacing around panel-mounted equipment.
5. ISA-RP60.3 Recommended Practice: used as a guide in layout and arrangement of panels and panel mounted components.

#### P. Nameplates

1. Furnish panels and panel devices with nameplates identifying panel and individual devices with the following.
  - i. Device tag number: as shown on Drawings.
  - ii. Functional description
  - iii. Functional control description
2. Furnish 3/32-inch thick, black and white, Lamacoid nameplates with engraved inscriptions, unless escutcheon plates are specified or noted on Drawings. Letters: black against a white background. Edges of nameplates: beveled and smooth. Affix to panels using #4-40 threaded stainless-steel button head hex screws.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 13420

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## SECTION 13465

### SEQUENCE OF OPERATIONS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. This Specification has been developed to describe a basic functional description of each process by means of a loop description. These function descriptions shall act as a reference for the Contractor, Integrator, and Application Engineer.
- B. The loop descriptions are intended to provide for system operation. The loops specified under this section describe the general system operating requirements and may not include all required control interlocks or safety shutdowns required based on actual process equipment supplied. The control system supplier shall be responsible for coordinating the actual requirements with the individual equipment manufacturers and providing all control and safety equipment required. Coordinate final loop descriptions with Application Engineer, Engineer, and equipment manufacturers.
- C. Related Sections include the following:
  - 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements
  - 3. Division 13 – Special Construction
  - 4. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein.
- B. Submit flow diagrams for the programming of the Programmable Logic Controllers (PLCs).

##### 1.4 OPERATION AND MAINTENANCE MANUALS

- A. Submit materials for inclusion in Operating and Maintenance Manuals specified in Specification Section 01730.

## PART 2 – PRODUCTS (NOT USED)

## PART 3 – EXECUTION

### 3.1 SEQUENCE OF OPERATIONS

A. A summary of alarm conditions is provided in Specification Section 13400 and shown on the Contract Drawings. A summary of equipment interlocks is provided on the Contract Drawings.

B. Wells 2, 3, and 4 Pumps

Groundwater from Well 2 is pumped via one (1) of two (2) multistage inline vertical pumps (P-100A & P-100B), and groundwater from Wells 3 and 4 is pumped via vertical turbine well pumps (Well 3: P-141; Well 4: P-171) into the water treatment process. The pump motor speeds shall be controlled by variable frequency drives (VFDs) (Well 2: P-100A VFD & P-100B VFD; Well 3: P-141 VFD; Well 4: P-171 VFD). Each VFD is provided with a Hand-Off-Auto (H-O-A) selector switch. In the HAND (manual) mode, the operator can locally adjust the motor speed by the corresponding VFD keypad using local buttons to increase/decrease motor speed (0 to 100%). Motor speed (%) and hertz (0 to 60 Hz) are indicated locally on the VFD display; and remotely on the well stations SCADA panel operator interface terminal (OIT); Wells 2, 3, and 4 Water Treatment Plant (WTP) Main Control Panel (MCP) OIT; and in the SCADA system. In the AUTO (remote) mode, the motor speed of the well pump shall be controlled automatically by the SCADA system. An emergency stop push button located on the Well Station SCADA Control Panels (PB-117, PB-152, PB-183) shall de-energize the respective well pump (Well 2: P-100A & P-100B; Well 3: P-141; Well 4: P-171) and an “Emergency Stop” alarm shall be reported in the SCADA system.

In order for the well pumps to run in AUTO mode, the corresponding VFD H-O-A selector switch shall be in the AUTO position. The wells shall operate based on the WTP finished water wet well (FWWW) level via LIT-711 and LSH-712A. The well pumps (Well 2: P-100A & P-100B; Well 3: P-141; Well 4: P-171) and recycle pumps (P-800A, P-800B) shall start at an operator selectable “Well Pump Start” FWWW level set point and shut off at an operator selectable “Well Pump Stop” FWWW level set point. The well pumps shall start and stop sequentially, as determined during WTP startup and testing.

Each well pump shall run at an operator selectable speed or flow rate, as selected on the respective well station SCADA panel OIT, WTP MCP OIT, or in the SCADA system. Wells 2, 3, and 4 shall start sequentially (sequence shall be operator selectable). Each well shall reach the operator selectable speed set point before the next well starts. The speed of each well pump VFD shall be set at the well station OIT, the WTP MCP OIT, or in the SCADA system and shall not vary based on conditions at the WTP. The operator shall be able to toggle each well between “HAND”, “OFF”, and “AUTO” modes in the SCADA system. Well pumps (P-100A, P-100B, P-141, P-171) VFD Fault and High Temperature alarms shall be reported in the SCADA system. Well pumps



shall ramp up or ramp down for 30 seconds when called to start or stop, respectively. Normal shutdown of Wells 2, 3, and 4 shall occur sequentially (sequence shall be operator selectable).

### C. Well 2

Pressure transmitters shall be provided on the Well 2 pump suction piping (PIT-107) and pump discharge piping (PIT-108A & PIT-108B). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for low-low and low suction pressure (via PIT-107), and high-high and high discharge pressure (via PIT-108A & PIT-108B). The alarm set points shall be operator selectable. The Well 2 pumps (P-100A & P-100B) shall be de-energized by the SCADA system for low-low suction pressure (via PIT-107) or high-high discharge pressure (via PIT-108A & PIT-108B).

A flow meter shall be provided on the Well 2 pump discharge piping (FIT-110). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall be operator selectable. If the Well 2 pumps (P-100A & P-100B) are energized and no flow is detected (via FIT-110) after a 90 second start-up delay (operator selectable), the SCADA system shall de-energize the Well 2 pumps.

Daily (gallons) and total (million gallons) well production volumes shall be totalized and stored in the SCADA system for each well (via FIT-148, FIT-178). A running annual average totalizing the raw water production (million gallons) for a duration of four (4) consecutive billing quarters shall be stored in the SCADA system for each well. An alarm shall be reported in the SCADA system if the daily raw water production exceeds the maximum daily withdrawal rate (0.47 million gallons per day [MGD]) (operator selectable) is exceeded in a single calendar day (12:00 AM to 11:59 PM). The total daily raw water production shall be calculated as the sum of the daily production for each well and shall be reported in gallons. The daily well and total daily raw water totalizers shall reset at 12:00 AM each day.

A Vacuum Priming System at Well Station 2 is connected to the Well Station 2 MCP through a Vacuum Priming System Field Control Panel (VPS-FCP). The vacuum priming system is a pre-packaged system that includes rotary vane vacuum priming pumps (P-101A and P-101B), receiver tank (VT-102), vacuum pressure indicating transmitter (PIT-116), receiver tank level switch (LSH-114), proof of prime switches (LSL-115A & LSL-115B), and field control panel (VPS-FCP). The vacuum priming system shall operate locally based on the vacuum readings as measured by PIT-116 with local, hand, and automatic controls (HS-101C & HS-101D) and feedback as shown on the Contract Drawings. The call for a priming cycle shall be automatic based on vacuum readings as measured by PIT-116, and status shall be reported at the VPS-FCP, SCADA panel OITs, and WTP SCADA server. The proof of prime switches (LSL-115A & LSL-115B) shall be electrically interlocked with the well pump VFDs and shall serve to ensure that the Well 2 pump suction line is completely full of water during pump operation. A low suction piping water level via the proof of prime switch

(LSL-115A & LSL-115B) shall de-energize the respective Well Station 2 pumps (P-100A & P-100B, respectively) and a pump fault alarm shall be reported in the SCADA system.

#### D. Wells 3 and 4

Level transmitters shall be provided in Well 3 (LE-146) and Well 4 (LE-176). Level transmitters measure and transmit well level both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for low-low and low well levels. The alarm set points shall be operator selectable. The well pumps (Well 3: P-141; Well 4: P-171) shall be de-energized by the SCADA system for low-low well level (via LE-146 & LE-176, respectively).

Pressure transmitters shall be provided on the Well 3 pump discharge piping (PIT-147) and Well 4 pump discharge piping (PIT-177). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high-high and high discharge pressure. The alarm set points shall be operator selectable. The well pumps (Well 3: P-141; Well 4: P-171) shall be de-energized by the SCADA system for high-high discharge pressure (via PIT-147 & PIT-177, respectively).

Flow meters shall be provided on the Well 2 pump discharge piping (FIT-110), Well 3 pump discharge piping (FIT-148), and Well 4 pump discharge piping (FIT-178). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall be operator selectable. If the well pumps (Well 3: P-141; Well 4: P-171) are energized and no flow is detected (via FIT-148 or FIT-178, respectively) after a 90 second start-up delay (operator selectable), the SCADA system shall de-energize the corresponding well pump.

Daily (gallons) and total (million gallons) well production volumes shall be totalized and stored in the SCADA system for each well (via FIT-148, FIT-178). A running annual average totalizing the raw water production (million gallons) for a duration of four (4) consecutive billing quarters shall be stored in the SCADA system for each well. An alarm shall be reported in the SCADA system if the daily raw water production exceeds the maximum daily withdrawal rate (Well 3: 0.38 MGD; Well 4: 1.00 MGD) (operator selectable) is exceeded in a single calendar day (12:00 AM to 11:59 PM). The total daily raw water production shall be calculated as the sum of the daily production for each well and shall be reported in gallons. The daily well and total daily raw water totalizers shall reset at 12:00 AM each day.

#### E. WTP Raw + Recycle Water Pressure

A pressure transmitter shall be provided on the WTP Well 2 & 3 raw and recycle piping (PIT-211). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and low influent pressure. The alarm set points shall be operator selectable.

## F. Iron and Manganese (Fe/Mn) Filter Flow

The Fe/Mn filtration system shall be controlled in two modes: Manual and Automatic.

### Filter Flow – Manual Mode

The Manual mode of operation shall provide operator initiation or intervention of equipment operations. Each individual equipment device may be started locally and/or remotely without SCADA program interlocks. Interlocks shall still operate to prevent damage or injury. Manual equipment and valve control shall be provided by selector switches located at the equipment or integrated controls. H-O-A operation of each individual piece of equipment shall be provided at the WTP MCP OIT or MCC located in the Electrical Room. Manual mode operation is not typical.

### Filter Flow – Automatic Mode

In the Automatic mode, the Filter Flow loop shall start/stop based on the Well 2 and 3 pumps start/stop. Under normal operations, all three filters shall be online.

In the Automatic mode, all equipment selector switches and integral controls must be in the “AUTO” or “REMOTE” positions/modes for SCADA control. In the Automatic mode, the operator shall select the following via the SCADA system: Filter #1 (PF-200A) on-line (ON/OFF), Filter #2 (PF-200A) on-line (ON/OFF), Filter #3 (PF-200A) on-line (ON/OFF), and individual filter flow rates (via percentage of raw water). There are two SCADA modes: SCADA-Headloss and SCADA-Filter Run Time. The operator can select the automatic mode in the SCADA system or at the WTP MCP OIT. The operator shall be able to toggle each filter between “ACTIVE”/ “ON” and “INACTIVE”/ “OFF” modes. If a filter is put into the “INACTIVE” mode, all filter valves for that filter shall close and the filter shall be locked out from the automatic mode of operation.

In the SCADA-Headloss and SCADA-Filter Run Time modes, the total raw and recycle water flow to the Fe/Mn filters shall be delivered from Wells 2 and 3 based on operator-selected well pump variable speed set points or flow rate setpoints. The total Wells 2 & 3 raw and recycle flow (FIT-212) shall be evenly divided between the on-line filters per the individual filter flow rate set point. The filter influent flow meters (FIT-213A, FIT-213B, FIT-213C) measure individual filter flow, and the flow rate for each is displayed remotely at a flow indicator, at the WTP MCP OIT, and in the SCADA system. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) shall be modulated (%OPEN) by a signal from the SCADA system to meet the individual filter flow set point with feedback from the respective filter flow meter (FIT-213A, FIT-213B, FIT-213C). Filter influent control valve (BFV-236A, BFV-236B, BFV-236C) filter flow start position (%OPEN) shall be operator selectable and determined during startup. The valves shall modulate as necessary to achieve the desired flow. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) %OPEN position shall be reported locally, at the WTP MCP OIT, and in the SCADA system.

In the SCADA-Headloss and SCADA-Filter Run Time modes, the filter effluent control valve (BFV-238A, BFV-238B, BFV-238C) shall remain open. The other filter valves including backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), filter to waste (BFV-242A, BFV-242B, BFV-242C), air scour supply (BFV-243A, BFV-243B, BFV-243C), and air draindown (BFV-243A, BFV-243B, BFV-243C) shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The backwash supply control valve (PRV-832) shall remain closed during the Filter Flow-Automatic. All valve positions (open/closed) shall be reported and displayed locally, remotely at the WTP MCP OIT, and in the SCADA system.

In the SCADA-Headloss mode, the operator shall select the maximum allowable filter headloss during normal forward flow (7 to 10 psi) individually for Filter #1, Filter #2, and Filter #3. The headloss across each filter shall be measured by a differential pressure transmitter (DPIT-214A, DPIT-214B, DPIT-214C). Differential pressure is displayed locally, remotely at the WTP MCP OIT, and in the SCADA system. A high differential pressure alarm during Filter Flow-Automatic and a low differential pressure alarm during backwash (operator selectable setpoint) shall be reported in the SCADA system. The actual filter run time shall be recorded and reported in the SCADA system. Filter runtime shall be reset after a filter backwash. The current filter runtime and previous filter runtime shall be displayed at the WTP MCP OIT and in the SCADA system.

In the SCADA-Filter Run Time mode, the operator shall select the maximum filter run time (1 to 48 hours) for Filter #1, Filter #2, and Filter #3. The actual filter runtime shall be recorded and reported in the SCADA system. Filter runtime shall be reset after a filter backwash. The current filter runtime and previous filter runtime shall be displayed at the WTP MCP OIT and in the SCADA system. The filter headloss shall be measured by a differential pressure transmitter (DPIT-214A, DPIT-214B, DPIT-214C). Differential pressure shall be displayed locally, at the WTP MCP OIT, and in the SCADA system. A high differential pressure alarm during Filter Flow-Automatic and a low differential pressure alarm during backwash (operator selectable setpoint) shall be reported in the SCADA system.

Filter Valve Positions – Filter Flow Loop (All Filters)		
Valve Description	Tag Nos.	Position
Filter Influent Control	BFV-236A, -236B, -236C	Modulating
Filter Effluent Control	BFV-238A, -238B, -238C	Open
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Closed
Air Scour Supply	BFV-243A, -243B, -243C	Closed
Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Open

### Combined Fe/Mn Filtered Water Flow

Flow meters shall be provided on the WTP Well 2 & 3 raw and recycle piping (FIT-212) and combined Fe/Mn filter effluent (FIT-218). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall be operator selectable. An alarm shall be reported in the SCADA system if the Well 2 and Well 3 pumps (Well 2: P-100A & P-100B; Well 3: P-141) are energized and no flow is detected at the Wells 2 & 3 raw and recycle flow meter (FIT-212) after a 10 minute start-up delay (operator selectable). A no flow (via FIT-212) reading shall shut down the pre-filtration sodium hypochlorite metering pumps (MP-404 & MP-405). A no flow (via FIT-218) reading shall shut down the sodium bisulfite metering pumps (MP-603 and MP-604).

#### G. Fe/Mn Filter Backwash – General

Under normal operations, all three filters shall be active/online. Once a single filter meets an operator selectable headloss or run time set point (as set in the Filter Flow-Automatic loop description above), and the level reading (via LE/LIT-811A, LE/LIT-811B or LE/LIT-811C ) at the operator selected Backwash Waste Tank is lower than the “Backwash Start” setpoint (operator selectable), and the backwash supply flow meter (FIT-812) is reading no flow the filter backwash sequence will start while the other two filters maintain forward flow operations. Filter backwashing can also occur if the other two filters are offline.

The operator shall select the type of filter backwash procedure via the WTP MCP OIT or the SCADA system. Filter Backwash (Water Only) and Filter Backwash (Air/Water) shall be selected. All backwash sequences (described below) shall be automatically controlled by the SCADA system. The backwash sequence can also be initiated for a selected filter via “Start Backwash – Water Only”, “Start Backwash – Air/Water” buttons provided in the WTP MCP OIT and SCADA System. A filter in backwash mode shall be indicated at the WTP MCP OIT and in the SCADA system.

If the level reading (via LE/LIT-811A, LE/LIT-811B or LE/LIT-811C) at the operator selected Backwash Waste Tank is higher than the “Backwash Start” setpoint (operator selectable) when a backwash cycle is initiated, a backwash failure shall be reported in the SCADA system and the Filter Flow loop shall continue for 15 minutes (operator selectable) before trying the backwash sequence again. If the second (operator selectable) attempt at a backwash fails, the SCADA shall fail all filter valves to close on the filter in backwash mode. A Fe/Mn Filter Backwash failure alarm shall be reported in the SCADA system.

#### H. Fe/Mn Filter Backwash (Water Only)

Filter Backwash (Water Only) shall be controlled automatically by the SCADA system. All equipment selector switches and/or integral controls must be in “AUTO” or “REMOTE” positions/modes for SCADA control. The filter washwater source shall be the water distribution system. Upon backwash initiation, the backwash supply control

valve (PRV-832) shall modulate to achieve the required backwash flow rate (operator selectable) as measured via the backwash supply flow meter (FIT-812). The individual filter backwash supply valve (BFV-240A, BFV-240B, BFV-240C) shall open.

If the required backwash flow rate as measured via the backwash supply flow meter (FIT-812) cannot be achieved or the control valves (PRV-832, BFV-240A, BFV-240B, BFV-240C) do not open when a backwash is initiated, a backwash failure shall be reported in the SCADA system and the Filter Flow loop shall continue for 15 minutes (operator selectable) before trying the backwash sequence again. If the second (operator selectable) attempt at a backwash fails, the SCADA system shall fail all filter valves to close on the filter in backwash mode. A Fe/Mn Filter Backwash (Water Only) failure alarm shall be reported in the SCADA system. All actuated filter valve positions (open/closed) and all modulating actuated filter valve %OPEN readings shall be reported remotely at the WTP MCP OIT and in the SCADA system.

#### Fe/Mn Filter Washwater Supply

The online filters not in backwash mode shall keep their respective filter effluent control valves (BFV-238A, BFV-238B, BFV-238C) open and resume forward flow. The SCADA system shall assess the backwash flow requirement with the feedback from the backwash supply flow meter (FIT-812). If the distribution system can meet the backwash flow requirement (465 gpm +/- per filter, operator selectable), the backwash sequence shall initiate. The effluent valve (BFV-238A, BFV-238B or BFV-238C) of the Fe/Mn filter in backwash mode shall close, and the individual filter backwash control valve (BFV-240A, BFV-240B, BFV-240C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the backwash flow rate requirement of the filter in backwash mode of 465 gpm (operator selectable ) as measured by the backwash supply flow meter (FIT-812) during the backwash cycle. The SCADA system shall compare the backwash flow requirement with the feedback from the backwash supply flow meter (FIT-812). During normal filter run mode, the total Wells 2 & 3 raw and recycle flow (FIT-212) shall be evenly divided between the on-line filters per the individual filter flow rate set point. When a backwash sequence for a Fe/Mn filter is initiated, the total Wells 2 & 3 raw and recycle flow (via FIT-212) shall be evenly divided between the remaining online filter running in Filter Mode, measured via the dedicated filter flow meter (FIT-213A, FIT-213B, FIT-213C).

If the backwash supply control valve (PRV-832) modulated via the backwash supply flow meter (FIT-812) cannot meet the backwash flow requirement (465 gpm; operator selectable), the SCADA system shall fail all filter valves closed on the filter that triggered the backwash. A Filter Backwash (Water Only) alarm shall be reported in the SCADA system. The other online filters shall resume Filter Flow and shall divide the total raw and recycle water flow evenly (via FIT-213A, FIT-213B, FIT-213C). The other online filter valves including backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), filter to waste (BFV-242A, BFV-242B, BFV-242C), air scour supply (BFV-243A, BFV-243B, BFV-243C), and air draindown (BFV-244A, BFV-244B, BFV-244C) shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

For the Bed Settle sequence all filter valves (backwashing filter only) shall close.

For the Filter to Waste sequence, the total Wells 2 & 3 raw and recycle flow (FIT-212) shall be evenly divided between the filter in backwash mode and the remaining online filters. The filter to waste valve (BFV-236A, BFV-236B, BFV-236C) of the filter in backwash mode shall open. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) shall open to achieve the filter flow set point modulated via the individual filter flow meter (FIT-213A, FIT-213B, FIT-213C). The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) %OPEN shall be reported at the WTP MCP OIT and in the SCADA system. The well pump speeds shall not vary from normal Filter Flow operations. The influent valves (BFV-236A, BFV-236B, BFV-236C) on the on-line filters shall open to an operator selectable Filter to Waste position (%OPEN) to evenly divide the remaining raw water flow.

#### Fe/Mn Filter Backwash

The SCADA system shall fully close the filter influent control valve (BFV-236A, BFV-236B, BFV-236C) corresponding with the filter in backwash mode. The SCADA system shall keep the backwash supply valve (BFV-240A, BFV-240B, BFV-240C) corresponding with the filter in backwash mode open. The filter backwash waste valve (BFV-241A, BFV-241B, BFV-241C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the backwash flow rate requirement of the filter in backwash mode of 465 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812). The filter backwash cycle duration shall be based on a SCADA timer (10 minutes; operator selectable) per the recommendation of the filter manufacturer. The filter effluent (BFV-238A, BFV-238B, BFV-238C), filter to waste (BFV-242A, BFV-242B, BFV-242C), air draindown (BFV-244A, BFV-244B, BFV-244C), and air scour supply (BFV-243A, BFV-243B, BFV-243C) valves shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Backwash		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Open
Filter Backwash Waste	BFV-241A, -241B, -241C	Open
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Open
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Fe/Mn Filter Bed Settle

After the backwash cycle, the filter shall then enter a bed settle cycle and all filter valves (backwashing filter only) and backwash supply control valve (PRV-832) shall

close. Refer to the Bed Settle loop description in Washwater Supply above. The bed settle cycle duration shall be based on a SCADA timer (2 minutes; operator selectable) per the recommendation of the filter manufacturer. The air scour blower drain valve (SV-256) shall remain open. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Bed Settle		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Fe/Mn Filter to Waste

After the Bed Settle cycle has been completed, the filter in backwash mode shall go into the filter to waste cycle. Refer to the Filter to Waste loop description in Washwater Supply described above.

The filter influent valve (BFV-236A, BFV-236B, BFV-236C) of the filter in backwash mode shall open to achieve the filter flow set point modulated via the individual filter flow meter (FIT-213A, FIT-213B, FIT-213C). The Filter to Waste valve (BFV-242A, BFV-242B, BFV-242C) shall open. The filter to waste cycle duration shall be based on a SCADA timer (3 minutes; operator selectable) per the recommendations of the filter manufacturer. During the filter to waste cycle, the filter effluent (BFV-238, BFV-238B, BFV-238C), backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), air scour supply (BFV-243A, BFV-243B, BFV-243C), and air draindown (BFV-244A, BFV-244B, BFV-244C) valves shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Filter to Waste		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Modulating
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Open
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed



Filter Valve Positions – Filter in Filter to Waste		
Valve Description	Tag Nos.	Position
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Return to Fe/Mn Filter Flow

After Filter Backwash (Water Only) procedures are completed, the SCADA system shall begin a 2-hour “Backwash Settle” timer (operator selectable). The backwash supply control valve (PRV-832), the filter backwash supply control valve (BFV-240A, 240B, 20C), and filter to waste valve (BFV-242A, BFV-242B, BFV-242C) shall close. The Filter Influent Control Valve (BFV-236A, BFV-236B, BFV-236C) will remain open and the remaining filter valves shall return to the original Filter Flow mode (Manual, SCADA-Headloss, or SCADA-Filter Run Time).

#### I. Fe/Mn Filter Backwash (Air/Water)

Filter Backwash (Air/Water) shall be controlled automatically by the SCADA system. All equipment selector switches and integral controls must be in “AUTO” or “REMOTE” positions/modes for SCADA control. The filter washwaster and slow refill source shall be the finished water distribution system. The filter air draindown and air scour supply source shall be the air scour blower (ASB-202). Upon backwash initiation, the backwash supply control valve (PRV-832) shall modulate to achieve the required backwash flow rate (operator selectable) as measured via the backwash supply flow meter (FIT-812). The individual filter backwash supply valve (BFV-240A, BFV-240B, BFV-240C) shall open.

If the required backwash flow rate as measured via the backwash supply flow meter (FIT-812) cannot be achieved or the control valves (PRV-832, BFV-240A, BFV-240B, BFV-240C) do not open when a backwash is initiated, a backwash failure shall be reported in the SCADA system and the Filter Flow loop shall continue for 15 minutes (operator selectable) before trying the backwash sequence again. If the second (operator selectable) attempt at a backwash fails, the SCADA system shall fail all filter valves to close on the filter in backwash mode. A Fe/Mn Filter Backwash (Air/Water) failure shall be reported in the SCADA system. All actuated filter valve positions (open/closed) and all modulating actuated filter valve %OPEN readings shall be reported remotely at the WTP MCP OIT and in the SCADA system.

#### Fe/Mn Filter Washwater Supply

The online filters not in backwash mode shall keep their respective filter effluent control valves (BFV-238A, BFV-238B, BFV-238C) open and maintain forward flow. The SCADA system shall assess the backwash flow requirement with feedback from the backwash supply flow meter (FIT-812). If the distribution system can meet the backwash flow requirement (465 gpm +/- per filter, operator selectable), the backwash sequence shall initiate. The effluent valve (BFV-238A, BFV-238B or BFV-238C) of the Fe/Mn filter in backwash mode shall close, and the individual filter backwash control valve (BFV-240A, BFV-240B, BFV-240C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the backwash flow rate requirement

of the filter in backwash mode of 465 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812) during the backwash cycle. The SCADA system shall compare the backwash flow requirement with the feedback from the backwash supply flow meter (FIT-812). During normal filter run mode, the total Wells 2 & 3 raw and recycle flow (FIT-212) shall be evenly divided between the on-line filters per the individual filter flow rate set point. When a backwash sequence for a Fe/Mn filter is initiated, the total Wells 2 & 3 raw and recycle flow (via FIT-212) shall be evenly divided between the remaining online filter running in Filter Mode, measured via the dedicated filter flow meter (FIT-213A, FIT-213B, FIT-213C).

If the backwash supply control valve (PRV-832) modulated via FIT-812 cannot meet the backwash flow requirement (465 gpm), the SCADA system shall fail all filter valves closed on the filter that triggered the backwash. A Filter Backwash (Air/Water) alarm shall be reported in the SCADA system. The other online filters shall resume Filter Flow and shall divide the total raw and recycle water flow evenly (via FIT-213A, FIT-213B, FIT-213C). The other online filter valves including backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), filter to waste (BFV-242A, BFV-242B, BFV-242C), air scour supply (BFV-243A, BFV-243B, BFV-243C), and air draindown (BFV-244A, BFV-244B, BFV-244C) shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

For the Slow Refill sequence, the distribution system shall remain the washwater supply. The backwash supply control valve (PRV-832) shall modulate to meet the slow refill flow rate requirement of the filter in backwash mode of 155 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812) during the backwash cycle.

For the Air/Water Wash sequence, the well pumps shall remain online at the Filter Backwash flow rate (950 gpm, operator adjustable). The influent control valve (BFV-435A, BFV-435B, BFV-435C, BFV-435D) of the on-line filters shall modulate to meet the combined air/wash water flow rate requirement of 310 gpm (operator adjustable). The remaining on-line filters shall resume Filter Flow and shall divide the total flow evenly. The filtered water pressure sustaining valve (PSV-450) shall remain in the open position. The effluent control valve (BFV-438A, BFV-438B, BFV-438C, BFV-438D) of the on-line filters shall be open/closed. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

For the Bed Settle sequence, all filter valves (backwashing filter only) shall close.

For the Filter to Waste sequence, the total Wells 2 & 3 raw and recycle flow (FIT-212) shall be evenly divided between the filter in backwash mode and the remaining online filters. The filter to waste valve (BFV-236A, BFV-236B, BFV-236C) of the filter in backwash mode shall open. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) shall open to achieve the filter flow set point modulated via the individual filter flow meter (FIT-213A, FIT-213B, FIT-213C). The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) %OPEN shall be reported at the WTP MCP OIT and in the SCADA system. The well pump speeds shall not vary from normal Filter

Flow operations. The influent valves (BFV-236A, BFV-236B, BFV-236C) on the on-line filters shall open to an operator selectable Filter to Waste position (%OPEN) to evenly divide the remaining raw water flow.

Fe/Mn Filter Draindown

The filter in backwash mode shall close the filter influent control valve (BFV-236A, BFV-236B, BFV-236C) and filter effluent control valve (BFV-238A, BFV-238B, BFV-238C). The SCADA system shall send a start signal to the blower (ASB-202). Blower status shall be reported at the MCP OIT and in the SCADA system. After a 15 second delay (operator selectable), the filter draindown air valve (BFV-244A, BFV-244B, BFV-244C) and filter to waste valve (BFV-242A, BFV-242B, BFV-242C) shall open. The air scour blower solenoid valve (SV-256) shall close. The draindown cycle duration shall be based on a SCADA timer (5 minutes; operator selectable) per the recommendations of the filter manufacturer and as determined during startup. The other filter valves including backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), and air scour supply (BFV-243A, BFV-243B, BFV-243C) shall remain closed. The valve positions (open/closed) shall be reported remotely at the MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Draindown		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Open
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Open
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Closed

Fe/Mn Filter Air Scour

After the draindown cycle, the filter shall enter the air scour cycle. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C), filter effluent control valve (BFV-238A, BFV-238B, BFV-238C), and air scour blower drain valve (SV-256) shall remain closed. The air draindown valve (BFV-244A, BFV-244B, BFV-244C) and filter to waste valve (BFV-242A, BFV-242B, BFV-242C) shall close from the previous step. The air scour blower (ASB-202) shall remain energized from the previous step. The filter air scour supply valve (BFV-243A, BFV-243B, BFV-243C) shall open. The air scour cycle duration shall be based on a SCADA timer (2 minutes; operator selectable) per the recommendations of the filter manufacturer. The other filter valves including backwash supply (BFV-240A, BFV-240B, BFV-240C) and backwash waste (BFV-241A, BFV-241B, BFV-241C) shall remain closed. The valves positions (open/closed) shall be reported remotely at the MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Air Scour		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Open
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Closed

#### Fe/Mn Filter Air/Water Wash

After the air scour cycle, the filter shall enter the air/water wash cycle. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) and filter effluent control valve (BFV-238A, BFV-238B, BFV-238C) shall remain closed. The filter backwash waste valve (BFV-241A, BFV-241B, BFV-241C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the backwash flow rate requirement of the filter in backwash mode of 465 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812). The air scour blower (ASB-202) shall remain energized from the previous step. The filter air scour supply valve (BFV-243A, BFV-243B, BFV-243C) shall remain open. The air/water wash cycle duration shall be based on a SCADA timer (3 minutes; operator selectable in minutes) per the recommendations of the filter manufacturer. The other filter valves including filter to waste (BFV-242A, BFV-242B, BFV-242C) and filter air draindown (BFV-244A, BFV-244B, BFV-244C) shall remain closed. The valve positions (open/closed) shall be reported remotely at the MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Air/Water Wash		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Open
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Open
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Open
Air Scour Blower Drain Solenoid Valve	SV-454	Closed

#### Fe/Mn Filter Slow Refill

After the air/wash cycle, the filter shall enter the slow refill cycle. Refer to the Slow Refill loop description in Washwater Supply above. The filter influent control valve (BFV-236A, BFV-236B, BFV-236C) and filter effluent control valve (BFV-238A, BFV-238B, BFV-238C) shall remain closed. The air scour blower (ASB-202) shall

de-energize from the previous step by the SCADA system and the filter air scour supply valve (BFV-243A, BFV-243B, BFV-243C) shall close. The air scour blower drain valve (SV-256) shall open. The filter backwash waste valve (BFV-241A, BFV-241B, BFV-241C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the slow refill flow rate requirement of the filter in backwash mode of 155 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812). The slow refill cycle duration shall be based on a SCADA timer (2 minutes; operator selectable) per the recommendations of the filter manufacturer. The other filter valves including backwash waste (BFV-241A, BFV-241B, BFV-241C), filter to waste (BFV-242A, BFV-242B, BFV-242C), and air draindown (BFV-244A, BFV-244B, BFV-244C) shall remain closed. The valve positions (open/closed) shall be reported remotely at the MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Slow Refill		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Open
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Open
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Fe/Mn Filter Backwash

After the slow refill cycle, the filter influent control valve (BFV-236A, BFV-236B, BFV-236C) and filter effluent control valve (BFV-238A, BFV-238B, BFV-238C) shall remain closed. The filter backwash waste valve (BFV-241A, BFV-241B, BFV-241C) shall open. The backwash supply control valve (PRV-832) shall modulate to meet the backwash flow rate requirement of the filter in backwash mode of 465 gpm (operator selectable) as measured by the backwash supply flow meter (FIT-812). The backwash cycle duration shall be based on a SCADA timer (10 minutes; operator selectable) per the recommendations of the filter manufacturer. The filter valves including filter to waste valve (BFV-242A, BFV-242B, BFV-242C), air scour supply (BFV-243A, BFV-243B, BFV-243C) and air draindown valve (BFV-244A, BFV-244B, BFV-244C) shall remain closed, while the air scour blower drain valve (SV-256) shall remain in the open position. The valve positions (open/closed) shall be reported remotely at the MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Backwash		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Open
Filter Backwash Waste	BFV-241A, -241B, -241C	Open

Filter Valve Positions – Filter in Backwash		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Open
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Fe/Mn Filter Bed Settle

After the backwash cycle, the filter shall then enter a bed settle cycle and all filter valves (backwashing filter only) and backwash supply control valve (PRV-832) shall close. Refer to the Bed Settle loop description in Washwater Supply above. The bed settle cycle duration shall be based on a SCADA timer (2 minutes; operator selectable) per the recommendation of the filter manufacturer. The air scour blower drain valve (SV-256) shall remain open. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Bed Settle		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Closed
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Closed
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Fe/Mn Filter to Waste

After the Bed Settle cycle has been completed, the filter in backwash mode shall go into the filter to waste cycle. Refer to the Filter to Waste loop description in Washwater Supply described above.

The filter influent valve (BFV-236A, BFV-236B, BFV-236C) of the filter in backwash mode shall open to achieve the filter flow set point as reported by via the individual filter flow meter (FIT-213A, FIT-213B, FIT-213C). The Filter to Waste valve (BFV-242A, BFV-242B, BFV-242C) shall open. The filter to waste cycle duration shall be based on a SCADA timer (3 minutes; operator selectable) per the recommendations of the filter manufacturer. During the filter to waste cycle, the filter effluent (BFV-238, BFV-238B, BFV-238C), backwash supply (BFV-240A, BFV-240B, BFV-240C), backwash waste (BFV-241A, BFV-241B, BFV-241C), air scour supply (BFV-243A, BFV-243B, BFV-243C), and air draindown (BFV-244A, BFV-244B, BFV-244C) valves shall remain closed, while the air scour blower drain valve (SV-256) shall

remain in the open position. The valve positions (open/closed) shall be reported remotely at the WTP MCP OIT and in the SCADA system.

Filter Valve Positions – Filter in Filter to Waste		
<u>Valve Description</u>	<u>Tag Nos.</u>	<u>Position</u>
Filter Influent Control	BFV-236A, -236B, -236C	Modulating
Filter Effluent Control	BFV-238A, -238B, -238C	Closed
Filter Backwash Supply	BFV-240A, -240B, -240C	Closed
Filter Backwash Waste	BFV-241A, -241B, -241C	Closed
Filter to Waste	BFV-242A, -242B, -242C	Open
Filter Air Scour Supply	BFV-243A, -243B, -243C	Closed
Filter Air Draindown	BFV-244A, -244B, -244C	Closed
Backwash Supply Control	PRV-832	Closed
Air Scour Blower Drain Solenoid Valve	SV-256	Open

#### Return to Fe/Mn Filter Flow

After Filter Backwash (Air/Water) procedures are completed, the SCADA system shall begin a 2-hour “Backwash Settle” timer (operator selectable). The backwash supply control valve (PRV-832), the filter backwash supply control valve (BFV-240A, 240B, 20C) and filter to waste valve (BFV-242A, BFV-242B, BFV-242C) shall close. The Filter Influent Control Valve (BFV-236A, BFV-236B, BFV-236C) will remain open and the remaining filter valves shall return to the original Filter Flow mode (Manual, SCADA-Headloss, or SCADA-Filter Run Time).

#### J. Backwash Supply Control Valve (PRV-832)

The backwash supply control valve (PRV-832) shall be controlled by a valve controller furnished by the valve manufacturer. The SCADA system shall send an operator selectable flow rate set point to the valve controller for the following flow conditions:

1. Fe/Mn Filter Backwash: 465 gpm
2. Fe/Mn Filter Slow Refill: 465 gpm
3. GAC Filter Backwash: 945 gpm
4. IX Filter Backwash: 100 gpm

The operator will be able to manually set the desired flow rate through the backwash supply control valve to facilitate manual GAC and IX filter backwashes. The valve controller shall modulate the valve position using influent and effluent solenoid valves (SV-832A, SV-832B) to pace the flow rate measured by the backwash supply flow meter (FIT-812). Two backwash supply control valve alarms shall be reported in the SCADA system from the valve controller.

#### K. Bag Filters

A PFAS Treatment Influent flow meter shall be provided on the combined PFAS influent piping (FIT-311). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall be operator selectable. A no flow (via FIT-311) reading for 90 seconds (operator selectable) shall shut down the potassium hydroxide metering pumps (MP-503 and MP-504).

The WTP combined PFAS influent flow is directed through three parallel bag filter housings (BF-201A, BF-201B, BF-201C) prior to PFAS removal. The differential pressure across the bag filters shall be measured by a differential pressure transmitter (DPIT-215). Differential pressure is displayed locally, remotely at the WTP MCP OIT, and in the SCADA system. A high differential pressure alarm (operator selectable set point) shall be reported in the SCADA system.

#### L. PFAS Lead and Lag Filters

A flow meter shall be provided on the influent piping for each Lead-Lag PFAS train (FIT-319A, FIT-319B, FIT-319C). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. PFAS train throughput (million gallons) shall be totalized and stored in the SCADA system for each Lead-Lag PFAS train (via FIT-319A, FIT-319B, FIT-319C). The throughput totalizers shall be reset manually in the SCADA system after each media changeout.

Differential pressure transmitters shall be provided for each Lead PFAS vessel (PF-300A, PF-300B, PF-300C) (DPIT-313A, DPIT-313B, DPIT-313C, respectively) and each Lag PFAS vessel (PF-301A, PF-301B, PF-301C) (DPIT-315A, DPIT-315B, DPIT-315C, respectively). Differential pressure transmitters measure, locally indicate, and transmit PFAS vessel differential pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and low PFAS vessel differential pressure. The alarm set points shall be operator selectable.

Pressure transmitters shall be provided on the inlet piping for each Lead PFAS vessel (PF-300A, PF-300B, PF-300C) (PIT-316A, PIT-316B, PIT-316C, respectively) and each Lag PFAS vessel (PF-301A, PF-301B, PF-301C) (PIT-317A, PIT-317B, PIT-317C, respectively). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and high-high PFAS vessel influent pressure. The alarm set points shall be operator selectable.

#### M. PFAS Treatment Effluent Flow

A flow meter shall be provided on the combined PFAS treatment effluent piping (FIT-312). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall



be operator selectable. A no flow (via FIT-312) reading shall shut down the post-filtration sodium hypochlorite metering pumps (MP-407 and MP-408) and the sodium fluoride metering pump (MP-651).

#### N. Pressure Sustaining Valves

A pressure transmitter shall be provided on the FWWW influent piping (PIT-318) and Well 4 pump discharge piping (PIT-177). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and low pressure. The alarm set points shall be operator selectable.

Two parallel pressure sustaining valves (PSV-348A, PSV-348B) located on the combined filtered water shall maintain an operator selectable upstream pressure (via PIT-318). During normal operations, only one pressure sustaining valve shall operate at a time. The offline pressure sustaining valve shall be isolated from the process flow with manual valves. The pressure sustaining valve (PSV-348A, PSV-348B) open and close positions shall be controlled by the SCADA system via a three-way solenoid valve (SV-348A, SV-348B). The solenoid valve shall be de-energized to close the valve. When the solenoid valve (SV-348A, SV-348B) is energized, the pressure sustaining valve inlet pressure shall be controlled by an integral pilot valve, which shall have a pressure range of 0 to 75 psi. The pilot valve set point shall be manually set during startup. During operation, the valve open position shall be adjustable via the SCADA system to achieve an operator selectable upstream pressure set point, within an allowable range (+/- 2 psi). Pressure sustaining valve open position (0-100%) (ZIT-348A, ZIT-348B), fully closed (ZSC-348A, ZSC-348B), and fully open (ZSO-348A, ZSO-348B) positions shall be reported in the SCADA system. The pressure sustaining valve (PSV-348A, PSV-348B) shall close fully before the well pumps shut down.

#### O. Finished Water Wet Well and Finished Water Pumps

Finished water shall be pumped from the FWWW into the distribution system via three (3) finished water pumps (P-700A, P-700B, P-700C) operating in a lead, lag, standby configuration. The pump motor speeds shall be controlled by VFDs (VFD-700A, VFD-700B and VFD-700C) located in the WTP electrical room (Room 111). Each VFD is provided with a H-O-A selector switch. In the HAND (manual) mode, the operator can locally adjust the motor speed by the corresponding VFD keypad using local buttons to increase/decrease motor speed (0 to 100%). Motor speed (%) and hertz (0 to 60 Hz) are indicated locally on the VFD display; and remotely on the WTP MCP OIT and in the SCADA system. In the AUTO (remote) mode, the motor speed of the finished water pump shall be controlled automatically by the SCADA system.

In order for the finished water pumps to run in AUTO mode, the corresponding VFD H-O-A selector switch shall be in the AUTO position. The finished water pumps (P-700A, P-700B and P-700C) shall primarily operate based on the finished water wet well water level and the Upland Road Storage Tank water level. The finished water pump (P-700A, P-700B and P-700C) shall automatically de-energize if the water level in the Upland Road Storage Tank reaches an operator-selectable "OFF" level set point

and shall be automatically energized by the finished water pump VFDs if the Upland Road Storage Tank water level drops to the water storage tank level “ON” set point.

The finished water pumps (P-700A, P-700B and P-700C) speed is controlled via their respective VFDs (VFD-700A, VFD-700B and VFD-700C) located in the electrical room (Room 111). The finished water pumps (P-700A, P-700B and P-700C) shall run at operator selectable high and low speed set points, as selected at the WTP MCP OIT or in the SCADA system.

A level indicating transmitter shall be provided in the FWWW (LIT-711). Level transmitters measure, locally indicate, and transmit level both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and low FWWW level. The alarm set points shall be operator selectable.

The finished water pumps (P-700A, P-700B and P-700C) shall also operate based on the FWWW level. The pumps shall automatically de-energize if the water level in the finished water wet well drops to an operator-selectable “Finished Water Pump Off” level set point (via LIT- 711). The finished water pump lead, lag, standby status shall alternate every pumping cycle.

The lead finished water pump shall default a high speed set point (operator selectable) upon facility start-up. The lag finished water pump shall start at a low speed, controlled by the finished water pump VFD, when the level in the FWWW rises to “Lag Pump On” level setpoint (via LIT-711, operator selectable). If the water level in the FWWW rises to the “Lag Pump High Speed” level set point (via LIT-711; operator selectable), the finished water pump VFD shall increase the lag finished water pump speed to the high speed set point.

Float switches shall be provided in the FWWW (LSH-712A, LSL-712B). If the water level in the FWWW reaches the high-high level float switch (LSH-712A), the SCADA system shall de-energize the well pumps (Well 2: P-100A, P-100B; Well 3: P-141; Well 4: P-171) and recycle pumps (P-800A, P-800B), and a high-high FWWW level alarm shall be reported in the SCADA system. If the water level in the FWWW drops to the low-low level float switch (LSL-712B), the SCADA system shall de-energize the finished water pumps (P-700A, P-700B and P-700C) and a low-low FWWW level alarm shall be reported in the SCADA system.

Daily pump runtime and total runtime shall be logged and displayed in the SCADA system for each finished water pump. The finished water pump VFDs (VFD-700A, VFD-700B and VFD-700C) shall report respective pump speeds in the SCADA system. Finished water pump fault and high temperature (via VFD-700A, VFD-700B and VFD-700C) shall be alarms reported in the SCADA system.

Daily (gallons) and total (million gallons) finished water volumes shall be totalized and stored in the SCADA system by combining flow readings from FIT-714A, FIT-714B and FIT-714C. A running annual average totalizing the finished water production (million gallons) for a duration of four (4) consecutive billing quarters shall be stored in the SCADA system (via combined flow reading from FIT-714A, FIT-714B and FIT-

714C). An alarm shall be reported in the SCADA system if the combined daily finished water production of 1.85 MG (operator selectable) is exceeded in a single calendar day (12:00 AM to 11:59 PM). The total daily finished water production shall be reported in gallons. The daily finished water totalizer shall reset at 12:00 AM each day.

The finished water pumps shall shut off based on Upland Road storage tank level or the finished water wetwell level.

Finished Water Wet Well Set Points		
Description	Elevation (feet NAVD88)	Water Depth (feet)
High-High Wetwell Level (via LSH-712A)	223.5	9.3
High Wetwell Level (via LIT-711)	223.0	8.8
Well Pumps Off (via LIT-711)	221.3	7.1
Lag Finished Water Pump High Speed (via LIT-711)	220.3	6.1
Lag Finished Water Pump On, Low Speed (via LIT-711)	219.8	5.6
Lag Finished Water Pump Off (via LIT-711)	219.3	5.1
Well Pumps On (via LIT-711)	218.8	4.6
Lead Finished Water Pump Off (via LIT-711)	218.5	4.3
Low Wetwell Level (via LIT-711)	218.2	4.0
Low-Low Wetwell Level (via LSL-712A)	217.7	3.5

P. Finished Water Flow and Pressure

Flow meters shall be provided on the finished water pump discharge piping (FIT-714A, FIT-714B, FIT-714C). Flow meters measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow and no flow. The high flow alarm set point shall be operator selectable. If the finished water pumps (P-700A, P-700B, P-700C) are energized and no flow is detected (via FIT-714A, FIT-714B, FIT-714C, respectively) after a 90 second start-up delay (operator selectable), the SCADA system shall de-energize the finished water pumps and an alarm shall be reported in the SCADA system.

Pressure transmitters shall be provided on the finished water pump discharge piping (PIT-713A, PIT-713B, PIT-313C). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for low, high, and high-high discharge pressure. The alarm set points shall be operator selectable. The finished water pumps (P-700A, P-700B, P-700C) shall be de-energized by the SCADA system for high-high discharge pressure (via PIT-713A, PIT-713B, PIT-313C, respectively).

Q. Backwash Waste Tank, Recycle Pumps and Sludge Pumps

Backwash Waste Tank

Filter backwash waste (backwash waste and filter to waste) from backwashed Fe/Mn filters and PFAS filters shall be directed into one of three Backwash Waste Tank

(BWWT) compartments located in the WTP lower level. The WTP water quality analyzer and sample sink flows shall also discharge by gravity into the BWWT.

Ultrasonic level transmitters (LIT-811A, LIT-811B, LIT-811C) in the BWWT compartments shall monitor the liquid level in each compartment, which shall report a high and low alarms (operator selectable) in the SCADA system. The BWWT level (LIT-811A, LIT-811B, LIT-811C) shall be displayed locally, at the Sludge Pump Field Control Panel (SP-FCP), at the MCP OIT, and in the SCADA system. Backwash waste volume produced shall be measured in the SCADA system via backwash waste tank level, as measured by LIT-811A, LIT-811B, LIT-811C. The SCADA system shall log the backwash waste tank levels at the start and end of each backwash cycle and calculate the difference in volume based on gallons per foot calculations, which shall be determined during startup.

High-high level switches (LSH-815A, LSH-815B, LSH-815C) in the BWWT compartments shall report a high-high alarm in the SCADA system. If the water level in the “BACKWASH ONLINE” BWWT compartment reaches the high-high level (measured via LSH-815A, LSH-815B, LSH-815C) and an Fe/Mn or PFAS filter backwash is in progress, the SCADA system shall end the backwash cycle, fail the filter valves closed (for the filter in backwash only), and close the corresponding backwash waste tank isolation valve (BFV-834A, BFV-834B, BFV-834C). Backwash Fail and BWWT Compartment High-High Level alarms shall be reported in the SCADA system.

Low-low level switches (LSL-816A, LSL-816B, LSL-816C) in the BWWT compartments shall report a low-low alarm in the SCADA system. If the water level in the “RECYCLE ONLINE” BWWT reaches the low-low level (measured via LSL-816A, LSL-816B, LSL-816C) and a recycle pump (P-800A, P-800B) is running, the SCADA system shall close the corresponding recycle backwash tank waste isolation valve (BFV-836A, BFV-836B, BFV-836C) and de-energize the active recycle pump (P-800A, P-800B). Recycle Pump Fault and BWWT Compartment Low-Low Level alarms shall be reported in the SCADA system.

The backwash waste tanks shall operate in one of two operator selectable modes: SCADA-Hand or SCADA-Automatic.

#### *SCADA-Hand*

At the MCP OIT or the SCADA server, the operator shall select the SCADA-Hand Mode. When in SCADA-Hand mode, the operator shall select the “BACKWASH ONLINE” and “RECYCLE ONLINE” BWWT compartments for manual operation. The corresponding backwash waste tank isolation valve (BFV-834A, BFV-834B, BFV-834C) of the “BACKWASH ONLINE” BWWT compartment shall open; and the corresponding recycle backwash waste tank isolation valve (BFV-836A, BFV-836B, BFV-836C) of the “RECYCLE ONLINE” BWWT compartment shall open.

#### *SCADA-Automatic*

At the MCP OIT or the SCADA server, the operator shall select the SCADA-Automatic Mode. When in SCADA-Automatic Mode, the active backwash waste tank compartments shall cycle based on liquid level in the compartment. Upon initiation of

the SCADA-Automatic mode, the operator shall select the “BACKWASH ONLINE” and “RECYCLE ONLINE” BWWT compartments for automatic operation. The corresponding backwash waste tank isolation valve (BFV-834A, BFV-834B, BFV-834C) of the “BACKWASH ONLINE” BWWT compartment shall open; and the corresponding recycle backwash waste tank isolation valve (BFV-836A, BFV-836B, BFV-836C) of the “RECYCLE ONLINE” BWWT compartment shall open.

If the water level in the “BACKWASH ONLINE” BWWT compartment reaches the backwash max level (measured via LIT-811A, LIT-811B, LIT-811C) and an Fe/Mn or PFAS filter backwash is not in progress, the SCADA system shall automatically select the next BWWT compartment (BWWT #1, BWWT #2, BWWT #3) as the “BACKWASH ONLINE” compartment and open the corresponding backwash waste tank isolation valve and close the previously active backwash waste tank isolation valve (BFV-834A, BFV-834B, BFV-834C).

If the water level in the “RECYCLE ONLINE” BWWT compartment reaches the recycle pump stop level (measured via LIT-811A, LIT-811B, LIT-811C) and the water level in the “BACKWASH ONLINE” BWWT compartment reaches the backwash max level (measured via LIT-811A, LIT-811B, LIT-811C), the SCADA system shall automatically select the next BWWT compartment (BWWT #1, BWWT #2, BWWT #3) as the “RECYCLE ONLINE” compartment and open the corresponding recycle backwash waste tank isolation valve and close the previously active recycle backwash waste tank isolation valve (BFV-836A, BFV-836B, BFV-836C).

The “RECYCLE ONLINE” and “BACKWASH ONLINE” compartments (BWWT #1, BWWT #2, BWWT #3) shall not be the same tank.

### Recycle Pumps

Settled backwash waste shall be pumped from the BWWT to the Wells 2 & 3 raw water WTP influent via two (2) recycle pumps (P-800A, P-800B) operating in a duty-standby configuration. The pump motor speeds shall be controlled by VFDs (VFD-800A, VFD-800B) located in the WTP electrical room (Room 111). Each VFD is provided with an H-O-A selector switch. In the HAND (manual) mode, the operator can locally adjust the motor speed by the corresponding VFD keypad using local buttons to increase/decrease motor speed (0 to 100%). Motor speed (%) and hertz (0 to 60 Hz) are indicated locally on the VFD display; and remotely on the WTP MCP OIT and in the SCADA system. In the AUTO (remote) mode, the motor speed of the finished water pump shall be controlled automatically by the SCADA system.

To operate the recycle pump automatically via the SCADA system the operator shall select an “AUTO” button located in the SCADA system or the MCP OIT. When the “AUTO” button is selected, the recycle backwash waste tank isolation valve (BFV-836A, BFV-836B, BFV-836C) located in the decanter pipe of the “ONLINE” BWWT compartment shall open and the recycle pump (P-800A and P-800B) shall run only if the level (measured via LIT-811A, LIT-811B, LIT-811C) at the backwash waste tank is at “Recycle Pump Start” setpoint or higher AND the “Backwash Settle” timer has expired.

The recycle pumps and the corresponding recycle backwash waste tank isolation valve shall automatically shut down and close if all well pump statuses (P-100A, P-100B, P-141, P-171) are reported in the SCADA system to be OFF, the Wells 2 & 3 raw and recycle flow meter (FIT-212) reads less than 100 gpm (operator selectable), the backwash waste tank level reaches the “Recycle Pump Stop” set point (operator selectable via LIT-811A, LIT-811B, LIT-811C), or a Fe/Mn filter enters backwash mode.

The Recycle Pumps speed set point is dependent on the Wells 2 & 3 raw water influent flow (via FIT-212). The recycle pump VFDs shall adjust the recycle pump speed such that the recycle flow (via FIT-813) equals 5% of Wells 2 & 3 raw water flow (via FIT-212). Recycle water pump fault and high temperature (via VFD-800A and VFD-800B) alarms shall be reported in the SCADA system. FIT-813 shall measure recycle water flow, and the flow rate shall be displayed locally, and remotely at the MCP OIT and in the SCADA system. A recycle water high flow alarm (>10% of FIT-212 flow, operator selectable set point) shall be reported in the SCADA system. A no flow (via FIT-813) reading for 90 seconds (operator selectable) shall shutdown the respective recycle water pump (P-800A and P-800B) and an alarm shall be reported in the SCADA system. Daily and total pump runtimes shall be logged in the SCADA system. Daily pump runtime shall reset at the start of each day. The total daily recycle water production shall be calculated as the sum of the daily production for each recycle pump and shall be reported in gallons. The daily recycle water totalizers shall reset at 12:00 AM each day.

Pressure transmitters shall be provided on the recycle pump discharge piping (PIT-817A, PIT-817B). Pressure transmitters measure, locally indicate, and transmit pressure both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high and high-high discharge pressure. The alarm set points shall be operator selectable. The recycle pumps (P-800A, P-800B) shall be de-energized by the SCADA system for high-high discharge pressure (via PIT-817A, PIT-817B, respectively).

The recycle pumps shall turn on and shut off based on the “Online” BWWT compartment level, measured via the level indicating transmitters (LIT-811A, LIT-811B, LIT-811C). Alarms shall be reported in the SCADA system for low and high backwash waste tank compartment levels.

Backwash Waste Tank Operating Elevations		
Description	Elevation (feet NAVD88)	Water Depth (feet)
Overflow Elevation (LSH-815A, LSH-815B, LSH-815C)	223.5	9.3
High Level Alarm (via LIT-811A, LIT-811B, LIT-811C)	223.0	8.8
Backwash Max Level (via LIT-811A, LIT-811B, LIT-811C)	221.4	7.2
Recycle Pump Start (via LIT-811A, LIT-811B, LIT-811C)	217.7	3.5
Recycle Pump Stop (via LIT-811A, LIT-811B, LIT-811C)	216.2	2.0
Low Level Alarm (via LIT-811A, LIT-811B, LIT-811C)	215.7	1.5
Minimum Water Level (via LSL-816A, LSL-816B, LSL-816C)	215.2	1.0

### Sludge Pumps

Two end suction centrifugal pumps (P-801A, P-801B) shall pump settled backwash solids from the backwash waste tank to a truck connection for disposal. The operator shall energize the sludge pump (P-801A, P-801B) with a HAND/OFF selector switch (HS-801A, HS-801B) on the sludge pump field control panel (SP-FCP) located on the WTP exterior. When the HAND/OFF switch is turned clockwise, the sludge pumps shall energize. Once the switch is released and automatically returns to the OFF position the sludge pump de-energizes. The sludge pump run statuses shall be displayed at the SP-FCP, at the MCP OIT, and in the SCADA system. The level indicators (LI-811A, LI-811B, LI-811C) in the SP-FCP display the sludge level in the respective backwash waste tanks, measured via LE-811A, LE-811B, LE-811C. Sludge pump fault and high temperature (via motor controller) alarms shall be reported in the SCADA system and indicated at the SP-FCP. There shall be no SCADA remote control of the sludge pumps

A flow meters shall be provided on the sludge pump discharge piping (FIT-814). The flow meter shall measure, locally indicate, and transmit flow both to the site-local SCADA/control panel and in the SCADA system. Alarm conditions shall be reported in the SCADA system for high flow. The high flow alarm set point shall be operator selectable.

## R. Sodium Hypochlorite Chemical Feed

### Bulk Tank

Sodium hypochlorite (NaOCl) is added for chemical oxidation and disinfection. NaOCl shall be stored in a 905 gallon bulk storage tank (BT-400), which shall be equipped with a high-high level switch (LSH-412) and an ultrasonic level transmitter (LIT-411) to monitor liquid level in the tank. A high-high bulk tank level alarm (via LSH-412) shall be reported in the SCADA system, which shall activate a strobe and horn on the NaOCl bulk chemical fill panel (BCFP; located on the building exterior) to prevent overflow and spills. The bulk tank level (via LIT-411) is displayed at the MCP OIT, in the SCADA system, and at the bulk chemical fill panel (via LI-421). An emergency indication pushbutton (PB-422) shall be located on the NaOCl BCFP. When depressed a chemical fill emergency alarm (acknowledged via PB-422A) shall be reported in the SCADA system. Alarm conditions shall be reported in the SCADA system for high,

low, and low-low level in the bulk tank. The alarm set points shall be operator selectable.

### Transfer Pump

Sodium hypochlorite is pumped from the bulk storage tank to the pre- and post-filtration NaOCl day tanks (DT-401 and DT-402) via dedicated transfer pumps (pre-filtration: TP-403, post-filtration: TP-406).

The operator shall energize the transfer pump (TP-403, TP-406) with a local ON/OFF selector switch (pre-filtration: HS-414, post-filtration: HS-417). When the transfer pump selector switch is turned clockwise, the transfer pump shall energize. Once the switch is released and automatically returns to the OFF position the transfer pump de-energize. There shall be no SCADA remote control of the chemical transfer pumps. A high day level via tank level switch (pre-filtration: LSH-413, post-filtration: LSH-416) shall de-energize the respective transfer pump (pre-filtration: TP-403, post-filtration: TP-406) via run permissive from the SCADA system.

### Day Tank

Sodium hypochlorite is stored in a 70-gallon day tank (pre-filtration oxidation) (DT-401) and a 30-gallon day tank (post-filtration disinfection/residual) (DT-402). The day tanks are equipped with a high level switches (pre-filtration: LSH-413, post-filtration: LSH-416) to monitor liquid level in the tank. A high day tank level alarm (via LSH-413, LSH-416) shall be reported in the SCADA system.

### Pre-Filtration Chemical Feed Pumps

Pre-filtration NaOCl feed shall be paced based on the treatment plant water flow rate as measured by the Wells 2 & 3 raw and recycle flow meter (FIT-212). The pre-filtration NaOCl chemical feed pumps (duty: MP-404, standby: MP-405) draw the chemical from the 70-gallon day tank and pump it to the injection point. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the pre-filtration pump shall be selected by an H-O-A selector switch (duty: HS-404A, standby: HS-405A) located on the pre-filtration NaOCl Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the Wells 2 & 3 raw and recycle flow meter (FIT-212) shall shut down the pre-filtration chemical feed pump (MP-404, MP-405).

Hand-Off-Auto controls for the metering pumps shall be located at the pre-filtration NaOCl Metering Pump Control Panels in the NaOCl storage area as selector switches (duty: HS-404A, standby: HS-405A). When the metering pump is in "AUTO" mode, it is controlled and operated via the SCADA system. There are two operator selectable "AUTO" modes: SCADA-ChemicalSetPoint and SCADA-FlowRatio. For SCADA-ChemicalSetPoint, the operator shall enter the desired chemical dosage and the SCADA system shall vary the speed of the metering pump based on chemical pump



characteristics (operator selectable), chemical characteristics (operator selectable), and measured Wells 2 & 3 raw and recycle flow meter (FIT-212) for pre-filtration NaOCl feed. For SCADA-FlowRatio, the operator shall enter the desired ratio of chemical to flow and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured Wells 2 & 3 raw and recycle flow meter (FIT-212) for pre-filtration NaOCl feed. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panels. Selection of “HAND” can only be performed at the Metering Pump Control Panel via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

#### Post-Filtration Chemical Feed Pumps

Post-filtration NaOCl feed shall be paced based on the treatment plant water flow rate as measured by the filtered water flow meter (FIT-312). The post-filtration NaOCl chemical feed pumps (duty: MP-407, standby: MP-408) draw the chemical from the 30-gallon day tank and pump it to the injection point. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the post-filtration pump shall be selected by an H-O-A selector switch for disinfection (duty: HS-407A, standby: HS-408A) located on the post-filtration NaOCl Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition calculated as measured by the filtered water flow meter (FIT-312) shall shut down the post-filtration chemical feed pump (MP-407, MP-408). A no-flow condition at the filtered water flow meter (FIT-312) shall shut down the post-filtration chemical feed pump (MP-407, MP-408). A no-flow condition at the filtered water flow meter (FIT-312) shall shut down the post-filtration chemical feed pump (MP-407, MP-408).

Hand-Off-Auto controls for the metering pumps shall be located at the post-filtration NaOCl Metering Pump Control Panels in the NaOCl storage area as selector switches (duty: HS-407A, standby: HS-408A). When the metering pump is in “AUTO” mode, it is controlled and operated via the SCADA system. There are two operator selectable “AUTO” modes: SCADA-ChemicalSetPoint and SCADA-FlowRatio. For SCADA-ChemicalSetPoint, the operator shall enter the desired chemical dosage and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the filtered water flow meter for post-filtration NaOCl feed (FIT-312). For SCADA-FlowRatio, the operator shall enter the desired ratio of chemical to flow and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the filtered water flow meter (FIT-312) for post-

filtration NaOCl feed. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of “HAND” can only be performed at the Metering Pump Control Panels via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

#### S. Potassium Hydroxide Chemical Feed

##### Bulk Tank

Potassium Hydroxide (KOH) is added for pH adjustment. KOH shall be stored in a 3,000 gallon bulk storage tank (BT-500), which shall be equipped with a high-high level switch (LSH-512) and an ultrasonic level transmitter (LIT-511) to monitor liquid level in the tank. A high-high bulk tank level alarm (via LSH-512) shall be reported in the SCADA system, which shall activate a strobe and horn on the KOH BCFP (located on the building exterior) to prevent overflow and spills. The bulk tank level (via LIT-511) is displayed at the MCP OIT, in the SCADA system, and at the bulk chemical fill panel (via LI-511). An emergency indication pushbutton (PB-517) shall be located on the KOH BCFP. When depressed, a chemical fill emergency alarm (acknowledged via PB-517A) shall be reported in the SCADA system. Alarm conditions shall be reported in the SCADA system for high, low, and low-low level via LIT-511 and high-high level via LSH-512 in the bulk tank. The alarm set points shall be operator selectable.

##### Transfer Pump

Potassium Hydroxide is pumped from the bulk storage tank to the 230-gallon KOH day tank (DT-501) via dedicated transfer pump (TP-502).

The operator shall energize the transfer pump (TP-502) with an ON/OFF selector switch (HS-514). When the transfer pump selector switch is turned clockwise, the transfer pump shall energize. Once the switch is released and automatically returns to the OFF position the transfer pump shall de-energize. There shall be no SCADA remote control of the chemical transfer pump. A high day level via tank level switch (pre-filtration: LSH-513) shall de-energize the transfer pump (TP-502) via run permissive from the SCADA system.

##### Day Tank

Potassium Hydroxide is stored in a 230-gallon day tank (DT-501) for chemical addition. The day tank is equipped with a high level switch (LSH-513) to monitor liquid level in the tank. A high day tank level alarm (via LSH-513) shall be reported in the SCADA system.

## Chemical Feed Metering Pumps

KOH feed shall be paced based on the Wells 2, 3, and 4 combined flow rate as measured by the PFAS Treatment Influent flow meter (FIT-311). The KOH chemical feed metering pumps (duty: MP-503, standby: MP-504) draw the chemical from the 230-gallon day tank and pump it to the injection point. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the metering pump shall be selected by an H-O-A selector switch for pH control (duty: HS-503A, standby: HS-504A) located on the KOH Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the PFAS Treatment Influent flow meter (FIT-311) shall shut down the chemical feed metering pumps (MP-503, MP-504).

H-O-A controls for the metering pumps shall be located at the KOH Metering Pump Control Panels in the KOH containment area as selector switches (duty: HS-503A, standby: HS-504A). When the metering pump is in "AUTO" mode, it is controlled and operated via the SCADA system. There are two operator selectable "AUTO" modes: SCADA-ChemicalSetPoint and SCADA-FlowRatio. For SCADA-ChemicalSetPoint, the operator shall enter the desired chemical dosage and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the PFAS Treatment Influent flow meter (FIT-311) for feed. For SCADA-FlowRatio, the operator shall enter the desired ratio of chemical to flow and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the PFAS Treatment Influent flow meter (FIT-311) for KOH feed. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select "HAND" position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. "Pump in Hand" shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of "HAND" can only be performed at the KOH Metering Pump Control Panel via the selector switch, and "HAND" operation of the metering pumps cannot be completed in the SCADA system. In the "OFF" position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

### T. Sodium Bisulfite Chemical Feed

#### Bulk Tank

Sodium bisulfite ( $\text{NaHSO}_3$ ) is added for dechlorination. Sodium bisulfite shall be stored in a 1,150 gallon bulk storage tank (BT-600), which shall be equipped with a high-high level switch (LSH-612) and an ultrasonic level transmitter (LIT-611) to monitor liquid level in the tank. A high-high bulk tank level alarm (via LSH-612) shall be reported in the SCADA system, which shall activate a strobe and horn on the sodium

bisulfite BCFP (located on the building exterior) to prevent overflow and spills. The bulk tank level (via LIT-611) is displayed at the MCP OIT, in the SCADA system, and at the bulk chemical fill panel (via LI-611). An emergency indication pushbutton (PB-612) shall be located on the sodium bisulfite BCFP. When depressed, a chemical fill emergency alarm (acknowledged via PB-612A) shall be reported in the SCADA system. Alarm conditions shall be reported in the SCADA system for high, low, and low-low level via LIT-611 and high-high level via LSH-612 in the bulk tank. The alarm set points shall be operator selectable.

### Transfer Pump

Sodium bisulfite is pumped from the bulk storage tank to the sodium bisulfite day tank (DT-601) via dedicated transfer pump (TP-602). A high day tank level alarm via the tank level switch (LSH-613) shall turn off the transfer pump (TP-602) via the SCADA system.

The operator shall energize the transfer pump (TP-602) with an ON/OFF selector switch (HS-615). When the transfer pump selector switch is turned clockwise, the transfer pump shall energize. Once the switch is released and automatically returns to the OFF position the transfer pump shall de-energize. There shall be no SCADA remote control of the chemical transfer pump. A high day level via tank level switch (LSH-613) shall de-energize the transfer pump (TP-602) via run permissive from the SCADA system.

### Day Tank

Sodium bisulfite is stored in a 30-gallon day tank (DT-601) for chemical addition. The day tank is equipped with a high level switch (LSH-613) to monitor liquid level in the tank. A high day tank level alarm (via LSH-613) shall be reported in the SCADA system.

### Chemical Feed Metering Pumps

Sodium bisulfite feed shall be paced based on the Fe/Mn filter effluent flow rate (via FIT-218). The sodium bisulfite chemical feed metering pumps (duty: MP-603, standby: MP-604) draw the chemical from the 30-gallon day tank and pump it to the injection point. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the metering pump shall be selected by an H-O-A selector switch for pH control (duty: HS-603A, standby: HS-604A) located on the sodium bisulfite Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the Fe/Mn filter effluent flow meter (FIT-218) shall shut down the chemical feed metering pumps (MP-603, MP-604).

H-O-A controls for the metering pumps shall be located at the sodium bisulfite Metering Pump Control Panels in the sodium bisulfite containment area as selector switches (duty: HS-603A, standby: HS-604A). When the metering pump is in

“AUTO” mode, it is controlled and operated via the SCADA system. There are two operator selectable “AUTO” modes: SCADA-ChemicalSetPoint and SCADA-FlowRatio. For SCADA-ChemicalSetPoint, the operator shall enter the desired chemical dosage and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the Fe/Mn filter effluent flow meter (FIT-218) for feed. For SCADA-FlowRatio, the operator shall enter the desired ratio of chemical to flow and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the Fe/Mn filter effluent flow meter (FIT-218) for sodium bisulfite feed. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of “HAND” can only be performed at the KOH Metering Pump Control Panel via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system

#### U. Sodium Fluoride Chemical Feed

##### Saturator and Overflow Assembly

Sodium Fluoride (NaF) is added for fluoridation. The chemical solution is prepared on a continuous basis by potable water flowing through a bed of fluoride and dissolving the fluoride to saturation concentration within a fluoride saturator. The fluoride bed is maintained within a manufacturer specified thickness range by the operator adding dry NaF to the saturator based on visual inspection of the fluoride bed thickness.

NAF shall be stored in a 55-gallon saturator tank (SAT-650) and shall include an overflow assembly. The saturator and overflow assembly shall be provided with a solenoid valve (SV-680), float switch (LSH-652), and mechanical float shutoff valve to facilitate automatic operation of the fluoride saturator. The float switch (LSH-652) shall be located within the saturator and shall be connected to the solenoid valve (SV-680), which controls potable water flow into the saturator.

Flow into the saturator is initiated when the tank level drops and the float switch signals for the solenoid valve to open. Flow into the saturator shall continue until the float switch returns to the manufacturer-specified level, at which point the float switch shall signal for the solenoid valve to close. A disc water meter indicates the process water flow rate locally.

The mechanical float shutoff valve shall be located within the overflow tank and act as a mechanical water shutoff. The mechanical float shutoff valve shall be located on the potable water line between the solenoid valve and the outlet to the saturator.

In the event of solenoid failure and the valve is stuck open, the saturator shall overflow to the overflow tank and fill until the float component of the mechanical float shutoff valve rises high enough to close the ball valve component of the mechanical float shutoff valve.

#### Chemical Feed Metering Pumps

NAF feed shall be paced based on the treatment plant water flow rate as measured by the filtered water flow meter (FIT-312). The NAF chemical feed metering pump (MP-651) draws the chemical from the 55-gallon saturator tank and pumps it to the injection point. The chemical feed pump is equipped with integral mode start/stop controls. Automatic or Manual control of the metering pump shall be selected by an H-O-A selector switch (HS-651A) located on the NAF Metering Pump Control Panel. The pump can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panel H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the filtered water flow meter (FIT-312) shall shut down the chemical feed metering pump (MP-651).

H-O-A controls for the metering pump shall be located at the NAF Metering Pump Control Panel in the NAF containment area as a selector switch (HS-651A). When the metering pump is in "AUTO" mode, it is controlled and operated via the SCADA system. There are two operator selectable "AUTO" modes: SCADA-ChemicalSetPoint and SCADA-FlowRatio. For SCADA-ChemicalSetPoint, the operator shall enter the desired chemical dosage and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the filtered water flow meter (FIT-312) for feed. For SCADA-FlowRatio, the operator shall enter the desired ratio of chemical to flow and the SCADA system shall vary the speed of the metering pump based on chemical pump characteristics (operator selectable), chemical characteristics (operator selectable), and measured flow by the filtered water flow meter (FIT-312) for NAF feed. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select "HAND" position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. "Pump in Hand" shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of "HAND" can only be performed at the NAF Metering Pump Control Panel via the selector switch, and "HAND" operation of the metering pump cannot be completed in the SCADA system. In the "OFF" position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system

#### V. Analyzers:

##### Wells 2&3 Raw & Recycle Water

A combined pH and temperature analyzer (AIT-961) shall measure pH and temperature of the Wells 2 & 3 raw & recycle water. High and low pH alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable.

### Oxidized Water

A combined chlorine residual, pH, and temperature analyzer (AIT-962) shall measure chlorine residual, pH, and temperature of the oxidized water. High, high-high, low, and low-low chlorine residual alarm conditions shall be reported in the SCADA system. High and low pH alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. In the event of a high-high or low-low oxidized chlorine residual, the SCADA system shall de-energize the Well 2 Pumps (P-100A &P-100B) and Well 3 Pump (P-141).

### Fe/Mn Filtered Water

A combined chlorine residual, pH, and temperature analyzer (AIT-963) shall measure chlorine residual, pH, and temperature of the Fe/Mn filtered water. High and low pH and chlorine alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable.

### PFAS Filter Influent Water

A combined chlorine residual, pH, and temperature analyzer (AIT-964) shall measure chlorine residual, pH, and temperature of the PFAS influent water. Alarm conditions for pH and chlorine shall be reported in the SCADA system. Low-low or high-high pH alarm conditions (operator selectable setpoint) shall turn off Well 2 Pumps (P-100A &P-100B), Well 3 Pump (P-141) and Well 4 Pump (P-171), and an alarm shall be reported in the SCADA system. A high-high chlorine alarm condition (operator selectable setpoint) shall turn-off Well 2 Pumps (P-100A & P-100B) and Well 3 Pump (P-141), and alarm shall be reported in the SCADA system. The alarm set points shall be operator selectable.

### Finished Water

A combined chlorine residual, pH, and temperature analyzer (AIT-965) shall measure chlorine residual, pH, and temperature of the finished water. Alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. Low-low or high-high finished water pH shall turn-off Well 2 Pumps (P-100A &P-100B), Well 3 Pump (P-141), Well 4 Pump (P-171) and Finished Water Pumps (P-700A, P-700B, P-700C), and an alarm shall be reported in the SCADA system. Low-low or high-high finished water chlorine reading shall turn off Well 2 Pumps (P-100A &P-100B), Well 3 Pump (P-141), Well 4 Pump (P-171) and Finished Water Pumps (P-700A, P-700B, P-700C), and an alarm shall be reported in the SCADA system.

### Finished Water (100-ft Sample Tap)

A combined chlorine residual, pH, and temperature analyzer (AIT-966) shall be used to measure chlorine residual, pH, and temperature of the 100-ft sample tap water. Alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. Low-low or high-high 100-ft sample tap water pH shall turn off Well 2 Pumps (P-100A & P-100B), Well 3 Pump (P-141), Well 4 Pump (P-171) and Finished Water Pumps (P-700A, P-700B, P-700C), and an alarm shall be reported in

the SCADA system. Low-low or high-high 100-ft sample tap water chlorine reading shall turn off Well 2 Pumps (P-100A &P-100B), Well 3 Pump (P-141), Well 4 Pump (P-171), and Finished Water Pumps (P-700A, P-700B, P-700C), and an alarm shall be reported in the SCADA system.

#### Sample Line Solenoid Valves

The normally closed sample line solenoid valves (SV-967A, SV-967B, SV-967C, SV-967D, SV-967E, SV-967F) shall be energized to open when the Well Pumps (Well 2: P-100A &P-100B; Well 3: P-141; Well 4: P-171) or Finished Water Pumps (P-700A, P-700B, P-700C) are called to run. The sample lines solenoid valves shall remain open during WTP operation.

#### W. Flood Alarms:

Flood switches shall be provided at each of the well stations (LSH-113, LSH-151, LSH-181). Flood level switches shall be provided in the WTP potassium hydroxide/sodium hypochlorite chemical room 105 (LSH-419), sodium bisulfite chemical room 104 (LSH-614), and Pipe Gallery (LSH-996). An area-specific flood alarm shall be reported in the SCADA system when a level switch is activated.

#### X. Room/Area Temperature

##### Well Station 2, 3, and 4

Temperature transmitters shall be provided at the Well Stations and will measure the room temperature for Well Stations 2, 3, and 4 (TT-112, TT-150, TT-180). The temperature shall be displayed at the respective well station OIT, WTP MCP OIT, and in the SCADA system. Alarm conditions shall be reported to the SCADA system for high and low temperature. The alarm set points shall be operator selectable.

##### Nitrate Removal Area (Room 101)

TT-921 measures the Nitrate Removal Area temperature, and the temperature reading shall be displayed at the WTP MCP OIT and in the SCADA system. Alarm conditions shall be reported to the SCADA system for high and low temperature. The alarm set points shall be operator selectable.

##### Fe/Mn Removal Area Area (Room 103)

TT-923 measures the temperature of the Fe/Mn Removal Area, and the temperature reading shall be displayed at the WTP MCP OIT and in the SCADA system. Alarm conditions shall be reported to the SCADA system for high and low temperature. The alarm set points shall be operator selectable.

##### Control Room (Room 106)

TT-926 measures the WTP Control Room temperature, and the temperature reading shall be displayed at the WTP MCP OIT and in the SCADA system. Alarm conditions



shall be reported to the SCADA system for high and low temperature. The alarm set points shall be operator selectable.

#### Electrical Room (Room 111)

TT-930 measures the Electrical Room temperature, and the temperature reading shall be displayed at the MCP OIT and in the SCADA system. Alarm conditions shall be reported to the SCADA system for high and low temperature. The alarm set points shall be operator selectable.

#### Y. HVAC

High humidity alarms from the dehumidifier units (DHU-1 and DHU-2) shall be reported in the SCADA system.

#### Z. Emergency Shower Flow Switches

FS-420 and FS-421 are emergency shower flow switches located in the KOH & NaOCl Chemical Room. Activation of the flow switches shall be reported in the SCADA system.

#### AA. Intrusion:

An intrusion condition shall be reported as a security alarm in the SCADA system at Well Stations 2, 3, and 4 and the WTP. The security alarm shall be reported via the local Security Access Control Panel.

#### BB. Fire:

A fire condition at the WTP shall be reported as an alarm in the SCADA system. A supervisory alarm shall be reported in the SCADA system. All alarms shall be reported via the Fire Alarm Control Panel.

#### CC. Generator:

In the event of a power failure at the WTP, the stand-by generator shall start. Generator alarms for run status and generator fault shall be reported in the SCADA system. Generator mode verifying if the generator is in auto mode shall be reported in the SCADA system.

#### DD. Automatic Transfer Switch

In the event of a power failure at the WTP or Well Station, the automatic transfer switch (ATS) shall automatically switch to generator power supply. The ATS position (normal, emergency) shall be reported in the SCADA system. An alarm signal shall be sent to SCADA for loss of utility power.

#### EE. Tight Tank

The tight tank shall be equipped with a high level switch (LSH-971) and a high-high level switch (LSH-972) to monitor the liquid level in the tank. The high and high-high level alarms (via LSH-971 and LSH-972) shall be reported in the SCADA system.

#### FF. Chemical Alarm

A chemical alarm condition shall be reported as an alarm in the SCADA system. The chemical alarm shall be reported via the Chemical Alarm Control Panel.

#### GG. Personnel Down Switch

A personnel down switch shall be provided at Well Station 2 (PB-111), Well Station 3 (PB-149), Well Station 4 (PB-179), WTP Nitrate Removal Area (PB-981), PFAS Removal Area (PB-982), Fe/Mn Removal Area (PB-983), Sodium Bisulfite Chemical Room (PB-984), Potassium Hydroxide and Sodium Hypochlorite Chemical Room (PB-985), Control Room (PB-986), Pipe Gallery Room 001 West (PB-991), and Pipe Gallery Room 001 East (PB-992). When activated, a personnel down alarm shall be reported in the SCADA system.

#### HH. Emergency Stop

An emergency E-STOP push button shall be provided on each well station control panel (Well 2: PB-117, Well 3: PB-152, Well 4: PB-183). When activated, the respective well pumps (Well 2: P-100A & P-100B; Well 3: P-141; Well 4: P-171) shall de-energize and an alarm shall be reported in the SCADA system. When activated, the WTP MCP Emergency Stop switches on the Main Control Panel (PB-993) and in the Fe/Mn Filter Area (PB-994) shall turn off the Well Pumps (P-100A & P-100B, P-141, P-171), Finished Water Pumps (P-700A, P-700B, P-700C), Recycle Pumps (P-800A, P-800B), Pre-Filtration NaOCl Metering Pumps (MP-404, MP-405), Post-Filtration NaOCl Metering Pumps (MP-407, MP-408), KOH Metering Pumps (MP-503, MP-504), NaHSO<sub>3</sub> Metering Pumps (MP-603, MP-604), NaF Metering Pumps (MP-651), and the Air Scour Blower (ASB-202).

#### II. Interlocks:

Refer to I-2 of the Contract Drawings and other Sections of Division 13 – Special Construction for equipment interlocks. Remote resetting of interlock conditions shall not be permitted.

Any WTP equipment de-energized by an interlock shall be reset at the WTP MCP.

Any well station equipment de-energized by an interlock shall be reset at the respective well station control panel.

#### JJ. Alarms: Refer to Specification Section 13400 for a summary of alarms.

END OF SECTION 13465

DIVISION 14 – HOISTING EQUIPMENT

14300 .....Hoisting Equipment

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## SECTION 14300

### HOISTING EQUIPMENT

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide and test hoisting equipment, gear reducers, controls and appurtenances as indicated and in compliance with Contract Documents.
  - 1. Rail and supporting beams included in building structure, refer to structural drawings.
  - 2. Hoist capacities and operating data are indicated herin.

##### 1.2 REFERENCES

- A. American Bearing Manufacturers Association (ABMA):
  - 1. 9: Load Ratings and Fatigue Life for Ball Bearings.
  - 2. 11: Load Ratings and Fatigue Life for Roller Bearings.
- B. American Welding Society (AWS):
  - 1. D1.1: Structural Welding Code Aluminum.
- C. National Electric Code (NEC).
- D. National Electrical Manufacturers Association (NEMA):
  - 1. MG1: Motors and Generators.
- E. Occupational Safety and Hazard Association (OSHA):
  - 1. 29 CFR 1910.179: Overhead and Gantry Cranes.

##### 1.3 SUBMITTALS

- A. Submit the following shop drawings in accordance with Section 01300:
  - 1. Data regarding hoisting equipment characteristics and performance:
  - 2. Certified setting plans, with tolerances, for anchor bolts.
  - 3. Manufacturer's literature as needed to supplement certified data.
  - 4. Operating and maintenance instructions and parts lists.
  - 5. Listing reference installations as specified with contact names and telephone numbers.
  - 6. List of recommended spare parts other than those specified.
  - 7. Shop and field inspection reports.
  - 8. Motor shop test results.
  - 9. Qualifications of field service engineer.
  - 10. Recommendations for short and long-term storage.
  - 11. Shop and field testing procedures, equipment to be used.
  - 12. Special tools.
  - 13. Number of service person-days provided and per diem field service rate.
  - 14. Manufacturer's product data, specifications and color charts for shop painting.
  - 15. The latest ISO 9001 series certification.

16. Provide scaled drawing height and weight of equipment serviced by the hoisting equipment including hook height and travel dimensions.

17. Material Certification:

- i. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
  - ii. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.
- B. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
  2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

#### 1.4 SPARE PARTS

- A. Comply with the requirements specified in Section .
- B. Provide spare parts that are identical to and interchangeable with similar parts installed.

#### 1.5 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section .
- B. Permanently mark the capacity of the hoist and trolley on each hoist, in easy to read letters and in a prominent position.
- C. Provide only safety type hooks.
- D. Provide hoists so that hook can reach the floor at the lowest level of the lift.
- E. Do not use hoists for construction purposes of any nature.
- F. Hoists shall be manufacturer's standard cataloged product and modified to provide compliance

with the drawings, specifications and the service conditions specified and indicated.

- G. Welding: In accordance with American Welding Society Code D1.1.
- H. Provide shop tests as specified.
- I. Hoisting equipment manufacturer shall provide hoists, motors, gear reducers, switches, and controls regardless of manufacturer as a complete integrated package to ensure coordination, compatibility, and operation of the systems.
- J. Services of Manufacturer's Representative as stated in Section and as specified herein.
- K. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
  - 1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
  - 2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping and electrical:
    - i. 1 person-days.
  - 3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
    - i. 1 person-days.
  - 4. Performance Testing: Field performance test equipment specified.
    - i. 1 person-days.
  - 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
    - i. 1 person-days.
  - 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
  - 7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- L. Manufacturer of hoisting equipment shall have a minimum of five (5) operating installations with hoists of the size specified and in the same service as specified operating for not less than five (5) years.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 – Delivery, Storage, and Handling and as specified herein. Ship equipment and material complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Store products in manufacturer's packaging or until ready for installation/furnishing to Owner.
- C. Equipment shall not be used by Contractor to complete work required by this Contract.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Hoisting equipment capacities and operating data are indicated in the Hoist Schedule.

### 2.2 CRANE HOISTS

- A. Hoist Mechanism: Fully enclosed high-speed, spur-gearred, ball or roller bearing, hand-operated, chain hoist with a retaining brake or other acceptable device built into hoisting mechanism.
- B. Hooks: High grade, forged steel with swivel, antifriction bearings.
- C. Load Wheel: Make with accurately formed chain pockets to fit load chain.
- D. Hoist Operating Wheel: A load limiting clutch mechanism consisting of spring loaded rollers that run between an outer race and an inner hub mounted on the outside of the wheel. The clutch shall be designed to limit the chain pull to not more than 150 percent of that required to lift the rated load capacity of the hoist. Provide with chain guides with chain of sufficient length to hang 3 feet (0.9 meters) above operating floor.
- E. Chain Bucket: Provide where specified to collect load chain. Arrange chain bucket so it will not interfere with smooth operation of hoist.
- F. Lightweight Hoists: Make with high strength aluminum frame, hand wheel and housing.
- G. Provide each hoist with a clevis connection for use with a trolley, a suspension hook at top, or be integrally built into trolley as indicated on drawings or specified herein.
- H. Hoist Capacity: 1/2 ton
- I. Trolley shall mount to W12x50 hoist beam. Refer to Structural Drawings for hoist beam details.
- J. Manufacturers
  - 1. Harrington.
  - 2. ACCO-Wright.
  - 3. Engineer-Approved Equal

### 2.3 ELECTRIC SCISSOR LIFT

- A. Platform Height: 26 feet
- B. Working Height: 32 feet
- C. Platform Capacity: 1200 lb
- D. Machine Width: 3 ft 10 in
- E. Brakes: Electric, friction
- F. Maximum Ground Bearing Pressure: 137 psi
- G. Drive Speed:
  - 1. Platform Elevated: 3 mph
  - 2. Platform Lowered: 0.5 mph
- H. Power Source:
  - 1. Battery powered: (4) 6V, 220 A-h
  - 2. Charger: automatic, 27 amp



- I. Lift Time: 62 sec
- J. Lower Time: 37 sec
- K. Turning Radius:
  - 1. Inside: 0 ft
  - 2. Outside: 7 ft 4 in
- L. Manufacturers
  - 1. JLG Model ES2646
  - 2. Engineer-Approved Equal

## 2.4 PORTABLE GANTRY

- A. Portable Gantry: Four-leg rolling-type gantry with 1 ton capacity. Horizontal standard aluminum beam suspended at each end by pipe legs adjustable for both height and span at floor, adequately braced, with locking swivel casters for each leg.
- B. Position legs and span by pins provided with springs and a locking device to fit matching holes in telescoping pipe members.
- C. Fit casters with ball bearings and wheels of rubber plastic treads designed for rated capacity of gantry.
- D. Provide stops at ends of beam to prevent trolley rolloff.
- E. Manufacturers
  - 1. RAZE Model RZAG-1
  - 2. Engineer-Approved Equal

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install items in accordance with manufacturer's printed instructions and as indicated and specified.
- B. Check horizontal and vertical alignment of track and rails.
- C. Erect rack level throughout, with section ends machined fitted and spliced with web-type couplings to provide flush level connections. Maximum gap between adjacent ends not exceeding 1/16-inch.
- D. Do not use cast fittings.

### 3.2 FIELD TESTING

- A. Provide as specified herein. Perform all tests with instrumentation controls and motor controls. Perform testing in accordance with OSHA 29 CFR 1910.179 and as specified herein.
- B. Make all adjustments to place equipment in specified working order at time of above tests.
- C. After three (3) unsuccessful testing attempts, remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated.

### 3.3 FIELD TOUCH-UP PAINTING

- A. After installation and testing, apply touch-up paint to all scratched, abraded, and damaged shop painted surfaces. Coating type and color shall match shop painting.

### 3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.

END OF SECTION

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DIVISION 15 – MECHANICAL

15001	.....Plumbing (Filed Sub-Bid Required)
15002	..... Heating, Ventilation, and Air Conditioning (HVAC) (Filed Sub-Bid Required)
15003	..... Fire Protection (Filed Sub-Bid Required)
15300	.....Fire Protection (Fire Protection Filed Sub-Bid Required)
15400	..... Plumbing (Plumbing Filed Sub-Bid Required)
15500	..... Heating, Ventilation, and Air Conditioning (HVAC) (Heating, Ventilation, and Air Conditioning Filed Sub-Bid Required)
15900	.....Laboratory Fume Hoods (Heating, Ventilation, and Air Conditioning Filed Sub-Bid Required)

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SECTION 15001

PLUMBING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 15001 – PLUMBING

2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.

3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.

C. Sub-Sub-Bid Requirements: None required under this Section.

D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, C-6, C-7, CD-11, A-5, A-6, A-12, S-4, S-5, S-6, P-1, P-2, P-3, P-4, P-5, P-6, P-7, P-8, and P-9.

E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 15001 – Plumbing and Section 15400 – Plumbing.

F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:

1. Division 1 – General Requirements
  2. Division 2 – Site Work
- G. Alternates: Not Applicable.

END OF SECTION 15001

SECTION 15002

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 15002 – HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.

3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.

C. Sub-Sub-Bid Requirements: None required under this Section.

D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, C-6, A-5, A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-21, H-1, H-2, H-3, H-4, H-5, H-6, H-7, H-8, H-9, H-10, H-11, and H-12.

E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 15002 – Heating, Ventilation, and Air Conditioning (HVAC), Section 15500 – Heating, Ventilation, and Air Conditioning (HVAC), and Section 15900 – Laboratory Fume Hoods.



- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
  2. Division 10 – Specialties
- G. Alternates: Not Applicable.

END OF SECTION 15002

SECTION 15003

FIRE PROTECTION  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 15003 – FIRE PROTECTION

2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.

3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.

C. Sub-Sub-Bid Requirements: None required under this Section.

D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, A-1, A-2, A-5, A-6, A-12, FP-1, FP-2, FP-3, FP-4, FP-5, and FP-6.

E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 15003 – Fire Protection and Section 15300 – Fire Protection.

- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
- G. Alternates: Not Applicable.

END OF SECTION 15003

## SECTION 15300

### FIRE PROTECTION

(Part of Filed Sub-Bid Section 15003 – FIRE PROTECTION WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
- 2. Division 1 – General Requirements

- B. Work included:

- 1. Design and provide new automatic wet pipe fire suppression sprinkler systems. The Work of this Section shall include all labor, materials, tools, equipment and appurtenances, and performing all operations necessary to furnish and install complete and operable systems in accordance with this Section of these Contract Specifications, the Contract Drawings, and the codes and standards listed herein.
- 2. Coordinate with the Local Water Department as to any Local restrictions or requirements relative to backflow prevention devices and metering.
- 3. Hydrant flow test.
- 4. Wet pipe automatic sprinkler system for full fire protection coverage throughout as indicated. Systems shall be separated into the zones indicated on the Contract Drawings.

- C. Work not included:

- 1. Excavation and backfilling, including gravel or sand bedding for buried pipe is included under Division 2 - Site Work of these Specifications.
- 2. Concrete mounting bases is included under Division 3 – Cast-In-Place Concrete of these Specifications.
- 3. Painting of pipe, pipe hangers and supports is included under Division 9 – Painting of these Specifications.
- 4. Fire Alarm system wiring is included under Division 16 – Electrical of these Specifications.

### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the Section 00700 - General Conditions And Section 01300 - Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Detail Drawings - Prepare 24 by 36 inch detail working drawings of sprinkler heads and piping system layout in accordance with NFPA 13, "Working Drawings." Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Submit Working Drawings signed by the Fire Protection Engineer.
  - 2. Coordination Drawings - Prepare as specified in Paragraph "Cooperation and Coordination with Other Trades" of this Section.
  - 3. Sprinkler system design - Prepare computer program generated hydraulic calculations in accordance with NFPA 13 to substantiate compliance with hydraulic design requirements. Submit name of software program used
  - 4. Provide hydrant flow test data less than one year old conforming to NFPA 291. In case of a winter test, provide comparison to local water department tests or estimates of minimum summer flow and pressure for basis of design. The lesser combined flow and pressure test results shall be used for the hydraulic design of the system.
  - 5. Pipe, fittings and mechanical couplings.
  - 6. Valves.
  - 7. Sprinkler heads.
  - 8. Alarm check valves.
  - 9. Alarm initiating devices.
  - 10. Fire department connections.
  - 11. Backflow preventers Submit a layout drawing indicating the location of all backflow preventers to the Massachusetts Department of Environmental Protection (DEP) for their approval prior to submitting to the Engineer.
  - 12. Pressure gauges.
  - 13. Pipe hangers and supports.
  - 14. Identification signs

- C. Submit all other data as specified herein.
- D. "As-built" copies of all shop drawings shall be submitted to the Engineer before final inspection and acceptance.
- E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section 15300 - Fire Protection.
- F. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

#### 1.4 QUALITY ASSURANCE

##### A. Requirements of the Regulatory Agencies

1. Pay for all fees and give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from Authorities Having Jurisdiction. Deliver all certificates of inspection to the Authorities Having Jurisdiction. No work shall be covered before examination and approval by Authorities Having Jurisdiction. Replace imperfect or condemned work to conform to inspectional requirements, satisfactory to the Architect, Owner, Engineer and Authorities Having Jurisdiction without extra cost to the Owner. If Work is covered before inspection and approval, pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.
2. State and Local Building Codes including, but not limited to, NFPA 13 as adopted by the State of Massachusetts and 248 CMR 2.00 Massachusetts Uniform Plumbing Code.
3. Massachusetts Department of Environmental Protection
4. Local Fire Department
5. Local Water and Sewer Authority or Department
6. Occupational Safety and Health Administration (OSHA)
7. Any other local codes or requirements of Authorities Having Jurisdiction

B. Materials and equipment used shall be Underwriters Laboratories, Inc. or Factory Mutual listed wherever standards have been established by that agency.

##### C. Qualifications of Installer

1. Prior to installation, submit data showing the name and license of the installer and that they has successfully installed systems of the same type and design as specified herein. Data shall include names and locations of at least two installations of such systems. Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months. The

installer shall be licensed to perform applicable fire protection systems installation in the state in which the project is located.

2. Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared by, or under the supervision of, an individual who is experienced with the types of work specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in Automatic Sprinkler System program. Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of Working Drawings.
3. Qualifications of Welders: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures, welders and welding operators shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Authority Having Jurisdiction shall be notified 24 hours in advance of any required testing and the tests shall be performed at the work site. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Prior to installation, submit data for approval showing the name and certification of each welder and welding operator to be used on the project. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Welders making defective welds after passing a qualifications test shall be given requalification test and, upon failing to pass this test, shall not be permitted to work on the Contract.
  - i. Each welder shall have a copy of a certified ASME qualification test report. Conduct a qualification test for each welder and submit results for approval.
  - ii. Submit welding procedure specifications for metals included in the Work.

#### D. Qualifications of Construction Supervisor

1. Provide a Construction Supervisor with a minimum of 5 years of experience in fire protection construction supervision who shall be responsible for the installation of the Work of this Section of the Contract Specifications. The Construction Supervisor shall be licensed to perform applicable fire protection systems supervision in the state in which the project is located. Prior to installation, submit data for approval showing the name and license of the Construction Supervisor.

#### E. Qualifications of Fire Protection Engineer

1. Design and construction control shall be by, or under the supervision of, a registered fire protection engineer licensed in the state in which the project is located.

- F. Certification - Submit documentation certifying completion of the following items in compliance with this Section.

1. Preliminary tests
2. Flushing
3. Manufacturers' services
4. Disinfection

#### G. REFERENCES

1. Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only. In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears
2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - i. ASTM A36 Carbon Structural Steel
  - ii. ASTM A 47 Malleable Iron Castings
  - iii. ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
  - iv. ASTM A 135 Electric-Resistance-Welded Steel Pipe
  - v. ASTM A 183 Carbon Steel Tract Bolts and Nuts
  - vi. ASTM A 536 Ductile Iron Castings
  - vii. ASTM A 795 Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
  - viii. ASTM B 88 Seamless Copper Water Tube
3. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
  - i. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
  - ii. ASME B16.3 Malleable Iron Threaded Fittings
  - iii. ASME B16.4 Cast Iron Threaded Fittings
  - iv. ASME B16.5 Pipe Flanges and Flanged Fittings
  - v. ASME B16.9 Factory-Made Wrought Steel Butt- Welding Fittings
  - vi. ASME B16.11 Forged Fittings, Socket-Welding and Threaded
  - vii. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
  - viii. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
  - ix. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
  - x. ASME B18.2.1 Square and Hex Bolts and Screws (Inch Series)
  - xi. ASME B18.2.2 Square and Hex Nuts (Inch Series)
4. AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
  - i. ASSE 1015 Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies



5. AMERICAN WATER WORKS ASSOCIATION (AWWA)
  - i. AWWA B300 Hypochlorites
  - ii. AWWA B301 Chlorine
  - iii. AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
  - iv. AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems
  - v. AWWA C110 Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids
  - vi. AWWA C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - vii. AWWA C151 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
  - viii. AWWA C651 Disinfecting Water Mains
6. FM GLOBAL (FM)
  - i. FM P7825 Approval Guide
7. FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)
  - i. FCCCHR List (continuously updated) List of Approved Backflow Prevention Assemblies
8. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
  - i. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture
  - ii. MSS SP-69 Pipe Hangers and Supports - Selection and Application
  - iii. MSS SP-71 Cast Iron Swing Check Valves, Flanges and Threaded Ends
9. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
  - i. NFPA 13 Installation of Sprinkler Systems
  - ii. NFPA 24 Installation of Private Fire Service Mains and Their Appurtenances
  - iii. NFPA 25 Inspection, Testing, and Maintenance of Water Based Fire Protection Systems
10. UNDERWRITERS LABORATORIES (UL)
  - i. UL 01 Building Materials Directory
  - ii. UL 04 Fire Protection Equipment Directory
  - iii. UL 262 Gate Valves for Fire-Protection Service
  - iv. UL 668 Hose Valves For Fire Protection Service
  - v. UL 789 Indicator Posts for Fire-Protection Service
  - vi. UL Fire Prot Dir Fire Protection Equipment Directory

## H. Tests

1. Formal tests and inspections.
2. Backflow preventer tests.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

#### 1.6 COORDINATION

- A. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- B. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work, and also furnish information and shop drawings necessary to permit trades affected by the work to install same properly and without delay.
- C. In all spaces, prior to installation of visible material and equipment, including access panels, review all contract Drawings for exact locations and where not definitely indicated, request information. Where the fire protection work shall interfere with the work of other trades, assist in working out the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owners, make reasonable modifications to the work as required by normal structural interferences. Maintain maximum headroom at all locations. All conduit, and associated components to be as tight to underside of structure as possible.
- D. If any fire protection work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the owners.
- E. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution for review and approval.
- F. Protect all materials and work of other trades from damage which may be caused by the fire protection work, and repair all damages without extra cost to the owner.
- G. Prepare and submit for approval Coordination Drawings consisting of 1/8 inch=1'0" scale or larger working plans and sections, clearly showing how this Work is to be installed in relation to the work of other Sections. Coordination Drawings shall be based upon approved equipment submittals. The HVAC FSB will prepare backgrounds for Coordination Drawings for all buildings in this Contract and will indicate all ductwork. These Coordination Drawings shall be used to work out the coordination of all work of all trades as specified in each applicable Section. Show and coordinate the Work of this Section on said Coordination Drawings.
- H. Sleeves and Forms for Openings

1. Provide and place all sleeves for pipes penetrating floors, walls, partitions etc. Locate all necessary slots for fire protection work and form before concrete is poured.

I. Cutting and Patching

1. All openings required by the work of these Sections shall be planned for in advance. Any cutting and patching required by the lack of such planning shall be done by the General Contractor at the expense of this Fire Protection FSB. It will be the responsibility of this Fire Protection FSB to keep the General Contractor informed of all required openings.

1.7 DESIGN CRITERIA

- A. Design automatic wet pipe fire extinguishing sprinkler systems in accordance with the required and advisory provisions of NFPA 13, except as modified herein. Design sprinkler systems by hydraulic calculations for uniform distribution of water over the design area. Discharge from individual heads in the hydraulically most remote area shall be between 100 percent and 120 percent of the specified density. Each system shall include materials, accessories, and equipment inside and outside the building to provide each system complete and ready for use. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, lights, ducts, and other construction and equipment in accordance with detailed Working Drawings to be submitted for approval. Provide sprinkler heads and piping system layout.
- B. Location of Sprinkler Heads
  1. Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13 for ordinary hazard occupancy. 130 square feet per head. Uniformly space sprinklers on the branch piping
- C. Water Distribution
  1. Distribution shall be uniform throughout the area in which the sprinkler heads will open. Discharge from individual heads in the hydraulically most remote area shall be 100 percent of the specified density.
- D. Density of Application of Water
  1. Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be 0.15 gpm per sq ft.
- E. Sprinkler Discharge Area
  1. Area shall be the hydraulically most remote 1950 sq ft area as defined in NFPA 13.
- F. Outside Hose Allowances

1. Hydraulic calculations shall include an allowance of 250 gpm for outside hose streams.

G. Friction Losses

1. Calculate losses in piping in accordance with the Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

H. Water Supply

1. Base hydraulic calculations on a residual pressure of 48 psig with 6870 gpm available and a static pressure of 83 psig. Pressures are based on elevation 231 feet at Tree Lane after water main construction.

1.8 COOPERATION AND COORDINATION WITH OTHER TRADES

- A. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow efficient completion of the project. Materials and equipment shall be installed as fast as conditions will permit, and installed promptly when and as directed.
- B. Furnish to all other trades advance information on location and size of all concrete pads, chases, frames, boxes, sleeves, and openings needed for the Work, and also furnish layout information and shop drawings necessary to permit other trades affected by the Work to install their work properly coordinated and without delay.
- C. Where there is evidence that Work installed interferes with the work of other Sections, assist in working out space conditions to make satisfactory adjustments.
- D. With the approval of the Engineer and without extra cost to the Owner, make reasonable modifications in Work specified under this Section of the Contract Specifications required to coordinate with normal structural interference's, or for proper execution of specified work.
- E. If work is installed before coordinating with other trades so as to cause interference with the work of such trades, make all necessary changes in Work under this Section of the Contract Specifications at no additional cost to the Owner.
- F. Protect all materials and work of other trades from damage that may be caused by the Work required under this Section of the Contract Specifications and be responsible for repairing any damages caused by such work without any additional cost to the Owner.
- G. Follow Contract Drawings in layout work. Check Contract Drawings of, and coordinate with, other trades to verify special provisions, installation requirements and spaces in which Work provided under this Section of the Contract Specifications will be installed. Maintain maximum headroom or space conditions at all points. Where headroom or space conditions appear inadequate, notify the Engineer before proceeding.

- H. Prepare and submit for approval Coordination Drawings consisting of 1/8 inch=1'0" scale or larger working plans and sections, clearly showing how this Work is to be installed in relation to the work of other Sections. Coordination Drawings shall be based upon approved equipment submittals. The HVAC FSB will prepare backgrounds for Coordination Drawings for all buildings in this Contract and will indicate all ductwork. These Coordination Drawings shall be used to work out the coordination of all work of all trades as specified in each applicable Section. Show and coordinate the Work of this Section on said Coordination Drawings.
- I. Attend regular coordination and job progress meetings required.

## 1.9 COORIDINATION DRAWINGS

- A. The HVAC FSB shall prepare a complete set of AutoCAD format floor plans and sections" background drawings at scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. These will be the Coordination Drawings.
- B. Each of the below specialty trades shall add its work to these background drawings in different colors and layers with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
  - 1. HVAC Systems and all sheet metal work.
  - 2. Plumbing Systems.
  - 3. Sprinkler System.
  - 4. Electrical System including light locations.
- C. Where conflicts occur with placement of materials of various trades, the HVAC FSB will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade.
- D. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- E. The HVAC FSB shall make AutoCAD electronic file of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect/Engineer and have been reviewed
- F. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.

G. The HVAC FSB shall provide the following distribution of documents:

1. Electronic file of the Coordination Drawings to each specialty trade and affected Subcontractor for their use.
2. Electronic file of the Coordination Drawings to the Engineer.
3. Electronic file of the Coordination Drawings to General Contractor.

H. Coordination Drawings include but are not necessarily limited to:

1. Structure.
2. Partition/room layout.
3. Ceiling tile and grid.
4. Light fixtures.
5. Access panels.
6. Sheet metal, grilles, diffusers, etc
7. Domestic water, gas, soil, waste and vent piping and associated valves.
8. Electrical conduit runs above 2" and electrical equipment.
9. Sprinkler piping, heads and mounting brackets.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Material and equipment for fire protection service shall be UL Fire Prot Dir listed and/or FM P7825 approved for use in wet pipe sprinkler systems where such classes of material and equipment are available as listed or approved by these organizations.
- B. Where applicable, all products requiring approval by the Massachusetts Department of Public Safety shall be so approved.

### 2.2 PIPE, FITTINGS AND MECHANICAL COUPLINGS

- A. NFPA 13, except as modified herein. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1 1/2 inch and larger. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded.

- B. All black steel pipe shall be preoxidized with a suitable protective coating. Drain pipe and fittings shall be hot dipped galvanized inside and out.
- C. Schedule 40 Steel Pipe: ASTM A53, Type E or S, Grade B black steel pipe for sizes 1-1/4 inch and smaller, and for all piping upstream of alarm check valves and pre-action deluge valves. Pipe 1-1/4 inch and smaller shall be joined by screwed joints in accordance with specification ANSI B 1.20.1. Pipe 1 1/2 inch and larger shall be joined by welded joints in accordance with the American Welding Society Standard AWS D10.9, flanged joints, or by mechanical couplings. Pipe ends shall have rolled grooves. Cut grooving shall not be permitted.
- D. Schedule 10 Steel Pipe: ASTM 135 black steel pipe for sizes 1-1/2 inch and larger for all piping downstream of alarm check valves and pre-action deluge valves. Pipe 1 1/2 inch and larger shall be joined by welded joints in accordance with the American Welding Society Standards AWS D10.9 or by mechanical couplings. Pipe ends shall have rolled grooves. Cut grooving shall not be permitted.
- E. Screwed fittings shall be cast iron, class 125, black, and in accordance with ASME B 6.4 or malleable iron, class 150, black, and in accordance with ASME B 16.3.
- F. Welded fitting shall be steel, standard weight, black, and in accordance with ASME B16.9.
- G. Flanged fittings shall be cast iron, short body, class 175. Flange bolts shall be hexagon head machine bolts with heavy finished hexagon head nuts, and washers, cadmium plated, having dimensions in accordance with ANSI B 18.2.
- H. Grooved mechanical couplings and fittings shall be NFPA 13 approved and consist of combination housings and gaskets. Housings shall either be malleable iron ASTM A47 or ductile iron ASTM A536. Gasket material shall be Listed for the intended service and shall be Grade "E", EPDM.
- I. Expansion: When crossing building expansion or seismic joints, expansion or seismic loops, as required by NFPA 13, shall be installed with the appropriate couplings to allow for expansion in agreement with that as provided for by the building joint. Piping shall be securely anchored to the building structure on both sides of the building expansion and/or seismic joint.
- J. Provide fittings for changes in direction of piping and for connections. Perform welding in the shop; field welding shall not be permitted. Conceal piping in areas with suspended ceiling.

### 2.3 SPRINKLER HEADS

- A. Provide nominal 0.50 inch or 0.53 inch orifice sprinkler heads. O-rings will not be permitted in sprinkler heads. Release element of each head shall be of the ordinary temperature rating or higher as required by NFPA 13. Provide corrosion-resistant sprinkler heads and sprinkler head guards as required by NFPA 13. Provide sprinkler

heads as indicated. Deflector shall not be more than 3 inches below suspended ceilings. Ceiling plates shall not be more than 0.5 inch deep. Ceiling cups shall not be permitted.

- B. Sprinkler heads located in uninhabited areas without ceilings (mechanical rooms, storage rooms, etc.) and combustible concealed spaces above ceilings shall be of conventional design, upright style, and shall have a rough brass finish.
- C. Sprinkler heads located in inhabited areas without ceilings shall be of conventional design upright style and shall have a polished chrome finish.
- D. Sprinkler heads located in areas with suspended or finished ceilings shall be of conventional design, concealed recessed adjustable style, with white colored cap.
- E. Sprinkler Head Guards: Provide head guards on all sprinkler heads in mechanical rooms, in storage rooms, in pump rooms, on all pendent-mounted sprinkler heads within 7'-0" of any floor or stair, and elsewhere where susceptible to accidental damage. Guards shall be constructed of galvanized wire with locking device to permit authorized removal for sprinkler and head repair. Do not provide guards on sidewall heads.
- F. Spare Heads Cabinet: Provide metal cabinet with extra sprinkler heads and two sprinkler head wrenches for each type of head adjacent to each alarm check valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

## 2.4 VALVES

- A. NFPA 13. Provide valves of types approved for fire service. Gate valves shall open by counterclockwise rotation that shall be confirmed with the Fire Department prior to valve submittal. Provide an OS&Y gate valve beneath each alarm check valve.
  - 1. Gate Valves 2-1/2 inch and larger: Outside screw and yoke indicating type, iron body, bronze mounted gate valves, straightway pattern, flanged ends, 175 psig working water pressure.
  - 2. Gate Valves 2 inch and smaller: Outside screw and yoke indicating type, bronze body, straightway pattern, screwed ends, 175 psig working water pressure.
  - 3. Butterfly Valves: Indicator type, built-in double pole/double throw tamper switch, 175 psig working water pressure. Butterfly valves of sizes up to 6 inch shall have locking type handles. Butterfly valves 8 inch size shall have gear operators. Butterfly valves may be substituted for gate valves except where NFPA/Underwriter specifically requires an outside screw and yoke gate valve.
  - 4. Check Valves 2-1/2 inch and Larger: Iron body, bronze mounted, flanged ends, swing type for placement in the horizontal position, 175 psig working water pressure. Provide flanged inspection and access cover plate for check valves 4 inch and larger.



5. Check Valves 2 inch and smaller: Iron body, stainless steel trim, EPDM seal, screwed ends, silent check type, 200 psig working water pressure.
6. Drain and Inspectors Test Valves: Bronze globe valve with integral bronze seat, renewable disc, union bonnet, inside screw rising spindle, suitable for 300 psig non-shock cold water.
7. Backflow Preventer Test Valves: 2-1/2 inch hose gate valve, iron body, bronze mounted, straightway or angle pattern, flanged end, 175 psig working water pressure. Provide hose threads to suit local fire department with cap and chain.
8. Automatic Ball Drip Valve: 1/2-inch, bronze body, corrosion resistant metal ball and spring, threaded ends, 175 psig working water pressure.

B. Valve Assemblies

1. Alarm Check Valve Assemblies: Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances necessary for the proper operation of the system.

## 2.5 ALARM INITIATING DEVICES

- A. Provide switches with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system and electric alarm bell where so indicated. Connection of switch shall be under Section 16721 - Fire Alarm System.

1. Flow Switches: Provide vane-type water flow switches. Each flow switch shall be equipped with plastic paddle. Alarm actuating device shall have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and shall instantly recycle. Provide two sets of single pole double throw (spdt) contacts for wiring to the fire alarm system. Potter-Roemer VSR-F Series, Gem, Reliable, Autocall, or approved equal. Flow switches shall be sized for the piping in which installed to ensure proper fit.
2. Tamper (Supervisory) Switches: Provide on all control valves, closed circuit supervisory tamper switches mounted in accordance with UL standard. Minimum contact ratings shall be 2.5 amps at 24 volt DC. Provide supervision against valve closure or tampering of valve. Switches shall be suitable for indoor installation (outdoor location for post indicator valves), and have sealed and gasketed enclosures. Switches shall have dual contacts for wiring the item to fire alarm system under other sections of these Contract Specifications. Potter-Roemer 6220 (OS&Y), 6221 (rising stem globe valve), or 6223 as required, Gem, Reliable, Autocall, or approved equal.

## 2.6 FIRE DEPARTMENT CONNECTIONS

- A. Provide 4 inch single Storz type connection approximately 3 feet above finish grade. Fire department connections shall have hose threads to suit local fire department with caps, chains, and identifying fire department connection escutcheon plate
- B. Coordinate location with Engineer, Owner and Fire Department prior to installation.

## 2.7 SIGHT DRAINS

- A. Reliable Model B or equal, one inch, to suit.

## 2.8 BACKFLOW PREVENTERS (DOUBLE CHECK VALVE ASSEMBLY)

- A. Provide reduced pressure principle backflow preventer with OS&Y gate valve on both ends. Backflow prevention assemblies shall have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List. Listing of the specific make, model, design, and size in the FCCCHR List shall be acceptable as the required documentation."
- B. Provide strainer without screen.

## 2.9 PRESSURE GAUGES

- A. Pressure gauges shall be ASME B40.1, liquid filled, 1 percent accuracy or better, with bronze bourdon tube and steel or brass case, as manufactured by U.S. Gauge American, Mueller, Terice, Ashcroft or approved equal.
- B. Gauges shall have a minimum 3 inch diameter face. Dial gradations reading in "PSIG" shall be such that the normal operating pressure of the system installed shall be indicated near the middle of the scale.
- C. Gauges shall be equipped with a ball valve shutoff and snubber. An outlet, at least 1/4 inch size, plugged for the installation of the inspector's gauge shall be located between each valve and gauge.

## 2.10 PIPE HANGERS AND SUPPORTS

- A. Provide in accordance with NFPA 13. Attach to steel joists with MSS SP-58, Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. All hangers and supports, exposed and concealed, shall be galvanized for all areas except for chemical rooms in which stainless steel shall utilized.

## 2.11 PIPE SLEEVES

- A. Sleeves in Masonry and Concrete Walls, Floors, Ceilings, and Flat Roofs: Standard Weight hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.
- B. Sleeves in Non-Masonry or Non-Concrete Walls, Floors, and Roofs: Hot-dip galvanized steel sheet, 26 gage minimum thickness.

## 2.12 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons at all pipe penetrations where penetration is exposed to view as specified herein with inside diameter closely fitting pipe outside diameter. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, wall, or ceilings; and pipe sleeve extension, if any. Escutcheons shall be held in place by internal spring tension or set screws.
- B. Provide pipe escutcheons in finished spaces. Pipe escutcheons shall be of stainless steel, anodized aluminum or chrome-plated brass, solid or split hinged.

## 2.13 DRIP PANS

- A. Examine all Contract Drawings and in cooperation with the Electrical FSB confirm the final location of all new electrical equipment to be installed in the vicinity of new and existing piping. All overhead piping containing liquid or vapor shall be no closer than 3 feet from a vertical line to electrical equipment including, but not limited to, electric motors, controllers, switchboards, panelboards, and similar equipment.
- B. Where the installation of new automatic sprinkler systems piping does not comply with the requirements of the foregoing paragraph, where feasible the piping shall be relocated. Where not feasible, provide drip pans as specified below, except as otherwise indicated on the Contract Drawings.
- C. Provide drip pans fabricated from 18 gauge galvanized steel sheet or 16 ounce cold rolled copper sheet with watertight joints, and with edges turned up 2-1/2 inches. Reinforce top edge, either by structural angles or by rolling top over 1/4 inch rod made of same material as drip pan sheet metal. Provide hole, gasket, and flange at low point for watertight joint and 1 inch drain line connection.
- D. Locate drip pans under piping passing over or within 3 feet horizontally of electrical equipment defined above, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Carefully pitch to a convenient point for drainage. Brace to prevent sagging or swaying. Connect 1 inch drain line to drain connection and run to nearest plumbing drain or elsewhere as indicated. Drip pans shall be installed within 12 inches below piping.

## 2.14 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Provide all supplementary steel, factory fabricated channels and supports required for proper installation, mounting and support of all equipment and systems provided under this Section.

- B. Supporting channels and supplementary steel shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for the specific loading on the system installed herein.
- C. All supplementary steel shall be ASTM A36 factory-formed standard mill finished structural shapes, and shall be hot dipped galvanized for all areas except for chemical rooms in which stainless steel shall utilized..

## 2.15 IDENTIFICATION SIGNS

- A. NFPA 13. Attach properly lettered and approved metal signs to each control valve and test valve. Permanently affix hydraulic design data nameplates to the riser of each system.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation, workmanship, inspection, and testing shall be in accordance with NFPA 13 and NFPA 24, with the additions specified herein. Install piping straight and true to bear evenly on hangers and supports. Keep the interior and ends of new piping and existing piping affected by the Work thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position. Provide Teflon pipe thread paste on male threads.
- B. Piping and other apparatus shall not be installed in such a manner so as to interfere with the full swing of doors, movement of personnel and equipment, and access to other equipment.
- C. Install aboveground pressurized piping to permit draining of all sections of each piping systems without traps. Pitch piping back to system low points. Provide drain valves at all piping low points.
- D. Make provisions for pipe expansion and contraction with suitable anchors and offsets, expansion joints, or expansion loops. Make provisions in buried piping for differential settlement. Install piping to allow freedom of movement in all planes without imposing undue stress on any section of the main piping, branch piping, equipment and structure.
- E. Sprinkler Heads Locations
  - 1. Sprinkler head locations shall be coordinated with all surface mounted items, such as cornices, curtains, low soffits and lighting fixtures and shall be located accordingly. Extended escutcheons may be utilized where heads cannot be moved, if approved by the Engineer.
  - 2. Sprinkler heads and piping locations shall be determined by actual field measurements. Care shall be taken to avoid obstruction of structural members, equipment, fixtures, lighting, ducts, other piping, ceiling tile supports, etc.

3. When sprinkler heads are shown on the reflected ceiling plan, they shall be so located. Unless specifically indicated otherwise, sprinkler heads shall be installed in the centers of tiles.
4. Sprinkler heads are to be provided above suspended ceilings in combustible concealed spaces with 6 inches or greater space between the bottom of joists and ceiling assembly. Sprinklers in these concealed spaces shall be located with deflectors a minimum of 1" and maximum of 6" below the bottom of the joists. Head spacing within these spaces shall not exceed 130 ft<sup>2</sup> per head. Provide additional heads in concealed spaces not identified on the Contract Drawings or where ducts, equipment, etc. create obstructions.

#### F. Test Connections

1. Inspector's Test Connections: Provide inspector's test valve approximately 6 feet above the floor in readily accessible location for each sprinkler system or portion of each sprinkler system equipped with a flow or pressure switch. Pipe from the end of the hydraulically most remote part of each system. Provide test connection piping to a drain location that can accept full flow where the discharge will be readily visible and where water may be discharged without property damage. Discharge to janitor sinks or similar fixtures shall not be permitted. Provide smooth bore corrosion resistant discharge orifice of same size as corresponding sprinkler orifice giving flow equivalent to one sprinkler. The penetration of the exterior wall shall be no greater than 2 feet above finished grade.
2. Backflow Preventer Test Connection: Provide test valves downstream of the backflow preventer assembly. Provide one valve for each 250 gpm of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve."

#### G. Main Drains

1. Provide separate drain piping to discharge at safe points outside each building of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13. Provide precast concrete splash block under each exterior drain discharge. The penetration of the exterior wall shall be no greater than 2 feet above finished grade. Main drain pipe and valve shall support full flow at system demand.

#### H. Pipe Hangers and Supports

1. The hanging and supporting of all piping and equipment shall conform to the requirements of NFPA 13 and the manufacturer's recommendations.
2. Furnish and install safe and substantial means of support for all parts of the piping system. Attach all pipes securely to the structure in correct alignment and pitch, to prevent vibration and to effectively care for expansion and contraction.

3. All piping shall be hung to true alignment, using appropriate hanger arrangements. Wire and strap hangers shall not be permitted. Hangers shall be located so that piping and hangers will be 6 inches clear from other piping, hangers, conduits, lighting fixtures, equipment, ceiling suspension systems, ductwork and other obstructions. Where insulation or other covering is provided, minimum clearance shall take into account such covering.
4. Supplementary steel and channels shall be firmly connected to the building construction in a manner approved by the Engineer, or as otherwise shown on the Contract Drawings. Equipment and piping shall not be supported from metal decking or plaster ceilings.
5. Seismic Pipe Hanging Requirements:
  - i. Seismic protection of all fire suppression piping shall comply with the requirements of NFPA 13 and Massachusetts State Building Code. Seismic bracing shall be provided for all piping larger than or equal to 2-1/2 inch. All feed mains regardless of size shall be braced.
  - ii. The Fire Protection FSB shall have the option of substituting alternate seismic supports and anchors provided his submittals are accompanied by calculations and shop drawings signed and sealed by the Fire Protection Engineer.
  - iii. All mechanical materials and equipment including all pipes shall be supported and anchored to resist the external seismic forces for seismic hazard exposure Group [IIID]. Force shall be resisted without failure or permanent displacement when it is applied in any direction, and shall conform to the Massachusetts State Building Code.
  - iv. The ends or all branch lines shall be provided with an acceptable method of lateral restraint. The use of a wrap around "U" hanger, or band hanger at 45 degree angle is acceptable.
  - v. Acceptable manufacturers of seismic bracing are: TOLCO Incorporated; Corona, California.
  - vi. All seismic braces shall be Listed for tension and compression service.
  - vii. All braces shall utilize ordinary black steel piping as the prime support member.
  - viii. Structural connection
    - (a) All bracing shall be connected to the building's structural members.
    - (b) All means of connection to the building's structure and sprinkler pipe shall be Listed for the intended use.
  - ix. At a minimum, the bracing shall be provided a maximum of 40 feet between lateral braces and 80 feet between longitudinal braces. However, if the pipe installation positioning selected by the Fire Protection FSB requires additional bracing, these locations and types of braces shall be submitted for review and shall be provided at no additional cost.

#### I. Pipe Through-Penetrations

1. Furnish pipe sleeves where piping passes through walls, floors, ceilings, roofs, and partitions. Sleeves will be installed, and secured in proper position and location during construction by the trade whose element will be penetrated. Such trades

include concrete, masonry, steel siding in the case of a steel building, and dry wall and/or plaster in the case of framed construction. Core drilling of masonry and concrete may be provided by this Section in lieu of pipe sleeves when cavities in the core-drilled holes are completely grouted smooth. Furnish sleeves of sufficient length to pass through entire thickness of walls, floors, ceilings, roofs, and partitions.

2. Pipe Penetrations Through Building Interior Construction: Provide not less than 1/4 inch space between exterior of piping or pipe insulation and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. For non-fire rated assemblies, seal at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable silicone. Seal both ends of penetrations through fire rated assemblies to maintain fire resistive integrity with UL listed fill, void, or cavity material.
3. Pipe Penetrations Through Building Exterior Construction: Provide a bolted collars that sealed against the metal wall and is sealed with a disk-seal. Collar and disk-seal sized as recommended by seal manufacturer.
4. Extend sleeves in floor slabs 2 inches above the finished floor. Sleeves through walls shall terminate flush with the finished surface on either side of the wall.
5. Seismic-braced pipe
  - i. Proper clearances between penetrating sprinkler system piping, including drains and fire department connections, and any barrier shall be provided. The penetration holes shall be sized such that the hole diameter is 2 inches larger for pipe diameters 1-inch nominal to 3-1/2 inch nominal, and 4 inches larger for 4 inch and larger nominal diameter pipe.
  - ii. All open space around seismically braced through-penetrations shall be protected by a Listed, flexible through-penetration seal system.

#### J. Cross Connections and Interconnections

1. No equipment, devices or piping shall be installed which will provide a cross or interconnection between a distribution water supply and a drainage, soil or waste pipe which will permit or make possible the backflow of sewage, polluted water or waste into the water supply system.

#### K. Connections to Water Supply Systems

1. Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around the main piping; bolt valve to the branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Fire Protection Engineer in writing at least 15 days prior to connection date and receive approval before any service is interrupted. Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, surface restoration and other incidental labor as required.

### 3.2 CORING

- A. Provide all coring for conduits penetrating floors, walls, partitions etc.
- B. Provide waterproof sealing for the penetrations through exterior walls, etc.
- C. Foam type water proofing is not allowed.

### 3.3 DISINFECTION

- A. Disinfect the new water piping in accordance with the specified Plumbing Code with the additions specified herein or AWWA C651 whichever is more stringent. Fill piping systems with chlorine solution and allow solution to stand. Following the required standing time, flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 ppm, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyzed by a certified laboratory, and submit results prior to the new water piping being placed into service. Disinfection of systems supplied by nonpotable water (service water) is not required.
- B. Where it is not possible to disinfect a potable water storage tank as specified above, the entire interior of the tank shall be swabbed with a solution which contains 200 parts per million of available chlorine; and the solution shall than be allowed to stand 3 hours before the tank is flushed and returned to service.
- C. For a potable water filter or similar device, the dosage shall be determined by the Massachusetts Department of Environmental Protection.

### 3.4 FIELD QUALITY CONTROL

- A. After piping installation has been completed and prior to initial operation, inspect piping systems for compliance with Contract Drawings, Contract Specifications, and approved submittals. As part of inspection, perform tests and flushing in compliance with the specified requirements.
- B. Preliminary Tests
  1. Perform pressure tests specified herein. Prior to application of test pressure, remove or valve off piping components which may be damaged by test and install a calibrated pressure gage in each system. In the even of leakage, locate and repair leak by remaking joints and/or replacing piping sections and repeat test. Material and equipment used in testing shall be subject to inspection by the Engineer. Provide electricity, instruments, connecting devices, and personnel for the tests. Correct defects in the Work and repeat tests until the Work is in compliance with contract requirements. Owner will furnish water for piping testing up to 10 percent of piping volume to be tested. Pay for test water losses greater than 10 percent. Pressure test each system hydrostatically at 200 psig for a 2 hour period with no leakage or reduction in pressure.
  2. Provide alarm tests for each alarm initiating device.



3. Provide flow tests for each riser, backflow preventer, and zone.

#### C. Backflow Preventers Test Report

1. Backflow preventers shall be tested by a locally approved and certified backflow assembly tester. A copy of the test report shall be provided to the Engineer and Owner prior to placing the domestic water system into operation, or no later than 5 days after the test.

#### D. Formal Tests and Inspections

1. Do not submit a request for formal test and inspection until the preliminary test and corrections are completed and approved. Submit a written request for formal inspection at least 15 days prior to inspection date. An experienced technician regularly employed by the system installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in Work, and repeat tests until Work is in compliance with contract requirements. Furnish equipment, electricity, instruments, connecting devices, and personnel for performing tests. The Owner will furnish water for the tests. The Fire Protection Engineer shall witness formal tests and approve systems before they are accepted. When tests have been completed and corrections made, submit a signed and dated test report, similar to that specified in NFPA 13.

#### E. Flushing

1. After completion of testing and before placing in operation, flush all new sprinkler piping including feed mains in accordance with Factory Mutual Loss Prevention Data Sheet 2-81, Sprinkler System Maintenance, Section 9.5 using the hydraulic method at a flow rate to achieve a minimum scrubbing velocity of 10 ft/sec. Flush entire sprinkler system as required to remove all foreign matter, under pressure as specified in NFPA 13. Use the permanent fire water service at its maximum available pressure for the source of flushing water. Flush piping through each sprinkler head outlet before sprinkler heads are installed. Flush until water runs clean. Discharge used water to sanitary system.

### 3.5 CONTRACT CLOSEOUT

#### A. Provide in accordance with Section 01700 – Contract Closeout

#### B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730. Submit a certified list of qualified service organizations for support of the equipment which includes their addresses and qualifications.

1. Alarm check valves
2. Valves
3. Alarm initiating devices
4. Backflow preventers

- C. Record drawings shall be provided by this Fire Protection FSB as specified in Section 00700 - General Conditions and Section 01170 - Special Provisions.
- D. All special tools necessary for the operation and maintenance of the Fire Protection system and equipment shall be furnished. Wrenches for the removal of each type of sprinkler head installed shall be furnished within the spare sprinkler head cabinet at the Alarm Check assembly or where directed by the Engineer.
- E. Provide warranty and guarantee on all equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

END OF SECTION 15300

## SECTION 15400

### PLUMBING

(Part of Filed Sub-Bid Section 15001 - PLUMBING – Filed Sub-Bid Required)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

- 1. 15400 – Plumbing

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements
  - 2. Division 1 – General Requirements

- C. Work included:

- 1. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide plumbing system(s), complete and operable and in accordance with this section of these specifications, the drawings and the standards of the applicable codes listed therein.

- 2. The Plumbing FSB shall be responsible for the following:

- i. Demolition and removal of gas piping at Well 4.
    - ii. Water supply system
    - iii. Domestic cold water distribution system.
    - iv. Domestic hot water system; including water heater and gas vent.
    - v. Tempered water distribution system to emergency eye wash/drench hose stations.
    - vi. Acid neutralization piping and tank.
    - vii. Natural Gas supply system underground from the street to the building and throughout the building connecting to each and every appliance requiring gas. This includes high pressure and low pressure gas services for the Generator and building heating appliances. NOTE: A high pressure gas permit will be required for the Generator service.
    - viii. Gas vent piping from **all** gas fired appliances, including connection to concentric vent kits furnished by the HVAC FSB contractor.

- ix. Bathroom with water closet and lavatory.
  - x. Floor drains.
  - xi. Trench drains
  - xii. Hose bibs and wall hydrants.
  - xiii. Portable Sump Pump – Purchased by Plumbing FSB and furnished to Owner.
  - xiv. Install water meter furnished by the Owner.
  - xv. Furnish and install pipe sleeves.
3. The Work shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.
  4. Secure all permits, inspection, and approvals and pay all costs and fees.
  5. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.
  6. Coordinate safety program with that of the General Contractor. Cooperate with other trades to establish lines, levels, openings, chases, clearances, and locations to avoid interference, and to protect the Work.

D. Work not included:

1. Section 02220 - Earthwork - Excavation, filling, sheeting, shoring, pumping, dewatering.
2. Section 03300 - Cast-In-Place Concrete
3. Section 16120 - Wire And Cables - Power wiring.
4. Masonry FSB shall handle interior openings.
5. Painting of Trap Primer cabinet shall be by Painting Contractor.

### 1.3 COORDINATION DRAWINGS

- A. The HVAC FSB shall prepare a complete set of AutoCAD format floor plans and sections background drawings at a scale not less than 3/8" equals 1' 0", showing structure and other information as needed for coordination. These will be the Coordination Drawings.
- B. Each of the below specialty trades shall add its work to these background drawings in different colors and layers with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.

1. HVAC Systems and all sheet metal work.
  2. Plumbing Systems.
  3. Fire Protection System.
  4. Electrical System including light locations.
- C. Where conflicts occur with placement of materials of various trades, the HVAC FSB will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade.
- D. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- E. The HVAC FSB shall make AutoCAD electronic file of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect/Engineer and have been reviewed.
- F. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- G. The HVAC FSB shall provide the following distribution of documents:
1. Electronic file of the Coordination Drawings to each specialty trade and affected Subcontractor for their use.
  2. Electronic file of the Coordination Drawings to the Engineer.
  3. Electronic file of the Coordination Drawings to General Contractor.
- H. Coordination Drawings include but are not necessarily limited to:
1. Structure.
  2. Partition/room layout.
  3. Ceiling tile and grid.
  4. Light fixtures.
  5. Access panels.
  6. Sheet metal, grilles, diffusers, etc
  7. Domestic water, gas, soil, waste and vent piping and associated valves.
  8. Electrical conduit runs above 2" and electrical equipment.

9. Sprinkler piping, heads and mounting brackets.

#### 1.4 SUBMITTALS

- A. Shop drawings, brochures and samples, as listed, shall be submitted for all items to be furnished in accordance with the provisions of Section 00700 - General Conditions and Section 01300 - Submittals.
- B. Provide submittals for the following items consisting of manufacturer's published data. All submittals shall show compliance with the referenced specification.
  1. Water and drain piping and fittings
  2. Natural Gas piping and fittings.
  3. Gas regulators.
  4. Hangers and supports
  5. Sleeves and escutcheons
  6. Plumbing specialties
  7. Plumbing fixtures
  8. Valves
  9. Tankless domestic water heaters (Gas fired and Electric)
  11. Domestic hot water recirculation pump and aquastat.
  11. Gas vent and combustion air inlet to and from all gas fired appliances, including but not limited to, GUH, Makeup Air Unit and Water Heater.
  12. Wall box for ice maker water supply.
  13. Acid neutralization piping and cartridge.
  14. Floor drains
  15. Trench drains.
  16. Portable Sump Pump
  17. Mixing valves
  18. Cleanouts
  19. Piping insulation

#### 1.5 QUALITY ASSURANCE

- A. The Work of this section shall comply with the requirements of the Massachusetts Uniform Plumbing Code (248 CMR) and of any other authorities having jurisdiction.
- B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.

C. All material shall be new and shall bear the manufacturer's full identification. All fixtures, fittings, specialties and materials installed shall be approved by the Commonwealth of Massachusetts.

D. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all Work shall comply with the requirements of the rules, regulations, standards, codes, ordinances and laws of local, state and federal governments, and other authorities that have legal jurisdiction over the Project. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:
  - i. Local and state/commonwealth building, plumbing, gas, mechanical, electrical, fire and health department codes.
  - ii. American Gas Association (AGA).
  - iii. National Fire Protection Association (NFPA).
  - iv. Occupational Safety and Health Act (OSHA).
  - v. Underwriter's Laboratories (UL).
  - vi. Material and equipment shall be listed by Underwriter's Laboratories (UL) and approved by ASME and AGA for intended service.
2. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.
3. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:
  - i. American National Standards Institute (ANSI).
  - ii. American Society of Mechanical Engineers (ASME).
  - iii. National Electric Manufacturers Association (NEMA).
  - iv. American Society for Testing and Materials (ASTM).
  - v. American Water Works Association (AWWA).
  - vi. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - vii. American Society of Plumbing Engineers (ASPE).
  - viii. Thermal Insulation Manufacturers Association (TIMA).
  - ix. Institute of Electrical and Electronics Engineers (IEEE).
  - x. Insulated Cable Engineers Association (ICEA).
  - xi. Cast Iron Soil Pipe Institute (CISPI).
  - xii. Plumbing and Drainage Institute (PDI).

- xiii. National Association of Plumbing-Heating Cooling Sub-Contractors (NAPHCC).

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.
- B. Inspect all Plumbing equipment and materials, upon receipt at the Project Site, for damage and correctness.
- C. Store all materials and equipment on site in a location approved by the Engineer. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.
- D. Protect all Work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.
- E. Deliver products to the Project Site and store and protect same as recommended by the manufacturer.

#### 1.7 COORDINATION

- A. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.
- B. Coordinate items furnished under this section of the specifications to fit within the building spaces.

#### 1.8 DISCREPANCIES IN DOCUMENTS

- A. Where Contract Drawings or Specifications conflict or are unclear, advise the Engineer in writing before Award of Contract. Otherwise the Engineer interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or incongruities thus resolved.
- B. Where Contract Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert the Engineer in writing before installation. Otherwise, make changes in installed Work as the Engineer requires at no additional cost to the Owner.
- C. If the required material, installation or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the Plumbing FSB shall provide that material, installation, or Work which is of the higher standard.
- D. Provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the Contract Documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the Plumbing FSB has failed to notify the Engineer of the situation in accordance with the Specifications, the Plumbing FSB shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the Contract Documents, where the Plumbing FSB needs engineering guidance, submit a sketch identifying the proposed solution to the Engineer for approval.



## 1.9 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other Work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from the Engineer.
- C. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- D. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate as specified herein. Systems shall be run in a rectilinear fashion.
- E. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

## 1.10 WARRANTIES

- A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the Plumbing FSB may have by law or by provisions of the Contract Documents.
- B. All materials, equipment and Work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of one year commencing with the Date of Substantial Completion. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.
- C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.
- D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

## 1.11 PROTECTION OF WORK AND PROPERTY

- A. Care and protect all Work included under this section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.
- C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by Work or workmen under this section and make good damage thus caused.

## 1.12 SPARE PARTS

- A. Furnish spare parts data for each different item of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra

cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the Plumbing FSB of any responsibilities under the guarantees specified herein.

### 1.13 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all plumbing equipment, piping, etc., required by the Specifications.
- B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.
- C. The type and size of the supporting channels and supplementary steel shall be determined by the Plumbing FSB and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading. Material shall be 316 stainless steel.

## PART 2 - PRODUCTS

### 2.1 GENERAL

#### A. SUPPLY PIPE AND FITTINGS

- 1. Above floor piping shall be Type L copper tubing, ASTM B88, hard tempered, with wrot copper fittings and unions, joints made up with 95/5 tin antimony solder and non-corrosive flux.
- 2. Under ground and under slab piping shall be Type K copper tubing, soft annealed copper tubing with ANSI B16.18 or ASME B16.22 solder joint fittings. Provide minimum number of joints in buried copper tubing. Joints shall be brazed. Brazing filler metal shall conform to AWS A5.8, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints. Braze joint fittings shall be specifically designed for brazing.

#### B. DRAIN-WASTE AND VENT PIPE AND FITTINGS

- 1. Below grade shall be service weight cast iron soil pipe and fittings, ASTM A74, coated with tar or asphaltum, resilient gasket joints.
- 2. Above grade shall be service weight cast-iron with no hub joints, except piping two inch or smaller may be schedule 40 galvanized steel with 150 lb. galvanized malleable iron drainage fittings, or type DWV copper with wrot copper drainage fittings.

#### C. CLEANOUTS

- 1. ANSI A112.36.2M; provide threaded bronze cleanout plugs.
- 2. Floor Cleanouts
  - i. Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated

copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

3. Exterior Cleanouts

- i. Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with grade. Cleanout construction including floor plate shall be suitable for exterior installation in non-paved areas. See Bid Drawing P-2 for exterior cleanouts.

D. ACID WASTE AND VENT PIPING

1. Pipe and fittings shall be one of the following:

- i. Flame Retardant Polypropylene meeting ASTM F1412. Connections shall be electro fusion except mechanical joint shall be allowed under laboratory benches. Pipe and fittings shall be manufactured by Georg Fischer, Enfield, Orion or approved equal.
- ii. Special drainage system for corrosive or acid waste shall be manufactured from CPVC Type IV Grade I compounds with a minimum cell classification of 23447. Pipe and Fittings shall conform to ASTM F 2618. Pipe shall be Schedule 40 dimensions. One Step solvent cement shall be specially formulated for chemical waste applications and conform to ASTM F493. All pipe, fittings and cement shall be supplied as a system by a single manufacturer and shall be certified by NSF International for use in corrosive waste drainage systems and shall bear the mark "NSF-cw". Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668. The system is intended for use in non-pressure chemical waste applications with a maximum working temperature of 220° F.

E. NATURAL GAS PIPING AND REGULATORS

1. UNDERGROUND GAS SUPPLY PIPING

- a. Underground natural gas supply piping shall be equal to Driscoplex 6500 MDPE PE 2708 by Performance Pipe. Pipe shall comply with ASTM D2513, shall have an SDR of 11.5 and shall be UV stabilized to withstand 4 years of exposure.
- b. Piping 2-1/2 inch diameter and larger shall be installed with butt fittings by the same manufacturer.
- c. Piping 2 inches in diameter and less shall be installed with socket type fittings by the same manufacturer.
- d. Detectable Underground Warning Tape shall be approved equal to Seton 5 mil tape with aluminum backing. Tape shall be 6 inch wide with yellow background and black letters.

2. ABOVE GROUND AND IN BUILDING PIPING

- a. Gas supply piping 2 inches and smaller shall be Schedule 40 A 106 black steel piping with malleable iron threaded fittings.
  - b. Gas supply piping 2-1/2 inch diameter and larger shall be Schedule 40 A 53 black steel pipe with ANSI B16.9 butt weld fittings.
3. Gas piping at equipment shall be provided with additional supports.
  4. All work shall be installed in strict accordance with the Massachusetts State Gas Code.
  5. Welders Qualifications (Natural Gas System): Qualifications of the procedure and of the welding operations and welders shall be as specified in American Welding Society, AWS D10.9-80, "Specification for Qualification of Welding Procedures and Welders for Pipe and Tubing"; ANSI B31.1 and ASME Boiler Code, Section IX.
    - a. The contractor shall provide certification in writing that the operator or welder has met the above prescribed standard. The Owner reserves the right to radiographically test a minimum of 5% of welds.
  6. NATURAL GAS LINE PRESSURE REGULATORS
    - a. Regulators shall be lever type equal to Maxitrol and shall be rated for the inlet pressure indicated on the bid drawings. (e.g. for 2 psi inlet pressure the regulator shall be equal to Maxitrol 325-L Series.) Size shall be as required to deliver the capacity shown on the bid drawings. Regulators shall comply with CSA 6.3:19/ANSI Z21.18:19. Contractor shall confirm inlet gas pressure before submitting regulator and shall provide a low pressure regulator for the building gas appliances and a high pressure regulator for the Generator.

#### F. HANGERS AND SUPPORTS

1. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.
2. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge galvanized protection shields (12 inches long) at hangers, when pipe is installed.
3. All hanger rods shall be hung from wood frame ceiling structure using wood screws designed for use with threaded rod adapters, or through-bolted with double nuts and flat washers.
4. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary

supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

5. As applicable, gas piping on the roof shall be set on rubber pipe supports as manufactured by "The Rubber Triangle Co." or an approved equal.

#### G. SLEEVES AND PENETRATIONS

1. Sleeves in Masonry and Concrete Walls, Floors, Ceilings and Flat Roofs: Standard Weight hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.
2. Sleeves in Non-Masonry or Non-Concrete Walls, Floors, and Roofs: Hot-dip galvanized steel sheet, 26 gage minimum thickness.
3. Duct Sleeves and Openings
  - i. Sleeves through floors, decks, and exterior structure shall be Schedule 40 galvanized steel pipe for round duct.
4. Materials for prepared openings in partitions shall match construction penetrated.
5. Pipe Sleeve Packing
  - i. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fibre or mineral fibre with approved sealant. Pack or foam to within 1" of both wall surfaces. Seal penetration packing with approved caulking and paintable water-proof mastic surface finish or silicone caulking.
  - ii. All materials must be installed in accordance with manufacturers instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.
6. Pipe penetrations through floors and exterior walls shall be sleeved and sealed using Thunderline Link-Seal wall sleeves and seals or approved equal.
7. Provide escutcheons at all exposed pipe penetrations in finished areas. Escutcheons shall be chrome plated, sized to cover the sleeve, with set screw.

#### H. PLUMBING SPECIALTIES

1. Pressure reducing valves shall be approved equal to Watts Lead Free series 223 sized to match the supply pipe. Reducing valve shall consist of an integral removable stainless steel strainer, nickel alloy seat, and bronze body. Provide a 0-100 psi pressure gauge immediately downstream of the valve.
2. Relief valves (for water heaters) shall be combination pressure/temperature relief valves, AGA rated and ASME labeled.

3. Reduced pressure backflow preventers shall be Watts Series 909, Hersey Beeco, ITT Lawlor, or approved equal bronze body reduced pressure zone back flow type, 175 psi maximum working pressure, complete with replaceable seats, strainer, test cocks, shut off valves, union ends, and air gap fitting. Backflow preventers shall be ASSE, AWWA, and FCCCHR or USC approved.
4. Vacuum breakers: Shall be provided in all domestic water heater cold water inlets, in hose bibb and wall hydrant outlets, and in all other locations specified and as directed by the authority having jurisdiction.
5. Thermal expansion tanks shall be furnished and installed as noted on the plans or in these specifications. Tanks shall be bladder type certified for potable water service and equal to Amtrol.
6. Water hammer arrestors shall be certified per PDI Standard WH-201 and have stainless steel shell and bellows, 250 psi rated as manufactured by Josam, Zurn, J.R. Smith, or approved equal.
7. Provide dielectric couplings at all ferrous to non-ferrous joints.
8. Pressure gauges shall be ASME B 40.1, liquid filled type, 1% accuracy or better, minimum 2 1/2 inch diameter casing, 0 to 100 psig range, with ball valve shutoff and snubber.
9. Furnish, install and connect trap primers to all new floor and trench drains installed as part of this work. Trap primers shall be Precision Plumbing Products Prime-Time Electronic Trap Priming Assembly Model PTS-X series selected for the number of connected drains; or approved equal by Sioux Chief or Watts. Primer unit shall consist of 16 gauge steel enclosure suitable for surface mounting on wall, 120V supply feed, circuit breaker, manual override, test switch, timer, UL listed solenoid valve, anti-siphon atmospheric vacuum breaker, 3/4 inch copper inlet piping, and 1/2 inch or 5/8 inch outlets with compression fittings. Assembly shall supply a minimum of 2 oz of potable water at a factory setting of 6 seconds every 24 hours. Install per manufacturer's requirements and recommendations.

#### I. VALVES

1. Gate Valves 2 inch and Smaller: MSS SP-80, Class 125, with bronze body and integral bronze seat, rising stem, screwed bonnet, solid wedge disk, and threaded ends as manufactured by Jenkins, Crane, Stockham, or approved equal.
2. Ball Valves for water service 2 inch and Smaller: MSS SP-110, 150 psi WSP, with 2 piece bronze body, PTFE seats and seals, full port, blowout proof pressure retaining stem, threaded ends, and vinyl covered carbon steel quarter-turn lever handle. Provide stainless steel ball and stem, with stem extension to accommodate thickness of pipe insulation.

3. Check Valves 2 inch and Smaller: MSS SP-80, Class 150, with bronze body, swing check, thread-in cap, and threaded ends, designed for horizontal or vertical mounting.
4. Gas Valves Underground
  - a. Eccentric Plug Valves shall be rated at 175 psig WOG and shall be UL listed for natural gas service. Valves shall be constructed with ductile iron body, ductile iron plug with resilient seals. Body end connections shall be screwed for sizes 1 inch and smaller and flanged for sizes 1-1/4 inch and larger. Valve shall be approved equal to De Zurick. Furnish and install curb stops and curb box hardware to allow valve operator access from at grade.
5. Gas Valves Interior
  - a. Eccentric Plug Valves shall be rated at 175 psig WOG and shall be UL listed for natural gas service. Valves shall be constructed with semi steel body, bronze plug with Buna-N resilient elastomer seals and plastic coated body sealing faces. Body end connections shall be screwed for sizes 1 inch and smaller and flanged for sizes 1-1/4 inch and larger.
  - b. Ball valves shall be the fire-seal type, conforming to UL 842 and UL 125. Valves shall be full port type rated for service at not less than 400 psi at 200 deg F. Valves shall be suitable for flow from either direction and shall seal tightly in either direction. Valve bodies in sizes 1 inch diameter and smaller shall be screwed-end type constructed of carbon steel, cast steel or ductile iron. Valve bodies in sizes 1-1/4 inch diameter and larger shall be flanged-end type constructed of carbon steel, cast steel or ductile iron unless otherwise specified. When welded valves are specified, valve ends shall be socket weld up to 1-1/2 inch diameter and shall be butt weld for valves 2 inches in diameter or larger. Balls and stems shall be Type 316 corrosion-resistant steel. Valve seats shall be tetrafluoroethylene; seats shall have secondary corrosion-resistant steel seating surfaces to effect shutoff should resin be burned out.

#### J. THERMOSTATIC MIXING VALVE

1. Mixing valves shall be Leonard TM-800-LF self-contained, thermostatic type with dial thermometer on inlet. Mixing valves by Lawler or Taco may be submitted subject to review and approval as equal.

#### K. PLUMBING FIXTURES

1. Emergency Eye Wash/Drench Hose Unit (P-1)
  - i. Furnish and install fixtures by Guardian, Speakman, Encon, or approved equal. Fixture shall be equal to Guardian model G5026 combination Eyewash/Drench Hose wall mounted unit. Unit shall be complete with 3/8 inch by 8 foot long reinforced PVC hose with a 3/8" NPT swivel inlet, forged brass squeeze valve with stainless steel lever handle, in-line vacuum

- breaker between valve and spray head, ABS spray heads mounted side by side, and wall bracket with spring clips. Unit shall comply with ANSI Z358.1-2014 as both an eyewash and a drench hose.
  - ii. Squeeze valve shall be capable of supplying at least 20 gpm at full flow.
  - iii. Furnish and install flow switch in supply piping. Flow switch shall be equal to Guardian Model AP275-615 and shall activate at 0.4 gpm flow.
  - iv. Furnish and mount ANSI-compliant identification sign on wall adjacent to unit.
2. Water Closet Wall Mounted (P-2)
- i. Sloan, American Standard, Kohler, or approved equal. Sloan Model ST-2459 1.6 GPF with Sloan 111 Flushometer Manual Operated Flush Valve. Church open front toilet seat. Wall Carrier by J.R. Smith or approved equal. NOTE: Wall carrier for individual as well as back to back water closet installation shall be no greater than 10 inches in depth to fit within plumbing chase.
3. Wall Mounted Lavatory (P-3)
- i. Sloan, American Standard, Kohler, Crane, or approved equal. Sloan Wall Hung Lavatory with 4-inch centerset faucet holes. Model number SS-3003. With 1-1/4" trap, grid drain and stops. Lavatory carrier by J.R. Smith or approved equal.
  - ii. Just JGN-4 Bar/Laundry Sink Faucet 4" centers with 4" wrist blade handles. Faucets by Chicago Faucet, Brasstech, Kohler or an approved equal.
  - iii. Point of use thermostatic mixing valve shall be approved equal to Sloan MIX-70-A.
4. Mop Sink (P-4)
- i. Mop Service Basin: Fiat, Crane, Guy Gray or approved equal. Basis of design is Fiat MSB 2424 molded stone floor sink.
  - ii. Faucet is Fiat Service Sink Faucet Model 830-AA wall mounted faucet on 8 inch center, with chrome plated brass body, support bracket, vacuum breaker, 3/4" threaded hose outlet, bucket hook and handles.
  - iii. Point of use thermostatic mixing valve shall be approved equal to Sloan MIX-70-A.
5. Metal Ice Maker Box (P-5)
- i. Oatey Efield, IPS or approved equal. Basis of design is Oatey Metal Ice Maker Box with 20 gauge steel box suitable for surface mounting, 28 gauge steel face plate, water hammer arrester, 1/4" brass ball valve. Comply with ASSE Standard 1010 and ASME A112.18.1.
6. Acid Waste Neutralization System for Lab Sink (Sink by Others)
- i. Acid Waste: Spears Acid Neutralization Tank consists of a High Density Polyethylene body with 2" mpt fitting top inlet, side outlet, side vent outlets, removeable bolted flange top assembly, and 5 gallon sediment collection chamber. Furnish 100 lbs of limestone chips for multiple fills of the tank and provide an initial fill of the tank when the installation has been completed.
7. Hose Bibb (HB)
- ii. Hose Bibbs shall be equal to Woodford B67 series 1/2 inch size X 3/4" garden hose connection, polycarbonate or metallic handle, female 1/2" NPT



inlet with wall mounting flange and lockable door, male hose thread outlet complete with bronze vacuum breaker. Hose bibb shall have rough chrome finish. Support hose bibb supply pipe 3" max above mounting height of hose bib.

8. Nonfreeze Wall Hydrant (WH)

- i. Wall Hydrant shall be equal to Woodford B24P; ASSE 1011, cast bronze, with aluminum wall box, lock shield and handwheel, 3/4" male IPS inlet, 3/4" inch external hose thread outlet with automatic draining vacuum breaker. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building. Bonnet and valve stem shall be removable from outside of the building. Wall hydrant shall be installed so that water can drain to the exterior when valve is closed.

9. Floor Drain

- i. Floor Drain FD-A shall be equal to MIFAB Figure 2100-C; Zurn, Josam, or approved equal; with sediment bucket, trap primer connection and ductile iron grate.
- ii. Floor Drain FD-B shall be equal to JR SMITH Figure F100-C-TS; Zurn, Josam, or approved equal; with sediment bucket, trap primer connection and ductile iron grate.
- iii. Floor Drain FD-C shall be equal to JR SMITH 1000-C-S; Zurn, Josam, or approved equal; with sediment bucket, trap primer connection and ductile iron grate.

10. Trench Drain (As Applicable)

- i. Trench Drain TD shall be MIFAB P9002-FL-32 as scheduled or approved equal. Drains shall be furnished with 304 stainless steel grate, anchor flange, frame, no hub center outlet, and trap primer connections. See fixture schedule on Plumbing drawings for manufacturer and model information.

L. PIPING INSULATION

- 1. All insulation, adhesives, tape, etc. shall be as specified herein.
- 2. Insulation materials and thickness shall be as noted in Tables 1 and 2 below:

TABLE 1  
INSULATION MATERIAL FOR PIPING

Service	Material	Spec	Type	Class	Vapor Barrier Required
Plumbing Domestic Hot Water and Tempered Water	Mineral Fiber	ASTM C 547	II	1	No
	Cellular Glass	ASTM C 552		2	No
	Urethane	ASTM C 59/ C 59M1	III		Yes
	Faced Phenolic Foam	ASTM C 1126			Yes
Plumbing Domestic Cold Water Piping	Mineral Fiber	ASTM C 547	II	1	Yes
	Cellular Glass	ASTM C 552		2	No
	Urethane	ASTM C 59/C 59 M1			Yes

Service	Material	Spec	Type	Class	Vapor Barrier Required
	Flexible Cellular	ASTM C 534	I		No

TABLE 2  
PIPING INSULATION THICKNESS (INCH)

Service	Material	Tube and Pipe Size (Inches)		
		< 1	1 < 1-1/2	1½ -4
Plumbing Domestic Hot Water and Tempered Water	Mineral Fiber	1	1	1.5
	Cellular Glass	1	1	1.5
	Urethane	1	1	1.5
	Faced Phenolic Foam	1	1	1.5
Plumbing Domestic Cold Water Piping and Service Water Piping	Mineral Fiber	0.75	1	1.5
	Cellular Glass	0.75	1	1.5
	Flexible Cellular	0.75	1	1.5
	Urethane	0.75	1	1.5
	Faced Phenolic Foam	0.75	1	1.5

- i. Insulation and vapor barrier adhesive shall comply with ASTM C916.
- ii. Cover water supplies and drains from lavatory and sinks with insulated protective jacketing equal to Truebro LavGuard.

#### M. TANKLESS GAS FIRED WATER HEATER

1. Tankless domestic water heaters shall be Noritz, Bradford-White, Rinnai, or approved equal, ANSI Z21.10.3 or ASME approved, wall-mounted, gas-fired, self-regulating instantaneous type with capacities as indicated on Contract Drawings. Units shall be designed for indoor installation and designed for operation between 50 and 80 psig water pressure.
2. Units shall include modulating gas burner and variable speed combustion air blower. Heat exchanger shall be multi-pass design and provided with anti-freeze heaters for protection in cold climate conditions.
3. Units shall have direct vent exhaust with coaxial combustion air supply pipe and fittings, concentric vent/intake air termination kit, and condensate collector furnished by the water heater manufacturer.
4. Controls shall be fully automatic. Primary control shall be integrated into the face of the water heater unit. Units shall be equipped with built-in sensor for monitoring outgoing water temperature (100 to 160 degrees F minimum setpoint range); water flow control consisting of water flow sensor, microprocessor controlled water flow solenoid, and bypass solenoid; lime accumulation sensor built into heat exchanger to alert of build-up; flame rod sensor to indicate flame

failure; boiling protection consisting of lockout thermistor and combustion fan rpm check; and direct electronic spark ignition. Diagnostic controls shall be provided to display fault codes. An electronic manifold controller designed for multiple water heater installations shall be furnished by the water heater manufacturer.

5. The burner and combustion air blower shall modulate between minimum and maximum input to maintain outgoing water temperature setpoint. If the temperature of the water exceeds the setpoint temperature by a pre-determined factory set amount, the burner shall shut down. The burner shall ignite once outgoing water temperature falls below the setpoint. Units shall only run when there is a demand for hot water.
6. Furnish and install 2 gallon bladder type expansion tank as part of the hot water system. Tank shall be by Amtrol or approved equal.

#### N. GAS VENT AND COMBUSTION AIR

1. Furnish and install gas vent and combustion air systems from all the gas fired appliances, including the Tankless Gas Fired Water Heater, Gas Fired Unit Heaters and the Makeup Air Unit as shown on the Contract Drawings. These specifications shall apply to all categories of appliances. This includes combustion air inlets and gas vent discharge.
2. The vent system shall consist of all items which form a part of the assembly standard tee sections, straight sections, elbows, support and bird proof terminal to provide a complete and approved system. All vent parts exposed to the weather shall be stainless steel.
3. Installation shall be made in accordance with the manufacturer's recommendations and in compliance with the Massachusetts Fuel Gas Code. Minimum clearance to combustible materials shall be as required by the heating equipment manufacturer but in no case less than 4 inches.
4. The vent shall be of the double-wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.
5. Vent shall be constructed with an inner and outer wall, with a 1" annular insulating air space. Vent shall be constructed of AL29-4C, and listed to UL1738; .015 thickness for 3"-12" diameters. Outer casing shall be constructed of aluminized steel, type 430 stainless steel of .018 thickness for 3" to 12" diameters. PVC and CPVC pipe are not acceptable.
6. Combustion air shall consist of 304 stainless steel pipe.
7. All supports, wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be stainless steel. Support vent from building structure using rigid structural shapes for attachment of fixed point

supports (Plate Support assembly). Anchor supports to structure by welding, bolting, steel expansion anchors, or concrete inserts. Size of structural shapes shall be in accordance with manufacturer's recommendations.

8. The Combustion Air and Vent system shall connect to the equipment and to a supply concentric vent kit for each piece of equipment. Supply and concentric vent kits shall be furnished by the HVAC FSB contractor to the Plumbing FSB contractor for installation.

#### O. ELECTRIC WATER HEATER

1. EWH-1: Water heater shall be model EX4208T, manufactured by EEMAX, having electrical input of 4.1 KW, 208 VAC, 1 phase, 60 hz, 0.3 gpm activation rate and a 28°F temperature rise at 1 gpm flow rate. Heater shall have a working pressure rating of 150 psi and shall be completely assembled. Water heater shall be equipped with replaceable inlet filter, adjustable thermostat, replaceable nichrome cartridge insert, and high temperature limit switch. Water heater shall be covered by a five-year limited warranty against tank leaks.

#### P. DOMESTIC HOT WATER RECIRCULATION PUMP

1. Furnish, install and wire an aquastat equal to Honeywell L4006A. Aquastat shall clamp to recirculation line and the aquastat contacts shall cycle the recirculation pump to maintain a recirculation setpoint of 100 deg F. (adjustable)
2. Furnish and install a domestic hot water recirculation pump equal to Taco 006 IFC with an integral flow check valve.. Pump shall comply with NSF 61.

#### Q. PORTABLE SUMP PUMP

1. Furnish a sump pump equal to Liberty Model 230. Pump shall consist of a 1/3 hp 120VAC motor, 10-foot power cord, polypropylene and aluminum construction, stainless steel shaft, manual switch, 1-1/2" discharge and capable of handling 3/8" solids. Provide to Owner for his use.
2. Furnish an 1-1/2" by 3/4" threaded adapter with end connection compatible with the sump pump for hose by Owner.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. The responsibility for determining the exact size and location of openings is part of the Work of this section. If this responsibility is not met, cutting and patching to achieve the correct size and location of openings and chases is part of the Work of this section.
- B. Masonry Contractor shall handle interior openings, including all cutting and patching required for the Work of the section. Cutting and patching of masonry walls, partitions, ceilings and floors is included. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. The use of jackhammers is prohibited.

C. Equipment shall be installed in strict accordance with manufacturer's instructions, unless otherwise specified herein, or on the Contract Drawings. In case of discrepancies, contact the Engineer for instructions.

D. INSTALLATION OF DOMESTIC WATER PIPING

1. Provide a shutoff valve on each pressure piping connection at each item of equipment, except vent and overflow connections.
2. Do not install valves with the stem below horizontal.
3. Provide a union or flange at each connection at each item of equipment.
4. Install piping parallel to or perpendicular to the lines of the building.
5. Pitch all pressurized water piping up 1 inch in 80 feet, or run dead level and provide an air vent every 40 feet.

## E. INSTALLATION OF NATURAL GAS PIPING

1. General: Install natural gas piping as shown on the drawings in accordance with the Massachusetts Fuel Gas Code 248 CMR 4.00 as follows:
2. AS APPLICABLE:
  - a. Exterior gas piping shall have a backfill cover of 30 inches and shall be a minimum of 3 feet from other structures such as other site piping. All exterior gas piping shall have a detectable warning tape installed at 6 inches above the pipe for its entire buried length.
  - b. Connections between metallic and plastic piping shall be made only underground, exterior and with an approved transition fitting.
3. The connection to the gas meter outside the building shall be in accordance with local gas utility requirements and the applicable codes. Gas piping shall begin at the outlet of the regulator and shall run to the connection at all gas-fired equipment. The gas supply pipe shall be of the size indicated on the drawings.
4. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.
5. Where concealed piping is indicated, it shall be installed in a location to permit access to the piping with a minimum amount of damage to the building.
6. Underground gas piping shall be installed in compliance with Department of Transportation regulations, as applicable.
7. Joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed and all burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.
8. Piping shall be graded not less than 1 inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.

9. Uncovered, exposed pipes shall be provided with plates at the point where they pass through floors, finished walls, and finished ceilings. Where necessary to cover beads of fittings, special deep escutcheons shall be provided in lieu of plates. Plates shall be not less than 0.018-inch thick. Wall and ceiling plates shall be secured with round head set screws, not with spring clips. Unless otherwise specified, plates shall be of the one-piece type. Wall and ceiling plates may be flat hinged pattern.
10. A full size tee fitting and a 6 inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.
11. Gas Valves inside the building: Provide and install gas valves at connection to gas train for each gas fired equipment item; at the base of each riser, at branches and as indicated on the drawings. Locate gas valves where easily accessible and where they will be protected from possible injury. Provide plugged or capped outlets for future extensions or connections as indicated on the drawings.
12. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility company's requirements and manufacturers installation instructions. Install gas shutoff valve upstream of each pressure regulating valve.
13. Equipment Connections: Connect gas piping to each gas fired equipment item, with drip leg (in heated spaces) and shutoff gas valve. Comply with equipment manufacturer's instructions. Drip legs shall not be installed on the exterior of the building.
14. Testing:
  - i. Inspect, test, and purge natural gas systems in accordance with local and Commonwealth code requirements, NFPA 54 requirements and as follows.
  - ii. Visually examine natural gas system after installation.
  - iii. Pressure test natural gas system with dry air or nitrogen at 100 psig for 2 hours. Soap test all joints to detect leaks.
  - iv. Flush and purge natural gas system and charge with gas in accordance with local utility requirements and NFPA 54.

## F. INSULATION

1. Application - General
  - i. Installation
    - a) Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of the Specifications are completed. Material such as rust, scale, dirt and moisture shall be

removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer insulation.

2. Pipe insulation shall be as follows:
  - i. Do not insulate the following:
    - a) Unions
    - b) Flexible connectors
3. Pipe insulation shall be continuous and installed on fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used.
4. Insulation (Except Flexible Cellular and Calcium Silicate Insulation):
  - i. Place sections of insulation around pipe and joints tightly butted into place. Draw jacket tight and smooth. Secure jacket with fire resistant adhesive, factory-applied self-sealing lap, or stainless steel outward clinching staples spaced not over 4 inches on center and 1/2 inch minimum from edge of lap. Cover circumferential joints with butt strips, not less than 3 inches wide, of material identical to jacket material. Overlap longitudinal laps of jacket material not less than 1 1/2 inches. Adhesive used to secure butt strip shall be same as that used to secure jacket laps. Apply staples to both edges of butt strips.
  - ii. Vapor Barrier Jacket: When a vapor barrier jacket is required, as indicated in Table 1, on ends of sections of insulation that butt against flanges, unions, valves, fittings, and joints, provide a vapor barrier coating or manufacturer's weatherproof coating for outside service unless pipe is supplied with factory-applied self-seal lap. Apply vapor barrier coating at longitudinal and circumferential laps. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as specified for butt strips. Extend patch not less than 1 1/2 inches past the break in both directions. At penetrations by pressure gages, thermometers, etc. fill voids with vapor barrier coating for outside service. Seal with a brush coat of the same coating.
  - iii. Metal Covers: Provide metal covers on insulated piping that is within 6 feet of the finished floor. Secure covers with ss banding.



## 5. Flexible Cellular Insulation

- i. Flexible cellular pipe insulation shall be tubular form. Sweat fittings shall be insulated with miter cut pieces the same size as on adjacent piping.
- ii. Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of finish as recommended by insulation manufacturer to flexible unicellular insulation in outside locations. Do not use vinyl lacquer finish or equivalent. Provide flexible cellular insulation for outdoor use with ultraviolet (UV) resistant coating.

## 6. Cellular Glass and Calcium Silicate Insulation

- i. Provide in accordance with manufacturer's printed instructions.

## 7. Hangers and Anchors

- i. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69 whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed. Where pipe is supported by insulation, provide galvanized steel shields or protection saddles.
- ii. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Insulation inserts shall be of calcium silicate, cellular glass, molded glass fiber, all minimum 8 pounds per cubic foot, or other approved material of the same thickness as adjacent insulation. Insulation inserts shall cover bottom half of pipe circumference and be not less in length than the protection shield. Vapor-barrier facing of insert shall be of same material as facing on adjacent insulation. Seal inserts into insulation with vapor barrier coating or weatherproof coating as applicable.
- iii. Where protection saddles are used, fill voids with same insulation material as used on adjacent pipe. Protection saddles shall not be used on piping carrying medium less than 60 degrees F.
- iv. Where anchors are secured to piping carrying medium less than 60 degrees F that is to be insulated, insulate anchors same as piping for a distance not less than four times the insulation thickness to prevent condensation. Vapor seal insulation around anchors.
- v. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe

jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

#### 8. Sleeves and Wall Chases

- i. Where interior wall is penetrated, extend aluminum jacket 2 inches out on either side of wall and secure on each end with a band. Where floor is penetrated, extend a aluminum jacket from a point below back-up material to a point 10 inches above floor with one band at the floor and one not more than one inch from end of metal jacket. Where exterior wall is penetrated, extend aluminum jacket through sleeve to a point 2 inches beyond interior surface of wall.
- ii. Pipe insulation shall be continuous through the sleeves.
- iii. An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.

#### 9. Flanges, Unions, Valves and Fittings for Piping

- i. Factory fabricated removable and reusable insulation covers may be used except with flexible cellular insulation. When nesting size insulation is used, overlap 2 inches or one pipe diameter, whichever is larger. Use insulating cement to fill voids. On pipe sizes larger than 2-1/2 inches, elbow insulated using segments shall not have less than three segments per elbow. Place and join segments with manufacturer's recommended water-vapor resistant, fire retardant adhesive appropriate for the temperature limit of the service. Overlap tape seams one inch. Total dry film thickness shall be not less than 1/16 inch. Unions are not to be insulated; taper insulation to union at a 45 degree angle. Provide finish coating as follows:
  - a) Coating with Embedded Glass Tape: Coat insulation and all purpose jacket with two coats of lagging adhesive and with glass tape embedded between coats. Total dry film thickness shall not be less than 1/16 inch. For cold piping, seal insulation and jacket with two coats of vapor barrier coating with glass tape embedded between coats. Insulate anchors attached directly to cold pipe for a sufficient distance to prevent condensation but not less than 6 inches from insulation surface.
  - b) PVC Fitting Covers: Factory premolded one-piece PVC fitting covers may be provided in lieu of two coats of adhesive with tape embedded between coats. Provide factory premolded field-fabricated segment or blanket insert insulation under fitting covers. Install factory premolded one-piece PVC fitting covers over insulation. Secure covers with stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks made for securing PVC fitting covers. Do not provide PVC fitting covers where exposed to weather. Provide PVC fitting covers only in ambient temperatures below 150 degrees F.

## 3.2 CLEANING, TESTING AND STARTUP

### A. CLEANING

1. Clean all debris resulting from the work of the section, and remove it from the Project Site, daily.
2. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all Work, thoroughly clean all fixtures, exposed materials and equipment.

### B. TESTS

1. Test water piping at 100 psi hydrostatic pressure before any covering is installed. Blank off or remove items which may be damaged by the test pressure. Correct all defects and retest as many times as is necessary to verify that all defects have been remedied. Neither peening nor the use of leak seals is permitted.
2. Test drain-waste piping by tightly plugging all openings except for the highest opening in the system. Fill all systems to overflowing. Systems shall be tight throughout with no drop in water level for a minimum period of 2 hours.

### C. DISINFECTION OF WATER SUPPLY SYSTEM

1. Fill all systems with a water and chlorine solution which contains 50 parts per million of available chlorine and allow it to stand 6 hours before flushing. Fill each system with a solution which contains 100 parts per million of available chlorine; allow it to stand 2 hours and flush it.

### D. TAGS

1. Upon completion of work, attach engraved laminated tags to all valves (listed in the valve directory called for in the "Bulletins, Manuals and Instructions" paragraph of these specifications) and all pieces of HVAC equipment (including but not limited to pumps, fans, air handlers, coils and all other equipment listed in the HVAC schedules). Valve tags shall have black characters on white face, consecutively numbered and prefixed by letter "V". Equipment tags shall have black characters on white face, with labels corresponding to drawing schedule numbers.
2. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8" thick.
3. Valve tags shall be at least 1" in diameter with numerals at least 3/8" high and attached by "S" hooks or chains. Equipment tags shall be at least 2" diameter securely attached to apparatus.

4. Provide manufacturers equipment nameplates, catalog numbers and rating identification securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

**E. PIPE IDENTIFICATION**

1. Provide color-coded pipe identification markers on piping installed under this Section. Pipe markers shall be snap-on laminated plastic protected by clear acrylic coating. Pipe markers shall be applied after architectural painting where such is required.
2. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.
3. Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room, and at intervals no longer than 20 ft.
4. Location of pipe markers, size of legend letters on markers and length of color field shall be per the latest edition of ANSI A13.1.
5. Markers shall be "Setmark" by Seton Name Plate Corp. or approved equal.
6. Following color coding shall be used with names in black letters on background and white letters on green background.

<b>Service</b>	<b>Legend</b>	<b>Background Color</b>
Domestic Hot Water Supply	DHWS	Green
Domestic Hot Water Return	DHWR	Green
Fuel Gas	FG	Yellow
Domestic Cold Water	CW	Green
Condensate	Condensate	Yellow
Non-Potable Cold Water	NPCW	Green
Tempered Water	TW	Green

7. Color banding shall meet latest edition of ANSI A13.1 and OSHA.

## F. PAINTING

1. Clean all surfaces free of dirt, oil, grease, etc. Surfaces shall be clean and dry before any paint is applied.
2. Restore to original condition and appearance any equipment which has sustained damage to the manufacturer's prime and/or finish coat.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.
- B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.
- C. Instruct Owner's operating personnel, during consecutive working days, in the operation and maintenance of the systems and equipment, to the written satisfaction of the Owner.
- D. Record drawings shall be provided by the Plumbing FSB as specified in Section 00700 - General Conditions and section 01170 - Special Provisions.

END OF SECTION 15400

## SECTION 15500

### HEATING, VENTILATION AND AIR CONDITIONING (Part of Filed Sub-Bid Section 15002 HEATING, VENTILATION AND AIR CONDITIONING - Filed Sub Bid Required)

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The Work covered under this Section of the Specifications includes the following:

- 1. 15900 – Laboratory Fume Hoods

- B. Related Sections include the following:

- 1. Division 0 – Bidding and Contract Requirements

- 2. Division 1 – General Requirements

- C. Work included:

- 1. The HVAC FSB shall be responsible for the following:

- i. Coordination drawings.

- ii. Heating system consisting of electric unit heaters, and gas fired unit heaters.

- iii. De-humidification system for the Filter Room with remote condensers for summer cooling.

- iv. Heat pump system for the Control Room and Break Room/Kitchen.

- v. Supply and exhaust ventilation systems including Fume Hood, and ductwork and accessories for Fume Hood, Makeup Air Unit, and Exhaust Fans.

- vi. Concentric Vent kits for Gas Fired Unit Heaters, and Makeup Air Unit. HVAC FSB shall furnish vent kits to Plumbing FSB for installation in the gas vent systems.

- vii. Make Up Air Unit for Control Room

- viii. Automatic controls.

- ix. HVAC work for Well 3 and Well 4 as shown on Bid Drawing H-9 and per equipment schedules on Bid Drawing H-10.

- ix. Testing, adjusting, balancing and commissioning.

- x. Duct Smoke Detectors – furnished by Division 16, installed by Division 15.

- D. Work not included:

- 1. Section 03300 - Cast-In-Place Concrete.

2. Section 05500 - Metal Fabrications except supplementary steel for supports and attachments.
3. Section 09900 - Painting and Coatings.
4. Section 10200 - Fixed Louvers.
5. Section 12350 - Laboratory Casework. (Coordination is required.)
6. Section 15195 – Liquified Petroleum Gas Piping System
7. Section 15400 - Plumbing.
8. Section 16085 - Miscellaneous Equipment.
9. Section 16120 - Wire And Cables.
10. Section 16443 - Motor Control Centers
11. Interior openings to be handled by the Masonry FSB.

### 1.3 SUBMITTALS

- A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 00700 - General Conditions and Section 01300 - Submittals.
- B. Provide submittals for the following items consisting of manufacturer's published data. All submittals shall show compliance with the referenced specification.
  1. Heat Pump System
  2. Hangers and supports
  3. Refrigerant piping and accessories
  4. Air-cooled condenser – remote mounted
  5. Dehumidification units
  6. Electric unit heaters
  7. Gas fired unit heaters
  8. Electric Wall Heaters
  8. Make Up Air Unit
  9. Fans
  10. Ductwork
  11. Ductwork accessories

12. Duct and Pipe Insulation
13. Gas Fired Equipment Concentric Vents (Gas Fired Unit Heaters, and Makeup Air Unit).
13. Refrigerant Detector
14. Automatic controls

#### 1.4 COORDINATION DRAWINGS

- A. The HVAC FSB shall prepare a complete set of AutoCAD format floor plans and sections background drawings at a scale not less than 3/8" equals 1' 0", showing structure and other information as needed for coordination. These will be the Coordination Drawings.
- B. Each of the below specialty trades shall add its work to these background drawings in different colors and layers with appropriate elevations and grid dimensions. Specialty trade information is required for all areas. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
  1. HVAC Systems and all sheet metal work.
  2. Plumbing Systems.
  3. Fire Protection Systems.
  4. Electrical System including light locations.
- C. Where conflicts occur with placement of materials of various trades, the HVAC FSB will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade.
- D. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- E. The HVAC FSB shall make AutoCAD electronic file of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect/Engineer and have been reviewed.
- F. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- G. The HVAC FSB shall provide the following distribution of documents:
  1. Electronic file of the Coordination Drawings to each specialty trade and affected Subcontractor for their use.



2. Electronic file of the Coordination Drawings to the Engineer.
3. Electronic file of the Coordination Drawings to General Contractor.

H. Coordination Drawings include but are not necessarily limited to:

1. Structure.
2. Partition/room layout.
3. Ceiling tile and grid.
4. Light fixtures.
5. Access panels.
6. Sheet metal, grilles, diffusers, etc
7. Domestic water, gas, soil, waste and vent piping and associated valves.
8. Electrical conduit runs above 2” and electrical equipment.
9. Sprinkler piping, heads and mounting brackets.

## 1.5 QUALITY ASSURANCE

A. Perform work strictly as required by rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities that have legal jurisdiction over the site. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

1. Local and state building, plumbing, mechanical, electrical, fire and health department codes.
2. State Plumbing Board Accepted Products.
3. Massachusetts 528 CMR Bureau of Pipe Fitters & Refrigeration Technicians
4. American Gas Association (AGA).
5. National Fire Protection Association (NFPA).
6. American Insurance Association (A.I.A.) (formerly National Board of Fire Underwriters).
7. Occupational Safety and Health Act (OSHA).
8. Factory Mutual Association (FM).
9. Underwriters' Laboratories (UL).

- B. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME and AGA for intended service.
- C. When requirements cited in this Specification conflict with each other or with Contract Documents, most stringent shall govern work. Engineer may relax this requirement when such relaxation does not violate ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.
- D. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:
  - 1. American National Standards Institute (ANSI).
  - 2. American Society of Mechanical Engineers (ASME).
  - 3. National Electric Manufacturers Association (NEMA).
  - 4. American Society for Testing and Materials (ASTM).
  - 5. American Water Works Association (AWWA).
  - 6. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - 7. Air Moving and Conditioning Association (AMCA).
  - 8. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
  - 9. American Diffuser Council (ADC).
  - 10. Air Conditioning and Refrigeration Institute (ARI).
  - 11. Thermal Insulation Manufacturers Association (TIMA).
- E. Special attention is directed to requirements of NFPA 45, Laboratories Using Chemicals.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.
- B. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification.
- C. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.

- D. Deliver products to the Project Site and store and protect same as recommended by the manufacturers'.
- E. Inspect all HVAC equipment and materials, upon receipt at the Project Site, for damage and correctness.
- F. Store all materials and equipment on site in a location approved by the Engineer.
- G. Protect all work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss. Care and protect for all Work included under this section until it has been tested and accepted.
- H. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.
- I. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen under this section and make good damage thus caused.

#### 1.7 COORDINATION

- A. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.

#### 1.8 DESIGN CRITERIA

- A. The Work of this section shall comply with the requirements of the Massachusetts Building Code and of all other authorities having jurisdiction.
- B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.
- C. All material shall be new and shall bear the manufacturer's full identification.
- D. Requirements of Regulatory Agencies
  - 1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by state and local authorities.
  - 2. In general, all Work shall comply with the requirements of rules, regulations, standards, codes, ordinances, and laws of local, state, and federal governments, and other authorities that have legal jurisdiction over the Project Site. Materials

and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

- i. Local and state building, HVAC, plumbing, mechanical, electrical, energy, fire and health department codes.
  - ii. American Gas Association (AGA).
  - iii. National Fire Protection Association (NFPA).
  - iv. Occupational Safety and Health Act (OSHA).
  - v. Underwriters' Laboratories (UL).
  - vi. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME and AGA for intended service.
3. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.
4. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:
- i. American National Standards Institute (ANSI).
  - ii. American Society of Mechanical Engineers (ASME).
  - iii. National Electric Manufacturers Association (NEMA).
  - iv. American Society for Testing and Materials (ASTM).
  - v. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - vi. Air Moving and Conditioning Association (AMCA).
  - vii. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
  - viii. Air Conditioning and Refrigeration Institute (ARI).
  - ix. Thermal Insulation Manufacturers Association (TIMA).
  - x. Institute of Electrical and Electronics Engineers (IEEE).
  - xi. Insulated Cable Engineers Association (ICEA).

E. Tests, Adjusting and Balancing (TAB)

1. Test all systems furnished under this section and repair or replace all defective Work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of all systems.
2. Defined to include, but not necessarily limited to, air distribution systems, and associated equipment and apparatus of mechanical Work. Work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to Work as required by the Contract Documents.
3. Startup the following pieces of equipment in strict accordance with manufacturer instructions and with the manufacturer's representative.
  - i. Electric unit heaters.
  - ii. Gas fired unit heaters

- iii. Air-cooled condenser for Dehumidifier.
  - iv. Dehumidification units
  - v. Fans.
  - vi. Makeup Air System
  - vii. Heat Pump System.
4. Submit certified test reports signed by test and balance supervisor performing TAB Work.
  5. Include identification and types of instruments used and most recent calibration date with submission of final test report.
  6. Shop Drawings
    - i. Submit sample test data forms complete with certifying agency logo, identifying required test data, date, page number, system designation, system location, Project name, and balancer's name.
  7. Tester's Qualifications: Firm with at least 3 years successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for the Project, not installer of system to be tested, and otherwise independent of the Project.
  8. NEBB or AABC Compliance: Comply with either National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, as applicable to mechanical air distribution systems and associated equipment and apparatus.
  9. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing except as otherwise indicated.
  10. Do not proceed with testing, adjusting, and balancing Work until system complete and operable. Ensure no later residual Work still to be completed.
  11. Do not proceed until Work scheduled for testing, adjusting, and balancing clean and free from debris, dirt, and discarded building materials.
  12. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.
  13. Upon completion of the work herein described, the Testing Firm shall submit Test and Inspection Reports to the Engineer.
  14. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, promptly

implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

15. Upon completion of the remedial work, the Testing Firm shall repeat all of the tests on components previously found deficient on the first test or any additional test if they be required. Have all remedial Work accomplished as may be required by second and/or additional tests.

## 1.9 PROCEDURE

- A. Secure all required permits, inspections, and approvals and pay all costs and fees.
- B. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.
- C. Coordinate safety program with that of the General Contractor. Cooperate with other trades to establish lines, levels, openings, chases, clearances, and locations to avoid interference; and to protect the Work.
- D. Deliver all materials as needed to avoid delays.

## 1.10 INTERPRETATION OF DRAWINGS

- A. Listing of Drawings does not limit responsibility of determining full extent of Work required by the Contract Documents. Refer to Architectural, HVAC, Electrical, Structural, and other Contract Drawings and other sections that indicate types of construction in which Work shall be installed and Work of other trades with which Work of this section must be coordinated.
- B. Except where modified by a specific notation to the contrary, the indication and/or description of any item, in the Contract Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete Work.
- D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the Contract Drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the HVAC FSB shall provide all other components and materials necessary to make the systems fully complete and operational.
- E. Data that may be furnished electronically by the Engineer (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such

data is for convenience and generalized reference, and shall not substitute for the Engineer's sealed or stamped construction documents.

#### 1.11 DISCREPANCIES IN DOCUMENTS

- A. Where Contract Drawings or Specifications conflict or are unclear, advise the Engineer in writing before Award of Contract. Otherwise, the Engineer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies thus resolved.
- B. Where Contract Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, alert the Engineer in writing before installation. Otherwise, make changes in installed Work as the Engineer requires at no additional cost to the Owner.
- C. If the required material, installation, or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the HVAC FSB shall provide that material, installation, or Work which is of the higher standard.
- D. Provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the HVAC FSB has failed to notify the Engineer of the situation as specified, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by Paragraph (D) above, where the HVAC FSB needs engineering guidance, submit a sketch identifying his proposed solution and the Engineer shall review, note if necessary, and approve the sketch.

#### 1.12 MODIFICATIONS IN LAYOUT

- A. Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other Work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.
- C. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- D. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate as specified. Systems shall be run in a rectilinear fashion.

- E. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

#### 1.13 RECORD DRAWINGS

- A. As Work progresses and for duration of the Contract, maintain complete and separate set of prints of Contract Drawings at the Project Site at all times. Record Work completed and all changes from original Contract Drawings clearly and accurately including Work installed as a modification or addition to the original design.
- B. At completion of Work prepare a complete set of reproducible record drawings showing all systems as actually installed.
- C. The Engineer will not certify the accuracy of the Record Drawings. This is the responsibility of the HVAC FSB.
- D. The HVAC FSB shall submit the record set for approval by the building department in a form acceptable to the department, when required by the jurisdiction.
- E. Drawings shall show record condition of details, sections, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

#### 1.14 MATERIAL LIST

- A. Within 4 weeks of Award of Contract, the HVAC FSB shall submit an “HVAC Equipment and Material List”.
- B. The list shall contain all categories of material required with names of intended manufacturers. The list does not replace submittals specified herein.

#### 1.15 MANUFACTURER'S SERVICES

- A. Provide manufacturer's services for testing, training and start-up of the following equipment:
  - 1. Dehumidifier
  - 2. ACCUs
  - 3. Lab Fume Hood Management System
  - 4. Lab Fume Hood Exhaust Fan
  - 5. Makeup Air Unit
  - 6. Gas Fired Unit Heaters
- 2. The time required for each system shall be as specified in this section. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or HVAC FSB for field adjustments due to manufacturing or shipping defects. The time allotted shall be one 8 hr day.



3. Proximity of service personnel is a prime concern of the Owner. The Factory trained and certified technicians and service personnel for the preventive maintenance and repair of equipment such as the Dehumidifier must reside within a 2-hour radius of the site (considered to be 120 miles maximum.)

#### 1.16 ELECTRICAL WORK

- A. Except for electrical apparatus specifically called for as part of this Section, all switches and controllers required will be provided under DIVISION 16 - ELECTRICAL.
- B. All electrical apparatus and controls furnished as a part of the Work of this section shall conform to applicable requirements under DIVISION 16 - ELECTRICAL. Enclosure types shall be as indicated on the Contract Drawings.
- C. All motors furnished under this section shall be furnished by the manufacturer of the equipment served and shall be mounted and aligned so as to run free and true. Each motor shall be built to conform to the latest applicable NEMA, ANSI and IEEE standards for the type and duty of service it is to perform.
- D. Each motor shall be designed to operate on 60 Hz., and each shall be expressly wound for the voltage specified. Each motor shall operate successfully as rated load and frequency with a voltage variation of plus or minus 10% of voltage specified.
- E. All motors shall be provided with adequate starting and protective equipment as specified, and each shall have a terminal box of adequate size to accommodate the required conduit and wires.
- F. All electrical apparatus furnished under this section shall be approved by UL and shall be labeled or listed where such is applicable.
- G. All motors shall be TEFC (totally enclosed fan cooled).

#### 1.17 WARRANTIES

- A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the HVAC FSB may have by law or by provisions of the Contract Documents. All refrigeration compressors shall have the manufacturer's extended replacements warranty for a total of 5 years.
- B. All materials, equipment and work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of 1 year commencing with the Date of Substantial Completion and Final Acceptance by the Owner. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.
- C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.

- D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be placed.

#### 1.18 SURVEY AND MEASUREMENTS

- A. Base all required measurements, horizontal and vertical, from referenced points established by the General Contractor and be responsible for correctly laying out the Work required under this section of the Specification.
- B. In the event of discrepancy between actual measurements and those indicated, notify the General Contractor, in writing, and do not proceed with the related Work until instructions have been issued.

#### 1.19 SUPERVISION

- A. Supply the service of an experienced and competent supervisor who shall be in charge of the HVAC Work at the Project Site.

#### 1.20 SAFETY PRECAUTIONS

- A. Comply with all of the safety requirements of OSHA throughout the entire construction period of the Project.
- B. Provide and maintain proper guards for prevention of accidents and any other necessary construction required to secure safety of life and/or property.

#### 1.21 SCHEDULE

- A. Construct Work in sequence under provisions of DIVISION 1 - GENERAL REQUIREMENTS.

#### 1.22 SPARE PARTS

- A. Furnish spare-parts data for every component that is required to be maintained for normal service of equipment furnished (as determined by the equipment manufacturer). The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the Contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the HVAC FSB of any responsibilities under the guarantees specified herein.

### 1.23 HOISTING, SCAFFOLDING AND PLANKING

- A. The Work to be done under this section of the Specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.

### 1.24 SLEEVES, INSERTS, ANCHOR BOLTS, AND PLATES

- A. Be responsible for the furnishing, location of and the maintaining in proper position all sleeves, inserts and anchor bolts supplied and/or set in place for the work of this section. In the event that failure to do so requires cutting and patching of finished Work, it shall be done at the HVAC FSB expense without any additional cost to the Owner. See other sections for sleeve material description.

### 1.25 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all HVAC equipment, piping, etc., required by the Specifications.
- B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.
- C. The type and size of the supporting channels and supplementary steel shall be determined by the HVAC FSB and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
- D. All steel used for supplementary steel, channels and supports shall be 316 stainless steel.

### 1.26 CERTIFICATES OF INSPECTION/APPROVAL

- A. Furnish upon completion of all Work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.

### 1.27 ACCESSIBILITY

- A. All Work shall be installed so that parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to receipt of written approval from the Engineer.

## 1.28 DEFINITIONS

- A. As used in this section, the following terms are understood to have the following meanings:
1. "Furnish" shall mean purchase and deliver to the project site, complete with every necessary accessory and support.
  2. "Install" shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting, proper location and operation in the project.
  3. "Provide" shall mean furnish and install.
  4. "Work" shall mean all labor, materials, equipment, apparatus,, controls, accessories, and all other items required for a proper and complete installation.
  5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.
  6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, embedded in construction or in crawl space.
  7. "Exposed" shall mean not installed underground or concealed as defined above.
  8. "Furnished by others" shall mean materials or equipment purchased and set in place under other sections of the general contract and connected to the systems covered by this section of the specifications by the HVAC FSB.
  9. "Coordinate" shall mean all work provided under this section of the specification shall be in compliance with work of other trades.

## PART 2 PRODUCTS

### 2.1 GENERAL

#### A. CONDENSATE PIPE AND FITTINGS

1. Condensate drain piping shall be Type 1, Grade 1, Class 12454-B, Schedule 40 polyvinyl chloride (PVC) pipe conforming to ASTM D-1785. Drain piping shall have Schedule 40 PVC socket fittings conforming to ASTM D-2466. All joints between pipe and fittings shall be solvent cemented joints conforming to ASTM D-2235 and ASTM D-402. Provide protection for PVC piping exposed to weather from ultraviolet radiation. All condensate drains shall have an insect screen at the end of pipe at the exterior.

## B. HANGERS AND SUPPORTS

1. All hangers and supports shall be 316 stainless steel (SS).
2. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.
3. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge SS protection shields (12 inches long) at hangers, when pipe is installed.
4. Duct hangers shall be in accordance with the "HVAC Duct Construction Standards" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA).
5. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

## C. UNIONS

1. Unions for PVC pipe 2 inch and smaller shall be Schedule 40 PVC.

## D. PIPING SPECIALTIES

1. Provide dielectric couplings or flanges in all copper to ferrous transitions.
2. Sleeves
  - i. Provide sleeves at all penetrations. Sleeves shall be 316 stainless steel. Sleeves shall be sized to allow 1/2 inch of annular space between the covering (or bare pipe) and the inside of the sleeve.
  - ii. Pipe penetrations of walls below grade shall be sleeved and sealed using Thunderline Link-Seal wall sleeves and seals.
  - iii. Pack the annular space and seal with caulking flush with finished surface.
  - iv. Sleeves in concrete construction shall be galvanized steel pipe, except where passing through exterior walls and slabs-on-grade they shall be ductile iron. Sleeves passing through floors shall project two inches above the finish floor and sleeves passing through walls shall be trimmed flush with the wall surface.

## E. REFRIGERANT PIPING AND ACCESSORIES

1. Refrigerant piping shall be Type L hard drawn copper tubing cleaned, dehydrated and capped for refrigerant service conforming to ASTM B 280. Refrigerant piping

shall have wrought copper brazed joint pressure fittings conforming to ANSI B 16.22. All joints shall be made using a brazing alloy containing silver or using a copper - phosphorous alloy. Brazing alloys shall have a minimum of 1100 degree F melting temperature and shall conform to ASTM B 260.

2. Filter dryer in the liquid line shall consist of a steel cylinder filled with a suitable desiccant that will not plug, cake, rust, channel or break down and shall remove both water and acid from the refrigerant. The dryer shall be constructed so that none of the desiccant will pass into the refrigerant lines. The filter dryer shall be the replaceable core type "catch all" as manufactured by Sporlan Alco or approved equal.
3. Provide all accessories and appurtenances to provide a complete and properly functioning refrigerant system under all conditions of operation.
4. Install all refrigerant piping in accordance with the requirements of ASME Standard B 31.5, refrigerant piping; and ASHRAE Standard 15, standard safety code for mechanical refrigeration. All refrigerant piping shall be installed to ensure that all oil returns to the compressor. Suction line piping shall be sized on a pressure drop between the evaporator and compressor equal to an equivalent temperature of not greater than 2 degrees F, with a velocity in the vertical rise of not less than 1000 fpm. Liquid line piping shall be sized on a pressure drop not to exceed 5 psig. Provide the minimum number of piping joints to limit refrigerant leaks.
5. Refrigeration system installation shall be in accordance with all state and local codes.

F. **SPLIT SYSTEM HEAT PUMP FOR CONTROL ROOM AND ELECTRICAL ROOM**

1. The variable capacity heat pump air conditioning system shall be a split system ceiling cassette type as indicated. The system shall consist of an evaporator and a two-pipe refrigeration distribution system using PID control. The outdoor unit is a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed driven compressors using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 200% of the outdoor condensing unit capacity. Provide controllers, etc. to provide individual temperature control. LG, Trane, Climatemaster, Mitsubishi or equal. Unit cabinet shall be 20 gauge galvanized steel, with prime coat and two-part epoxy finish.
2. The indoor unit shall be connected to the condensing unit utilizing proprietary piping joints and headers to ensure correct refrigerant flow and balancing. The manufacturer shall submit piping installation drawings for review and approval by the Engineer.
3. Provide interconnecting piping and interlock wiring.
4. R410a refrigerant.

5. Heating & cooling capability must be available when the outside temperature is as low as -10°F. The Cooling Capacity SEER shall be 20.5 or greater and the Heating Capacity HSPF shall be 9.7 or greater.
6. Energy Star Tier II rated.
7. The condensing unit shall use a high efficiency, variable speed “inverter” compressor coupled with inverter fan motors for part load performance. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads. Indoor fan coil units shall use PID control to control superheat to deliver a comfortable room temperature condition.
8. Provide compressor with crankcase heater to prevent oil dilution on off cycle, and suction line thermostat to stop compressor when suction line temperature falls below setpoint.
9. Provide 24-inch-high support stand with snow shield for outdoor condensing units to lift units off the ground and mitigate impact of snow and ice falling from the roof. Stand shall be equal to Quick Sling by DiversiTech.
10. Hard-wired controller for wall mounting. Packaged controls with BACnet interface.
11. Provide contactor, 24 V control transformer, blower relay, lockout relay and low voltage terminal board and remote mounted H-C deadband-type thermostat with sub-base. Heating setpoint shall be 70 deg F and cooling setpoint shall be 75 deg F.
12. Provide circuit to lock compressor off when safety controls have been activated. Unit shall not be restartable until room thermostat has been turned off and on.
13. Provide factory-mounted air filters.
14. The drain pan shall be constructed to inhibit corrosion and fully insulated. Drain outlet shall be located on pan as to allow complete and unobstructed drainage of condensate. Vertical units will be supplied with factory installed trap inside of cabinet. The unit as standard shall be supplied with solid-state electronic condensate overflow protection conforming to UL 508 that shuts off the unit when the primary drain is blocked. Mechanical float switches will not be accepted.
15. Furnish and install a condensate pump for the fan coil unit. Pump shall be equal to Little Giant with plastic body, float, and pump. Pump shall be wired to the heat pump electrical supply.
16. Insulate evaporator and compressor compartment panels with 1-1/2 lb. fibrous glass insulation.

17. Provide either direct drive ECM or belt-driven evaporator blowers with common shaft and three speed switch. Belt-driven evaporator blower motor shall be 1750 rpm, three-phase, with inherent overload protection or starter with quick trip heaters and sealed ball bearings.

#### G. AIR-COOLED CONDENSERS FOR DEHUMIDIFIER

1. Provide outdoor-mounted, factory-assembled, single piece, air-cooled condenser as part of a dehumidifier as manufactured by Desert Aire, Dehumidifiers Corp of America (DCA), Munters or approved equal. Air cooled condenser and dehumidifier shall be by the same manufacturer. Air cooled condenser shall consist of an air-cooled coil, hot gas bypass valve, integral subcooler, propeller-type condenser fans, and a control box. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant holding charge, and all accessories indicated. Units shall have single or multiple independent refrigeration circuits as is furnished standard by the manufacturer. Units shall discharge cooling air vertically upward. Units shall be used in a refrigeration circuit matched with a packaged fan coil unit.
2. Units shall be rated in accordance with ARI Standard 210/240 or 365 as applicable. Unit construction shall comply with ANSI/ASHRAE 15 safety code latest revision and comply with NEC. Units shall be constructed in accordance with UL standards and shall carry the UL label. **Any alternate units submitted shall have a noise rating no louder than the specified units.**
3. Unit Cabinet
  - i. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a pre-painted baked enamel finish or aluminum. Unit cabinet shall be capable of withstanding 500 hour salt spray exposure per ASTM B117 (scribed specimen).
  - ii. A heavy-gauge roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging. Units shall have hinged or removable panels for service access to all components.
4. Fans
  - i. Condenser fans shall be direct driven, propeller-type with fan blades statically and dynamically balanced. Condenser fan discharge openings shall be equipped with wire safety guards constructed of coated steel or corrosion resistant metal. Condenser fan and motor shaft shall be corrosion resistant.
5. Condenser Coils
  - i. Condenser coils shall be air-cooled and circuited for integral subcooler. Coils shall be constructed of aluminum fins or copper fins mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed. Condenser coils for semi-hermetic compressor units shall be leak tested at 150 psig and pressure tested at 480 psig, and for hermetic compressor



units shall be leak tested at 200 psig and pressure tested at 428 psig. Acceptance criteria for test duration and leakage shall comply with the applicable AHRI manufacturing standard.

- ii. Coils shall be protected by a sheet metal casing to eliminate the need for wind baffles and avoid damage due to the elements and vandalism.

#### 6. Refrigeration Components

- i. Refrigeration circuit components and arrangement shall be as recommended by equipment manufacture, including an ORD valve and subcooler.

#### 7. Controls and Safeties

- i. Minimum control equipment shall include:
  - a) Power and control terminal blocks.
  - b) Head pressure control to fixed set point between 50 – 55 degrees F ambient temperature by fan cycling. One condenser fan shall be cycled by ambient temperature to maintain proper head pressure.
  - c) Type ORD Hot Gas Bypass Valve.
  - d) Sub Cooler.
- ii. Minimum safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:
  - a) High discharge pressure cutout.
  - b) Low suction pressure cutout.
  - c) Condenser fan motors protection against overload or single-phase condition by internal overloads.
  - d) Electrical overload protection through the use of definite-purpose contactors and calibrated, ambient-compensated, magnetic trip circuit breakers. Circuit breakers shall open all 3 phases in the event of an overload in any one of the phases or a single-phase condition.

#### 8. Electrical Requirements

- i. Unit electrical power shall be single-point connection. Unit control circuit shall contain a 24-volt transformer for unit control.

#### 9. Accessories

- i. Provide the accessories indicated on the Contract Drawings and as specified herein.
- ii. Install Remote Condenser as indicated on support detail on the drawings. NOTE: Set Condenser on stand with steel dunnage arranged so Condenser is not more than 10 feet below Dehumidifier.

## H. DEHUMIDIFIER

1. Provide indoor, draw-thru, packaged dehumidifier as manufactured by Desert Aire, Dehumidifiers Corp of America (DCA), Munters, or approved equal. Dehumidifier and Air Cooled Condenser shall be by the same manufacturer. Units shall be capable of horizontal installation on a suspended structural frame as indicated on the Contract Drawings, with or without ductwork. Units shall have direct-expansion coils, compressor, and thermostatic expansion valve and associated controls. Where shown on the Contract Drawings each unit shall be used with a matching air-cooled condenser. Units shall consist of supply fan(s), motor and drive assembly, pre-wired fan motor contactor, factory-installed refrigerant metering devices, factory installed temperature sensor and relative humidity sensor, disposable air filters and condensate drain pans.
2. The dehumidifier is configured to remove moisture at low space temperature (32 to 70°F). The system is equipped with an adjustable timer which will initiate the defrost cycle (if it is needed). The need to defrost is determined by monitoring the suction line temperature and activating the defrost when it drops below 30°F. During the defrost cycle, the blower is disengaged and 100% of the system's heating capacity is diverted to the evaporator where it quickly thaws the coil. The defrost cycle is monitored and automatically terminates when suction line temperatures confirm that the evaporator has fully thawed. There is an additional safety timer which limits the total defrost time to 10 minutes. If the facility cannot, at times, accept the recovered heat, then the remote condenser installed outside provides the full cooling capacity. In this mode, a thermostat is also installed in the facility. If the air temperature should exceed the desired set point, the controller will shift the dehumidifier from the reheat mode and reject all of the energy to the remote condenser, thereby providing sensible cooling to the space.
3. Refrigerant shall be R-407c or as noted by Vendor.
4. Coils shall be designed and tested in accordance with ASHRAE 15 Safety Code for Mechanical Refrigeration, latest edition. Units shall be constructed in accordance with ETL standards and shall carry the ETL label.
5. The Dehumidifiers shall be installed on a platform furnished by the PEMB manufacturer. The platform shall include an access ladder to allow routine maintenance.
6. Unit Cabinet
  - i. Cabinet shall be constructed of a minimum 16 gauge mill galvanized steel with removable panels for serviceability. Units shall be painted with a power-coat type paint capable of withstanding 500-hour salt spray exposure per ASTM B117.
  - ii. Cabinet panels shall be fully insulated with ½ inch fire-retardant material. Unit insulation and adhesive shall comply with NFPA-90A requirements for flame spread and smoke generation. Insulation shall contain an EPA-registered immobilized antimicrobial agent to effectively resist the growth of

bacteria and fungi as proven by tests in accordance with ASTM standards G21 and 22.

- iii. Units shall contain stainless steel condensate drain pan. Drain pan shall have connections on right and left sides of unit to facilitate field connection. Drain pans shall have the ability to be sloped toward the right or left side of the unit to prevent standing water from accumulating in pans.

#### 7. Fans

- i. Units shall consist of forward-curved belt-driven centrifugal fan(s), motor and drive assembly, and pre-wired fan motor contactor. Fan motor of the size and electrical characteristics specified on the equipment schedule shall be factory supplied and installed.

#### 8. Condenser and Evaporator Coils

- i. Coils shall be direct expansion type and consist of 3/8 inch copper tubes with sine-wave aluminum fins bonded to the tubes by mechanical expansion. Coil tubing shall be internally rifled to maximize heat transfer. Suction and liquid line connections shall be made on the same side of the coil. Coils shall feature factory-installed thermostatic expansion valves (TXVs) for refrigerant control. The TXVs shall be capable of external adjustment. Coils shall be burst tested at 435 psi and leak tested at 150 psi. Coils shall be properly separated from each other to prevent re-hydration.

#### 9. Electrical Requirements

- i. Unit electrical power shall be single-point connection. Unit control circuit shall contain a 24-volt transformer for unit control.
- ii. Provide auxiliary contacts to shut down system upon signal from smoke detector.
- iii. Provide dry contacts in the electrical panel to close upon high dewpoint signal. (adjustable, setup for 55 deg F) Wire from SCADA system to dry contacts on Dehumidifier for alarm notification.
- iv. HVAC Contractor is responsible to furnish cable to connect controllers to DHUs. See 9.i.a following.

#### 10. Accessories

- i. Provide the following accessories where indicated on the Contract Drawings and as required.
  - a. Microprocessor Controller: Desert Aire CM 3540 or approved equal standalone wall mounted with Remote Display Terminal. Controller shall sequence dehumidification cycles for the Dehumidifier and the Remote Condenser and shall display operating parameters including space temperature, relative humidity, and occupied/unoccupied schedule. Program unit for constant occupancy. HVAC contractor is responsible to furnish control cable of sufficient length to connect each

controller to its respective Dehumidification Unit. **Controls shall include dry contacts for dewpoint temperature high limit for connection to SCADA.**

- b. Condensate Drain Trap: Trap shall have transparent, serviceable design for easy cleaning.
- c. Air Filters: Units shall have factory supplied 30% efficient 4-inch MERV 7 throwaway type filters installed upstream from the cooling coil. Filter access shall be from either the right or left side of the unit.
- d. Low ambient defrost control.
- e. Subcooler.
- f. ORD valve.

11. Service Representative Availability: Proximity of service personnel is a prime **concern of the Owner**. The Factory trained and certified technicians and service personnel for the preventive maintenance and repair of the Dehumidifier must reside within a 2-hour radius of the site (considered to be 120 miles maximum.) Equipment submittal shall include the municipality where the personnel resides.

## I. ELECTRIC UNIT HEATERS

- 1. Provide propeller type electric unit heaters as manufactured by Indeeco, Qmark, Electromode, or approved equal designed for horizontal. Heaters shall be of the draw-through air flow design to eliminate element hot spots and extend design life. Units shall be UL listed, and shall comply with National Electrical Code and OSHA requirements.
- 2. Casing
  - i. Cabinet shall be made of not less than 22 gauge die formed cold rolled steel with smooth contours and minimization of exposed fasteners. All metal surfaces of the enclosure shall be cleaned of all oils and phosphate coated to resist corrosion, then finished in a electrostatically applied decorative baked enamel for optimum corrosion protection.
  - ii. Individual adjustable louvers with 30 degrees downward stops shall be furnished to provide desired control of discharge air.
  - iii. Mounting brackets designed for either ceiling or wall swivel mounting shall be furnished.
- 3. Heaters
  - i. All heaters shall be UL Listed and meet the requirements of the National Electrical Code. The electric heating bank shall consist of metal sheath heating elements. The elements shall consist of 80/20 Ni-chrome wire and have a copper clad steel sheath for strength and corrosion resistance, and aluminum fins. The heating bank shall have protective air inlet louvers. All heaters drawing in excess of 48 amperes shall be provided with factory installed subdivided and fused circuits of 48 amperes or less.
- 4. Fan/Motor Assembly

- i. Each unit shall have a single motor and direct drive propeller fan completely factory assembled and resiliently mounted. Motor shall be totally enclosed. Single phase motors shall be equipped with thermal overload protection. Fans shall be aluminum. Fans shall be statically and dynamically balanced for quiet operation. Propeller fan shall be equipped with a safety fan guard.

#### 5. Controls

- i. Provide integral control transformer and contactor integral to unit heater. All controls shall have pig tails and spade terminals for ease of wiring to centrally located terminal board.
- ii. Heaters shall be equipped with automatic reset thermal overload protection of the linear capillary type wired for instantaneous de-energizing in case of the thermal overload.
- iii. Fans shall have delay on both start and stop. Upon call for heat, fan start shall be delayed until heating element is warm. When thermostat is satisfied, fan stop shall be delayed until heating element is cool.
- iv. Wall mounted thermostat with NEMA4 cover.

#### 6. Accessories: Factory furnished and installed disconnect switch.

### J. NATURAL GAS FIRED UNIT HEATERS

1. Provide high efficiency, natural gas fired unit heaters as manufactured by Modine, Trane, Sterling or approved equal. Unit heaters shall have AGA (American Gas Association) design certification. The output capacity shall be AGA certified to be a minimum of 80% of the input based on steady-state thermal efficiency.

#### 2. Casing

- i. The unit heater casing shall be constructed of not less than 20 gauge die formed cold rolled steel, with smooth contours and minimization of exposed fasteners. All metal surfaces of the enclosure shall be cleaned of all oils and phosphate coated to resist corrosion, then finished in an electrostatically applied decorative baked enamel for optimum corrosion protection.
- ii. Casing shall have a removable or hinged panel for easy access to the burner compartment.
- iii. Unless otherwise indicated on the Contract Drawings and as specified hereinafter, horizontal air deflector louvers shall be provided to aid in controlling the discharge air pattern.

#### 3. Burner

- i. Burner material shall be 409 stainless steel with non-clogging, slotted ports with 409 stainless steel separator strip designed for good lighting characteristics without noise of extinction.

#### 4. Heat Exchanger

- i. Unit heat exchanger shall be constructed of 409 stainless steel. Heat exchanger shall be heliarc machine-welded and designed with contoured stress-free tubes.

#### 5. Venting

- i. Each unit shall have a factory mounted and wired integral power exhaustor directly connected to the unit collector box assembly. The unit shall also include a factory mounted and wired safety pressure switch designed to prevent pilot and main burner ignition until positive venting has been proved. Filter Room units shall be designed for single vent connection.
- ii. HVAC FSB shall furnish a concentric vent kit for each Unit Heater to the Plumbing FSB contractor for installation.

#### 6. Fan/Motor Assembly

- i. Each unit shall have a single motor and direct drive propeller or centrifugal fan, as indicated on drawings completely factory assembled and resiliently mounted. Motor shall be totally enclosed. Single phase motors shall be equipped with thermal overload protection. Fans shall be aluminum. Fans shall be statically and dynamically balanced for quiet operation. Propeller fans shall be equipped with a safety fan guard.

#### 7. Controls

- i. All units shall include a 2 stage control system, pilot valve, low voltage control transformer, safety high limit control (overheat control), safety pressure switch, gas pressure regulator, manual shut-off valve and terminal board for low voltage wiring. All gas controls shall be rated for a maximum inlet pressure of 1/2 psi and shall be exposed for easy access. All units shall have energy saving electric ignition with electronic flame supervision.

#### 8. Accessories

- i. Provide the accessories as indicated on the Contract Drawings.
- ii. Adjustable horizontal discharge louvers.

### K. ELECTRIC WALL HEATER

1. Provide electric wall heater as manufactured by Qmark, Berko, Faherheat or approved equal. Wall heater shall consist of 20 gauge steel with a white factory painted polyester finish for corrosion resistance, steel support brackets, nickel chromium wiring in a steel sheath with aluminum fins, integral circulation fan, integral junction box, and integral thermostat. Units shall be UL listed, and shall comply with National Electrical Code and OSHA requirements.

## L. MAKE UP AIR UNIT

### 1. General Description

- i. Fabricate draw-thru type indoor air handling units suitable for the capacities scheduled on the drawings as manufactured by Greenheck, Accurex, AAON, or approved equal.
- ii. Fabricate units as indicated on the drawings.
- iii. Factory fabricate and test air handling unit of size, capacity, and configuration as indicated and specified.
- iv. Base performance on sea level conditions.
- v. The following internal components shall be factory furnished and installed, including, but not limited to, a lockable disconnect and a fan motor starter. Unit(s) shall be completely factory assembled.
- vi. Units shall ship in one (1) piece where possible. Shipping splits can be provided for installation. Lifting lugs will be supplied on each side of the split to facilitate rigging and joining of segments. Units requiring field installed gasketing must be assembled under supervision by factory trained and employed personnel from the air unit manufacturer.
- vii. **This equipment is part of the Lab Hood Exhaust / Makeup Air system. See bid drawing H-1 for the equipment Sequence of Operation.**

### 2. Casing

- i. All segments shall be double wall and shall be constructed of G90 mill galvanized sheet steel, formed and reinforced to provide a rigid assembly. The exterior casing shall be constructed of a minimum 18 gage galvanized steel. The interior lining shall be a solid lining of a minimum of 20 gage galvanized steel. All cabinet walls, access doors, floor and roof shall be fabricated of double wall, impact resistant, fiberglass or polyurethane foam panels. Note that units are installed on dunnage and exposed underneath.
- ii. Insulation shall be at least 1-inches thick, have a minimum density of 1-1/2 pounds/cubic foot and have a minimum R-value of 6.25. Foam insulation shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F. Insulation shall meet the flame and smoke generation requirements of NFPA-90A.
- iii. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- iv. Access to filters, dampers, supply fans and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Doors shall be double wall construction with a solid liner and a minimum thickness of 1 inch. Double wall access doors shall be provided in the fan, and also for the control cabinet. All hinged panels shall

- be provided with suitable gasketing to prevent moisture leakage. Furnish unit with duct flanges at inlet and outlet.
- v. The entire unit shall be provided with a full-length, continuous, base rail channel. Base rail channels will be formed of a minimum of 12 gage galvanized steel. All major components shall be supported from the base. Integral lifting lugs shall be provided. If an integral base rail is not furnished with the unit, the HVAC FSB is responsible to furnish and install a base rail support equal to Thycurb.
3. Furnish unit with damper section consisting of a 100% outside air damper and spring return damper actuator. Unit shall include an inlet damper end switch which will not allow the unit to operate until the damper is at least 80% open. Damper shall be low-leak type constructed of 16 gage galvanized steel with blade edge seals and jamb seals.
  4. Fans
    - i. The supply fan segment shall be equipped with axial, plenum or double width double inlet (DWDI) centrifugal type wheels. All fans shall be backward curved or airfoil selected for stable operation.
    - ii. Fan and unit performance shall be rated and certified in accordance with ARI Standard 430. All units that are not ARI Certified shall be witness tested at an independent laboratory to assure performance.
    - iii. All airfoil fans shall bear the AMCA Seal. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air and sound.
    - iv. Fans shall be fabricated in accordance with Air Moving and Control Association
    - v. After the pre-balanced fan is installed in the air handler, the entire fan section shall be run-balanced at the specified speed to insure smooth and trouble-free operation.
    - vi. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 2" springs. The fan discharge shall be connected to the fan cabinet using a flexible connection. The isolator support rail shall be structurally supported from the unit base. Cantilever supports of the isolator support base are unacceptable.
  5. Bearings and Drives
    - i. All bearings shall be factory lubricated. Fan bearings shall be self-aligning, pillow block or flanged type regreaseable ball bearings and shall be designed for an average life (L50) of at least 200,000 hours.
    - ii. Fan drive shall be selected for a 1.5 service factor.
    - iii. Fan shaft shall be selected to operate well below the first critical speed and each shaft shall be factory coated after assembly with an anti-corrosion coating.
    - iv. Unit shall be furnished with an integral factory installed motor starter matched to the specified motor size.



- v. After final assembly, the fan and motor assembly shall be factory balanced.
6. Electrical Characteristics and Components
- i. Single electrical power connection point.
  - ii. Fan motors shall be Totally Enclosed Fan Cooled type.
  - iii. The motor shall be mounted on the same isolation base as the fan.
  - iv. Each unit shall be equipped with a factory furnished and installed lockable disconnect switch. The disconnect shall be mounted in a NEMA 3R enclosure. The disconnect shall be UL listed.
  - v. The disconnect shall be factory wired to the power panel. All wiring shall be Class 1 Division 2. All wiring shall be done in accordance with the latest N.E.C. Guidelines.
7. Gas Burner
- i. Gas burner shall be separated combustion type with a ducted combustion air inlet and a separate gas vent discharge. HVAC FSB contractor shall furnish a concentric vent kit to the Plumbing FSB contractor for installation on the gas vents.
  - ii. Heat exchanger shall be manufactured of 409 stainless steel.
  - iii. Burner control shall be at minimum a 5 stage turndown type capable of firing rates between 20% and 100% of full capacity.
  - iv. Furnish a supply air discharge temperature controller compatible with the gas burner controller.
  - v. Furnish unit with standard gas manifold consisting of black iron piping with malleable iron threaded fittings. Furnish unit with a main redundant safety shut-off valve with servo regulator, safety pilot valve, and manual shutoff valve.
8. Filters
- i. Furnish unit with a filter section and rack. Filter Segments shall accommodate 2-inch media. Media shall be MERV 13 pleated type.
  - ii. The filters shall be sealed against the filter frame with spring-loaded, nut and clip assemblies to prevent air bypassing around the filter.
9. Control Components
- i. Unit shall include microprocessor control for programmable operation and sequencing of the gas burner, supply fan and control dampers.
  - ii. Discharge air temperature controller.
  - iii. Furnish unit with relay mounted inside the cabinet. Relay shall start the unit supply blower upon receiving a signal from the Hood Management System.
  - iv. Unit supply fan speed shall be start/stopped via an external signal input. See Sequence of Operation for description.

## M. FANS

1. Centrifugal in-line fans shall be of the centrifugal belt driven or direct drive in-line type as manufactured by Greenheck, Cook, Penn, or approved equal. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance. **Fan EF-2 for the Sodium Hypochlorite and Potassium Hydroxide Storage Rooms shall have the internals, including the wheel, completely coated with a chemical resistant coating equal to Greenheck Hi-Pro Polyester.**
  - i. The fan housing shall be of the square design constructed of heavy gauge galvanized steel or aluminum and shall include square duct mounting collars. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels shall be of sufficient size to permit easy access to all interior components.
  - ii. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.
  - iii. Motors shall be totally enclosed, heavy-duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the air stream. Motors shall be readily accessible for maintenance. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% if driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor sheaves shall be adjustable for final system balancing.
  - iv. Accessories:
    - a. Furnish and install break glass wall switch for EF-2. Switch shall be a Push Button Station with 30mm Selector Switch in a NEMA 4X enclosure equal to Allen Bradley.
    - b. Furnish and install signage at EF-2 wall switches. Sign shall read "Break Glass for Fan Emergency Shutoff."
    - c. EF-4 shall be controlled by the room light switch.
    - d. EF-5 shall be controlled by a manual switch in "Hand" mode and by the Refrigeration Monitor system in "Auto" mode.
    - e. Furnish and install manual wall switch for EF-6. Switch shall be a Pushbutton Station with 30mm Selector Switch in a NEMA 4X enclosure equal to Allen Bradley. Furnish and install signage at EF-6 manual wall switch. Sign shall read "Start Fan upon entering building. Shut fan off when leaving building" Provide additional accessories as indicated on the Contract Drawings.
2. Centrifugal wall mount fans shall be of the centrifugal belt driven or direct drive in-line type as manufactured by Greenheck, Cook, Penn, or approved equal. All

fans shall bear the AMCA Certified Ratings Seal for both sound and air performance. Fan impellers shall be statically and dynamically balanced.

i. Accessories:

3. The Lab Hood Exhaust Fan for the Fume Hood in the Control Room (see specification section 15900) shall be a corrosion resistant utility set blower equal to MK Plastics. The fan shall consist of FRP construction including body, solid molded impeller with radial tip curved blades, access door, weather hood, and flanged outlet connection. Housing shall be aerodynamically designed with high efficiency inlet to reduce incoming air turbulence. Impeller shall be statically and dynamically balanced. Enclosure fasteners shall be encapsulated in FRP. Fan motor shall be inverter duty suitable for Variable Frequency Drive application.

N. DUCTWORK

1. Provide all sheet metal ductwork required for the various supply and exhaust air systems. Unless otherwise indicated on the Contract Drawings or in these specifications, ductwork shall be 316 stainless steel duct. All ductwork and sheet metal plenums shall be constructed meeting the requirements of ASTM A 653, lock-forming quality. Stainless steel sheet metal shall conform to ASTM A 167. All ductwork, except where specified otherwise herein, shall be fabricated in accordance with the "HVAC Duct Construction Standards for Metal Ducts" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA), 2 inch water gauge Pressure Class.
2. **Exhaust Ductwork from the Chemical Storage Area shall be Kynar (PVDF) round ductwork from the Ceiling Exhaust Fans in the room to the EF-2 inlet.** Duct shall be equal to SimTech. As alternates, the ducting can be CPVC PROVIDED it is fabricated and installed with silica-free cement and material.
3. Ductwork for the Fume Hood shall be 316 stainless steel round ductwork from the connection at the Fume Hood to the discharge termination of the exhaust stack outside the building. The exhaust stack system shall include wall supports provided by the duct vendor and shall be equal to Wall Support Assembly by Metal Fab. The wall support assembly shall consist of a full angle ring, two clamp rings, wall brackets and struts. The brackets shall attach to the building structure. **The Fume Hood duct vendor shall review the building structural drawings and shall fabricate Wall Support Assemblies that coordinate with the building structure. See specification section 15900 for the Fume Hood specification.**
4. Ducts shall be true to the inside dimensions indicated on the Contract Drawings. Cross break all duct panels over 12 inches wide. Support ducts rigidly and securely. Support horizontal ducts not over 8 feet on center. Ducts shall be straight and smooth on the inside with neatly finished joints and all transverse joints and longitudinal seams of all low pressure ducts shall be sealed in conformance with SMACNA seal classification B.

5. Elbows narrower than 16 inches shall be full radius elbows with inside radius equal to the dimension of the duct in the plane of the elbow or offset. Elbows wider than 16 inches may be full radius elbows or square elbows with air foil section turning vanes (Duct Manual Figure 2-3) and 6 inch inside radius. Vanes shall be "Runner" Type 2, 3 1/4 inches on centers. Install outside vane flush against the outside of the elbow.
6. Transitions in duct mains and branches shall be made with sides sloping at not more than 1 inch in 7 inches on the side of the transformation for diverging transitions and 1 inch in 4 inches for converging transitions. Transitions in ductwork to pieces of equipment shall be made with a 20 degree maximum angle projected from the straight duct side on a diverging transition and a 30 degree maximum angle projected from the straight duct side on a converging transition. Any conditions requiring deviations from the above shall be brought to the attention of the Engineer for approval.
7. All notches for connecting sections of duct, including longitudinal seam notches, shall not be cut any deeper than 1 7/8 inches to insure tight corners in 2 inch deep slip joints.
8. Slips shall be at least 2 gauges heavier than the duct and all joints shall be made in a neat and workmanlike manner and in all cases shall be tight. All ducts shall have all joints sealed with EC-800 as manufactured by 3M, Hardcast or approved equal.
9. Duct penetrations of walls or decks shall have the annular space between the duct and the structure sealed with approved material.

#### O. DUCTWORK ACCESSORIES

1. Duct Flexible Connections:
  - i. Other than the Lab Hood Exhaust, provide 6 inch metal edge Ventglas or Thermafab flexible connections at fan and unit inlets and outlets. Leave 1 inch minimum slack, (this means 1/2 inch standing fold). Duct openings shall be lined up on either side of flexible connections.
  - ii. Lab Hood Exhaust ductwork flex connector shall be equal to Labconco Flexible Duct Connection. Seal openings with fire resistant caulk.
2. Wire Mesh Screen: 1/2 inch x 1/2 inch 316 series stainless steel welded wire mesh. Brush screen with chemically resistant sealant equal to Ceilcote 242 Flakeline.
3. Volume Dampers
  - i. Provide volume dampers where indicated on the Contract Drawings.
  - ii. Dampers less than 12 inches in height shall be Young Regulator manual adjustable rectangular opposed blade dampers.
  - iii. Dampers 12 inch and larger in height shall be opposed multi-blade equal to Greenheck, Nailor, or Vent Products.

- iv. Damper frame shall be constructed of 316 series stainless steel channel with minimum thickness of .050 inches. Opposed damper blades shall be 316 series stainless steel with minimum thickness of .050 inches and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8 inch square steel control shaft.
- v. Damper blades shall be 2 gauges heavier than adjoining ductwork, and shall be riveting to supporting rods. Hem over edges parallel to rods.
- vi. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms. Provide 2-inch handle extension for all dampers on externally insulated ductwork.

#### 4. Sheet Metal Access Panels

- i. Provide access panels of the proper size and at all locations in ductwork necessary to service control devices, fan bearings and as required to service all systems.
- ii. Access panels shall have foam gasketing, fixed hinges and compression type latches as manufactured by Ventlock, Duro-Dyne or approved equal. Access doors for insulated ducts shall be insulated with 1 inch thick 1 ½ lb density coated duct liner. Panels shall be 316 stainless steel.

#### 5. Diffusers, Registers and Grilles

- i. Supply Grille, Supply Register:
  - a. Minimum 22 gauge type 316 stainless steel construction.
  - b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
  - c. Double deflection.
  - d. Vertical front blades and horizontal rear blades.
  - e. Individual adjustable front and rear blades on ¾-inch centers.
  - f. Mill finish.
  - g. Register to be provided with integral opposed blade type 316 stainless steel damper adjustable from face.
  - h. Tuttle & Bailey, T64SS.
- ii. Exhaust Registers, Exhaust Grilles:
  - a. Minimum 22 gauge type 316 stainless steel construction.
  - b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
  - c. Fixed vertical zero deflection bars.
  - d. Mill finish.
  - e. Register to be provided with integral opposed blade type 316 stainless steel damper adjustable from face.
  - f. Tuttle & Bailey, T80SS.

#### 6. Control Dampers

- i. Furnish motor operated control dampers for Inlet Louvers and Exit Louver as follows: IL-1: one 24" x 24" damper; IL-2: one 60" x 36" damper; IL-3: one 36" x 24" damper; EL-1: one 36" x 60" damper. Provide direct connected Universal Power Supply damper actuator for each damper.
- ii. Damper Assembly: Damper shall conform to SMACNA HVAC Duct Construction Standards. A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall consist of a combination of sections. Damper shall be 316 stainless steel. Flat blades shall be made rigid by folding the edges. Provide blades with compressible seals at points of contact. Provide channel frames of dampers with jamb seals to minimize air leakage. Dampers shall not leak in excess of 10 cfm per square foot at 4 inches water gage static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity. Moving parts of operating linkage in contact with each other shall consist of dissimilar materials. Damper axles shall be 0.5 inches minimum plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by non-ferrous dissimilar thrust bearings. Pressure drop through dampers shall not exceed 0.05 inch water gage at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches wide. Dampers shall be tested in accordance with AMCA 500-D.
- iii. Operating Links: Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators or dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be 316 stainless steel. Mating parts shall consist of dissimilar materials. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crank arms shall control the open and closed positions of dampers.
- iv. Lab Hood Exhaust Duct Control Damper shall be a round butterfly damper entirely constructed of 316 stainless steel. Damper shall shut off tightly to prevent gravity flow of air through the ductwork. Damper shall be operated by a spring return Universal Power Supply actuator which shall be arranged to fail open upon loss of electrical power.

## P. SLEEVES AND PENETRATIONS

1. Sleeves in Masonry and Concrete Walls, Floors, Ceilings and Flat Roofs: Standard Weight hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.
2. Sleeves in Non-Masonry or Non-Concrete Walls without membranes, Floors, and Roofs: Hot-dip galvanized steel sheet, 26 gage minimum thickness.
3. Sleeves in Non-Masonry or Non-Concrete Walls with membranes, Floors, and Roofs: Per wall manufacturers direction.
4. Duct Sleeves and Openings

- i. Sleeves through floors, decks, and through exterior structure, shall be Schedule 40 galvanized steel pipe for round duct. Packing shall be applied to seal any openings between sleeve and wall.
- ii. Openings in walls, partitions and other fire-rated construction that do not require smoke dampers shall meet NFPA 90A, Section 3-3.8.
- iii. Materials for prepared openings in partitions shall match construction penetrated.

#### 5. Pipe Sleeve Packing

- i. Packing between the pipe and the sleeve (or wall or slab opening) shall be a combination of insulation and caulk. Fiberglass shall not be used as the insulation material.
- ii. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within 1" of both wall surfaces. Seal penetration packing with approved caulking and paintable water-proof mastic surface finish or silicone caulking.
- iii. All materials must be installed in accordance with manufacturers instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.

### Q. MOTORS AND DRIVES

1. Motors shall be totally enclosed (TEFC) and conform to applicable sections of Division 16.
2. Drives for belted motors shall be as manufactured by Dodge Manufacturing Company, Browning Manufacturing Company, T.B. Woods Company or approved equal with adjustable motor sheaves and adjustable sliding bases where applicable. The drive belts shall be as short as practicable. V-belt drives for all fans and fan units shall be sized for 150% of the design drive capacity. All multiple belt drives shall have matched sets of belts.

### R. VIBRATION ISOLATION

#### 1. Manufacturer Responsibility

- i. Manufacturer of vibration equipment shall have the following responsibilities:
  - a. Guarantee specified isolation system deflections.
  - b. Provide installation instructions, drawings and field supervision to ensure proper installation and performance of systems.

#### 2. Quality Assurance

- i. All vibration isolators shall have calibration markings or some method to determine adjustment, the actual deflection under the imposed load after installation and adjustment.
- ii. All isolators shall operate within the linear position of their load vs. deflection curves. Load vs. deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.
- iii. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than  $\nabla 10\%$ .
- iv. Substitution of internally isolated equipment in lieu of the isolation specified in this section, is acceptable provided all conditions of this section are met. The equipment manufacture shall provide a letter of guarantee stating that the specified noise and vibration levels will be obtained or the cost of converting to the specified external vibration isolation shall be born by the equipment manufacturer.
- v. The following specifications describe spring hanger with 30 degree misalignment feature. This requirement is mandatory. Replace any hangers without the 30 degree capability at no additional cost to the Owner.

### 3. Description

- i. All vibration isolation devices shall be the product of a single manufacturer. Products of other manufacturers are acceptable provided their systems strictly comply with intent, structural design, performance, and deflections of the base manufacturer.
- ii. Acceptable manufacturers of vibration isolation products shall be: Mason Industries, Amber Booth Company, Peabody Noise Control, Korfund Dynamics Corporation, Vibration Mountings and Equipment, Vibration Eliminator Co., provided they meet the requirements of the Specifications. Mason Industries model numbers have been used in the Specifications to establish quality of components but are in no way to limit competitive bidding by other manufacturers.
- iii. Refer to Table A at the end of this Article for application of the various types listed to appropriate equipment and efficiency level.

### 4. Vibration Isolation Types

- i. Vibration Isolators
  - a. Type A: Spring Isolator
    - 1) Having a minimum OD to OH of 0.8:1.
    - 2) Springs cadmium plated.
    - 3) Hardware cadmium plated.
    - 4) All other metal parts hot-dip galvanized.
    - 5) Reserve deflection (from loaded to solid height) of 50% of rated deflection.



- 6) Minimum ¼ inch thick neoprene acoustical base pad on underside.
- 7) Designed and installed so that ends of springs remain parallel.
- 8) Non-resonant with equipment forcing frequencies or support structure natural frequency.

b. Type E: Elastomer hanger rod isolator.

- 1) Molded (min. 1 ¾ inch thick) neoprene element with projecting bushing lining the rod clearance hole. Static deflection at rated load shall be a minimum of 0.35 inches.
- 2) Steel retainer box encasing neoprene mounting capable of supporting equipment up to four times the rated capacity of the element.

c. Type F: Combination spring/elastomer hanger rod isolator.

- 1) Spring and neoprene elements in a steel retainer box with the features as described for Type A and E isolators.

d. Type J: Steel Rails.

- 1) Steel members of sufficient strength to prevent equipment flexure during operation.
- 2) Height saving brackets as required to reduce operating height and cradle the unit.

5. Execution

i. General

- a. Isolation systems shall be installed in strict accordance with the manufacturer's written instructions. Vibration isolator shall not cause any change of position of equipment resulting in stress on equipment connections.

b. Equipment Installation

- 1) Equipment shall be isolated as per Table A below.
- 2) Additional requirements:
  - a) After the entire installation is complete, and under full operational load, the isolators shall be properly adjusted. Verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
  - b) Install equipment with flexibility in wiring.

TABLE A

Equipment	MTNG	ISOL	DEFLECTION in inches	BASE

Dehumidifier	Flr	A	0.75	J
In-Line Fans	Flr	A	0.75	
Unit Heaters	Clg	E	0.30	
Heat Pump	Clg	E	0.30	
Air Cooled Condenser	Flr	A	0.75	J

NOTES:

1. "ISOL" and "BASE" column indicates letter type as it appears in the Specifications.
2. "MTNG" refers to method of support of equipment from the structure.

S. INSULATION

1. All insulation, adhesives, tape, etc. shall conform to NFPA 90A. No voids in insulation will be permitted.
2. Pipe insulation shall be as specified in Table 1 and Table 2.

TABLE 1  
INSULATION MATERIAL FOR PIPING

Service	Material	Spec	Type	Class	Vapor Barrier Required
A/C Refrigerant Liquid & Suction	Mineral Fiber	ASTM C		1	Yes
	Cellular Glass	547	II	2	No
	Flexible Cellular	ASTM C	I		No
	Faced Phenolic	552	III		Yes
	Foam	ASTM C 534 ASTM C 1126			
Emergency Generator Exhaust (As applicable)	Calcium Silicate				No

TABLE 2  
PIPING INSULATION THICKNESS (INCH)

Service	Material	Tube and Pipe Size (Inches)		
		< 1	1 < 1- 1/2	1 1/2 -4
	Mineral Fiber			

Service	Material	Tube and Pipe Size (Inches)		
		< 1	1 < 1- 1/2	1 1/2 -4
A/C Refrigerant Liquid & Suction	Cellular Glass Flexible Cellular Faced Phenolic Foam	1	1.5	1.5
Emergency Generator Exhaust, Piping, Fittings and Muffler. (As applicable)	Calcium Silicate	4" thick minimum all pipe sizes -rated for 1200 Deg F.		

3. Insulation indoors shall have all-purpose jacket.
4. Insulation outdoors and exposed indoors within six feet of floors shall have a protective jacket. Jacket shall be fabricated from 0.016" thick aluminum and shall be fastened with stainless steel clamps.
5. Generator exhaust insulation shall have staggered joints. Secure with 1/2" wide 0.015" thick stainless steel bands on 12" centers.
6. Duct Insulation
  - i. Cover outdoor air intake ducts and plenums between the wall cap and the wire mesh screen outlets. Cover outdoor air intake duct from wall cap to HP-1. Cover exhaust air ducts and plenums between the control damper and the outdoors. Cover outdoor air intake duct, including but not limited to, all the intake ductwork to MUA-1, including the plenum. Cover supply air ducts in their entirety, including but not limited to, MUA-1, DHU-1 and DHU-2. Insulate to R-12.
  - ii. Insulate ducts with Johns-Manville 0.75 lb Microlite with FSK facing (foil-skrim-kraft) complete with vapor barrier, with an installed R-value of 12 and a thermal conductivity of 0.27. Longitudinal and circumferential joints shall be sealed with 2 inch wide self-sealing FSK strips. Additionally the insulation shall be adhered to the bottom of all ducts over 12 inches wide with "Stick-Clips" spaced not more than 12 inches on center.

#### T. GAS FIRED EQUIPMENT VENTS

1. All gas fired appliance vents and combustion air inlets shall be furnished and installed by the Plumbing FSB. Combination combustion air and vent concentric vent fittings furnished as part of gas-fired appliances under the HVAC specifications shall be provided to the Plumbing FSB for installation as part of the gas vent installation.

#### U. REFRIGERANT MONITORING AND DETECTION (SINGLE POINT)

1. Provide a refrigerant sensitive infra red sensor based stationary refrigerant gas leak monitor system designed to measure the level of a single refrigerant gas compound (R-407C is basis of design – HVAC FSB to confirm before ordering) in a single monitoring area. (In this case monitored area is the PFAS/FEMN space.) Monitor shall be Bachrach 3015-4200 HGMSZ or approved equal. The monitor equipment shall be a single area, self-contained wall mounted device, recommended for installation 3 feet above the floor located in the air flow path of the area where refrigerant gases are most likely to concentrate. Monitoring system shall support compliance with ANSI/BSR ASHRAE 15-2019 Mechanical Safety Code requirements.
2. The monitor shall automatically and continuously monitor for the selected refrigerant gas. The installing contractor shall furnish, install and connect a 12 inch ½” diameter stainless steel sample tube and a 12 inch ½” diameter stainless steel exhaust tube at the monitor to sense refrigerant leaks. Separate sample and exhaust tubes as directed by installation instructions.
3. The monitor shall be sensor type with factory calibrated settings for the selected refrigerant. Measurement range for the refrigerant gas selected shall be as follows: 2,500 ppm, with an accuracy as a percentage of full scale in ambient temperature ranges of 32 degrees F to 120 degrees F, and 5% to 90% ambient humidity, (non-condensing).
4. The monitor shall be equipped with dry contacts, and indicator lights. Alarm operation shall be as follows:
  5. Low Alarm 500 ppm detection: The LED flashes red at 0.5 hz and the buzzer sounds. The dry contact closes and Exhaust Fan 5 is started and the associated inlet louver control damper is opened.
  6. High Alarm 2000 ppm detection: The LED flashes red at 2 hz and the buzzer sounds. See Electrical specifications for controls connections to building data system.
7. Unit power consumption shall be less than 20 Watts maximum and power supply shall be 100 to 240 volts AC 60 Hz. 24 VAC power supply monitor/detectors will not be accepted.
8. The monitor will have a warranty period of one (1) year from the date of shipment from the manufacturer covering defects in material and workmanship and ninety (90) days labor from date of shipment within the continental United States.
9. The enclosure size shall not be larger than will fit on than a three-gang electrical box.
10. The monitor system shall require no periodic maintenance other than periodic checking and verification of accuracy. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.

## V. AUTOMATIC CONTROLS

1. The HVAC FSB shall provide electric automatic control devices as indicated on the drawings and in these specifications.
2. Provide control dampers, damper actuators and thermostats.
3. Furnish and install Operator Station for EF-6.
4. Furnish and install Refrigeration Monitor for control of EF-5.
5. HVAC Contractor is responsible to carry the cost for the interconnecting wiring and conduit materials and labor between the Lab Hood Exhaust Fan VFD, Hood Management System, and the MUA unit supply fan control as part of the bid spec. See paragraph 9 for additional detail.
6. Install:
  - i. Duct smoke detector for DHU-1 and 2.
  - ii. Packaged controllers for HP-1, DHU-1 and DHU-2.
  - iii. Packaged duct sensors, etc. for DHU-1 and DHU-2.
7. Submittals
  - i. The following shall be submitted for approval:
    - a. Data sheets for control system components.
8. Instruction and Adjustment
  - i. Upon Completion of the Work, the HVAC FSB shall:
    - a. Completely adjust and ready for use: thermostats, controllers, actuators and other components and equipment provided under this section.
    - b. Furnish operation and maintenance manuals covering function and operation of control systems on project for use by Owner's operating personnel. Competent technician shall be provided for instruction purposes.
    - c. Provide adequate instruction (not less than 2 hours) to the Owners personnel by means of a competent technician. Obtain written confirmation from the Owner that adequate instructions for each system has been provided in an acceptable manner.
9. **All wiring, wiring connections and rigid conduit shall be provided by DIVISION 16 - ELECTRICAL. Conduit and wiring for power connections will be provided under DIVISION 16 - ELECTRICAL.**
10. Provide components factory ordered for this project. Rebuilt equipment, warehoused equipment, or earlier generation equipment shall not be acceptable.

Electrical and electronic devices not located within control panels shall have a NEMA 250 Type 4X enclosure in accordance with NEMA 250 unless otherwise indicated on the Contract Drawings. Actuators and transmitters shall operate within temperature limit ranges of plus 35 to 150 degrees F. Panel mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10% to 95% relative humidity, non-condensing. Devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F.

11. Actuators. Actuators shall function as required within 80% to 110% of their power supply rating. Actuators shall fail to their spring return positions on signal or power failure and shall have visible position indicators. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale signal input change. Actuators shall be Universal Power Supply type that may be powered an electrical supply ranging from 24 to 240 VAC at 60 hz. Provide electric spring return actuators with NEMA 4X enclosures suitable for installation in corrosive environments.
  - i. Damper actuators shall be rated for at least 125% of the motive power necessary to operate the connected damper. The actuator stroke shall be limited by an adjustable stop in the direction of the return stroke. Actuators shall be provided with mounting and connecting hardware.

## 12. Thermostats

- i. Fan thermostats shall be electric cooling type, 1-stage. Contacts shall be double-pole single-throw (DPST), 20-amp, 120-volt, hermetically sealed, and wired to identified terminals. Thermostat covers shall consist of locking metal, and shall be capable of being locked by an Allen wrench or special tool. Thermostats shall have manual switches as required by the application and a minimum range of 45 to 90 degrees F.
- ii. Gas Fired Unit heater thermostats shall be electric 2-stage 4 wire connected to a terminal strip in the UH. Contacts shall be double-pole single-throw (DPST), 20-amp, 24-volt, hermetically sealed, and wired to identified terminals. Thermostat covers shall consist of locking metal, and shall be capable of being locked by an Allen wrench or special tool. Thermostats shall have a minimum range of 45 to 90 degrees F.
- iii. Electric Unit heater thermostats shall be electric 1-stage connected to a terminal strip in the UH. Contacts shall be double-pole single-throw (DPST), 20-amp, 24-volt, hermetically sealed, and wired to identified terminals. Thermostat covers shall consist of locking metal and shall be capable of being locked by an Allen wrench or special tool. Thermostats shall have manual switches as required by the application and a minimum range of 45 to 90 degrees F.
- iv. Electric Wall Heater thermostats; if not integral to the unit; shall be electric 1-stage connected to a junction box in the EBB. Contacts shall be single-pole single-throw.

## W. CONTROL SEQUENCES

1. Control sequences of operation shall be as indicated on the Contract Drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all items specified under this section according to the manufacturer's requirements, shop drawings, the details as shown on the Contract Drawings and/or as specified.
- B. Install all Work so that parts requiring inspection, replacements, maintenance and repair shall be readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but any substantial change shall not be made without prior written approval from the Engineer.
- C. Equipment bases mounted on concrete slabs and pads, or mounted on stands, gratings, platforms, or other, shall not be set in any manner, except on the finished and permanent support.
- D. Support of equipment on studs or other means, and the placing or building of the supporting slab, pad, pier, stand, grating, or other "to the equipment", is prohibited.
- E. Concrete supporting structures shall have been constructed and cured a minimum of 14 days before equipment is mounted.

### F. OPENINGS

1. The responsibility for determining the exact size and location of openings is part of the Work of this section. If this responsibility is not met, cutting and patching to achieve the correct size and location of openings and chases is part of the work of this section. **As part of this responsibility the HVAC FSB shall produce a layout plan for review and approval of the Architect and Engineer prior to cutting of openings.**

### G. CUTTING AND PATCHING

1. **Masonry FSB shall be responsible to handle interior openings, including cutting and patching.** Cutting and patching of masonry walls, partitions, ceilings and floors is included. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. Jackhammers are prohibited.

### H. CONNECTIONS TO EQUIPMENT

1. Connections shall be provided by the HVAC FSB unless otherwise indicated. Unless otherwise indicated, the size of the connections to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

### I. SUPPORTS

1. General

- i. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while supporting the load.

#### J. PIPE HANGERS AND SUPPORTS

1. Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:
  - i. Types 5, 12, and 26 shall not be used.
  - ii. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.
  - iii. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
  - iv. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.
  - v. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
  - vi. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.
  - vii. Vertical pipe shall be supported at intervals of not more than 15 feet, except that pipe shall be supported not more than 8 feet from end of risers, and at vent terminations.
  - viii. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

#### K. PIPE EXPANSION

1. The expansion of pipes shall be provided for by changes in the direction of the run of pipe.

#### L. REFRIGERATION SYSTEMS PIPING INSTALLATION

1. Refrigeration Piping and Accessories
  - i. Unless otherwise specified, pipe and fittings installation shall conform to requirements of ASME B31.5. Pipe shall be cut accurately to measurement established at the jobsite and worked into place without springing or forcing. Cutting or otherwise weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipes shall be cut square, shall have burrs removed by reaming, and shall be installed in a manner to permit free expansion and contraction without damage to joints or



hangers. Filings, dust, or dirt shall be wiped from interior of pipe before connections are made.

## 2. Directional Changes

- i. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide-sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, or other malformations will not be accepted.

## 3. Functional Requirements

- i. All piping shall be pitched down 1/2 inch per 10 feet of pipe toward the compressor to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt and other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the Contract Drawings.

## 4. Filter Dryer

- i. A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. The filter dryer shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed. The filter dryer shall be installed such that the filter dryer can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Filter dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

## 5. Sight Glass

- i. A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of all filter dryers.

# M. REFRIGERATION SYSTEMS TESTS

## 1. Field Tests

- i. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein.
- ii. Refrigerant Pipe Testing
  - a. Refrigerant Leakage Test: After all components of the refrigerant system have been installed and the piping connected, the system shall be subjected to a refrigerant leakage test. The refrigerant leakage test shall be done with dry nitrogen before any refrigerant pipe is insulated or covered. High and low side of the refrigerant system shall be tested for

the minimum refrigerant leakage test pressure specified in ASHRAE 15, for the refrigerant employed in the system. System shall be proved tight and free of leaks by allowing the refrigerant leakage test pressure to remain on the system for 24 hours with no drop in pressure. The initial test pressure and surrounding air temperature will be recorded. After the 24 hour hold period, the final system pressure and surrounding air temperature will be recorded. A correction of 0.3 psi shall be allowed for each degree C (F) change in the initial and final temperature of the surrounding air, plus for an increase and minus for a decrease. The system shall have passed the refrigerant leakage test if the corrected final system pressure is equal to the initial system test pressure. If the pressures are not equal, the leaks shall be located and repaired.

- b. Refrigerant Leaks: To repair leaks, the joint shall be taken apart, thoroughly cleaned, and remade as a new joint. Joints repaired by caulking or re-melting and adding more brazing material will not be acceptable. After leak repairs have been made, the refrigerant leakage test shall be conducted again.
- c. System Charging and Startup Test: Following satisfactory completion of the evacuation tests, the system shall be charged with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system shall operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. The entire system shall be tested for leaks. Fluorocarbon systems shall be tested with halide torch or electronic leak detectors.
- d. Evacuation Test: After the foregoing tests have been satisfactorily completed and the pressure relieved, entire system shall be evacuated to an absolute pressure of 300 microns. During evacuation of the system, the ambient temperature shall be higher than 35 degrees F. Vacuum line shall be closed, and the system shall stand for 1 hour. After this period, the absolute pressure shall not exceed 500 microns. If the pressure rises over 500 microns, the system shall continue to be evacuated until the system reaches 300 microns and can stand for 1 hour with the vacuum line closed without the absolute pressure rising over 500 microns. During evacuation, pressures shall be recorded by a thermocouple type, electronic type, or a calibrated-micron type gauge.

### iii. System Performance Tests

- a. After the foregoing tests have been completed and before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's startup representative experienced in system startup and testing, at such times as directed. Tests shall cover a period of not less than 5 days for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified.

## N. DUCTWORK

1. Installation shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated shall not be used. Supports shall be attached only to structural framing members. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.
2. Dust Control
  - i. To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's Work. Temporary protection shall remain in place until system is ready for startup.

## O. POWER TRANSMISSION COMPONENTS ADJUSTMENT

1. V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

## P. TAGS

1. Upon completion of work, attach engraved laminated tags to all valves (listed in the valve directory called for in the "Bulletins, Manuals and Instructions" paragraph of these specifications) and all pieces of HVAC equipment (including but not limited to pumps, fans, air handlers, coils and all other equipment listed in the HVAC schedules). Valve tags shall have black characters on white face, consecutively numbered and prefixed by letter "V". Equipment tags shall have black characters on white face, with labels corresponding to drawing schedule numbers.
2. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8" thick.
3. Valve tags shall be at least 1" in diameter with numerals at least 3/8" high and attached by "S" hooks or chains. Equipment tags shall be at least 2" diameter securely attached to apparatus.

4. Provide manufacturers equipment nameplates, catalog numbers and rating identification securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

**Q. PIPE AND DUCT IDENTIFICATION**

1. Ductwork shall be stenciled at each junction or branch takeoff, at least once in each room, and at intervals not longer than 20 ft. Stencil shall clearly identify duct service (S for supply, R for return, X for exhaust), area served by branch, and arrow indicating direction of flow.
2. Provide color-coded pipe identification markers on piping installed under this Section. Pipe markers shall be snap-on laminated plastic protected by clear acrylic coating. Pipe markers shall be applied after architectural painting where such is required.
3. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.
4. Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room, and at intervals no longer than 20 ft.
5. Size of legend letters on markers and length of color field shall be per the latest edition of ANSI A13.1.
6. Markers shall be "Setmark" by Seton Name Plate Corp. or approved equal.
7. Following color coding shall be used with names in black letters on yellow background and white letters on green background:

Service	Legend	Background Color
Refrigerant	Refrigerant	Yellow
Condensate	Condensate	Yellow

8. Color banding shall meet latest edition of ANSI A13.1 and OSHA.

**R. AIR SYSTEMS BALANCING**

1. Balancing shall be performed in compliance with the standards listed in paragraph 1.8.E.8. The building shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with registers, ducting, diffusers, returns, and control components in place. Fans shall be operational. Air motion and distribution from air terminals shall be as shown. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, promptly notify the Engineer in writing.

## 2. Air Systems

- i. Each system shall be adjusted until all flow quantities are within plus 10% and minus 0%. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Fans shall be checked for correct direction of rotation and proper speed shall be verified.

## 3. General Balancing Methods

- i. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Flows shall be checked at all supply and exhaust outlets. All flows shall be recorded before and after each adjustment.  
**NOTE: Lab Exhaust Hood to be balanced to between 1260 to 1200 cfm at full airflow. Makeup Air Unit to be balanced to approximately 90% of Lab Exhaust Hood airflow or 1100 to 1045 cfm at MUA Unit design airflow.**

## 4. Control Systems

- i. Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.
- ii. Adjustment of the temperature controls shall be coordinated by the person in charge of the balancing and adjusting and shall be performed coincidental therewith. Simulate a complete cycle of operation for each system.

## S. BASES AND SUPPORTS

1. As part of paragraph 1.25 SUPPLEMENTARY STEEL, provide all bases and supports not part of the building structure, of required size, type, and strength, as approved by the Engineer, for all equipment and materials furnished by him. All equipment, bases and supports shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.
2. All concrete foundations and all concrete supports will be provided by the General Contractor. Furnish shop drawings and templates for all concrete foundations and supports for setting all required hanger and foundation bolts and other appurtenances necessary for the proper installation of his equipment.
3. NOTE: The Dehumidifier and the Air Cooled Condenser must have no more than a 10 foot vertical lift from the Condenser to the Dehumidifier. Furnish sufficient steel dunnage to raise the Condenser and the support stand above the concrete support pad to comply with the 10 foot limitation. Anchor support steel and stand securely to withstand wind and seismic forces.

## T. SUPPLEMENTAL STEEL FABRICATION AND INSTALLATION

1. All Work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets, and framework shall be properly sized and firmly constructed.
2. Measurements shall be taken on the job and worked out to suit adjoining and connecting Work. All Work shall be by experienced metal working mechanics. Members shall be straight and true and accurately fitted. Scale, rust, and burrs shall be removed. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other trades as directed by them.
3. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical.
4. All shop fabricated iron and steel work shall be cleaned and dried and given a shop coat of paint on all surfaces and in all openings and crevices. Field fabricated iron and steel work shall be given prime and finish coats of paint after installation.

#### U. PLACING IN SERVICE

1. At the completion of performance tests and following approval of test result, recheck all equipment to see that each item is adequately lubricated and functioning correctly.

#### V. CLEANING AND ADJUSTING

1. During the progress of the Work, clean up and remove all oil, grease, and other debris caused by the Work performed under this section.
2. At the conclusion of the Project, clean and repair all areas and finishes as installed or affected by this installation of Work under this section.
3. Equipment
  - i. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension.

#### W. INSULATION

1. Application - General
  - i. Installation
    - a. Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall

not be applied until tests specified in other sections of the Specifications are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer insulation.

- ii. Pipe insulation shall be as follows:
    - a. Do not insulate the following:
      - 1) Unions
      - 2) Flexible connectors
    - iii. Pipe insulation shall be continuous and installed on fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used.
2. Insulation (Except Flexible Cellular and Calcium Silicate Insulation):
- i. Place sections of insulation around pipe and joints tightly butted into place. Draw jacket tight and smooth. Secure jacket with fire resistant adhesive, factory-applied self-sealing lap, or stainless-steel outward clinching staples spaced not over 4 inches on center and 1/2 inch minimum from edge of lap. Cover circumferential joints with butt strips, not less than 3 inches wide, of material identical to jacket material. Overlap longitudinal laps of jacket material not less than 1 1/2 inches. Adhesive used to secure butt strip shall be same as that used to secure jacket laps. Apply staples to both edges of butt strips.
  - ii. Vapor Barrier Jacket: When a vapor barrier jacket is required, as indicated in Table 1, on ends of sections of insulation that butt against flanges, unions, valves, fittings, and joints, provide a vapor barrier coating or manufacturer's weatherproof coating for outside service unless pipe is supplied with factory-applied self-seal lap. Apply vapor barrier coating at longitudinal and circumferential laps. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as specified for butt strips. Extend patch not less than 1 1/2 inches past the break in both directions. At penetrations by pressure gages, thermometers, etc. fill voids with vapor barrier coating for outside service. Seal with a brush coat of the same coating.
  - iii. Metal Covers: Provide metal covers on insulated piping that is within 6 feet of the finished floor. Secure covers with ss banding.

### 3. Flexible Cellular Insulation

- i. Flexible cellular pipe insulation shall be tubular form. Sweat fittings shall be insulated with miter cut pieces the same size as on adjacent piping.
- ii. Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of finish as recommended by insulation manufacturer to flexible unicellular insulation in outside locations. Do not use vinyl lacquer finish or equivalent. Provide flexible cellular insulation for outdoor use with ultraviolet (UV) resistant coating.

### 4. Cellular Glass and Calcium Silicate Insulation

- i. Provide in accordance with manufacturer's printed instructions.

### 5. Hangers and Anchors

- i. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69 whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed. Where pipe is supported by insulation, provide galvanized steel shields or protection saddles.
- ii. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Insulation inserts shall be of calcium silicate, cellular glass, molded glass fiber, all minimum 8 pounds per cubic foot, or other approved material of the same thickness as adjacent insulation. Insulation inserts shall cover bottom half of pipe circumference and be not less in length than the protection shield. Vapor-barrier facing of insert shall be of same material as facing on adjacent insulation. Seal inserts into insulation with vapor barrier coating or weatherproof coating as applicable.
- iii. Where protection saddles are used, fill voids with same insulation material as used on adjacent pipe. Protection saddles shall not be used on piping carrying medium less than 60 degrees F.
- iv. Where anchors are secured to piping carrying medium less than 60 degrees F that is to be insulated, insulate anchors same as piping for a distance not less than four times the insulation thickness to prevent condensation. Vapor seal insulation around anchors.
- v. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

### 6. Sleeves and Wall Chases



- i. Where interior wall is penetrated, extend aluminum jacket 2 inches out on either side of wall and secure on each end with a band. Where floor is penetrated, extend a aluminum jacket from a point below back-up material to a point 10 inches above floor with one band at the floor and one not more than one inch from end of metal jacket. Where exterior wall is penetrated, extend aluminum jacket through sleeve to a point 2 inches beyond interior surface of wall.
- ii. Pipe insulation shall be continuous through the sleeves.
- iii. An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.

#### 7. Flanges, Unions, Valves and Fittings for Piping

- i. Factory fabricated removable and reusable insulation covers may be used except with flexible cellular insulation. When nesting size insulation is used, overlap 2 inches or one pipe diameter, whichever is larger. Use insulating cement to fill voids. On pipe sizes larger than 2-1/2 inches, elbow insulated using segments shall not have less than three segments per elbow. Place and join segments with manufacturer's recommended water-vapor resistant, fire retardant adhesive appropriate for the temperature limit of the service. Overlap tape seams one inch. Total dry film thickness shall be not less than 1/16 inch. Unions are not to be insulated; taper insulation to union at a 45 degree angle. Provide finish coating as follows:
  - a. Coating with Embedded Glass Tape: Coat insulation and all purpose jacket with two coats of lagging adhesive and with glass tape embedded between coats. Total dry film thickness shall not be less than 1/16 inch. For cold piping, seal insulation and jacket with two coats of vapor barrier coating with glass tape embedded between coats. Insulate anchors attached directly to cold pipe for a sufficient distance to prevent condensation but not less than 6 inches from insulation surface.
  - b. PVC Fitting Covers: Factory premolded one-piece PVC fitting covers may be provided in lieu of two coats of adhesive with tape embedded between coats. Provide factory premolded field-fabricated segment or blanket insert insulation under fitting covers. Install factory premolded one-piece PVC fitting covers over insulation. Secure covers with stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks made for securing PVC fitting covers. Do not provide PVC fitting covers where exposed to weather. Provide PVC fitting covers only in ambient temperatures below 150 degrees F.

## 8. Duct and Plenum Insulation Installation

- i. Insulate plena and ductwork between the motorized damper and the exterior louver.
- ii. Insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- iii. For ducts and plena, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18-inch centers and not more than 18 inches from duct corners.
- iv. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hanger. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.
- v. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 4-inch centers. Staples and seams shall be coated with a brush coat of vapor barrier coating.
- vi. Breaks in the jacket material shall be covered with patches of the same material as the vapor barrier. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor barrier coating.
- vii. At jacket penetrations such as hangers and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor barrier coating.
- viii. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- ix. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

## 9. Duct Test Holes

- i. After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

## 3.2 STARTUP AND TRAINING

### A. OPERATING AND MAINTENANCE INSTRUCTIONS

1. All operating equipment installed under this section shall be placed in operation and shall function continuously in an operating test for a period of one week without shutdown due to mechanical failure or necessity of adjustment. Prior to

scheduling the Project Final Inspection and after completion of all installation and running adjustments, perform all work required to place the equipment in complete operating condition to meet all requirements under the Specifications.

2. During this running test period, deliver operating, service and replacement data for all equipment as per section 01730.

#### B. TRAINING

1. Conduct a training course for the maintenance and operating staff. The training period of 2 hours normal working time shall start after the system is functionally complete but before the final acceptance tests. The training shall include all of the items contained in the operating and maintenance instructions as well as demonstrations of routine maintenance operations. The Engineer shall be given at least 2 weeks advance notice of such training.
2. During all working hours of the one-week operating test, instruction personnel shall be available for and provide thorough and detailed training to the Owner's operating and maintenance personnel in operation, maintenance and adjustment of all equipment installed.
2. Give sufficient notice to the designated operating personnel of the owner in advance of this period. Upon completion of instruction, obtain from such representatives written verification on that which the above-mentioned instruction has been performed, such verification to be forwarded to the Engineer.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout.
- B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730 - Operation and Maintenance Data.
- C. Record drawings shall be provided by the HVAC FSB as specified in Section 00700 - General Conditions of the Contract and Section 01170 - Special Provisions.
- D. Provide warranty and guarantee on all equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

END OF SECTION 15500

SECTION 15900  
LABORATORY FUME HOODS  
(Part of Filed Sub-Bid Section 15002 – HEATING, VENTILATING AND AIR CONDITIONING –  
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. 15500 – HEATING VENTILATING AND AIR CONDITIONING

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements
2. Division 1 – General Requirements

- C. Work included:

1. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide a complete and operable system in accordance with this section of these specifications, the drawings and the standards of the applicable codes listed therein.
2. The HVAC FSB shall be responsible for the following:
  - i. Fume Hood
  - ii. Fume Hood Controls including Hood Management System.
  - iii. Storage Cabinet PVC Vent into Fume Hood
  - iv. Coordination with Lab Hood exhaust ductwork and accessories included in specification section 15500.
  - v. Coordination with 12350 LABORATORY CASEWORK for support of Fume Hood.
  - vi. Coordination for wiring at Fume Hood for Blower, Lighting and controls.
  - vii. Manufacturer technicians for startup and training of the Lab Fume Hood Exhaust Fan, Hood Management System, and Exhaust Fan.
  - viii. The Work shall include the furnishing, set-up and maintenance of all hoisting machinery, staging, planking, ladders, etc. as required for the Work.
3. Secure all permits, inspection, and approvals and pay all costs and fees.

4. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.
5. Coordinate safety program with that of the General Contractor. Cooperate with other trades to establish lines, levels, openings, chases, clearances, and locations to avoid interference, and to protect the Work.

D. Work not included:

1. SECTION 16120, WIRE AND CABLES - Power wiring and wiring for sensors and controllers; including hood control wiring for vfds, sensors, switches and controller.

### 1.3 SUBMITTALS

- A. Shop drawings, brochures and samples, as listed, shall be submitted for all items to be furnished in accordance with the provisions of SECTION 00700, GENERAL CONDITIONS and Section 01300 SUBMITTALS.
- B. Provide submittals for the following items consisting of manufacturer's published data. All submittals shall show compliance with the referenced specification.
  1. Fume Hood
  2. Fume Hood Controls

### 1.4 COORDINATION DRAWINGS

- A. The HVAC FSB shall prepare a complete set of AutoCad format floor plans and sections background drawings at a scale not less than 3/8" equals 1' 0", showing structure and other information as needed for coordination. These will be the Coordination Drawings.
- B. Each of the below specialty trades shall add its work to these background drawings in different colors and layers with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
  1. HVAC Systems and all sheet metal work.
  2. Plumbing Systems.
  3. Sprinkler System.
  4. Electrical System including light locations.
- C. Where conflicts occur with placement of materials of various trades, the HVAC FSB will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade.

- D. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- E. The HVAC FSB shall make AutoCad electronic file of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect/Engineer and have been reviewed.
- F. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- G. The HVAC FSB shall provide the following distribution of documents:
  - 1. Electronic file of the Coordination Drawings to each specialty trade and affected Subcontractor for their use.
  - 2. Electronic file of the Coordination Drawings to the Engineer.
  - 3. Electronic file of the coordination drawings to General Contractor.
- H. Coordination Drawings include but are not necessarily limited to:
  - 1. Structure.
  - 2. Partition/room layout.
  - 3. Ceiling tile and grid.
  - 4. Light fixtures.
  - 5. Access panels.
  - 6. Sheet metal, grilles, diffusers, etc
  - 7. Domestic water, gas, soil, waste and vent piping and associated valves.
  - 8. Electrical conduit runs above 2” and electrical equipment.
  - 9. Sprinkler piping, heads and mounting brackets.

## 1.5 QUALITY ASSURANCE

- A. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.
- B. All material shall be new and shall bear the manufacturer's full identification.
- D. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all Work shall comply with the requirements of the rules, regulations, standards, codes, ordinances and laws of local, state and federal governments, and other authorities that have legal jurisdiction over the Project. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:
  - i. Local and state building, plumbing, mechanical, electrical, fire and health department codes.
  - ii. ASHRAE Standard 110.1995 - Method of Testing Performance of Laboratory Fume Hoods
  - iii. National Fire Protection Association (NFPA).
  - iv. Occupational Safety and Health Act (OSHA).
  - v. Underwriter's Laboratories (UL).
  - vi. Material and equipment shall be listed by Underwriter's Laboratories (UL).
2. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.
3. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:
  - i. American National Standards Institute (ANSI).
  - ii. National Electric Manufacturers Association (NEMA).
  - iii. American Society for Testing and Materials (ASTM).
  - iv. Institute of Electrical and Electronics Engineers (IEEE).

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.
- B. Inspect all delivered equipment and materials, upon receipt at the Project Site, for damage and correctness.
- C. Store all materials and equipment on site in a location approved by the Engineer. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.
- D. Protect all Work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.
- E. Deliver products to the Project Site and store and protect same as recommended by the manufacturer.

## 1.7 COORDINATION

- A. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.
- B. **The Fume Hood is supported by floor mounted Storage Cabinets. The dimensions of the Fume Hood and Storage Cabinets must be coordinated to allow space behind the Storage Cabinets for cabinet vents as well as allowing space for electrical wiring for the lighting and remote Hood Exhaust Fan switches and controls. The Architect and the Engineer shall review the Fume Hood submittal and the Storage Cabinet submittals together for proper coordination before either the Fume Hood or the Storage Cabinet submittals are accepted.**

## 1.8 DISCREPANCIES IN DOCUMENTS

- A. Where Contract Drawings or Specifications conflict or are unclear, advise the Engineer in writing before Award of Contract. Otherwise, the Engineer interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or incongruities thus resolved.
- B. Where Contract Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert the Engineer in writing before installation. Otherwise, make changes in installed Work as the Engineer requires at no additional cost to the Owner.
- C. If the required material, installation or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the HVAC FSB shall provide that material, installation, or Work which is of the higher standard.
- D. Provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the Contract Documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the HVAC FSB has failed to notify the Engineer of the situation in accordance with the Specifications, the HVAC FSB shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the Contract Documents, where the HVAC FSB needs engineering guidance, submit a sketch identifying the proposed solution to the Engineer for approval.

## 1.9 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other Work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Drawings for exact locations and where not definitely indicated, request information from the Engineer.
- D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate as specified herein. Systems shall be run in a rectilinear fashion.



- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

#### 1.10 WARRANTIES

- A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the HVAC FSB may have by law or by provisions of the Contract Documents.
- B. All materials, equipment and Work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of one year commencing with the Date of Substantial Completion. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.
- C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.
- D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

#### 1.11 PROTECTION OF WORK AND PROPERTY

- A. Care and protect all Work included under this section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.
- C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by Work or workmen under this section and make good damage thus caused.

#### 1.12 SPARE PARTS

- A. Furnish spare parts data for each different item of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the HVAC FSB of any responsibilities under the guarantees specified herein.

#### 1.13 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all plumbing equipment, piping, etc., required by the Specifications.
- B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.
- C. The type and size of the supporting channels and supplementary steel shall be determined by the HVAC FSB and shall be of sufficient strength and size to allow only

a minimum deflection in conformance with the manufacturer's requirements for loading.

## PART 2 - PRODUCTS

### 2.1 GENERAL

#### A. FUME HOOD

1. Basis of Design is Kewaunee Scientific Corporation. Fume Hoods by CiF Lab Solutions, Diversified Casework, and Mott Manufacturing may be submitted for review as alternates. Acceptance of the alternates is contingent upon approval by the Engineer.
2. Specific Basis of Design Model is Kewaunee Model H05 Supreme Air Fume Hood with Restricted By-Pass.
3. Fume Hood shall be furnished pre-assembled and palletized.
4. Fume Hood dimensions are 48" wide by 36 " deep by 54" high. Hood is designed to fit atop 35 ¾" high cabinets for a total height of 89 ¾".
5. Superstructure frame shall be free standing steel angle to support exterior panels, interior liner and baffle panels. Exterior and interior panels shall be removeable without disassembly of the frame structure and outer steel panels to allow for maintenance. Side panels shall be removeable on both sides. Color: Glacier White.
6. Exterior superstructure shall be 18 gauge cold rolled steel, phosphate coated with a baked chemical resistant synthetic resin finish. Color: Glacier White. Provide 18 gauge cold rolled steel corner posts with access covers on the right and left sides.
7. Interior superstructure shall be galvanized steel.
8. Left/Right facia shall be powder coated steel.
9. Liner material shall be white modified epoxy resin sheet reinforced with glass fibers.
10. Work surface shall be black epoxy resin.
11. Provide integral airfoil at bottom of fume hood to provide airflow through coil when sash is closed.
12. Furnish hood with single point adjustable baffles that are operable by a selector knob near the front of the hood. Baffle material shall be molded Fiberglas Reinforced Polyester Resin.
13. Duct collar shall be 12" diameter stainless steel mounted on top of the cabinet.

14. Sash shall be vertical travel 28" high opening with tempered safety glass and counterweighted, balanced pulley system.
15. HOOD SHALL NOT BE FURNISHED WITH PLUMBING FIXTURES.
16. Furnish hood with factory wired T-5 single tube fluorescent light fixture with bulb. Light switch shall be mounted on front panel. Provide junction box for connection.
17. Furnish hood with two factory wired 120VAC 20 amp duplex GFCI receptacles. Receptacles shall be mounted on the front; one on each side. Provide junction box for connection.
18. Furnish hood with factory wired lab hood exhaust fan manual switch mounted on front panel. Voltage and amperage shall match the scheduled electrical characteristics on bid drawing H-10. Provide junction box for connection.
19. Furnish hood configured, arranged and ready to receive a field furnished and field mounted Hood Management System.
20. HVAC contractor shall furnish and field install a Hood Management System equal to Johnson Controls/Triatek Hood Management System HMS-1655-1-S. System shall include a Sash Position Sensor, Sidewall Face Velocity Sensor; and Controller with display pad, display alarms, and microprocessor controls to receive the sensor inputs and send a signal to the Fume Hood Exhaust Fan VFD. The microprocessor analog inputs and outputs shall be universal type suitable for 0 to 10 VDC and 4 to 20 mA signals. **Hood Management System Controller and Sensors shall be furnished and installed in the field by the HVAC FSB. Controller and Sensors shall be field wired by Electrical FSB.**

## 2.2 COORDINATION WITH CASEWORK

### A. STORAGE CABINET VENT

1. For Storage Cabinets containing acids, furnish and install 1-1/2" PVC vent. Vent shall commence inside the Storage Cabinet, run out the back of the cabinet, and connect to a 90-degree ell. A 1-1/2" vent stack pipe shall rise into the back of the Fume Hood behind the back panel and terminate with an open end about 7 inches above the Fume Hood working surface.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The Fume Hood and Storage Cabinets which support the Fume Hood shall be coordinated as described in section 1.6 COORDINATION.
- B. The responsibility for determining the exact size and location of openings is part of the Work of this section. If this responsibility is not met, cutting and patching to achieve the correct size and location of openings and chases is part of the Work of this section.
- C. Do all cutting and patching required for the Work of the section, except cutting and patching of finish (visible) materials. Cutting and patching of masonry walls,

partitions, ceilings and floors is included. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. The use of jackhammers is prohibited.

- D. Equipment shall be installed in strict accordance with manufacturer's instructions, unless otherwise specified herein, or on the Contract Drawings. In case of discrepancies, contact the Engineer for instructions.

### 3.2 CLEANING TESTING AND PAINTING

#### A. CLEANING

1. Clean all debris resulting from the work of the section, and remove it from the Project Site, daily.
2. Cover duct collar during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all Work, thoroughly clean all fixtures, exposed materials and equipment.

#### B. TESTS

1. ASHRAE Standard 110-1995 Test:
  - i. Hood shall be tested with a face velocity of 100 FPM full open vertically and at 100 FPM right, left and center open horizontally.
  - ii. After test is complete, set sash stops at 1/3 open position for proper operation of MAU. Adjust as necessary.

#### C. PAINTING

1. Clean all surfaces free of dirt, oil, grease, etc. Surfaces shall be clean and dry before any paint is applied.
2. Restore to original condition and appearance any equipment which has sustained damage to the manufacturer's prime and/or finish coat.

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – CONTRACT CLOSEOUT.
- B. OPERATION AND MAINTENANCE MANUALS - Prepare manuals in accordance with Section 01730.
- C. Instruct Owner's operating personnel, during consecutive working days, in the operation and maintenance of the systems and equipment, to the written satisfaction of the Owner.
- D. Record drawings shall be provided by the HVAC FSB as specified in SECTION 00700, GENERAL CONDITIONS and SECTION 01170, SPECIAL PROVISIONS.

END OF SECTION 15900

DIVISION 16 – ELECTRICAL

16001	.....	Electrical (Filed Sub-Bid Required)
16050	.....	Electrical General Conditions (Electrical Work Filed Sub-Bid Required)
16060	.....	Grounding Systems (Electrical Work Filed Sub-Bid Required)
16080	.....	Underground Systems (Electrical Work Filed Sub-Bid Required)
16085	.....	Miscellaneous Equipment (Electrical Work Filed Sub-Bid Required)
16120	.....	Wire and Cables (Electrical Work Filed Sub-Bid Required)
16130	.....	Raceways and Fittings (Electrical Work Filed Sub-Bid Required)
16442	.....	Panelboards (Electrical Work Filed Sub-Bid Required)
16443	.....	Motor Control Centers (Electrical Work Filed Sub-Bid Required)
16495	.....	Variable Frequency Drives (Electrical Work Filed Sub-Bid Required)
16500	.....	Lighting System (Electrical Work Filed Sub-Bid Required)
16601	.....	Lightning Protection System (Electrical Work Filed Sub-Bid Required)
16612	.....	Engine Generator (Electrical Work Filed Sub-Bid Required)
16650	.....	Photovoltaic Power System (Electrical Work Filed Sub-Bid Required)
16720	.....	Security Alarm System (Electrical Work Filed Sub-Bid Required)
16721	.....	Fire Alarm System (Electrical Work Filed Sub-Bid Required)
16722	.....	Manual Alarm System (Electrical Work Filed Sub-Bid Required)
16740	.....	Communication System (Electrical Work Filed Sub-Bid Required)

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SECTION 16001

ELECTRICAL  
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
  - 1. Sub-Bids for work under this Section shall be for the complete work and shall be filed electronically on ProjectDog as stipulated in the Invitation to Bid.

The following shall be included in the electronic file name of the Sub-Bid:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

PROJECT: (Insert project name and number)

SUB-BID FOR SECTION: 16001 – ELECTRICAL

- 2. Each Sub-Bid submitted for work under this Section shall be on forms furnished as required by Section 44F of Chapter 149 or the Massachusetts General Law, as amended.
- 3. Sub-Bidders shall submit a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent (5%) of the Bid. Bid Securities shall be submitted in accordance with the Instructions to Bidders.
- C. Sub-Sub-Bid Requirements: None required under this Section.
- D. Reference Drawings: Work of this Filed Sub-Bid is shown in part or in full on the following Contract Drawings: G-1, G-2, C-6, C-7, A-5, A-6, E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, E-9, E-10, E-11, E-12, E-13, E-14, E-15, E-16, E-17, E-18, E-19, E-20, E-21, E-22, E-23, E-24, E-25, E-26, E-27, E-28, E-29, E-30, E-31, E-32, I-1, I-4, and I-5.
- E. Work Included: Provide labor, materials and equipment to complete the work this Section, including but not limited to the following:

1. All work of: Section 16001 – Electrical, Section 16050 – Electrical General Conditions, Section 16060 – Grounding Systems, Section 16080 – Underground Systems, Section 16085 – Miscellaneous Equipment, Section 16120 – Wire and Cables, Section 16130 – Raceways and Fittings, Section 16442 – Panelboards, Section 16443 – Motor Control Centers, Section 16495 – Variable Frequency Drives, Section 16500 – Lighting System, Section 16601 – Lightning Protection System, Section 16612 – Engine Generator, Section 16720 – Security Alarm System, Section 16721 – Fire Alarm System, Section 16722 – Manual Alarm System, and Section 16740 – Communications System
- F. Related Sections: The Sub-Bidder is directed to the following Specification Sections for determination and description of the full character and extent of the work to be included in this filed sub-bid:
1. Division 1 – General Requirements
  2. Division 11 – Equipment
  3. Division 13 – Special Construction
  4. Division 15 – Mechanical
- G. Alternates: Not Applicable.

END OF SECTION 16001



## SECTION 16050

### ELECTRICAL GENERAL CONDITIONS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the following:

1. Section 16060 – Grounding Systems
2. Section 16080 – Underground Systems
3. Section 16085 – Miscellaneous Equipment
4. Section 16120 – Wire And Cables
5. Section 16130 – Raceways And Fittings
6. Section 16442 – Panelboards
7. Section 16443 – Motor Control Centers
8. Section 16495 – Variable Frequency Drives
9. Section 16500 – Lighting System
10. Section 16601 – Lightning Protection Systems
11. Section 16612 – Engine Generator System
12. Section 16650 – Photovoltaic Power System
13. Section 16720 – Security Alarm System
14. Section 16721 – Fire Alarm System
15. Section 16722 – Manual Alarm System
16. Section 16740 – Communications System

- B. Related Sections include the following:

1. Division 0 – Bidding and Contract Requirements

## 2. Division 1 – General Requirements

### C. Work included:

1. All labor, materials, tools, equipment, and accessory items and performing all operations necessary to furnish and install the complete electrical work in accordance with this section of these specifications, the Drawings and the standards of the applicable codes listed herein.
2. Furnishing and installation of equipment and items listed below and installation only of items furnished under other sections of these specifications.
  - i. Complete electrical service as hereinafter specified.
  - ii. Conduit, wire and electrical connections are required on certain items specified in sections of these specifications other than the electrical section. The Electrical FSB shall examine all sections of these specifications to determine the complete scope of the electrical work.
  - iii. Raceways and fittings
  - iv. Wires and cables
  - v. Miscellaneous equipment
  - vi. Panelboards
  - vii. Motor control centers
  - viii. Variable frequency drives
  - ix. Grounding systems
  - x. Underground systems
  - xi. Lighting systems
  - xii. Lightning Protection Systems
  - xiii. Communications system
  - xiv. Engine generator system
  - xv. Automatic transfer switch
  - xvi. Photovoltaic Power System
  - xvii. Security alarm system
  - xviii. Fire alarm system
  - xix. Manual alarm system
  - xx. Electrical demolition
3. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.
4. Mount and wire process instruments and equipment furnished under other Divisions of these Specifications. Furnish and install all conduit, wire and interconnections between process instrumentation primary elements, transmitters, local indicators and receivers. Mount and wire all lightning and surge protection equipment at process instrumentation transmitters and receivers.
5. Mount and make field connections to “packaged” equipment furnished under other Divisions of these Specifications.

6. Provide conduit and power/control wiring for all Process Mechanical, Instrumentation/Controls, HVAC (Heating, Ventilation and Air Conditioning), Plumbing, and Fire Protection equipment furnished under other Divisions of these Specifications.
7. Install and wire all thermostats, controllers and other devices furnished under other Divisions of these specifications which directly control HVAC equipment.
8. Review all submittals for equipment, devices, instrumentation, control panels, and ect. furnished under other Divisions to determine the point to point termination points for all wiring.

D. Work not included:

1. Excavation and backfilling, including gravel, common backfill or sand bedding for underground electrical work is included under Division 2 - Site Work of these Specifications.
2. Concrete work, including concrete electrical duct encasement, mounting pads, and housekeeping pads, is included under Division 3 - Concrete of these Specifications.

### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the Section 00700 - General Conditions.
- B. Submittals required under this section include, but are not limited to the following:
  1. Panelboards
  2. Motor control centers
  3. Variable frequency drives
  4. Lighting fixtures
  5. Disconnect switches
  6. Control stations
  7. Security alarm system
  8. Fire alarm system
  9. Manual alarm system
  10. Miscellaneous equipment
  11. Generators

12. Automatic Transfer Switches
  13. Lightning Protection Systems
  14. Photovoltaic Power System
  15. Electric Vehicle Chargers
  16. Transformers
  17. Terminal cabinets
  18. Wire
  19. Conduit
  20. Receptacles
  21. Boxes and fittings
  22. Grounding Systems
  23. Underground Systems
- C. Submit all other data as specified herein.
- D. “As-built” copies of all shop Drawings shall be submitted to the Engineer before final inspection and acceptance.
- E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section 16050 - Electrical General Conditions.
- F. No material shall be ordered or shop work started until the Engineer's approval of shop Drawings has been given.
- G. Prior to submitting shop Drawings for lighting fixtures, verify the type of ceiling suspension systems being installed. Notify Engineer of any discrepancies between fixture type specified and suspension system. Additional cost rising from failure to notify the Engineer will be the responsibility of the Electrical FSB.

#### 1.4 QUALITY ASSURANCE

- A. Requirements of the Regulatory Agencies
1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. The Electrical FSB shall arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all work shall comply with the requirements of the National

Electrical Code, all state codes and the codes and ordinances of the city or town in which the work is to be done.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed wherever standards have been established by that agency. Written approval by the Engineer and local inspecting authority is required wherever UL Listed approval is not available.

C. Manufacturer of Principal Equipment

1. All lighting and power panelboards shall be made by one manufacturer.
2. All motor controls furnished under this Section shall be made by one manufacturer.
3. All conduit of a given type shall be made by one manufacturer.
4. All wire and cables of a given type shall be made by one manufacturer.

D. Tests and Settings

1. Test all systems furnished under Division 16 - Electrical and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the system.
2. Make all circuit breaker and motor circuit protector settings.
3. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. A certified test report shall be submitted stating that the equipment meets and operates in accordance with manufacturer's and job specifications, and that equipment and installation conforms to all applicable standards and specifications.
  - i. Testing of protective relays, static devices, circuit breakers and motor circuit protectors for calibration and proper operation and settings.
  - ii. Over potential, high potential, insulation resistance and shield continuity tests for cables.
  - iii. Mechanical inspection of air interrupter switches and circuit breakers.
4. Provide labor and electrical test equipment to assist the General Contractor, HVAC, Fire Protection and Plumbing contractors with systems testing and commissioning.
5. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.
6. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Electrical FSB shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.
- B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for the proper storage of equipment. Proper storage in this context shall include the provision of heaters and dehumidifiers to keep the equipment dry at all times. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the Owner. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.

## 1.6 COORDINATION

- A. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- B. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work, and also furnish information and shop Drawings necessary to permit trades affected by the work to install same properly and without delay.
- C. In all spaces, prior to installation of visible material and equipment, including access panels, review all Contract Drawings for exact locations and where not definitely indicated, request information. Where the electrical work shall interfere with the work of other trades, assist in working out the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owners, make reasonable modifications to the work as required by normal structural interferences. Maintain maximum headroom at all locations. All conduit, and associated components to be as tight to underside of structure as possible.
- D. If any electrical work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the electrical trades involved without extra cost to the owners.
- E. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution for review and approval.
- F. Protect all materials and work of other trades from damage which may be caused by the electrical work, and repair all damages without extra cost to the owner.

## 1.7 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions etc. Locate all necessary slots for electrical work and form before concrete is poured.

## 1.8 CUTTING AND PATCHING

- A. All openings required by the work of these Sections shall be planned for in advance and coordinated with the Masonry FSB when penetration masonry walls. Any cutting and patching required by the lack of such planning shall be done by the General Contractor at the expense of this Electrical FSB. It will be the responsibility of this Electrical FSB to keep the General Contractor informed of all required openings.

## 1.9 SIZE OF EQUIPMENT

- A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the structure.
- B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably to ensure that the tilting does not impair the functional integrity of the equipment.

## 1.10 SUPPLEMENTARY SUPPORTING STEEL

- A. Provide all supplementary steelwork required for mounting or supporting equipment and materials.
- B. Steelwork shall be firmly connected to building construction as required.
- C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.
- D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction; all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized steel for NEMA 1 and NEMA 12 Areas and stainless steel for NEMA 4 and NEMA 4X areas.

## 1.11 DESIGN CRITERIA

- A. Service Characteristics
  - 1. Primary Utility Voltage: 13.8KV
  - 2. Secondary Building Voltage - High Level: 480/277 V
  - 3. Secondary Building Voltage - Low Level: 120/208V
  - 4. All equipment and wiring shall be suitable for the applied voltage.
- B. Service and Metering

1. The power company serving this project is Eversource
2. A new service will be obtained at 480/277Volts, 3-phase, 4-wire from an existing utility pole and new pad mounted transformer provided by the utility company.
3. Furnish and install the primary service conduit.
4. General Contractor to furnish and install the pre-cast transformer mounting pad and oil containment curb.
5. Furnish and install the secondary service conduit, wire and connectors
6. Eversource will provide the meter. The Electrical FSB shall provide the meter socket and install all the metering equipment in accordance to the utility company requirements.
7. All Work and material for the electrical service shall be in accordance with the requirements of Eversource.
8. Make all arrangements and file work orders with Eversource for obtaining the water treatment plant's new service and furnish all labor and material for the services.
9. Make all arrangements and file work orders with Eversource for replacing Well #2 Station's existing service and furnish all labor and material for the services.
10. Make all arrangements and file work orders with Eversource for replacing Well #3 Station's existing service and furnish all labor and material for the services.
11. Make all arrangements and file work orders with Eversource for removing Well #4 Station's existing service and furnish all labor and material for the services.
12. Submit all Eversource invoice(s) associated with their services to the General Contractor. The Generator Contractor shall make all payments to Eversource as part of the Owner's Contingency Allowance as indicated in Section 00301 – Bid Form and Section 01024 – Measurement and Payment.

C. NEMA Ratings for Electrical Enclosures and Installations

1. NEMA Type 1 for building's Control Room, Electrical Room, Storage Room, Toilet Room, and Corridor.
2. NEMA Type 12 for building's Mechanical Room.
3. NEMA Type 4 for building's FE/MN Removal Room, PFAS Removal Room, Nitrate Removal Room, and existing pump stations interior.
4. NEMA Type 4X for building exterior, KOH & NaOCL Room, NaHSO<sub>3</sub> Room, and within holding tanks.



5. NEMA Type 7 for within the Tight Tank.

#### 1.12 INTERPRETATION OF DRAWINGS

- A. Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. The Drawings are not intended to show exact routing of conduit runs or terminations. Electrical FSB shall determine exact location of conduit terminations by examinations of approved shop Drawings. The Electrical FSB shall not reduce the size or number of conduit runs indicated on the Drawings.
- C. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the Drawings in locations which are found to be inaccessible, advise the Engineer of the situation before work is advanced to the point where extra costs will be involved.
- D. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.
- E. Unless otherwise approved by the Engineer conduits shown exposed shall be installed exposed; conduits shown concealed shall be installed concealed.
- F. Where circuits are shown as “home-runs” all necessary fittings and boxes shall be provided for a complete raceway installation.
- G. In general, wiring and raceway systems for lighting, receptacles, and security alarm systems are not indicated on the Drawings but shall be furnished and installed under this section.
- H. Each branch circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one single phase circuit is not allowed.
- I. Any work installed contrary to Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.
- J. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by actual construction conditions, major deviations from locations shall be approved by the engineer. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
- K. Circuits on three phase panelboards shall be field connected to result in evenly balanced loads on each phase.

- L. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- M. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical system shown. Additional circuits shall be wherever needed to conform to the specific requirements of the equipment.
- N. All connections to equipment shall be made as required, and in accordance with the approved shop and setting Drawings.
- O. Schematic diagrams shown on the Drawings indicate the required functions only. Standard circuits of the particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional wiring or conduit required for such deviations shall be furnished at the Electrical FSB expense. The Electrical FSB must ensure that all components necessary to accomplish the required function are provided.

#### 1.13 TEMPORARY POWER AND LIGHTING

- A. Furnish and install feeders of sufficient size from the utility company for the electric light and power requirements for the project while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, and stairwells. Minimum sized lamp used shall be 1500 lumens. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified lumens shall be increased to provide these increased intensities.
- B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical FSB.
- C. Provide and maintain in each area of the building and the building exterior, a feeder or feeders of sufficient capacity for the requirements of the entire floor and he shall provide a sufficient number of outlets, located at convenient points, so that extension cords of not over 50 ft. in length will reach all work requiring temporary light or power.
- D. Install and maintain the wiring and accessories for the portable trailer office of the General Contractor and Engineer.
- E. All temporary electrical work shall meet the requirements of the National Electrical Code Article 305 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws
- F. All temporary wiring and accessories thereto installed shall be removed after their purposes have been served.

- G. The General Contractor will pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.
- H. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning the temporary power and lighting 2 hour before and 2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical FSB will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

#### 1.14 COORIDINATION DRAWINGS

- A. The HVAC FSB shall prepare a complete set of AutoCAD format floor plans and sections” background Drawings at scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. These will be the Coordination Drawings.
- B. Each of the below specialty trades shall add its work to these background Drawings in different colors and layers with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
  - 1. HVAC Systems and all sheet metal work.
  - 2. Plumbing Systems.
  - 3. Sprinkler System.
  - 4. Electrical System including light locations.
- C. Where conflicts occur with placement of materials of various trades, the HVAC FSB will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade.
- D. A Subcontractor who fails to promptly review and incorporate his work on the Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- E. The HVAC FSB shall make an AutoCAD electronic file of all coordination Drawings. Fabrication shall not start until such transparencies of completed coordination Drawings are received by the Architect/Engineer and have been reviewed.

- F. Review of coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- G. The HVAC FSB shall provide the following distribution of documents:
  - 1. Electronic file of the Coordination Drawings to each specialty trade and affected Subcontractor for their use.
  - 2. Electronic file of the Coordination Drawings to the Engineer.
  - 3. Electronic file of the Coordination Drawings to General Contractor.
- H. Coordination Drawings include but are not necessarily limited to:
  - 1. Structure.
  - 2. Partition/room layout.
  - 3. Ceiling tile and grid.
  - 4. Light fixtures.
  - 5. Access panels.
  - 6. Sheet metal, grilles, diffusers, etc.
  - 7. Domestic water, gas, soil, waste and vent piping and associated valves.
  - 8. Electrical conduit runs above 2” and electrical equipment.
  - 9. Sprinkler piping, heads and mounting brackets.

## PART 2 –PRODUCTS - NOT APPLICABLE

## PART 3 – EXECUTION

### 3.1 WORK IN EXISTING STRUCTURES

- A. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of the existing structures in which work under this bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that he or his representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

- B. In general, any or all existing electrical equipment and services are to remain in operation and shall not be disturbed unless otherwise noted in these Specifications and/or on the Drawings or as required for the proper execution of the work.
- C. In each area of the work, disconnect and carefully remove the existing electrical equipment and devices so noted. With the exception of items indicated as having to be re-used, all such existing equipment and device shall be turned over to the Owner. If not required by the Owner, remove them from the premises and site. All existing electrical equipment and devices indicated as not removed or abandoned are to be maintained in operation and any circuits disturbed by the construction shall be restored.
- D. Maintain existing electrical services and systems to and in the buildings throughout the project and all “down-time” shall be scheduled at least two weeks in advance with the permission of the Engineer and such scheduling shall be rigidly adhered to.

### 3.2 CORING

- A. Provide all coring for conduits penetrating floors, walls, partitions etc.
- B. Provide waterproof sealing for the penetrations through exterior walls, etc.
- C. Foam type water proofing is not allowed.

### 3.3 MANUFACTURER'S SERVICES

- A. Provide manufacturer's services for testing, training and start-up of the following equipment:
  - 1. Generator System
  - 2. Automatic Transfer Switch
  - 3. Variable Frequency Drives
  - 4. Photovoltaic System
  - 5. Security Alarm System
  - 6. Fire Alarm System
  - 7. Manual Alarm System
  - 8. Electric Vehicle Charger
- B. The time required for each system shall be as hereinafter specified. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or Electrical FSB for field adjustments due to manufacturing or shipping defects.

### 3.4 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.
- C. Record Drawings shall be provided by the Electrical FSB as specified in Section 00700 – General Conditions of the Contract and Section 01700 – Contract Closeout.
- D. Provide warranty and guarantee on all equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

END OF SECTION 16050

## SECTION 16060

### GROUNDING SYSTEMS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work covered under this Section of the Specifications includes the furnishing and installing of a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as specified herein and as shown on the Drawings.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Wire
  - 2. Ground rods
  - 3. Ground bus bars

##### 1.4 QUALITY ASSURANCE

- A. Testing
  - 1. The grounding system shall be tested under this section.
  - 2. The equipment grounding shall be checked to insure continuity of the ground return path.
  - 3. The ground grid systems shall be tested using the three terminal fall in potential method. A minimum of eight test points for each ground grid system shall be submitted for review by the Engineer. The test points shall be made along a straight line from the grid system to the reference terminal. The distance between the grid system and the reference terminal shall be consistent with normal practices for ground testing.
  - 4. All test equipment shall be furnished hereunder and shall be similar to Biddle Earth Tester No. 250220 or equal.

5. These tests shall be performed during the dry season. Tests shall be performed before loaming and seeding or paving work has been performed.
6. The Electrical FSB shall notify the Engineer immediately if the ground grid system exceeds 5 ohms.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## PART 2 – PRODUCTS

### 2.1 WIRE

- A. Wire shall be as specified under Section 16120 – Wire and Cables.

### 2.2 GROUND RODS

- A. Ground rods shall be copper clad steel 3/4 inch in diameter and 10 feet in length unless otherwise shown on the Drawings. Rods shall be either one 10 foot length or two shorter lengths coupled together by a thermic welding process. Ground rods shall be Copperweld, equal by A.B. Chance Co., or equal.

### 2.3 GROUNDING BUS BARS

- A. Grounding bus bars shall be copper, not less than ¼ inch by 2 inch by 24 inch.
- B. All lugs, bolts and nuts shall be silicon bronze.
- C. Bus bars to be securely mounted to room wall with brackets and insulators.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Grounding electrode conductors shall be run in rigid conduits. Protecting conduits shall be bonded to the grounding electrode conductors at both ends.
- B. Grounding conductors shall be run with feeders where shown on the Drawings or hereinafter specified.
- C. Liquid tight flexible metal conduit in sizes 1 inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps. Tie wraps shall be installed 12 inches apart and not more than 6 inches from ends.
- D. Connect the following equipment by separate wire or cable directly to the grounding grid system.



1. Service entrance meter
  2. Frame of each transformer
  3. Neutral of each transformer
  4. Service entrance circuit breaker
  5. Ground buses
  6. Metal Fencing
  7. Propane Tanks
  8. Generator Enclosure
- E. Connect the following equipment by separate wire or cable to the equipment's ground bus and or ground terminal:
1. Panelboards
  2. Control panels
  3. Equipment having feeders and branch circuit installed in non-metallic raceways.
  4. Motors
  5. Receptacle circuits
- F. The following equipment shall be grounded separate wire or cable to the equipment's ground chassis or ground terminal:
1. All metal cases and support frames
  2. Lighting system
  3. 120 Volt motors
- G. Bond the following N.E.C. approved electrodes together to form a ground grid system:
1. Metallic water piping
  2. Building steel frame
  3. Steel reinforcing rods
  4. Grounding rods and plates
  5. Buried bare copper conductors

- H. Grounding electrodes shall be driven where shown on the Drawings. Spacing between electrodes shall be equal to or greater than the length of the electrodes.
- I. Exposed grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No. Oxide Paint Grade A, or equal.
- J. All grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal.
- K. All buried connections shall be made by a thermic welding process equal to Cadweld. Molds used for the welding process shall be new having no prior usage. Molds shall be the specific type for the connection to be made.
- L. All buried conductors shall be laid slack in trenches. The earth surrounding the cables shall be void of sharp objects which may injure the cables. Backfill material shall be natural earth. Where cables are exposed to mechanical injury they shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.
- M. Do not allow water piping to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16060

## SECTION 16080

### UNDERGROUND SYSTEMS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes furnishing and installing of a complete underground system of raceways, handholes, and frames and covers as specified herein and as shown on the Drawings.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Raceways
  - 2. Handholes, frames, and covers
  - 3. Warning Tape

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

#### PART 2 – PRODUCTS

##### 2.1 RACEWAYS

- A. Raceways shall be PVC schedule 40 conduit. Raceway materials shall be in accordance with Section 16130 – Raceways and Fittings.

##### 2.2 CONCRETE HANDHOLES, FRAMES AND COVERS

- A. Electric Hand holes shall be either precast or cast in place steel reinforced concrete per details in contract Drawings, concrete to have minimum strength of 5000 psi after 28 days.

- B. Hand holes frame and covers shall be steel and meet or exceed the Tier 20 load requirements set forth in the American National Standards Institute's ANSI/SCTE 77. The frame shall be securely bolted to handhole with stainless steel bolts and the cover be embedded with the following logs:
  - 1. "ELECTRICAL" logo for electrical power applications.
  - 2. "COMMUNICATIONS" logo telecommunication applications.
  - 3. "CONTROL" logo low voltage applications.
- C. General Contractor to furnish and install all concrete Handholes and their associated frames and covers.

### 2.3 HANDHOLES

- A. Non-Utility Hand holes shall be UL listed, made of Polymer Concrete with Polymer Concrete Cover and open bottom.
- B. The polymer concrete shall be molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- C. Impact resistant tested per ASTM D-2444.
- D. Hand hole enclosure and covers shall meet or exceed the Tier 22 load requirements set forth in the American National Standards Institute's ANSI/SCTE 77 2010
- E. Hand holes shall be a minimum 11"x18".
- F. Covers shall be securely bolted to enclosure with stainless steel bolts and be on type and be embedded with the following logs:
  - 1. "ELECTRICAL" logo for electrical power applications
  - 2. "COMMUNICATIONS" logo telecommunication applications.
  - 3. "CONTROL" logo low voltage applications.
- G. Provide 12 inches of compacted crushed stone under all hand holes

### 2.4 POLYETHYLENE WARNING TAPE

- A. Warning tape shall be red polyethylene film, 6 inch minimum width, Type XB-720 by W.H. Brady Co., or equal.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Raceways shall be installed to drain away from buildings. Raceways between handholes shall drain toward the handholes. Raceway slopes shall not be less than 3 inches per one hundred feet.
- B. Raceway banks shall be encased in concrete. Concrete shall be reinforced with steel rods.
- C. Plastic spacers shall be used to hold raceways in place. Spacers shall provide not less than two inch clearance between raceways.
- D. The minimum cover for raceway banks shall be 30 inches unless otherwise permitted by the Engineer.
- E. Raceway entrances to buildings and structures shall be made with steel conduit not less than ten feet long.
- F. Conduits in duct banks entering buildings and structures shall be spread to allow adequate room for conduit wall seals, pull and terminal boxes.
- G. Where bends in raceways are required, long radius elbows, sweeps and offsets shall be used. Sweeps at riser pole shall be rigid steel encased in concrete.
- H. All raceways shall be swabbed clean before cable installation.
- I. Spare raceways shall be plugged and sealed watertight at all buildings and structures.
- J. Raceways in use shall be sealed watertight at all buildings and structures.
- K. Rigid steel conduit shall be used for risers at the service pole and other locations shown on the Drawings. Conduit sweep at pole base shall be rigid steel conduit.
- L. Raceway terminations at manholes shall be with end bells.
- M. Pulling-in irons shall be installed opposite all raceway entrances to manholes.
- N. All underground metallic conduit run underground in direct contact with earth shall be coated with asphaltum or bitumastic varnish or similar corrosion protection the entire length of the run.
- O. All underground raceways/ductbanks shall be marked with warning tape located approximately 12 inches below grade above the raceway/ductbank.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16080

## SECTION 16085

### MISCELLANEOUS EQUIPMENT

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes the furnishing and installing of all miscellaneous equipment as specified herein and as shown on the Drawings.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.

- B. Submittals required under this section include, but are not limited to the following:

1. Automatic Transfer Switches
2. Manual Transfer Switches
3. Generator Docking Stations
4. Enclosed Circuit Breakers
5. Surge Protection Device (SPD)
6. Disconnect switches
7. Motor Starters
8. Dry type transformers
9. Electric vehicle charging stations
10. Enclosure types
11. Control Stations
12. Break Glass Stations
13. Wireway

14. Terminal cabinets and Junction Boxes

15. Relays

16. Nameplates

17. Floor Mats

18. Warning Signs

19. Meter Socket

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

### PART 2 –PRODUCTS

#### 2.1 AUTOMATIC TRANSFER SWITCH

- A. The automatic transfer switch shall be true 3-pole, solid neutral, delayed transition type, microprocessor based control designed for an emergency and normal source of 480 Volts, 3 Phase, 4 Wire, 60 Hertz. Current ratings shall be as indicated on the Drawings.
- B. Each switch shall be mounted in a NEMA 12 enclosure.
- C. The complete switch assembly including accessories shall be listed under UL-1008 for use on emergency systems.
- D. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.
- E. System Operation
  - 1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9999 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.
  - 2. The transfer switch shall transfer to emergency when the emergency source has reached specified voltage and frequency on all phases.
  - 3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal



power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

#### F. Construction

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Minimum transfer time shall be 400 milliseconds.
2. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.
3. The transfer switch shall be equipped with a safe manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.
4. Transfer switch shall be adequately constructed to carry its full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to de-rating.
5. The minimum withstand and close-in current rating in symmetrical amperes shall be equal to or greater than the interrupting rating of the normal power source circuit breaker. In no case shall this rating be less than 20 times the transfer switch full load current rating. The switch contacts shall not weld or be damaged in any way as a result of a fault of up to the withstand and close-in rating.
6. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.
7. A fully rated solid neutral bus bar with required AL-CU neutral lugs shall be provided.
8. Control components and wiring shall be front accessible. All control wires shall be multiconductor 18 gauge 600-volt SIS switchboard type point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.
9. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.

#### G. Controls

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with NiCad battery back up.
2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit
3. A door mounted controller with a 20 character, LCD display, with a keypad, which allows access to the system shall be provided. The controller shall have password protection required to limit access to qualified and authorized personnel.
4. The controller shall include three-phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.
5. The controller shall be capable of storing the following records in memory for access either locally or remotely:
  - i. Number of hours transfer switch is in the emergency position (total since record reset).
  - ii. Number of hours emergency power is available (total since record reset).
  - iii. Total transfer in either direction (total since record reset).
  - iv. Date, time, and description of the last four source failures.
  - v. Date of the last exercise period.
  - vi. Date of record reset.
6. Reference the I-Drawings for additional requirements.

#### H. Accessories

1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.
2. Programmable three phase sensing of the emergency source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.
3. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.

4. Time delay to control contact transition time on transfer to either source. Programmable 0-9999 seconds, factory set at 3 seconds.
5. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.
6. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.
7. A maintained type load test switch shall be included to simulate a normal power failure, keypad initiated.
8. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.
9. A time delay bypass on retransfer to normal shall be included. Keypad initiated.
10. Dry contact, rated 10 Amps 120 volts AC, to close on failure of normal source to initiate engine starting.
11. Dry contact, rated 10 Amps 120 volts AC, to open on failure of normal source for customer functions.
12. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.
13. An exerciser shall be provided with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one-minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated.
14. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reached 90% of its rated values (switch will remain in normal). In the "commit position" the load will transfer to the emergency position after any normal power failure. Keypad initiated.
15. Two auxiliary contacts rated 10 Amp, 120 volts AC, shall be mounted on the main shaft, one closed on normal, the other closed on emergency. Both contacts will be wired to a terminal strip.
16. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency source.

17. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.
18. An LCD readout shall display normal source and emergency source availability.
19. Include (2) time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts close after a time delay upon transfer. Programmable 0-9999 seconds after transfer.

## 2.2 MANUAL TRANSFER SWITCHES

- A. The manual transfer switch shall be UL listed, designed for transfer between normal source and alternate source of 277/480 Volts, 3 Phase, 4 Wire, 60 Hertz. Current ratings shall be as indicated on the drawings.
- B. The transfer switch shall be service entrance rated of double throw contact construction with a 3-position emergency-off-normal external handle.
- C. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.

## 2.3 GENERATOR DOCKING STATIONS

- A. Docking stations shall include 16 Series Camlok Panel Mounts for use as connection to portable generator.
- B. Entire package must be listed to ETL or UL 1008 Standards. UL listing of individual components is not acceptable.
- C. Enclosures:
  1. NEMA 3R rain-tight, aluminum enclosure
  2. Pad-lockable front door shall include a hinged access plate at the bottom for entry of cables from portable generator or portable load bank. NEMA 3R integrity shall be maintained with access plate open for cable entry.
  3. Front and side through a front access panel shall be accessible for maintenance.
  4. Top, side, and bottom through a front access panel shall be accessible for permanent cabling.
- D. Phase, Neutral, and Ground Buses:
  1. Material: Silver-plated Copper
  2. Equipment Ground Bus: bonded to box.
  3. Isolated Ground Bus: insulated from box.

4. Ground Bus: 50% of phase size.
  5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
- E. Generator connectors shall be male Camlok style mounted on gland plate, color coded according to system voltage.
1. A phase – Brown
  2. B phase – Orange
  3. C phase – Yellow
  4. N Neutral – White or Gray
  5. G Ground – Green
- F. Temporary connectors shall include protective flip lids to prevent accidental contact.
- G. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.
- H. Short Circuit & Withstand Rating: 65KAIC.
- I. Panel mounted Phase monitoring relay.
- J. Power Cables:
1. For each docking station provide colored power cables for each phase, ground, and neutral connection with pre-wired color coded male and female Camlok connectors at each cable end. Cable color coding to match Camlok color.
  2. Cable to be UL type W portable power cable with copper conductors insulated with synthetic rubber (EPDM). The cable is to be covered with a colored CPE rubber jacket applied in two layers with reinforcement placed between the layers.
  3. Cable and plug assembly to have full rated capacity of the Generator Docking Station, cables shall be 4/0 AWG rated for 405 Amps.
  4. All cables shall have a minimum length of 50 feet.

## 2.4 ENCLOSED CIRCUIT BREAKERS

- A. Circuit breakers shall be molded case, 3 pole unless otherwise noted, with voltage rating as required. Ampere rating shall be as shown on the Contract Drawings. Provide with service entrance rating where required.
- B. Main breaker shall be solid state with digital trip and adjustable trip setting with LED on face of breaker providing amps per phase. Provide auxiliary contacts for trip status to remote alarm.

- C. The interrupting capacity shall be not less than as indicated on the Drawings, RMS symmetrical.
- D. All circuit breakers with 225 Ampere frames and larger shall have interchangeable trips.
- E. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.

2.5 SURGE PROTECTION DEVICE (SPD)

A. Electrical Service SPD

- 1. Certify unit listed to UL 1449, 3rd Edition and UL 1283.
- 2. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent devices. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- 3. SPD to be enclosed, surfaced mount and to include surge counter, audible alarm and dry contact for remote status.
- 4. Minimum surge current capability (single pulse rated) per phase shall be 200kA
- 5. Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1000V	600V
480Y/277	1200V	1200V	2000V	1200V

- 6. Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

- 7. SPD shall be installed per manufacturer’s installation instructions with lead lengths as short (less than 24”) and straight as possible. Gently twist conductors together.

2.6 DISCONNECT SWITCHES (VISIBLE BLADE TYPE)

- A. Visible blade type disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 pole with full cover interlock.
- B. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.

- C. Provide service entrance rated disconnect switches for all feeders originating from an outdoor generator source.

## 2.7 DISCONNECT SWITCHES (TOGGLE TYPE)

- A. Toggle type disconnect switches shall be quick-make, quick-break with handle guard and lock-off feature.
- B. Switches shall be provided for resistance type loads only. Switches shall not be installed where full load current of utilization equipment exceeds 18 Amperes.
- C. Switches shall be rated 20 Amperes at 600 Volts and 30 Amperes at 250 Volts, 60 Hertz, 2 or 3 pole.
- D. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.

## 2.8 MANUAL MOTOR STARTERS

- A. Manual motor starters shall be provided for single-phase motors. Manual starters shall be non-reversing, reversing or two speed type as shown on the Drawings. Built-in control stations shall be provided where shown on the Drawings.
- B. Where indicated on Drawings manual motor starters shall have a local/remote or hand/off/auto selector switch.
- C. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.

## 2.9 DRY TYPE TRANSFORMERS

- A. Dry type transformers shall be dry type, copper, two-winding with KVA and voltage ratings as shown on the Drawings.
- B. Transformers shall be furnished with full capacity primary voltage taps as follows:
  - 1. 0.25 KVA to 2 KVA - None
  - 2. 3 KVA to 10 KVA - Two - 5 percent below normal.
  - 3. 11 KVA to 500 KVA - Two - 2-1/2 percent below normal and two 2-1/2 percent above normal.
- C. Transformers shall be designed for indoor or outdoor service as required for the locations shown on the Drawings.
- D. Transformers shall be designed in accordance with ANSI, IEEE and NEMA standards.

- E. Normal efficiency transformers shall be furnished in sized to 15 KVA. Maximum temperature rise of transformers as measured by resistance above a 40 degree C ambient shall not exceed:
  - 1. 115 degree C for transformers rated up to 25 KVA.
  - 2. 80 degree C for transformers rated up to 500 KVA.
- F. Energy efficient transformers shall be furnished in ratings 30 KVA and larger and certified to meet DOE 10 CFR Part 431:2016. Temperature rise of transformers above a 40 degree C ambient shall not exceed 80 degree C.
- G. All insulating materials shall be in accordance with NEMA standards for a 220 degree C UL component recognized insulation system.
- H. Transformers shall be manufactured by ABB, General Electric, Hammond Corp., or Schneider Electric.

## 2.10 ELECTRIC VEHICLE CHARGING STATIONS

- A. Provide UL listed, NEMA 3R, dual port, bollard mount charging stations at locations indicated on the drawings.
- B. Electrical Ratings:
  - 1. Electrical Input: 208V, 60Hz, 1-Phase, 30A for each port.
  - 2. Electrical Output: 7.2KW at each port
- C. Operating Conditions:
  - 1. Operating Temperature: -22 to 122 F
  - 2. Non-Operating Humidity: Up to 95% @ 122 F non-condensing
  - 3. Operating Humidity: Up to 85% @ 122 F non-condensing
  - 4. Terminal Block Temperature Rating: 221 F
- D. Safety Features:
  - 1. Compliance: UL 2594, UL 2231, NEC Article 625, FCC Part 15 Class A
  - 2. Surge Protection: 6kV @ 3000A
  - 3. Internal service panel protected GFCI, 20mA CCID with auto retry that continuously monitors ground connection.
  - 4. Surge Protection: 6kV @ 3000A



- E. Charging cords shall be maintenance free, light weight, self retracting, 18' length with SAE J1772 connector, overhead cable management system and have dedicated locking holsters on the station.
- F. Charger to have ISO 15693, ISO 14443, NFC card reader, LTE Category 4 integral modem, and 2.4 GHz WiFi (802.11 b/g/n) connectivity.
- G. Charger to have interface display indicating full user instructions and charger information.

## 2.11 ENCLOSURE TYPES

- A. NEMA Type 1 and Type 12 enclosures shall be general purpose sheet steel.
- B. NEMA Type 4 enclosures shall be stainless steel, PVC or fiberglass.
- C. NEMA Type 3R enclosures shall be galvanized steel or aluminum.
- D. Type 4X enclosures shall be stainless steel.

## 2.12 CONTROL STATIONS

- A. Control stations shall be heavy-duty type, with full size operators.
- B. All control stations located at motors and where shown on the Drawings shall have a padlock attachment for locking out the stop button or position.
- C. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.
- D. Control stations shall be equivalent to Class 9001 as manufactured by Square D Co.

## 2.13 BREAK GLASS STATION

- A. Break Glass stations shall be industrial duty pushbutton type with operator held in the depressed position by a glass disc mounted in a NEMA 4X wall mounted enclosure.
- B. The station shall have 2-SPST NO and 2-SPST NC contacts rated at 10 amps continues at 480V. The NC contacts shall be utilized for equipment shutoff, the NO contacts shall be designated for remote alarms.
- C. A break glass hammer shall be provided, mounted and permanently chained to the station.
- D. Provide clear identification of the break glass station and the equipment the station is controlling.

## 2.14 WIREWAY

- A. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.
- B. Wireway shall be equivalent to "Square Duct" as manufactured by Square D Co.

## 2.15 TERMINAL CABINETS AND JUNCTION BOXES

- A. Enclosures shall meet the area NEMA designation for which they are located, NEMA Type 1, 12, 3R, 4, and 4X enclosures shall be as specified herein.
- B. Provide terminal strips for all terminations.

## 2.16 RELAYS

- A. Control relays shall be heavy duty machine tool type, with 10 Ampere, 300 Volt convertible contacts. Time delay relays shall be true type, adjustable 0.2 to 180 seconds.
- B. Interposing relays shall be of the type designed to operate motor starters. Relays shall be panel mounted where associated with motors starter enclosures and variable frequency drives enclosures. Standalone relays can be NEMA 4X enclosed type with ½" NPT connection and wire leads for mounting to junction boxes.

## 2.17 NAMEPLATES

- A. Nameplates shall be provided for all special purpose tumbler switches, disconnect switches, remote control stations, motor starters, time clocks, panelboards, terminal cabinet, etc. to designate the equipment controlled and function.
- B. Nameplates shall be black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the black face into the white layer.
- C. Nameplates shall be attached to the panel by self-tapping stainless steel screws or rivets.

## 2.18 FLOOR MATS

- A. Provide 1/4" x 36" corrugated all rubber insulating matting in front of new 480V power distribution equipment.
- B. Matting shall be proof tested to 20,000 volts and conform to ASTM D178-93.
- C. Matting to be manufactured by Biltrite or equal.

## 2.19 WARNING SIGNS

- A. Electric rooms shall be furnished with a warning sign. Sign shall read “DANGER HIGH VOLTAGE KEEP OUT!”. Signs shall be as manufactured by Thomas & Betts, Seton, or equal.

## 2.20 METER SOCKET

- A. Provide a utility meter socket in a NEMA 3R enclosure with HASP cover provision of the type approved by the utility company.
- B. Meter Socket shall be 13 Jaw with 10 pole FT switch terminal block form 9s transformer rated.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. All field mounted devices shall be mounted four feet-six inches above the finished floor or grade. Devices shall be adequately supported on walls, columns or other supports. Furnish and install channel iron imbedded in the ground or floor to support devices where necessary.
- B. Devices installed in areas with hung ceilings, in toilet and administrative areas, and in similar areas, shall be installed flush with finished surfaces.
- C. All control equipment shall be identified as to the equipment it controls.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16085

## SECTION 16120

### WIRE AND CABLES

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes the furnishing, installing and testing of all wire, cable and appurtenances as specified herein and as shown on the Drawings. All wiring of a given type shall be the product of one manufacturer.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Wire
  - 2. Cable
  - 3. Terminations
  - 4. Lugs
  - 5. Markers
  - 6. As-Built Wire Marking List

##### 1.4 QUALITY ASSURANCE

- A. Testing
  - 1. All 600 Volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 500 Volts. Submit a written test report of the results to the Engineer.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## 1.6 DESIGN CRITERIA

- A. Wire for single phase circuits shall be Type XHHW or THWN-THHN.
- B. Wire for three phase circuits shall be Type XHHW.
- C. Single conductor wire for control, indication and metering shall be Type THWN/THHN No. 12 or 14 AWG, stranded.
- D. Multi-conductor control cable shall be used for the underground system and shall be No. 12 or 14 AWG, stranded.
- E. Wire for process instrumentation shall be twisted shielded pairs No. 16 AWG, stranded.
- F. Ground wires shall be Type THW, green. Bare ground wires shall be soft drawn copper, 98 percent conductivity.
- G. Except for control and signal leads, no wire smaller than number 12 AWG shall be used.

## PART 2 –PRODUCTS

### 2.1 MATERIALS

- A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.
- B. All conductors No. 12 AWG and larger sizes shall be stranded.

### 2.2 600 VOLT WIRE

- A. Type XHHW shall be cross-linked polyethylene, as manufactured by Pirelli Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.
- B. Type RHW shall be cross-linked polyethylene, as manufactured by Pirelli Cable Corp., Collyer Insulated Wire Co., The Okonite Co., or equal.
- C. Type THWN/THHN shall be as manufactured by Pirelli Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.
- D. Multi-conductor control cable shall be stranded, 600 Volt, cross-linked polyethylene insulated, neoprene jacketed, as manufactured by Rome Cable Corp., or equal.

### 2.3 VFD CABLE

- A. VFD cable shall be three conductor, stranded copper, PVC jacketed shielded type, tray cable (TC) rated 600 volts with three symmetrical ground conductors.
- B. Individual conductors shall be 600 Volt rated Type XHHW-2 as specified herein.

### 2.4 INSTRUMENTATION CABLE

- C. Process instrumentation wire shall be twisted pair, 600 Volts, polyethylene insulated, aluminum tape, tinned copper braid shielded, polyvinyl chloride jacketed, as manufactured by Okonite Co., Belden Corp., or equal.

### 2.5 METAL CLAD CABLE

- A. Metal Clad sheathed cable NFPA 70, type MC may be used above suspended ACT ceiling systems only. All branch circuits shall be run in conduit from the panelboard to the first outlet with the ceiling system.
- B. MC cable used shall contain a full-size insulated ground conductor. All conductors shall be copper TWHN.
- C. MC cable conductors' insulation shall have voltage rating of 600 volts, shall have a temperature rating of 75 degrees C. and shall be thermoplastic material.
- D. Armor material shall be steel and armor design shall be interlocked metal tape.
- E. Fire alarm rated MC cable may be used for fire alarm work above the suspended ACT ceiling system.

### 2.6 COAXIAL CABLE

- A. Coaxial cable shall be LMR-900 type, bare copper .222" ID tube, foam polyethylene dielectric, tinned copper braid shielded, aluminum tape outer conductor, polyethylene jacketed, as manufactured by Times Microwave Systems, Allied Wire & Cable, or equal.
- B. Provide all LMR-900 coaxial cable metallic connectors.
- C. Provide a PolyPhaser or equal lightning surge suppressor for connection to the antenna cable to each panel. The surge suppressor shall be mounted on a plywood backboard secured to the wall.
  - 1. Insertion loss: less than or equal to 0.1 dB over the frequency range
  - 2. Throughput energy: less than or equal to 600  $\mu$ J for a 50kA 8/20  $\mu$ s waveform.

## 2.7 CONNECTORS AND TERMINAL LUGS

- A. Splices for No. 10 or No. 12 A.W.G. solid wires, such as for lighting branch circuits, shall be made with insulated wire connectors.
- B. Connectors and terminal lugs on wires No. 8 A.W.G. and larger shall be of the mechanical or clamp type.

## 2.8 WIRE AND CABLE MARKERS

- A. Wire and cable markers shall be “Omni-Grip” as manufactured by W.H. Brady Co., or equal.
- B. Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by W.H. Brady Co., T&B Fasteners Inc., or equal.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. All conductors shall be carefully handled to avoid kinks or damage to insulation.
- B. All wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) shall be uniquely identified at each end with wire and cable markers.
  - 1. Where wiring originates from a motor control center or process control panel the wire identification number shall incorporate the terminal numbers used in the control center or panel and a number to identify the motor control center or panel.
  - 2. Wires shall be identified at both ends and at intermediate junction boxes, terminal cabinets, etc. Wire identification numbers shall be unique.
  - 3. A typed list of the numbers used at each motor control center and control cabinet shall be submitted for approval.
- C. Multi-conductor cables shall be marked at all terminations.
- D. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. approved for use with the insulation specified.
- E. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.
- F. Shielded instrumentation wire shall be installed in termination and pull boxes that contain only shielded instrumentation wire.
- G. Shielding on instrumentation wire shall be grounded at the transmitter end only.
- H. Each branch circuit shall have a dedicated neutral.

3.2 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16120



## SECTION 16130

### RACEWAYS AND FITTINGS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes the furnishing and installing of complete raceway systems as specified herein and as shown on the Drawings.
- B. All raceway systems shall be complete with fittings, boxes or cabinets, and necessary connections to result in a complete system.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Raceways.
  - 2. Boxes and Fittings.

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

##### 1.5 DESIGN CRITERIA

- A. Except where otherwise shown on the Drawings, or hereinafter specified, all interior raceways installed shall be exposed and be PVC Schedule 80. Metal clad cable is allowed above suspended ACT ceiling systems but shall not be located anywhere outside the suspended ceiling area.
- B. Except where otherwise shown on the Drawings, or hereinafter specified, all exposed exterior raceways installed shall be rigid galvanized conduit. PVC Coated Rigid galvanized steel conduit sweeps shall be used where concealed conduits rise up through concrete slabs and mounting pads.

- C. PVC Schedule 40 conduit shall be used underground and below floor slabs except as specified herein and where otherwise indicated on the Drawings.
- D. All conduit of a given type shall be the product of one manufacturer.
- E. Unless otherwise hereinafter specified or shown on the Drawings, all boxes shall be metal.
- F. PVC boxes and fittings shall be used with PVC conduit all other boxes shall be metal.
- G. Combination expansion-deflection fittings shall be used where conduits cross structure expansion joints. Refer to Structural Drawings for expansion joint locations.
- H. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the Drawings.

## PART 2 –PRODUCTS

### 2.1 RIGID CONDUIT

- A. Rigid heavy wall steel conduit shall be hot-dipped galvanized as manufactured by the Youngstown Sheet and Tube Co., Allied Tube and Conduit Corp., Wheeling-Pittsburgh Steel Corp., or equal.
- B. PVC conduit where installed underground shall be rigid polyvinyl chloride Schedule 40 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.
- C. PVC conduit used in non-underground locations shall be rigid polyvinyl chloride Schedule 80 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.
- D. PVC coated rigid steel conduit shall have a 0.040 inch thick, polyvinyl chloride coating permanently bonded to hot-dipped galvanized steel conduit, as manufactured by Calbond, Ocal, Robroy Industries, or equal.

### 2.2 LIQUIDTIGHT, FLEXIBLE METAL CONDUIT, COUPLINGS AND FITTINGS

- A. Liquidtight, flexible metal conduit shall be Sealtite, Type UA, as manufactured by Anaconda American Brass Co., or equal by American Flexible Conduit Co., Inc., or equal.
- B. Fittings used with flexible conduit shall be of the screw-in type as manufactured by Thomas and Betts Co., Crouse-Hinds Co., O.Z. Manufacturing Co., or equal.

### 2.3 BOXES AND FITTINGS

- A. PVC boxes and fittings shall be as manufactured by Carlon, An Indian Head Co., O.Z. Manufacturing Co., or equal.

- B. Steel elbows and couplings shall be hot-dipped galvanized.
- C. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., O.Z. Manufacturing Co., or equal.
- D. Conduit wall seals shall be Type WSK as manufactured by O.Z. Manufacturing, Co., or equal by Link Seal Co.
- E. Combination expansion-deflection fittings shall be Type XD as manufactured by Crouse-Hinds Co., or equal by Appleton Electric Co., O.Z. Manufacturing Co.
- F. Conduit seal bushings shall be Type CSB as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co.
- G. Explosion proof conduit seals shall be Type EYS as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co. and Appleton Electric Co.

#### 2.4 CONDUIT MOUNTING EQUIPMENT

- A. Hangers, rods, backplates, beam clamps, etc. shall be hot-dipped galvanized iron or steel. Mounting equipment shall be as manufactured by B-Line Co., Thomas and Betts Co., Unistrut Corp., or equal.

#### 2.5 CORROSION PROTECTION FOR GALVANIZED CONDUIT

- A. Corrosion protection for galvanized conduit shall be cold galvanized zinc based paint as manufactured by L.P.S. Co., Los Angeles, California, CRS Chemicals, Drecher, Pennsylvania, or equal.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Approved factory elbows shall be used when sharper bends are necessary. Pull boxes shall be provided as required or directed.
- B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
- C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.
- D. Conduit supports shall be spaced at intervals of eight feet or less, as required to obtain rigid construction.
- E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of

conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8 inch diameter. Wire hangers will not be accepted.

- F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.
- G. All conduits on exposed work and concealed above hung ceilings shall be run at right angles to or parallel with surrounding wall and shall conform to the form of the ceiling. Diagonal runs will not be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.
- H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.
- I. PVC conduits shall be installed using a fusing cement process. Conduits shall be water tight.
- J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.
- K. Metallic heavy wall conduits shall be installed using threaded fittings. Threadless fittings may be used in isolated instances when approved by the Engineer.
- L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.
- M. When a conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw cutter, or an approved pipe cutter using knives. The use of pipe cutter wheels will not be permitted. The cut ends of the field cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory cut threads on conduits. Field cut threads shall be protected by a field applied cold galvanizing compound.
- N. Conduits entering buildings below grade shall be furnished with a conduit seal bushing.
- O. Where ducts terminate at panelboards, terminal cabinets, etc. panel of sufficient width and depth shall be provided to maintain the 2 inch spacing between ducts or wireways shall be provided below panels, cabinets, etc.
- P. A ground wire shall be run in all runs of PVC conduit.
- Q. All bends in PVC conduit shall be made using a hotbox and bending guide tool.
- R. Conduits run underground below the highest known ground water level shall not enter buildings below this groundwater level without first being run through a drain manhole, handhole, or exterior pull box.

3.2 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16130

## SECTION 16442

### PANELBOARDS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes the furnishing and installing of all panelboards as specified herein and as shown on the Drawings. All panelboards shall be provided with the applicable NEMA enclosure in accordance with the Electrical Specification, NEMA 1 enclosures shall be utilized for areas designated as NEMA 12.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Panelboards, including construction details and enclosures.
  - 2. Terminals and lugs
  - 3. Trim
  - 4. Buses
  - 5. Circuit Breakers
  - 6. Groundfault Circuit Interrupter
  - 7. Metering

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

##### 1.5 DESIGN CRITERIA

- A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

- B. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.
- C. Panelboards used for service entrance shall be Underwriter Laboratories labeled “Suitable for use as service equipment”.

## PART 2 –PRODUCTS

### 2.1 PANELBOARD CONSTRUCTION

#### A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, and buses. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper wire of the sizes indicated.
2. Interiors shall be designed such that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be such that circuits may be changed without machining, drilling or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
4. A factory provided label shall be provided listing panel type, number of circuit breakers and ratings.

#### B. Buses

1. Main bus shall be copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper. All buses shall be tinned.
2. Main bus shall be distribution phase sequence type configuration to allow installation of two or three pole circuit breakers at any location.
3. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
4. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.
5. Solderless main lugs or main circuit breakers shall be furnished as shown on the Drawings.
6. Bus bracing to be at least equal to the interrupting rating of lowest rated circuit breaker installed in panel. Series rated breakers and panels shall not be acceptable.

### C. Boxes

1. Recessed boxes shall be made from galvanized code gauge steel having multiple knockouts unless otherwise noted. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of four inches on all sides.
2. Surface mounted boxes shall have an internal and external finish as specified herein. Surface mounted boxes shall be field punched for conduit entrances.
3. At least four interior mounting studs shall be provided.

### D. Trim

1. Hinged door-indoor construction shall enclose all circuit breaker handles and shall be included in all panel trims.
2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inch in height shall have a vault handle and three point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike. A directory frame and card having a transparent cover shall be furnished on each door.
3. Trims shall be fabricated from code gauge sheet steel.
4. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

### E. Manufacturer

1. 120/208 Volt and 277/480 Volt three phase distribution panelboards rated for 1200 Amps and less shall be Pow-R-Line 4X type as manufactured by Eaton, or equal by Square D and General Electric. Equipment layouts are based on the dimensions on the Eaton Power R-Line 4X distribution panelboards.
2. 120/240 Volt, single phase, 3 wire, and 120/208 Volt three phase, 4 wire branch circuit panelboards rated for 225 Amps and less shall be Pow-R-Line 1X single tub type as manufactured by Eaton, or equal by Square D and General Electric.

## 2.2 CIRCUIT BREAKERS

- A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings. Circuit breaker mounting shall not exceed 78 inches above floor.
- B. Circuit breakers shall be molded case, bolt-in type.



- C. Circuit breakers shall have an interrupting capacity of not less than the RMS symmetrical panelboard rating as indicated on the Drawings.
- D. Main circuit breaker shall be attached to the main vertical bus.
- E. Main breaker shall have solid state digital trip unit with adjustable long, short, and instantaneous trip settings.

### 2.3 GROUND FAULT CIRCUIT INTERRUPTER (GFCI)

- A. GFCI shall be provided for circuits where indicated on the Drawings. GFCI units shall be molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (30 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity matching the circuit breakers in the panelboards.

### 2.4 DIGITAL POWER MULTIMETER

- A. Main Distribution panelboard shall be metered with a digital power multimeter.
- B. Digital Power Meter
  - 1. Digital power meter shall be true RMS type power monitor with features to data log (30 days) and communicate remotely the AC amperes on each phase, voltage, harmonic distortion, watts, volt amperes, bars, power factor, frequency, demand watts, demand volt ampere and watt hours; and capable of providing alarm status for phase loss, phase on balance, phase reversal and provides all data to remote monitoring systems.
  - 2. The power meter shall communicate using Modbus RTU via a RS-485 port and Ethernet protocol via a RJ-45 port and be able connect to any host devices.
- C. Provide small control wiring, necessary fuse blocks, suitable numbering strips and terminal blocks as required
- D. Provide current transformers for each meter. Current transformers shall be wired to shorting type terminal blocks. All transformers used for metering shall meet the requirements of IEEE C12.11 and IEEE C57.13.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2 inch air space between the box and the wall.
- B. Circuit directories shall be typed identifying location and nature of load served.
- C. Panelboards installed in areas with finished walls shall be installed recessed into the wall with the front of the panel flush with the finished wall

3.2 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16442



## SECTION 16443

### MOTOR CONTROL CENTERS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes furnishing all labor, materials, tools and equipment necessary to furnish and install Motor Control Centers as shown on Drawings, specified herein, or evidently required to complete the work.
- B. Refer to various DIVISION 11 sections and E-Drawings control wiring diagrams for field device interface.
- C. Refer to I-Drawings for additional requirements.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Complete wiring diagrams, and elementary or control schematics of each compartment, including coordination with other electrical control devices operating in conjunction with the motor control center and suitable outline Drawings shall be submitted for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above Drawings be clear, full-size and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or Drawings simply marked to indicate applicability to this Contract will not be acceptable.
  - 2. Bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.
  - 3. Catalog cut sheets and other necessary information on each device (relay, timer, circuit, breaker etc.) furnished and installed in or on the motor control center, to describe operating characteristics completely.
  - 4. Where it is not explicitly shown and completely obvious from the outline Drawings the following items shall be verified in a written statement accompanying the submittal.

- i. Type of terminal blocks used that the removal of plug-in compartments can be performed without disconnecting or removing wires
  - ii. Plating of bus
  - iii. Insulation and isolation of vertical bus
  - iv. Underwriter's Laboratories (UL) approval.
5. Clear and concise information for storage, installation, operation, and care of the equipment. Non-applicable portions of standard publications shall be so marked.
  6. Time current curves of each size and type of each overcurrent protective device.

#### 1.4 QUALITY ASSURANCE

- A. The motor control centers and protection devices in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted).
  1. ANSI/IEEE/NFPA 70 - National Electrical Code.
  2. Federal Specification W-C-375, Rev. B, Amend. 1, Circuit Breakers, Molded Case; Branch Circuit and Service.
  3. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches.
  4. NEMA AB 3, Molded Case Circuit Breakers and Their Application.
  5. NEMA AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
  6. ANSI C84.1, Voltages Tolerances for North America.
  7. NEMA Publication 250, Enclosures for Electrical Equipment.
  8. UL 508, UL Standard for Safety Industrial Control Equipment.
  9. UL 845, UL Standard for Motor Control Centers.
  10. UL 50, UL Standard for Safety Enclosures for Electrical Equipment.
  11. ANSI/NEMA ICS 6, Enclosures for Industrial Controls and Systems.
  12. NEMA 250, Enclosures for Electrical Equipment.
  13. NEMA ICS 2, General Standards for Industrial Control Systems.
  14. NEMA ICS 3, Standards for Industrial Control Devices, Controllers and Assemblies.
  15. NEMA ST 20, Dry Type Transformers for General Applications.

16. UL 508, Industrial Control Equipment.

B. The entire MCC shall go through a quality inspection before shipment. This inspection will include:

1. Physical Inspection of Structure.

- i. Bussing.
- ii. General wiring.

2. Electrical Tests AC Dielectric Tests of:

- i. Power circuits
- ii. Control circuits.

3. Electrical Tests before shipment shall include:

- i. Power circuit phasing.
- ii. Control circuit wiring.
- iii. Instrument transformers.
- iv. Meters.
- v. Ground fault system.
- vi. Device electrical operation.

4. Markings/Labels, include:

- i. Instructional type.
- ii. Underwriters Laboratory (UL)/Canadian Standards Association (CSA).
- iii. Inspector's stamps.

5. The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.

C. Tests and Checks

1. Prior to energizing megger terminals and buses for grounds after disconnecting devices sensitive to megger voltage.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance

B. Separate Motor Control Center into shipping splits of up to 3 vertical sections. Each shipping split shall include a removable lifting angle, or lifting tabs, for positioning equipment at job site.

C. Store, protection, and handle motor control centers in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

- D. Delivery each motor control center split on individual shipping skids wrapped for protection.
- E. Inspect and report concealed damage to carrier within specified time.
- F. Store MCCs in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Provide heat to prevent condensation.

## 1.6 DESIGN CRITERIA

- A. All motor control centers shall be furnished by a single motor control center manufacturer. Equipment modified by intermediate equipment assemblers will not be acceptable.
- B. All units and sections shall be U.L. labeled. Motor control centers designed for service entrance application shall be U.L. labeled "Suitable for Use as Service Equipment."
- C. Make all necessary field measurements to verify that equipment shall fit in allocate space in full compliance with minimum required clearances specified in National Electrical Code.
- D. Motor control centers as shown on the Drawings are sized based upon the specified manufacturers. If the motor control centers actually furnished deviate from the sizes shown on the Drawings, these deviations shall be clearly delineated as exceptions to the specifications, and will be subject to approval by the Engineer.
- E. MCC shall be inspected before shipment including structure, electrical conductors, bussing, general wiring, and devices.

## PART 2 –PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton
- B. General Electric Company
- C. Square D Corp.

### 2.2 MATERIALS

- A. Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly.
- B. Steel material shall comply with UL 845 and CSA requirements.
- C. A removable 7 gauge structural steel lifting angle shall be mounted full width of the MCC lineup at the top. Removable 7 gauge bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the lineup.

- D. Vertical sections made of welded side-frame assembly formed from a minimum of 12 gauge steel. Internal reinforcement structural parts shall be of 12 and 14 gauge steel to provide a strong, rigid assembly.
- E. The entire assembly shall be constructed and packaged to withstand normal stresses included in transit and during installation.

## 2.3 STRUCTURES

- A. Structures shall be totally enclosed, dead-front, free-standing assemblies. Motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.
- B. Structures shall be capable of being bolted together to form a single assembly.
- C. The overall height of the MCC shall not exceed 90 in (2286 mm) (not including base channel or lifting angle).
- D. Base channels, of 1.5 in (38 mm) in height, and lifting angles, of 3 in (76 mm) in height, shall be removable.
- E. The total width of one section shall be 20 in or 21 in, minimum. Widths of 25 in (630 mm), 30 in (760 mm), and 35 in (890 mm) shall be used for large devices.
- F. Structures NEMA Type shall meet the NEMA designations for where they are located.
- G. Each standard wide section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered with manual bus shutters.
- H. Each section shall include a top plate and bottom plate. Top and bottom plates shall be removable for ease in cutting conduit entry openings.
- I. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates.

## 2.4 WIREWAYS

- A. Structures shall contain a minimum 12 in (305 mm) high horizontal wireway at the top of each section and a minimum 6 in (152 mm) high horizontal wireway at the bottom of each section. These wireways shall run the full length of MCC to allow room for power and control cable to connect between units in different sections.
- B. A full-depth vertical wireway shall be provided in each MCC section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway and shall be isolated from unit interiors by a full height barrier. The vertical wireway shall be 4 in (102 mm) wide minimum with a separate hinged



door. There should be a minimum of 4,000 cu. in. of cabling space available. Access to the wireways shall not require opening control unit doors.

- C. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units must open directly into the MCC horizontal wireways.
- D. All openings used for wiring shall have insulating grommets.

## 2.5 BUSSING

- A. All bussing and connectors shall be tin-plated or silver-plated copper. All bolted bus sections shall be silver-plated at the point of connection.
- B. The main horizontal bus shall be rated per the Drawings and shall extend the full length of the MCC. Bus ratings shall be based on 65° C maximum temperature rise in a 40° C ambient. Provide copper compression lugs of appropriate ampacity. Bottom plates shall be furnished when neutral bus is specified.
- C. Provisions shall be provided for splicing future additional sections onto the ends of the MCC.
- D. The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack is installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts must not be required when splicing higher amperage bus.
- E. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus, and shall be rated at 300 A continuous minimum. Provide 600 A vertical bus where required by loads. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.
- F. A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The ground bus shall be 0.25 in (6.0 mm) x 2.0 in (50 mm) and be rated for 600 amps.
- G. Copper compression lugs shall be provided in the MCC for a 4/0-250 kcmil ground cables, two per each lineup. The ground bus shall be provided with (6) 0.38 in (10 mm) holes for each vertical section to accept customer-supplied ground lugs for any loads requiring a ground conductor.
- H. Each vertical section shall have a tin-plated copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

- I. MCC's shall be rated for the available short circuit capacity as indicated on the Drawings.

## 2.6 TYPICAL UNIT CONSTRUCTION

- A. Units shall be service entrance rated and provided with:
  1. UL service entrance label.
  2. Ground bus.
- B. Provide NEMA Class IIS, type B wiring configuration. All wiring, relays, controls, ect. for each motor shall be located in the associated motor unit compartment.
- C. Provide all controls and accessories as shown on the equipment motor wiring diagrams in the Contract Drawings.
- D. All surfaces (back, side and bottom plates) of the unit interior shall be painted white.
- E. Units with circuit breaker disconnects through 400 A frame, and fusible switch disconnects through 400 A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus. Stabs on all plug-on units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted.
- F. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.
- G. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.
- H. A handle operator must be provided on each disconnect. With the unit stabs engaged onto the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.
- I. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.
- J. A non-defeatable interlock shall be provided between the handle operator and the cam lever to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

- K. The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.
- L. Provisions shall be provided for locking all disconnects in the OFF position with up to three padlocks.
- M. Unit construction shall combine with the vertical wireway isolation barrier to provide fully compartmentalized design.
- N. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material.
- O. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal.
- P. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status.
- Q. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully-compartmentalized design.
- R. Up to a maximum of twelve six-inch units can be installed per vertical section without placement restrictions in new or existing applications.
- S. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size so as to allow for ready removal of any of the components in the compartment. Doors shall open at least 90 degrees, and far enough to remove units without removing doors. A minimum of two hinges per door shall be provided. Doors 36 to 48 inches in height shall have a minimum of three hinges. Doors in excess of 48 inches shall have a minimum of four hinges.
- T. Each unit to be provided with a control panel for up to a maximum of four pilot devices. Control panel to be removable by loosening two semi-captive fasteners for access.

## 2.7 MCC COMPONENTS

### A. Combination Starters

1. All motor starters shall be combination motor circuit protector and contactor three pole, 60 Hertz, 600 Volt, magnetically operated, of the types shown on the Drawings. All motor starters shall have a 120 Volt operating coil.
2. NEMA sizes shall be as required for the horsepower shown on the Drawings, but shall not be less than NEMA Size 1. Verify final horsepower ratings before placing motor control centers into production.
3. All combination starters shall utilize a unit disconnect as specified above. Magnetic starters shall be furnished in all combination starter units.

4. All starters shall utilize NEMA rated contactors.
5. Starters shall be provided with a three-pole, external manual reset, overload relay for ambient compensated bimetallic thermal overload units.
6. Control circuit transformers shall be oversized, 100 VA minimum, and shall include two primary protection fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s), all connected control circuit loads, motor heaters and auxiliary relays and devices. The transformer rating shall be fully visible from the front when the unit door is opened.
7. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
8. Auxiliary control circuit interlocks shall be provided where indicated.
9. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.
10. NEMA Size 1 through size 4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.
11. Auxiliary relays shall be 600V, 10 amp, heavy duty type and located within the associated equipment's starter bucket. Timing relays shall be true on and true off type.
12. Motor circuit protectors shall be molded case 600 Volts, 3 Pole, 60 Hertz with adjustable magnetic trip settings. Motor circuit protectors shall have toggle type, quick-make/quick-break, overcenter switching mechanism and auxiliary disconnect contacts when used with starters having external control circuits. Rating selected shall provide complete protection of, and coordination with, motor starter overload relays and heaters. Electrical FSB shall verify the motor horsepower and install rating as required by the NEC for the full load current of the motor actually installed. Motor circuit protectors shall be furnished with bolt on current limiting fuses.
13. All starters shall be provided with run timers. Running time meters shall be 3-1/2 inch square case; non-reset, 99,999.9 hour range
14. Control stations shall be standard 30mm sizes, heavy-duty, oiltight type.
15. Indicating light shall be LED type, with push-to-test features.
16. Provide all controls and accessories as shown on the equipment motor wiring diagrams in the Contract Drawings. Specialized interface relays supplied by the equipment manufacture shall be installed in the each associated motor MCC bucket

by the MCC manufacture at the MCC manufacturing plant. Coordinate with the equipment manufacture for space requirements and delivery of the relays

#### B. Terminal Blocks

1. Provide Type B wiring with all starter units provided with unit control terminal blocks.
2. Terminal blocks shall be the pull-apart type 600 volt and rated at 25 amps.
3. All current carrying parts shall be tin-plated.
4. Terminals shall be accessible from inside the unit when the unit door is opened.

#### C. Nameplates and Identification

1. Provide engraved phenolic nameplates for each MCC and unit compartment screwed to the doors of each individual compartment and wiring diagrams pasted inside each door.
2. Compartments containing panel boards shall have a card-holder on the inside of the door. Compartments containing motor starters shall have an overload heater selection table pasted inside the door.
3. Provide with white background with black letters, measuring a minimum of 1.5 in (38 mm) x 6.25 in (159 mm).
4. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE - KEEP OUT!". Letters shall be not less than one inch high. Signs shall be laminated plastic, engraved red letters with a white background.
5. All compartments with voltages from sources outside of the compartment shall have a sign on the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE THIS UNIT". Letters shall be black on a high visibility yellow background. Background shall be vinyl approximately three inches by five inches.

## 2.8 WIRING

- A. All wiring shall be copper.
- B. Compartment wiring shall be no. 14 AWG minimum, and connected to compartment mounted, plug-in terminal blocks that allow compartments to be withdrawn without having to remove wires from fixed terminal blocks.
- C. Power wiring shall be black in color, control wiring shall be red in color, wiring energized from sources other than the starter control power transformer shall be yellow in color. No deviations from this wiring scheme shall be accepted.

## 2.9 MCC FINISH

- A. All steel parts shall be provided with UL and CSA listed acrylic/alkyd baked enamel paint finish, except plated parts used in bus connections.
- B. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.
- C. Pre-treatment shall include:
  - 1. Hot alkaline cleaner to remove grease and oil.
  - 2. Iron phosphate treatment to improve adhesion and corrosion resistance.
- D. The paint shall be applied using an electro-deposition process to ensure a uniform paint coat with high adhesion.
- E. The standard paint finish shall be tested to UL 50 per ASTM B117 (5% ASTM Salt Spray) with no greater than 0.125 in (3 mm) loss of paint from a scribed line.
- F. Paint color shall be #61 light gray per ANSI standard Z55.1-967 (60-70 gloss) on all surfaces unless specified otherwise.
- G. Control station plates and escutcheon plates shall be painted a contrasting gray.
- H. All unit interior saddles shall be painted white for better visibility inside the unit.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Motor control centers shall be bolted to angle iron sills. The sills shall be imbedded in a smooth, level raised concrete pad on the on the two longest sides. The sills shall be the full length of the motor control center and shall be installed level in all directions. Where motor control centers are installed back to back, or against a wall they shall be secured to the wall or adjacent MCC by means of a channel support.
- B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.
- C. Motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.
- D. The motor control shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by the motor control center manufacturer.
- E. Install all required interlock wiring.

- F. Motor control center section shall be arranged such that all large and/or heavy components are located in the lower spaces of the various section. Top heavy sections shall be avoided.

### 3.2 SPARE PARTS

- A. Provide the following spare parts to the Owner:

1. Indicating lamps, 4 of each type.
2. Control switches, 2 of each type.
3. Overload heaters, 1 of each type installed.
4. Starter and relay coils, 2 of each type.
5. Fuses, 3 of each type

### 3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16443

## SECTION 16495

### VARIABLE FREQUENCY DRIVES

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes furnishing all labor, materials, tools and equipment necessary to furnish and install Variable Frequency Drives (VFD) as shown on Drawings, specified herein, or evidently required to complete the work.
- B. Refer to various DIVISION 11 sections and E-Drawings control wiring diagrams for field device interface.
- C. Refer to I-Drawings for additional requirements.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Shop Drawings showing complete fabrication and construction details, materials, electrical components, enclosures, input line reactors, harmonic filters, weights, dimensions, clearances, anchorage locations, piping and utility requirements, and step by step sequence of controls.
  - 2. Certified Performance and Efficiency Characteristics.
  - 3. Provide the VFD manufacturer with copies of all motor shop drawing submittals and or nameplate data. The VFD manufacturer shall review this data and shall certify in writing that the equipment has been coordinated with the variable frequency drives and motors for complete compatibility.
  - 4. Harmonic Analysis and written summary report.
  - 5. Complete master wiring diagrams, VFD layout Drawings and control schematics, including required coordination with other electrical control devices operating in conjunction with each VFD and suitable outline Drawings shall be furnished for each VFD being supplied for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above Drawings be



clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or Drawings simply marked to indicate applicability to this contract will not be acceptable.

#### 1.4 QUALITY ASSURANCE

- A. Each VFD unit shall be U.L. listed or labeled.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.
- B. The materials and components shall be stored on a flat, clean surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

#### 1.6 DESIGN CRITERIA

- A. The materials and equipment covered by this specification are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- B. Provide enclosed type individual constant torque VFD's with LCL line filters and low harmonic drives. Each individual VFD requires all these devices to be factory mounted within its enclosure. Field mounting of drive related accessories is unacceptable.
- C. All equipment submitted shall be provided with enclosures that can be installed in the spaces shown on the Drawings. Enclosures that exceed the allowable space provided shall be subject to rejection.
- D. Heat dissipation from VFD enclosures shall meet all requirements of the specifications.
- E. Under normal operating conditions, the line harmonics introduced into the power system from the AC VFD unit(s) shall be within the distortion limits as defined in IEEE 519 and less than %5 Ithd. The point of common coupling shall be the main distribution panel.
- F. All VFDs shall be low harmonic drives for the wastewater and water industry meeting the requirements of IEEE-519 as manufactured by ABB, Eaton or General Electric.

### PART 2 –PRODUCTS

#### 2.1 DRIVES

- A. This specification is intended to outline the overall physical features, performance and functional requirements of the VFD equipment required under this section, consisting

of a variable speed adjustable frequency converter, filters, accessories, and enclosure. The VFD system shall be fully tested by the manufacturer before initial startup with all components compatible in function and appearance.

B. Variable Speed Adjustable Frequency Converter. The adjustable frequency drive modules shall be UL Listed solid state type in a NEMA 12 filtered enclosure and blower cooled. The filter element shall be of the removable and replaceable type for each drive unit. Front access shall be provided. Top, rear and side access shall not be required. The enclosure shall be coated with an epoxy resin base and acrylic resin enamel finish. The drive shall meet applicable provisions of DIVISION 16, ELECTRICAL, the National Electric Code and NEMA. The drive shall be arranged for 480 Volts plus 10 percent to minus 5 percent, three phase, 57 to 63 Hertz input converted into adjustable frequency/Voltage output in an ambient temperature of -10 to 40 degrees C. The VFD shall be capable of sustaining operation with a line voltage dip of 15 percent of normal operating voltage on a constant torque or variable torque load. During line dip the VFD shall automatically provide a speed drop allowing maximum capable speed for the duration of the input voltage dip. Each individual drive shall be mounted in a separate enclosure. The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads. Each individual drive and associated equipment shall be mounted in a single and individual enclosure unless otherwise specified. The following features shall be included with each adjustable frequency drive:

1. Control. The control method shall be sinusoidal Pulse Width Modulation. Output Voltage shall be three phase, 480 Volts and output frequency shall be 0.1 to 66 Hz when shipped. Frequency shall be selectable by a digital keypad. The frequency resolution shall be 0.1 Hz and the accuracy shall be within 1.0 percent of the maximum frequency at 25 degrees plus or minus 10 degrees C. Voltage/frequency (V/f) characteristics shall be characterized by selectable patterns. Up to 82 control functions shall be programmed. The overload capacity shall be 110 percent continuous and a minimum two minute rating of 150 percent of rated current. The frequency setting signal shall be 4 to 20 mA. The VFD shall employ a full wave rectifier to prevent input line notching, DC bus choke, DC bus capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device. SCRs, GTOs and Darlington transistors are not acceptable.
2. Function. The adjustable parameters consisting of: accelerating time, decelerating time, upper and lower limit of output frequency, and 4 to 20 mA reference bias and reference gain shall be indicated on a digital display. Braking shall be achieved through capacitor charging and starting shall be achieved by external contact. The VFD shall be software configurable to automatically restart following power outage, overcurrent and overvoltage detection. Soft stall shall occur when motor runs continuously at overload.
3. Protection. The drive shall be protected from stalling, overcurrent, overload, short circuit, overvoltage, undervoltage, loss of one (1) phase of input power, instantaneous power failure (approximately 30 msec), overheating, fuse burnout protection and earth (ground) fault detection. The fault cause shall be displayed (flickering) for overcurrent, short circuit, overload, overvoltage, overheating and

earth (ground) fault. There shall be a main capacitor charging indicator for internal circuit. Fault shall be reset by a reset push button on the printed circuit board and an external reset contact.

4. Displays. The digital display shall be a 2 line, 40 character unit with readout in plain English. A separate LED indicator shall be provided for capacitor charge. Display shall be located on the door of the VFD enclosure.
5. Internally mounted set point control shall be provided to receive either a 4 to 20 mA or 0 to 10 vdc analog input control signal from a process panel to control the speed of the motor. An external digital display shall be provided outside of the inverter. The following control devices shall be available for external control of the inverter; frequency/speed meter, frequency setting variable resistor, knob for frequency setting variable resistor and drive switch. The drive shall be capable of receiving a dry contact input to override the analog input control signal and control the flow rate to 95%.
6. A lockable main load break disconnect switch interlocked with the enclosure door with through the door handle to provide positive disconnect of incoming AC power shall be furnished for each individual drive and enclosure. The circuit breaker shall be rated at a minimum 25,000 amperes at 480 volts, RMS symmetrical.
7. Each drive shall be provided with the following accessories:
  - i. "Local-Off-Remote" keypad switch for local/remote speed control. In the "Remote" mode, the motor speed shall be adjusted in response to the related remote 4 to 20 mA pacing signal. In "Local" mode the motor speed shall be adjusted in response to keypad entry speed and the VFD shall run when the "Hand-Off-Auto" selector switch is in "HAND". . In "Off" mode the VFD shall not run.
  - ii. Provide a 4-20 mA speed feedback output signal.
  - iii. Provide four (4) Type C dry contacts at each VFD for remote indication of motor running status.
  - iv. "Hand-Off-Auto" selector switch located on the door of the VFD enclosure. In the "Auto" position the VFD shall be started and stopped remote via an external dry contact. In the "Hand" position the VFD shall run. In "Off" mode the VFD shall not run.
  - v. Elapsed time meters located on the door of the VFD enclosure.
  - vi. Provide two (2) type C contacts at each VFD for remote indication of VFD run and fault conditions.
  - vii. Motor running indicating light located on the door of the VFD enclosure.
  - viii. Motor off indicating light located on the door of the VFD enclosure.
  - ix. Drive failure indicating light located on the door of the VFD enclosure.
  - x. All indication lights pushbutton shall be LED push to test type.
  - xi. All delay time relays shall be true-off and true-on type delay relays.
  - xii. Provide all controls and accessories as shown on the equipment control wiring diagrams in the E-Drawings and as shown on the I-Drawings. Specialized interface relays supplied by the equipment manufactures shall be installed in the VFD cabinet by the VFD manufacturer at the VFD manufacturing plant.

Coordinate with the equipment manufacturer for space requirements and delivery of the relays.

C. VFD enclosures shall be coated with an electrostatically-applied epoxy enamel.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. All materials and equipment shall be installed in a neat, workmanlike manner.
- B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

#### 3.2 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's Field Services shall be provided for installation and startup for all the VFDs provided.
- B. Manufacturer's Field Services shall be a minimum of two (2) calendar days.

#### 3.3 MANUFACTURER'S TRAINING

- A. Manufacturer's training shall be provided for training of Owner's personnel for each type of VFD provided.
- B. Manufacturer's Training of Owner's Personnel shall be a minimum of two (2) calendar days performed at the project site.

#### 3.4 SPARE PARTS

- A. One set of spare parts shall be provided for each VFD size.
- B. Spare parts for each VFD Size:
  - 1. One (1) control interface.
  - 2. Three (3) fuses.
  - 3. One (1) VFD module each size provided without enclosure.

#### 3.5 WARRANTY

- A. A manufacturer warranty for three years shall be provided for each VFD.

#### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16495

## SECTION 16500

### LIGHTING SYSTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes the furnishing and installing of complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, clocks and all accessories and appurtenances required as specified herein and as shown on the Drawings.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Light Switches
  - 2. Occupancy Sensors
  - 3. Receptacles
  - 4. Astronomical Digital Time Clock Switch
  - 5. Lighting Fixtures
  - 6. Device Plates
  - 7. Emergency Lighting Battery Units and Exit Lights

##### 1.4 QUALITY ASSURANCE

- A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the Underwriters Laboratories “Standards for Safety, Electric Lighting Fixtures.” All lighting fixtures shall be Underwriters Laboratories labeled.
- B. Exterior light fixtures shall be in accordance with local zoning requirements.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## PART 2 –PRODUCTS

### 2.1 LIGHT SWITCHES

- A. NEMA WD 1, UL 20, Heavy-Duty, AC only general-use toggle switch.
- B. Rated 20 Amperes, 120/277 Volts for inductive and resistive loads.
- C. Totally enclosed in a phenolic base and cover.
- D. U.L. Listed.

### 2.2 OCCUPANCY SENSORS

- A. Occupancy sensor single circuit wall switch with dual technology (ultrasonic and passive infrared) and manual button control shall be equal to No. LHMTS1 as manufactured by Hubbell or equal by Leviton, Legrand or equal.
- B. Switch to be manual on operation except for bathrooms which shall be auto on operation.
- C. Rated 800W Incandescent/ Electronic, Ballast/ LED Driver, 1,000W Magnetic Ballast, 1/6 HP Motor.
- D. Occupancy (auto-ON) and Vacancy (manual-ON) operating modes.
- E. Casing - high - impact injection – molded plastic (UL–94–5V Impact-resistance lens)
- F. U.L. Listed.

### 2.3 RECEPTACLES

- A. NEMA WD 1, UL 498, Heavy-duty general use receptacle.
- B. GFCI Receptacle: UL 943, Convenience receptacle with integral ground fault circuit interrupter and indication light that is lighted when device is not tripped.
- C. NEMA WD 6, straight blade type for rated current and phases as indicated on Drawings.
- D. Weatherproof Cover Plate: NEMA 3R, thermoplastic while use type covers by Hubbell or equal

## 2.4 ASTRONOMICAL TIME CLOCK SWITCH

- A. Astronomical Time Clock Switch shall be programmable astronomically controlled switch front LCD time display and programmable buttons mounted in a standard back box.
- B. The switch shall be 1-pole, 15 Amp rated and capable of 7-day week time scheduling, equal to Leviton VPT24-1PZ Vizia by Leviton or equal by Hubbell or Legrand.
- C. Operation: Exterior lights shall be energized when the astronomical dusk time of day dial is past time. The lights shall remain energized until either the "Off" time of day or astronomical dawn time of day is past time.

## 2.5 LED LIGHT FIXTURES

- A. The fixture shall be tested to IESNA LM-79-08 and LM-80 Testing Standards at 25° C ambient temperature.
- B. The LED package shall be designed around the lumen maintenance of 87% at 60,000 hrs. and is to be expected to achieve L70 at 100,000 hrs.
- C. The Light Engine shall be a high efficacy LED light engine equipped with brand-name LEDs available in outputs of 100%, 85%, 70% and 55
- D. The LED Drivers shall be Electronic Class 2, high efficiency with the following power factor correction (PFC):
  - 1. Standard Non-Dimming Driver (PFC>0.95).
  - 2. Dimming Drivers (PFC>0.90).
- E. All exterior light fixtures shall be dark sky compliant.

## 2.6 DEVICE PLATES

- A. Plates shall be of the required number of gangs for the application involved and shall be Type 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

## 2.7 EMERGENCY LIGHTING BATTERY UNITS AND EXIT SIGNS

- A. Emergency lighting units shall be fully automatic with nickel cadmium or lithium-ion batteries. The wattage of the unit shall be sufficient to power the remote lamps as shown on the Contract Drawings, plus 20% spare capacity, for 1-1/2 hour upon loss of AC power. Units shall be designed for 120 Volt, 60 Hertz input and have an automatic clock timer and solid state charger, ready/off switch, press-to-test switch, amber "ready" light, red "charge" light and required number of supervisory relays.
- B. Provide Holophane DeSoto DSL46 series emergency lighting units, in NEMA 4 or 4X areas, Holophane DeSoto DSL3 series in NEMA 12 areas, and Holophane

Cortez CZQ6L in NEMA 1 areas. Units manufactured by Hubbell, Dual Lite or approved equal are also acceptable. Lighting heads shall be 1100 lumens, LED type.

- C. Provide exit signs with LED lamps, nickel cadmium battery, battery charger, white background with red lettering. In NEMA 1 and 12 areas provide Holophane QM-LED series and in NEMA 4X areas provide Holophane DLTX series. Equivalent units manufactured by Dual Lite, Sure Lite or approved equal are acceptable.
- D. Provide remote wall mounted lamp heads sealed wet location rated thermoplastic, 1100 lumens, LED type with weatherproof mounting base by Holophane. Equivalent units manufactured by Hubbell, Dual Lite or approved equal are acceptable.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for Connection to the branch circuit wires at the outlet. All pendant mounted fixtures shall be mounted plumb with floors and walls.
- B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.
- C. Flexible fixture hangers shall be used for all pendant mounted fixtures.
- D. Receptacles and switches shall be mounted at 45” above finished floor.
- E. Mounting heights given are to the bottom of the fixture. When “mount up” is indicated, fixture is to be mounted the stated distance off the finished floor.

#### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16500



## SECTION 16601

### LIGHTNING PROTECTION SYSTEMS

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this subsection includes the furnishing and installing of a complete lightning protection systems for the Water Treatment Plant Building, Well #2 Building, Well #3 Building, and Well #4 Building in compliance of the latest “Code for Protection Against Lightning” for structures as adopted by the National Fire Protection Association and the Underwriters Laboratories, Inc. for a Master Label system.
- B. The Electrical Subcontractor shall retain the services of a UL listed Master Label Lightning Protection design/build firm to provide certified design plans, manufacture specification sheets, and installation instruction for submittal review and installation services for a complete UL listed Master Label Lightning Protection system for each building and includes requirements for lightning protection systems components.
- C. Building Lightning protection systems shall coordinate with all building systems as shown in the Contract Documents including but not limited to the Architectural, Structural, Electrical, HVAC, Plumbing and Fire Protection systems where bonding is required.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Scaled Drawings detailing lightning protection system including, but not limited to, air terminal locations, conductor routing, connections and grounding conductor sizes and termination details.
  - 2. Manufacturer's Installation instructions.
  - 3. Air terminals.
  - 4. Bonding plates.
  - 5. Conductors.

6. Connectors.
7. Fasteners.
8. Grounding rods.
9. Rod clamps.
10. Splicers.
11. Roof Adhesive where used

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

#### 1.5 DESIGN CRITERIA

- A. Installer Qualifications: Engage an experienced Installer to install lightning protection system. An experienced Installer is defined as an installer who has over 10 years' experience in the installation of lightning protection systems.
- B. Electrical Component Standard: Provide work complying with applicable requirements of State Electrical Code.
- C. NFPA and UL Compliance: Comply with requirements of NFPA Standard 780, and UL Standard 96 and 96A as applicable to lightning protection systems for building projects.
- D. LPI Compliance: Comply with requirements of Lightning Protection Institute (LPI) Standards 175, 176, and 177, pertaining to lightning protection system material, components, installation and quality assurance procedures.
- E. ANSI Compliance: Comply with applicable requirements of ANSI Standard C2.

### PART 2 –PRODUCTS

#### 2.1 CONDUIT

- A. Conduit shall be specified under SECTION 16130, RACEWAYS AND FITTINGS.

#### 2.2 GROUND RODS

- A. Ground rods shall be as specified under SECTION 16060, GROUNDING SYSTEM.

### 2.3 FASTENERS, CLAMPS, CONNECTORS, LUGS, BOLTS, ETC.

- A. Fasteners, Clamps, Connectors, lugs, bolts etc. shall be copper or an approved type of non-corrosive metal.

### 2.4 AIR TERMINALS

- A. Building air terminals shall be 3/8 inch by 12 inch solid copper and shall extend at least 10 inches above the object to be protected. Spacing of Air terminals shall not exceed 20 feet apart on the ridge of the roof. The Air terminal base shall be suitable for the roof (tile, slate, concrete, flat, sloping etc.).

### 2.5 CONDUCTORS

- A. Conductors shall consist of 32 strands of 17 gauge copper wire weighing 215 pounds per 1,000 feet.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Conductor fasteners shall be spaced not to exceed 3 feet on centers.
- B. All metal bodies within 6 feet of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.
- C. The lightning protection system shall be bonded to the associated building's grounding system.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

END OF SECTION 16601

## SECTION 16612

### ENGINE GENERATOR

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this section includes all labor, materials, tools, equipment and incidentals necessary to furnish and install, put in operation and field test quantity a natural fired engine driven generator with sound attenuated weatherproof enclosures of the size and ratings as specified herein and on the Drawings.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Manufacturer and model of engine and generator
  - 2. Rated capacity B.H.P.
  - 3. Generator
  - 4. Generator KVA, KW and P.F. rating
  - 5. Voltage
  - 6. Class insulation
  - 7. Temperature rise above 40 degree C ambient
  - 8. Generator efficiency and fuel consumption at full load, 3/4 load and 1/2 load
  - 9. Operating weight and noise levels of complete unit
  - 10. Exhaust piping
  - 11. Battery and charger
  - 12. Auxiliary system power requirements and wiring diagrams.

13. Enclosure with all conduit openings for system operation identified.
14. Manufacturer's certified test record. The test record shall show the generator performance and frequency regulation to satisfy the requirements specified herein, and shall also show fuel consumption rates at 1/2 load, 3/4 load and full rated load.

#### 1.4 QUALITY ASSURANCE

- A. The generator unit shall be the standard product, as modified by these Specifications, of a manufacturer regularly engaged in the production of this type of equipment. Engine generator unit shall be a standard production model of proven ability and shall be designed, constructed, and installed in accordance with the best practice and methods. In addition, the manufacturer shall maintain a permanent service organization and supply of spare parts as necessary to provide adequate service within 60 miles of the site.
- B. The engine generator shall be a factory assembled unit specifically designed and fitted for operation on natural gas. The engine generator unit shall be free from injurious torsional or other vibration, and shall be assembled on an adequate steel subbase suitable for mounting on vibration isolation pads, on a flat concrete surface which is suitable for supporting the weight of the unit. The vibration installation material shall be furnished with the engine generator unit.
- C. The engine generator unit shall be designed and built in accordance with the latest standards of IEEE, NEMA, ANSI and ASME.
- D. The engine generator unit shall be designed to minimize the danger of accidents to operating and maintenance personnel. The manufacturer shall, prior to shipment, verify that all electrical connections are tight and that circuits are isolated, that on-set piping connections are well-made, and that standard safety equipment is included and functions according to design.
- E. Tests
  1. At least 48 hours prior to the load test, the manufacturer shall perform a pretest. The pretest shall be conducted in the presence of the Engineer. The pretest shall determine that the unit is ready for load testing and that all components are functioning correctly. All adjustment for tuning the unit shall be made during the pretest. If remedial work is required, the work shall be performed before the load test is conducted.
  2. Upon completion of the installation, the manufacturer of the equipment shall test the complete unit, at full load, using load banks, for four continuous hours. During the test, the following data shall be taken at 15 minute intervals:
    - i. Outside air temperature
    - ii. Generator enclosure temperature
    - iii. Oil pressure
    - iv. Oil temperature

- v. Jacket water temperature
  - vi. Battery charge rate
  - vii. Fuel pressure
  - viii. A.C. Volts
  - ix. A.C. Amps
  - x. Frequency
  - xi. Kilowatts
3. Following the test, three successive simulated power outages shall be conducted using all connected building load.
  4. The equipment shall be left in good operating order and the settings of all alarm and shutdown devices verified.
  5. Provide on-site sound measuring testing to assure specified maximum sound levels are not exceed at full load, provide test report.

F. Warranty/Service

1. The manufacturer's and dealers Extended Service Coverage shall in no event be for a period of less than five (5) years from date of Owner/Engineer's acceptance of the system and shall include repair parts, labor, travel expense necessary for repairs at the jobsite, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of maintenance and repair. Applicable deductible costs applying only after the first year shall be specified in the manufacturer's warranty. Submittals received without written warranties as specified will be rejected in their entirety. Warranty and maintenance shall be issued and executed by the dealer and may not be subcontracted.
2. The generator set supplier shall have factory trained service representatives and tooling necessary to install, test maintain, and repair all provided equipment and shall be located within 150 miles of the customer's site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.
- B. Protect material and equipment, in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.6 DESIGN CRITERIA

- A. The engine generator units shall comply with the requirements of the Federal Environmental Protection Agency and State of Massachusetts Department of Environmental Protection.

- B. The engine generator unit shall be arranged for automatic starting and stopping on failure of, and restoration of the normal source of power, and for automatic load transfer, but not including the automatic load transfer switch which will be furnished separately.
- C. The engine generator unit shall include, but not be limited to excitation system, controls, keep warm system, cooling system, silencer, starting batteries, charger, and all essential and desirable appurtenances whether specifically mentioned in this specification or not.
- D. The system described herein, including but not necessarily limited to the engine generator set, engine auxiliaries, batteries and engine generator control panels shall be furnished by a single supplier who is regularly engaged in the production of natural gas fired engine driven generators.
- E. The voltage regulation shall be within plus or minus two percent from no load to full rated load. On application or removal of full rated load in one step, the transient voltage dip or overshoot shall not exceed twenty percent of rated voltage. Frequency regulation shall be within 3 Hertz from no load to full load.
- F. The voltage regulator shall be insensitive to severe load induced waveshape distortion from SCR or thyrister circuits such as those used in battery charging (UPS) and motor speed control equipment. This SCR immune regulator shall not reduce the motor starting capabilities as specified herein.
- G. An engine generator unit of not less than the KW rating shown on the Drawings, 0.8 power factor capacity. Three (3) phase, 60 Hertz, 480 Volts, 4 wire (grounded wye) alternating current generator shall be furnished.
- H. The engine generator unit shall be completely prewired and piped so that only field connections to a master terminal strip for control, auxiliaries and alarms, and power connections to a molded case line circuit breaker and fuel line connections will be required.
- I. The engine generator unit and associated auxiliaries systems and components shall be skid mounted and installed indoors.

#### 1.7 ENGINE GENERATOR UNIT PERFORMANCE

- A. The engine generator unit shall maintain rated frequency from no load to full rated load.
- B. The voltage regulation shall be as specified herein and recovery to steady state operation shall be within two seconds.
- C. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of rated voltage. A rheostat shall provide a minimum of plus or minus five percent voltage adjustment from rated voltage.

- D. Frequency regulation shall be maintained within 2-1/2 percent of rated frequency from no load to full load. The steady state frequency shall be within 0.5 percent of rated frequency.
- E. The engine shall be equipped with a electronic isochronous governor capable of maintaining the engine speed from no load to full load within plus or minus .25 percent of the synchronous speed.

## PART 2 –PRODUCTS

### 2.1 ENGINE

- A. The engines shall be natural gas fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine shall meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 Emissions Cycle at specified ekW/bHP rating.
- B. The engine shall be furnished with thermostatically controlled jacket water heaters of the size recommended by the supplier. Heaters shall be rated for operation on 208 Volts.
- C. The oil sump will be fitted with pipe nipples, a ball valve, and an extension oil drain.
- D. The engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine-generator set, without special tools, from 90 to 110% of the rated speed/frequency, over a steady state load range of 0 to 110% or rated capacity.
  - 1. Steady state speed band, +/- 0.25% of rated speed.
  - 2. Internal oil pump, relief valve and accumulator controls governor operating pressure.
  - 3. Manual speed adjustment knob at top of unit.
  - 4. Positive locking to allow manual speed adjustment.

### 2.2 COOLING SYSTEM

- A. The engine shall be furnished with a unit mounted radiator. The radiator shall be of sufficient size to cool the water when ambient temperature is 100 degrees F. and the engine generator unit is operating at full rated load continuously.
- B. Cooling system shall further include water cooled manifolds, pusher fans and high temperature cutout. Provide radiator duct connector complete with suitable gasket,



bolts and nuts. The cooling system shall be furnished with sufficient antifreeze solution to protect the cooling system with ambient air temperature down to minus fifty degrees F.

- C. Provide an anti-freeze treatment as recommended by the manufacturer for protection against corrosion and scale formation. The anti-freeze treatment shall be compatible with the antifreeze solution. The anti-freeze will be long life environmentally friendly polypropylene glycol. The concentration will be as recommended by the manufacturer.

## 2.3 FUEL SYSTEM

- A. The engine shall be equipped with a complete base mounted gas fuel system rated for 7 to 11 inch H<sub>2</sub>O incoming gas pressure including:
  - 1. Fuel line solenoid valve.
  - 2. Flexible fuel connectors
  - 3. Fuel injection system.
  - 4. Dry fuel filters
  - 5. Manual shutoff valve
  - 6. Pressure Gauge
  - 7. Fuel regulator and any other components normally supplied or recommended by the manufacturer for this application.

## 2.4 EXHAUST SILENCERS

- A. The engine generator unit shall be provided with a critical type silencer including flexible exhaust fittings. Mounting shall be provided within the enclosure by the Manufacturer. Silencers shall be mounted so that its weight is not supported by the engine. Exhaust piping shall be sized as recommended by the manufacturer. Connection between engine and silencer shall be of the flexible type.
- B. Silencers shall be Maxim Model M41, equal by Kitell, or equal for naturally aspirated engines. Silencers shall be Maxim MT41 equal by Kitell, or equal for turbocharged engines.
- C. A flexible section shall be provided at each engine and an expansion joint at each muffler. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for gas-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

- D. Horizontal sections of exhaust piping shall be sloped downward away from the engine to a drip leg for collection of condensate with drain valve and cap. Changes in direction shall be long radius. Exhaust piping, mufflers and silencers installed shall be insulated with 3 inches of calcium silicate insulation and covered with aluminum flashing to protect personnel.
- E. All portions of the exhaust system shall be insulated and covered with flashing.

## 2.5 STARTING SYSTEM

- A. The electric starting system shall consist of the following equipment:
  - 1. The engine shall have a two wire, direct current starter suitable for automatic starting through the load transfer switch.
  - 2. Batteries shall be of the lead-acid type. Batteries shall be guaranteed to have sufficient capacity when in a fully charged state to perform not less than five, 15 second cranks while in an ambient temperature of 0 degrees F without recharging.
  - 3. Current limiting type automatic battery charger conforming to UL 1236 shall be of the static type, magnetic amplifier control with D.C. voltmeter, D.C. ammeter and potentiometer for voltage adjustment. Charger to be completely automatic, charging rate to be determined by the state of the battery, and reducing to milliamp current on a fully charged battery. Charger shall be for 120 Volt, single phase, 60 Hertz A.C. input with an output of not less than 10 amperes. The charger shall be for the correct voltage for the battery, and specifically for charging a lead-acid battery and for panel mounting. The charger shall be furnished with a battery under-voltage alarm system consisting of dry contacts for remote use.

## 2.6 ALTERNATOR

- A. The alternator shall be single bearing, open, dripproof revolving field, four pole brushless type, permanently aligned to the engine by flexible disc coupling. Each unit shall be reconnectable type having nine leads and shall be factory connected for three phase, 4 wire, 60 Hertz. The rating of the unit shall be as hereinbefore specified.
- B. Alternators shall have Class H insulation provided with a 2/3 pitch rated for use with non-linear variable frequency drive loads and shall be furnished with Amortisseur windings. Alternators shall have a complete static automatic voltage regulator which will hold the voltage within plus or minus two percent from no load to full rated load. On application of rated load in one step, the transient voltage dip shall not exceed twenty percent. The generator windings shall be braced to withstand any possible short circuit stresses. Alternator shall be "Radio Interference Proof" (RIP) and "Telephone Influence Factor" (TIF) and shall be within the limits of Section 9, ANSI C50.12. Alternators shall have a rotating brushless exciter and rectifier.
- C. The alternator characteristics shall be matched to the torque characteristics of the engine in such a manner that with full load connected to the alternator terminals, the alternator will utilize all the available engine power without exceeding it at all speeds.

- D. The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 40 degrees C 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.
- E. Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine-generator voltage output without special tools, during operation, from 90 to 110% of the rated voltage over the steady state load range of 0 to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 20 degrees C. 68 degrees F.
- F. Alternators shall be furnished with 120V stator heater and controls.

## 2.7 CONTROLS

- A. The engine generator unit shall be furnished with a shock resistant, engine mounted microprocessor instrument panel in NEMA 1 enclosure, dead front, with removable panel.
- B. Standard data available shall include:
  - 1. Jacket water temperature
  - 2. Lube oil temperature
  - 3. Lube oil pressure
  - 4. Battery voltage
  - 5. RPM
  - 6. A.C. Voltmeter
  - 7. A.C. Ammeter
  - 8. Frequency meter
  - 9. Elapsed time meter calibrated in hours and tenths of hours
- C. Accessories shall include:
  - 1. Current transformers
  - 2. Fuses
  - 3. Generator voltage regulator

4. Voltage adjusting rheostat
  5. Fault indication lights one each for:
    - i. Low Oil Pressure
    - ii. High Water Temperature
    - iii. Overspeed
    - iv. Overcrank (Fail to Start).
  6. Prewarn indication lights one each for:
    - i. Low Oil Pressure
    - ii. High Water Temperature.
  7. 90 DB (a) Audible alarm to sound on any fault or prewarn and an alarm silencer.
  8. Mode selector switch – "AUTO", "OFF", "MANUAL" with audible alarm when switch is not in "AUTO" position.
  9. Control power fuse.
  10. Fixed overcrank timer - four-10 second cranks shall be provided. After four cranks, the unit shall stop and an alarm initiated.
  11. Auxiliary contacts which close when engine is in operation. Contacts shall be rated 10 amperes and shall be used to interlock combustion and ventilation air dampers.
  12. Common failure relay
  13. Dry contact kit with the minimum following contact signals for remote monitoring:
    - i. Engine Running
    - ii. Not in Auto
    - iii. Engine Trouble
    - iv. Battery Charger Alarm
    - v. Low Fuel Alarm
    - vi. Generator Emergency Stop
  14. Engine sensors for low water temperature near low oil pressure, near high water temperature.
  15. Refer to I-Drawings for additional requirements.
- D. In addition to the equipment included in the control panel described above, the unit shall include a power and control junction box mounted on the generator. This junction box shall include:
1. Three phase power conductors terminated with pressure type ring connectors.
  2. Neutral connection.

3. Terminal block with marked connection points for all external control connections and for jacket heaters, etc.
  4. Molded case line circuit breaker with interrupting rating of 42 KA amperes RMS.
- E. Automatic shutdown shall be provided for each of the following conditions:
1. High jacket water temperature
  2. Low jacket water pressure
  3. Low lubricating oil pressure
  4. Engine overspeed
  5. Unit fail to start.
- F. Auxiliary normal open dry contacts shall be provided for remote transmission of unit failure.
- G. Provide emergency stop pushbutton operator station for remote mounting in the electrical room.

## 2.8 SUBBASE

- A. The engine, generator and radiator shall be mounted on a structural steel base designed to maintain proper alignment. Vibration isolators shall be furnished of the size and type recommended by the supplier.

## 2.9 ENCLOSURE

- A. A sound-attenuated weather-protective housing shall be furnished. The housing shall enclose the complete unit and all related equipment (e.g. battery, battery charger, engine controls and control panel, etc). All components shall be wired and piped within the enclosure.
- B. The housing shall be constructed of 14 gauge rolled steel and shall include hinged locking access doors. Housing surfaces shall be prime painted with two coats of a rust resistant primer and finished with a dark green enamel paint.
- C. The housing shall be sound insulated, vandal proof, and padlocked. The resulting structure with engine-generator in full load operation shall not transmit more than 70 db at a distance of 23 feet from the generator in any direction. There shall be no Puretone. The generator set manufacturer shall choose the thickness of insulation to meet the aforementioned sound criteria.
- D. The housing shall be furnished with weather-protective fixed louvers, and weather-protective flanged door openings to insure weather-resistant construction.

- E. Stainless steel flexible exhaust sections shall be provided. Exhaust outlet shall be terminated with a “shanty cap” designed so to prevent entrance of rain into exhaust outlet. All handles, sheet metal screws, bolts, nuts, hinges, and other exterior hardware shall be stainless steel.

### PART 3 – EXECUTION

#### 3.1 MANUFACTURER'S SERVICES

- A. A minimum of one, eight-hour day shall be provided to supervise the installation and testing of the equipment furnished, to assist in start-up and train Owners maintenance personnel.
- B. A minimum of one, four hour day, not including travel time to and from the site, shall be used by a fully qualified field service engineer to make necessary adjustments and to provide operator training on the equipment furnished. This work shall occur after the equipment has been in operation and at the request of the owner, but not to exceed one year after the acceptance of the facility.
- C. Upon completion of the startup and owner acceptance off all engine generators provide an 8 hour on-site training owner training session.

#### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Operation and Maintenance Manuals
  - 1. Furnish Operation and Maintenance Manuals as specified in SECTION 01730 – Operation and Maintenance Data.
  - 2. Maintenance instructions shall be furnished for batteries, to include simple and clear procedures for addition of liquids, maintaining cleanliness, proper ventilation, proper electrical connections.
  - 3. Maintenance instruction shall be furnished for engines, including recommended lubricants, coolants, etc., recommended maintenance intervals, and recommended ventilation requirements.
  - 4. The Operating manual shall be a simple starting and stopping procedure, with reference to shop Drawings information for more complicated procedures.
- C. Complete and submit MassDEP standby generator installation compliance permit – refer to Appendix F.

END OF SECTION 16612

## SECTION 16650

### PHOTOVOLTAIC POWER SYSTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The Work of this Section includes furnishing all labor, materials, tools, and equipment necessary to provide a 25 kilowatt photovoltaic (PV) type solar power system as specified herein and/or as shown on the Contract Drawings complete with supports, instrumentation and controls, and required supporting systems.
- B. Provide roof mounted PV panels with an mounting support system, rapid shutdown modules, cables, cable support system, PV Inverter, service disconnect, and utility grade revenue meter.
- C. The PV solar power system package shall be complete in all respects and shall include all equipment, wiring systems and controls necessary for a fully operational system.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Manufacturer and model number of PV Panels, inverter, quick disconnects,
  - 2. Outline equipment drawings, equipment catalog cuts, interconnecting wiring and other documents required to completely describe the systems and equipment being furnished.
  - 3. Drawings, indicating PV panel layout, mounting details, size and location of anchor bolts, conduit locations, and estimated weights identified.
  - 4. Certificate of conformance to UL 1741/IEEE Standard 1547, Standard for Interconnecting Distributed Resources with Electric Power Systems, and UL Standard 1741, Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
  - 5. Signed and sealed analysis report by a professional engineer licensed in the State of Massachusetts for Engineer review and approval for the

roof/wind/snow/ice/seismic loads and detailed installation requirements in accordance with the current version of the International Building Code as determined by the Massachusetts State Building Code Review Board.

6. Solar Power System supplier shall provide proof of work experience for similar sized PV systems.
7. Operations and Maintenance Manuals, covering all equipment furnished, annotated to reference only the specific model numbers supplied. Include parts lists and parts prices current to the date of submittal; include information relevant to part supply and ordering. Submit prior to the startup and testing of the systems. Submit Construction details and dimensions and the following:
  - i. A complete set of all approved submittals including shop drawings and product literature.
  - ii. As-built drawings showing the final placement of all equipment, connections, and conduit placement.
  - iii. Trouble shooting guidelines.
  - iv. System maintenance schedule and procedures.
  - v. Contact information for technical assistance and parts ordering.

#### 1.4 QUALITY ASSURANCE

- A. PV System shall have the following safety and quality tests and certifications or equivalent:
  1. IEC 1215 Certification.
  2. IEEE 1262 Certification.
  3. UL listing with Class C or better fire rating.
  4. DC-AC Inverter shall meet UL1741 standards.
- B. PV panels shall be commercial grade.
- C. The PV panel mounting equipment, rapid shutdown modules, and cabling shall be listed compatible with the PV panels.
- D. The inverter manufacturer must have adequate experience in the industry and a product that is applicable for this project. The manufacturer must be able to provide an inverter as described in Part 2 and the manufacturer must have at least 5 years experience in the manufacture of battery-less, grid-interactive, inverters for commercial applications.
- E. Submit a detailed testing and startup plan for review by Engineer. The Contractor shall incorporate any modifications to the plan required by Engineer. Once the installation has been completed, and after all inspections have been performed and approved, the Contractor will test and start up the system. The Contractor will provide notice, in writing, to Engineer and to the local utility of his intent to start the system one week prior to the proposed start up date. After receiving written permission to start the



system from Engineer and the local utility, the Contractor will commission the system in keeping with all requirements of the commissioning plan, the inverter manufacturer startup procedures and the utility interconnection requirements. Once the system has been commissioned, the site will be left free of all tools, materials and debris.

F. The installation, testing, and startup shall be supervised by NABCEP certified installer. The shop drawing submittal shall provide the name, company, and contact information of the certified installer. Submittals that do not include the required information will be summarily rejected.

G. Test

1. Provide technicians, equipment and apparatus for performing field tests.
2. Measure output of each system over a 7 day period and provide summary report identifying energy output on a daily basis.
3. Compare test data to design data and identify any system deficiencies for resolution by solar power system manufacturer.
4. Measurement and record voltage of every source circuit.
5. Perform inverter startup tests as specified by the inverter manufacturer in the inverter operation manual.
6. Measure AC power and compare to predicted power based upon estimated irradiance level.
7. Perform loss of grid test and verify five-minute delay upon restoration of grid.
8. Verify data acquisition/display system is functioning properly comparing independent measurements to data acquisition display.
9. Correct any deficiencies uncovered by the testing prior to startup of the system.
10. Submit test reports for approval.

H. Warranty/Service

1. All materials and equipment shall be guarantee to be free from all defects due to faulty materials or workmanship for a period of five years from the date of acceptance of the system.
2. In addition the above, the additional written warranties shall be provided:
  - i. Photovoltaic System Panels - photovoltaic system panels shall have a minimum warranties as described herein.
  - ii. Inverters - Inverters shall be warranted to be free of defects for a period of not less than 10 years. The Contractor will list optional warranties with incremental cost.

- iii. Mounting Systems - Mounting System shall be warranted to be free of defects for a period of not less than five years. The Contractor will list optional warranties with incremental cost.
- iv. Roof - Installation shall not compromise existing building roof warranty. The Contractor shall provide a written statement from the roofing contractor or manufacturer stating that the roof warranty has not been compromised.
- v. Warranted System Rating - The Contractor will supply a written warranty stating the STC rating of the completed system.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.
- B. Protect material and equipment, in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

#### 1.6 DESIGN CRITERIA

- A. System equipment included PV panels shall not be manufactured in China or supplied by a Chinese company.
- B. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The Specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.
- C. The photovoltaic system shall be manufactured/supplied by a company of good reputation that is regularly engaged in the manufacture and fabrication of photovoltaic systems. The photovoltaic system manufacturer shall have at least five years experience in manufacturing photovoltaic systems.
- D. The manufacturer/supplier of the photovoltaic system shall be completely responsible for the proper design of its system. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the Contract Documents.
- E. The Contractor shall assign full responsibility for the functional operation of all photovoltaic system components to a single source supplier. This supplier shall be responsible for all engineering necessary in order to select, furnish, inspect the installing contractor's equipment installation and connections, calibrate, and place into operation the photovoltaic system along with all other equipment and accessories as specified herein.

- F. The photovoltaic system shall be utility grid connected following the local electric utility's required design and installation standards for grid-tied customer-sited generation. Contractor shall prepare applications for interconnection with the local utility. An electrical permit will be filed for this project by the Contractor with a valid Massachusetts electrician license.
- G. The output of the photovoltaic inverter(s) will not interfere with or damage the function of building electrical distribution systems. All serviceable components must be accessible. The installation shall comply with all Federal, State, and local building codes.
- H. The system shall provide a data monitoring system with sensors and an interface integrated into the Owner's SCADA system
- I. Contractor shall provide all necessary materials for a complete photovoltaic system, as described within this specification, with a nominal combined capacity of 25 kW.
- J. The system shall be suitable for use at a Massachusetts public water supply site.

## PART 2 –PRODUCTS

### 2.1 GENERAL

- A. All mounting materials will be corrosion-proof aluminum or 304 stainless steel. All materials subject to exposure to the sun must be sunlight resistant material. All conductors will be copper.

### 2.2 INVERTER

- A. Inverter efficiency, based upon the California Energy Commission's (CEC) list of eligible inverters weighted efficiencies, shall be greater than or equal to 94 percent (refer to <http://www.gosolarcalifornia.ca.gov/equipment/inverter.php>).
- B. The inverter shall meet the current UL 1741/IEEE Standard 1547, NEC codes and the latest applicable ANSI and FCC standards and addenda.
- C. The single central inverter shall be sized for a 30 KW minimum complete photovoltaic system with a 277/480V, 3-phase, 4-wire output.
- D. Each inverter shall include:
  - 1. Automatic operation including start-up, shutdown, self-diagnosis, and fault detection.
  - 2. LCD for display of operating status.
  - 3. Ground fault protection.

- i. The AC interconnection shall comply with NEC by providing ground fault protection for the inverter AC output circuit. The protective circuit design will include a discrete ground fault relay that will trip the interconnecting shunt trip circuit breaker in the event of detection of excessive AC ground fault currents.
  - ii. Coordinate the photovoltaic system AC ground fault detection and protection device thresholds with the existing distribution system ground fault protection.
4. Ethernet Modbus communications capability for reporting internal system parameters.
5. NEMA 4X rated enclosure.
- E. Inverter shall be sized for a solar panel system with the following environmental conditions:
  1. High Temperature: 50 degrees C.
  2. Low Temperature: -40 degrees C.
- F. Configuration: 6 MPP Trackers with 2 strings with number of combiner modules as required to achieve minimum inverter DC input requirements. The inverter shall have an DC combiner input module for with number of DC input to at least match the configured system strings.
- G. The inverter shall be a grid-interactive, non battery-based model.
- H. The inverter shall be designed to accept the PV array output and shall be listed to UL1741 standards and shall be acceptable to the local utility.
- I. The inverter shall start, synchronize, operate, PV panels rapid shutdown, and disconnect automatically without the need for user action or intervention. The inverter shall communicate with PV panels of the DC power line via power line communications (PLC).
- J. The inverter shall be capable of operating in parallel with other grid interactive inverters.
- K. The inverter shall have integral AC and DC disconnect switches with through cover handles.
- L. The inverter shall have alarm output contacts and the following protective functions: AC over/under voltage, AC under/over frequency, over temperature, AC and DC over current, DC over voltage.
- M. Data Monitoring System
  1. The data monitoring system shall report the system parameters and fault conditions in a ethernet modbus communications to the SCADA system.
  2. The system parameters reported will include:

- i. DC voltage for each subarray of the array (subarray size TBD)
- ii. DC current for each subarray of the array (subarray size TBD)
- iii. DC power for each subarray of the array (subarray size TBD)
- iv. Total AC power
- v. Back of panel surface temperature
- vi. Panel ambient temperature
- vii. Plane of Array (POA) irradiance main incline
- viii. Percent of AC power generated vs purchased

## 2.3 PHOTOVOLTAIC PANELS

- A. 144 Mono PERC diamond half cells, encapsulated and bonded to glass in multiple layers on a highly resistant polymer back sheet.
- B. 3.2mm high transmission tempered glass with, anti-reflection coating.
- C. Anodized aluminum frame with pre-drilled mounting holes.
- D. Manufactured to ISO 9001 Standards and UL approved.
- E. Photovoltaic panels shall be approximately rated for 400 Watt STC, 294 Watt NOTC, 40.16 Volts, 9.96 Amps, 19.88% module efficiency STC.
- F. Panels shall be UL 61730 (Type 1 Fire Rated) and 50mm hailstone listed.
- G. Panel manufacture shall warrant that the photovoltaic modules will free from defects in materials and workmanship for 25 years from the date of delivery.
- H. Panel manufacturer shall warranty power production loss of not more than 17 percent within 25 years of purchase.
- I. Approximate Panel Dimensions: 40"x79".

## 2.4 RAPID SHUTDOWN MODULE

- A. A rapid shutdown module shall be provided for each PB module that shall directly connect to the PV panel output cables and mount directly to the PV module mounting system.
- B. UL 1741 certified and NEC compliant for module rapid shutdown with power line communications (PLC) with the inverter.
- C. Modules shall be compatible with the PV panels and inverter.
- D. Module shall have a NEMA Type 4X enclosure with integrated plug and play input/output DC cables.

## 2.5 AC KILOWATT-HOUR METER

- A. The system will include a revenue grade kilowatt-hour meter that will record the full AC output of the inverter.
- B. Meter socket will be NEMA 3R.

## 2.6 MOUNTING SYSTEM

- A. The roof mounted system must fit within the roof area of the water treatment facility building on the South incline. The ground mounted system must fit within the identified area allocated on the site.
- B. The mounting system shall include a horizontal, east-west, racking system spanning the standing seams.
- C. The roof array mounting mechanism shall not create an additional static roof loading in excess of 20 pounds per square foot over the mount contact area with the roof (wind loads excluded).
- D. The array mounting system shall support the panels in an orientation as shown on the drawings. This angle shall allow water to run off the panels (thereby rinsing away dust or other particulates) and to provide airflow around the panel for cooler, more efficient operation
- E. Panels shall be individually removable for roof access, maintenance or repair. Perimeter setbacks shall be as shown on the Contract Drawings, but shall not be less than three feet.
- F. The mounting system shall be designed to meet or exceed requirements of applicable state and local building codes, including wind speed, snow and seismic load requirements.
- G. The PV array mounting mechanism shall be thoroughly engineered and tested as a stable support for the PV panels in wind speeds up to 110 mph.
- H. The array mounting mechanism shall require minimal roof penetrations and shall be designed to be secured on to a supporting system on a metal roof.
- I. The mounting mechanism shall not significantly impede the flow of water across the underlying roof or ground surface.
- J. The PV array mounting system shall be arranged for the mounting of rapid shutdown modules and associated conduit and enclosures.
- K. Exposed PV panel wiring shall be kept to a minimum, shall be properly rated for sunlight resistance, shall be properly rated for the hot temperatures associated with the PV array (90 degrees C insulation) and shall be properly secured to avoid physical damage from wind, hail, or other environmental factors. Means of securing exposed

wiring must be sunlight resistant and able to withstand expected rooftop environmental factors over the life of the system.

- L. Junction boxes shall be secured to the supporting system.
- M. Framing system shall consist of anodized aluminum tubular frames manufactured to withstand wind speed of 100 mph and gusts to 120 mph
  - 1. Roof clamping system shall be dimensionally coordinated and compatible with roof supports shown on structural contract drawings.
  - 2. Hardware to be 304 stainless steel material.
  - 3. Clamping system to be metallurgically compatible with roof materials without the addition of a separate cathodic protection system.
- N. System shall be Unirac Solar Mount for the roof mounted PV system, or approved equal.

## 2.7 SYSTEM WIRING

- A. All wiring and conduits shall be in compliance with DIVISION 16 – ELECTRICAL
- B. All system wiring shall be of an NEC approved wiring method. All conductors shall have a temperature rating of 90 degrees C.
- C. All conductors shall be copper.
- D. Conductors shall be sized such that calculated DC voltage drop from the output of each source circuit to the inverter DC input shall not exceed 3 percent of the system maximum power voltage (Vmp). Contractor shall submit their calculations for review.
- E. All outdoor electrical enclosures shall be NEMA 4 and have watertight connections.
- F. Exposed DC cables shall be listed as sunlight resistant.
- G. All source circuit conductor array wiring must be securely fastened and supported and may not lay on the roof surface.
- H. Provide DC system cables, #10 AWG minimum XHHW.

## 2.8 PHOTOVOLTAIC SYSTEM GROUND

- A. The photovoltaic system ground shall be installed and sized in accordance with NEC and shall terminate on the ground bus in the Main Distribution Panelboard in the Water Treatment Facility.

## PART 3 – EXECUTION

### 3.1 VERIFICATION OF CONDITIONS

- A. Before the start of the Work of this Section, verify that the Project is ready for this Work.
- B. Verify that field measurements are as shown on approved Shop Drawings and/or manufacturer's instructions.
- C. Verify that the equipment or material is in conformance with the approved Shop Drawings and Specifications and resolve any deviations.

### 3.2 FABRICATION

- A. Fabricate each element and connection as indicated on the shop drawings approved by the Engineer.
- B. Only skilled workers trained, experienced, and regularly active in PV System installation shall be utilized for the work described in this section.
- C. Work shall be performed in accordance with the installation and operation instructions provided by equipment manufacturers and in accordance with this specification.
- D. All work shall be conducted in a professional manner with appropriate courtesy toward and coordination with other workers on site.
- E. All work shall be conducted in a safe manner in accordance with all appropriate safety guidelines and regulations.
- F. Work areas shall be kept clean and orderly. Any waste, excess material, or packaging.

### 3.3 FABRICATION

- A. Solar Power systems shall be erected complete with all components and accessories specified and in strict accordance with the manufacturer's printed instructions and approved shop drawings. Systems shall be installed as indicated on the Contract Drawings.
- B. Align framing systems for solar panels with structural members.
- C. Provide bolts and anchors with templates for correct placement to supporting materials.
- D. Hold steelwork securely in place with temporary bracing and stays to resist all vertical and lateral loads, until framing is permanently fastened.
- E. Inspect and torque test field-assembled bolted construction in conformance with manufacturer's published data.
- F. Make all cable connections and ensure all exterior enclosures, are weathertight.
- G. Report errors in shop fabrication or deformation resulting from handling or transportation immediately to Engineer. Replace and remove from job site incorrect fabricated or deformed material at no additional cost to the Owner.



- H. Do not enlarge holes or damage roof supports during assembly.
- I. Enlarge holes to admit bolts for connections only if approved in writing by Engineer. Make enlargements only by drilling. Refinish enlarged holes with paint to match the shop coat. Use specified galvanize touch-up for galvanized members.
- J. Photo Voltaic System
  - 1. Attach PV supports to roof structure or ground support framing.
  - 2. Attach PV panels to the mounting/support structure.
  - 3. Install rapid shutdown panels, cable supports, and cables at the rooftop location.
  - 4. Provide wiring within each PV array and wiring from each PV array to system elements in raceways provided under Division 16. All DC wiring and components shall be labeled for polarity and circuit. All AC wiring and components shall be labeled for phase.
  - 5. Install disconnect devices, meter, and DC-AC inverter
  - 6. Label all equipment to meet NEC and utility requirements. A laminated B size, one-line drawing showing the photovoltaic system major components and interconnection to the facility AC distribution system will be posted at the inverter.
  - 7. Label to identify all system components.
- K. Installation Requirements
  - 1. All over-current protection devices shall have trip ratings no greater than the de-rated amperage of the conductor it protects.
  - 2. All mounting equipment shall be installed to the manufacturer's specifications. All outdoor materials shall be corrosion resistant material. No wood or ferrous metal may be used.
  - 3. All wiring shall be accessible to service personnel.
    - i. All cables, conduit, exposed conductors, and electrical boxes should be secured and supported according to NEC requirements.
  - 4. For any components installed on the roof, the system shall maintain roof and structural integrity. The loading impact of the array, wind, snow, etc. shall be determined prior to the installation. The successful contractor will enter into an agreement with the roof manufacturer to provide QA/QC during installation to ensure that the roof warranty is in affect. Sleeper conduit supports and pitch pockets will be approved by roofing contractor. The Contractor shall submit details of proposed work for review and approval as part of the shop drawing.

5. The photovoltaic system shall have no adverse impact on any of the building electrical systems. All conduits and equipment must be protected with bollards or comparable means where subject to mechanical damage.

#### L. Installation Standards

1. System installation shall conform to all manufacturer's installation manuals and approved project drawings and specifications.
2. All applicable local and NEC codes shall be observed.
3. Contractor shall comply with all specifications within this document. Contractor will ensure subcontractors (if used) shall comply with manufacturer's installation guidelines and this specification.

#### M. Point of Interconnection

1. Interconnect to the load side of the main electrical panel at the spare dedicated circuit breaker. The trip setting of the interconnection shall be adjusted to not less than the overcurrent rating required for the inverter(s).

#### N. Inverter Interoperability

1. Provide confirmation from the inverter manufacturer that interconnection to this local electrical distribution system will represent no hazard to the safe and reliable operation of the proposed inverter and that it will in no way affect the inverter warranty
2. The project includes the installation of a new on-site generator. On occasion, the generator may be run to electrically "island" the facility.

### 3.4 MANUFACTURER'S SERVICES

#### A. Provide services of Service Technician, specifically trained on type of equipment specified. Person-day requirements are listed exclusive of travel time:

1. Assist in location of devices, methods of mounting, field erection, inspection prior to energizing the equipment, etc.
  - i. 1 person-day
2. Start-up and testing.
  - i. 3 person-days
3. Owner Training
  - i. 1 person-day
4. Person-day is defined as one 8-hour day, excluding travel time.

### 3.5 SPARE PARTS

- A. One set of spare parts shall be provided for equipment as noted herein. Spare parts shall be effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. Spare parts shall be furnished in sturdy labeled boxes.
  - 1. One set of special tools required for normal operations and maintenance.
  - 2. Spare PV panels equal to 1/2 percent of the total STC capacity of the array.
- B. Spare parts shall be identical to and interchangeable with parts installed.

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Operation and Maintenance Manuals
  - 1. Furnish Operation and Maintenance Manuals as specified in SECTION 01730 – Operation and Maintenance Data.

END OF SECTION 16650

## SECTION 16720

### SECURITY ALARM SYTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this subsection includes the furnishing and installing of a complete security alarm system as specified herein and as shown on the Drawings. The system shall be electrically supervised, connected, tested and left in first class operating condition.
- B. The system shall consist of, but shall not be limited to a security alarm control panel, keypads, magnetic door switches, timed exit/entry delay control, conduit, fittings, outlet boxes and wire, operating instructions and maintenance instructions.
- C. Provide all required coordination with door installations for proper installation of alarm devices and wiring.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Complete system wiring diagrams and elementary or control schematic.
  - 2. Data sheets and outline drawings showing details for mounting all control devices and panel.
  - 3. Battery load calculations.
  - 4. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.
  - 5. Operating instructions and maintenance procedures. Operating instructions shall be furnished separate from manufacturers standard catalog literature and shall include recommended customer troubleshooting procedures. Maintenance procedures shall be furnished separate from manufacturer's standard catalog literature and shall include battery maintenance, lamp and fuse replacement, detector periodic checking and reset procedures, and other applicable procedures.

## 1.4 QUALITY ASSURANCE

### A. Testing

1. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect field-assembled components and perform system pretesting, testing, adjustment, and programming.
2. Before the installation is considered complete and acceptable, a demonstration test on the entire system shall be performed as follows:
  - i. Test shall ensure that the requisite degree of intrusion detection is provided.
  - ii. Test each sensor and component individually.
3. The system test shall be accomplished in linear fashion, end-to-end, and shall verify that each simulated intrusion performed within each detection zone produces an appropriate alarm or signal, and that alarm is correctly annunciated at the keypad and remotely.

### B. WARRANTY

1. The manufacturer shall guarantee all system equipment for a period of three (3) years from the date of final acceptance.
2. The Electrical FSB shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from the date of final acceptance of the system.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## 1.6 DESIGN CRITERIA

- A. The security system shall be the standard product, as modified by these Specifications of a manufacturer regularly engaged in the production of this type equipment. In addition, the manufacturer shall maintain a permanent service organization and a supply of spare parts as necessary to provide adequate service to this system within 24 hours from receipt of a request for service.
- B. All equipment shall be listed by Underwriters Laboratories.
- C. The equipment manufacturer shall have a local branch office within 75 miles staffed with trained, full time employees who are capable of performing testing, inspecting, repair and maintenance services for the life of the manual alarm system.
- D. All components of the system shall have been tested for compatibility with each other to ensure the system performs all intended functions.

E. The system shall be have the following alarm zones

1. Lower Level East Door Intrusion
2. Upper Level West Door Intrusion
3. Upper Level North Door Intrusion
4. Spare
5. Spare
6. Spare
7. Spare
8. Spare

F. System Operation

1. Actuation of the door switch while the system is armed shall:
  - i. Actuate the respective zone alarm lamp at the security alarm keypads.
  - ii. Actuate discrete remote dry contact alarm to the SCADA system.
2. The security alarm keypads panel shall allow a timed exit/entry control to access the building without tripping the alarm. Authorized personnel entering the building will have up to five minutes to de-activate the alarm system prior to sending an alarm output.
3. Opens, ground, or tampering, occurring on the zone monitor circuit during bypass or secure mode of operation shall cause a trouble signal. To clear a trouble signal transmission, the trouble must be corrected and the system will automatically return to its normal state of operation. To restore the device actuating the alarm, the alarm must be secured to its normal position and the system reset switch operated. A trouble signal on an individual zone monitor circuit shall not interfere with the automatic transmission of an alarm signal on another zone monitor circuit occurring during the same period.

G. All system functions, alarms and annunciations shall be monitored and controlled at the keypads.

H. The system shall have the capacity to collect date/time entry data in non-volatile memory and display the date/time entry when requested by an authorized user.

I. The system shall have the capacity to collect, communicate, and display a minimum of 8 programmable sensor zone alarms and to enable control of one or more response devices in each of the sensor zones.

- J. A single alarm shall be annunciated at keypads within 2 seconds after sensor transducer or other detection device activation.
- K. Provide the capability to detect when a critical component of the system experiences temporary or permanent loss of power and to declare an alarm at the keypads.
- L. Intrusion alarms shall not be generated by power switching; however, an indication of power switching and on-line source shall be provided at the security alarm keypad. Upon restoration of normal power, the system shall automatically switch back to the primary source. Low voltage condition of an on-line battery and battery charger circuit failure shall be detected and reported as a fault condition.
- M. System Wiring
  - 1. The system shall be wired, connected, and left in first class operating condition. Wiring shall be provided and installed in accordance with the manufacturers Drawings. The Contract Drawings indicate the devices required for each building, the types of devices to be installed, and the general method for connecting the system devices together. The actual number of wires to be installed in each raceway and the size of each raceway shall be in accordance with the manufacturer's Drawings.

## PART 2 –PRODUCTS

### 2.1 SECURITY ALARM CONTROL PANEL

- A. Provide micro-processor based modular components to make up a complete control system. The panel shall have the following features:
  - 1. Alarm output relays.
  - 2. Zone monitoring.
  - 3. Earth detection.
  - 4. Sealed lead acid battery standby power shall be supplied. It shall be under lock and key within this supervised cabinet to prevent deliberate tampering.
  - 5. Solid state battery charger.
  - 6. Alarm resound.
  - 7. Total system supervision by a micro-processor which will supervise all wiring regardless whether or not the area of protection is bypassed or not
  - 8. Quantity three normally open dry contacts which close on alarm conditions.
  - 9. Surge protector

- B. Electrical power shall be obtained by the normal electrical distribution system. Power shall be continuously monitored and, if interrupted, automatic switching from primary to emergency backup source shall be accomplished without interruption or degradation of critical system function.
- C. Furnish 120 volt AC service, transformed through a two-winding isolation transformer and rectified to low-voltage DC for system operation. Obtain primary power at the 120V breaker as indicated in the Contract Documents.
- D. Provide lockable device at circuit breaker and label the circuit breaker in that panelboard: "Alarm System Do Not Turn Off."
- E. Provide backup power to the primary power by dedicated batteries in the Control Panel. Batteries shall be capable of operation in any position and shall be protected against venting caustic chemicals or fumes within an equipment cabinet. Batteries shall also be capable of continuous operation for up to 4 hours without recharge or replacement. If the sensors power requirements exceed the allowable UL rated capacity of the control communicator battery, provide the number of separate power supplies required to power the sensors. Provide each power supply with its own rechargeable battery and charger.
- F. Provide system components to facilitate modular subassembly and part replacement. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state or hermetically sealed electromechanical type.
- G. Provide only components in current manufacturing production. Components shall be manufactured to meet requirements specified herein and shall be free from characteristics and defects which affect appearance or serviceability or which render equipment unsuitable for the intended purpose. Provide components designed for continuous operation at specified conditions.
- H. Intrusion detection, communication, and power circuits shall be protected against lightning and voltage transients. Surge suppression device shall conform to UL 1449, rated single pulse transient energy by metal oxide varistor (MOV). The protective device shall be automatic and resettable and shall be active at all times. Fuses shall not be permitted as protection devices.
- I. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices, input and output connectors, terminals, and test points shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location. Terminal markings and labels shall be of a permanent and legible type and located to be visible when the associated system wiring is in place. Identification markings shall be associated with each adjustment device or item requiring periodic maintenance. Safety warning or cautions shall be



marked in conspicuous red letters. Controls not required for operation of the system shall be inaccessible to the system operator.

- J. Cabinets, control communicators, wiring gutters, and other component housings, collectively referred to as enclosures, shall be formed and assembled to be sturdy and rigid. Metal thickness shall not be less than those in Tables 8.1, 8.2, and 8.3 of UL 1610 for alarm components, and NEMA ICS 2 and NEMA ICS 6 for other enclosures.
- K. Doors and covers shall be flanged. Where doors are mounted on hinges with exposed pins, hinges shall be of the tight-pin type, or ends of hinge pins shall be tack welded to prevent ready removal. Provide doors having a latch edge length of less than 24 inches with a single lock. Covers of junction boxes provided to facilitate initial installation of the system shall be held in place by tack welding, brazing, or one-way screws.
- L. Ventilation openings in enclosures and cabinets shall conform to the requirements of UL 1610. Sheet metal enclosures shall be designed for surface or recessed wall mounting with top hole slotted.
- M. Locks and key-lock-operated switches required to be installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "DO NOT DUP". Key-lock-operated switches shall be keyed differently.

## 2.2 KEYPADS

- A. Provide control surface mounted keypad devices to ensure ease of operation of specified characteristics. Controls, buttons, visual signals, and indicating devices shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location.
- B. Entry/Exit delay. Timer shall be adjustable from 0 to 5 minutes.
- C. Annunciators shall be liquid crystal displays (LCDs). Annunciators shall be so connected in the circuit that failure of the annunciator, socket, or protective circuitry shall not result in an improper or indeterminate signal. LCDs shall be compatible with standby power supplies.
- D. Common trouble signal, trouble silencing switch, power on lamp, reset switch, alarm acknowledge switch and common zone test.
- E. An alarm shall be annunciated to clearly identify any component experiencing power loss.
- F. Provide NEMA 4X clear plastic door hinged enclosure over keypads.

## 2.3 MAGNETIC DOOR SWITCHES

- A. The switch mechanism shall have a minimum gap of 3/8-inch and a maximum gap of 1 1/4 inches without internal adjustment.
- B. The magnetic and switch parts of the devices shall be fully encapsulated in a weatherproof enclosure, the switch portion shall have a factory 24" minimum armored cord containing the switch wiring.
- C. The magnetic and switch parts of the devices be secured using tamper resistant to the door and from with stainless steel screws.
- D. Each end of the armored cord shall terminate in a junction box above the door for hinged door and next to the door for overhead doors. Armored cord ends shall be mechanically secured to junction boxes by clamps or bushings. The armored cord shall experience no mechanical strain as the door is removed from fully open to closed.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall be supervised and tested by the system supplier. The work shall be performed by skilled technicians under the direction of experienced engineers, all of whom are properly trained and qualified.
- B. All wiring for the system shall be in accordance with Articles 760, 725, and 800 of the National Electrical Code and local electrical codes.
- C. Coordinate the installation of the door switches and wiring with doors. The door switches shall be located at the top of jam side of the door near for hinged doors and located at the bottom of overhead doors.
- D. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- E. Device wiring shall be No. 14AWG Type THWN copper type. All wiring shall be color coded. All wiring shall be tagged at each junction point. Proper connectors shall be installed at terminations to accept the No. 14 AWG wiring.
- F. No conduit smaller than 3/4 inch shall be installed.

#### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Training
  - 1. Provide the services of the manufacturer's representative to explain programming and operation of system and to train Owner's maintenance personnel on procedures and schedules for maintaining, programming, operating, adjusting,

troubleshooting, and servicing system. Provide a minimum of four hours' training in operation and maintenance.

END OF SECTION 16770

## SECTION 16721

### FIRE ALARM SYTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this subsection includes the furnishing and installing of a complete addressable fire alarm system as specified herein and as shown on the Drawings. The system shall be electrically supervised, connected, tested and left in first class operating condition.
- B. The system shall consist of, but shall not be limited to a fire alarm control panel, fire and smoke detection devices, manual pull stations, audible/visual alarms, alarm annunciator, Master Box, conduit, fittings, outlet boxes, wire, operating instructions and maintenance instructions.
- C. Fire Alarm Control Panels, all initiating devices and indicating devices shall be provided by one manufacturer, no exceptions.
- D. The system shall interface with the chemical manual alarm system installed under DIVISION 16 – ELECTRICAL, SECTION 16722, MANAUL ALARM SYSTEM and Contract Drawings
- E. The system shall interface with duct detectors installed under DIVISION 15 - MECHANICAL, SECTION 15500, HEATING, VENTILATION AND AIR CONDITIONING and Contract Drawings.
- F. The system shall interface with sprinkler system flow and tamper switches installed under DIVISION 15 – FIRE PROTECTION, SECTION 15300, FIRE PROTECTION and Contract Drawings.
- G. The General Contractor and Electrical FSB shall meet with the local fire department prior to submitting any shop Drawings for this project.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:

1. The system riser diagram shall indicate every alarm control panel, terminal panel, actuating device, annunciator panel and the required interconnecting wiring with wire type, quantity and raceways sizes.
2. Description of system operation, of each panel and device.
3. Original copies of catalog cuts of all devices, modules, batteries, battery chargers, etc. Copies of internet based data shall not be acceptable.
4. Battery load calculations for each panel.
5. Operating instructions and maintenance procedures. Operating instructions shall be furnished separate from manufacturers standard catalog literature and shall include recommended customer troubleshooting procedures. Maintenance procedures shall be furnished separate from manufacturer's standard catalog literature and shall include battery maintenance, lamp and fuse replacement, detector periodic checking and reset procedures, and other applicable procedures.

#### 1.4 QUALITY ASSURANCE

##### A. Testing

1. The system shall be fully tested by a UL certified testing company, in accordance with UL guidelines and NFPA standards. Each and every device shall be field tested.
2. A copy of the final test report and UL certificate shall be submitted indicating proper functioning of the system and conformance to the specifications. The test shall be performed by UL certified and factory-trained qualified technicians. Each and every device shall be tested, and standalone operation of remote panels shall be verified. Final testing and UL certification shall be performed by the same company that will hold and execute the Test and Inspection contract.

##### B. WARRANTY

1. The manufacturer shall guarantee all system equipment for a period of three (3) years from the date of final acceptance.
2. The Electrical FSB shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from the date of final acceptance of the system.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## 1.6 DESIGN CRITERIA

- A. The equipment and completed installation shall be in compliance with local and national codes, authorities having jurisdiction, the local Fire Department, and in accordance with applicable sections of the latest edition of NFPA 72 for Fire Alarm Systems.
- B. All equipment shall be listed by National Fire Protection Association, Underwriters Laboratories and/or the Factory Mutual System.
- C. The equipment manufacturer shall have a local branch office within 75 miles staffed with trained, full time employees who are capable of performing testing, inspecting, repair and maintenance services for the life of the fire alarm system.
- D. All components of the system shall have been tested for compatibility with each other to ensure the system performs all intended functions.
- E. System Operation
  - 1. The operation of a manual station or activation of any automatic alarm initiating device (system smoke, heat, sprinkler flow switch) shall automatically:
    - i. Initiate the transmission of the alarm via the cellular DACT.
    - ii. Sound a code 3 temporal evacuation signal over all audio circuits.
    - iii. Flash all visual signals throughout the building in a synchronized manner.
    - iv. Flash an alarm LED and sound an audible signal at the Fire Alarm Control Panel (FACP). Upon Acknowledgment, the alarm LED shall light steadily and the audible shall silence. Subsequent alarms shall re-initiate this sequence.
    - v. Visually indicate the alarm initiating device type and location via the LCD display located at the FACP.
    - vi. Automatically shut down or control HVAC equipment. Manual override controls and programmable relay interface shall serve as an interface to the HVAC equipment.
    - vii. Activate the exterior weatherproof beacon.
    - viii. Close a dry contact for interconnection to the SCADA system.
  - 2. The operation of a carbon monoxide detector shall automatically:
    - i. Sound a code 4 temporal evacuation signal over the detector's sounder base.
    - ii. Illuminate the red alarm LED on the detector.
    - iii. Flash an alarm LED and sound an audible signal at the FACP. Upon Acknowledgment, the alarm LED shall light steadily and the audible shall silence. Subsequent alarms shall re-initiate this sequence.
    - iv. Visually indicate the alarm initiating device type and location via the LCD display located at the FACP.
  - 3. The activation of a system trouble condition (system battery, broken circuit, ground fault, device failure, sprinkler tamper switches, communication failure, ect)

- i. Initiate the transmission of the trouble condition to an approved private monitoring station via a Digital Alarm Communicator/Transmitter (DACT).
- ii. Indicate the trouble condition and sound an audible signal at the FACP

F. System Wiring

1. The system shall be wired, connected, and left in first class operating condition. Wiring shall be provided and installed in accordance with the manufacturers Drawings. The Contract Drawings indicate the devices required for each building, the types of devices to be installed, and the general method for connecting the system devices together. The actual number of wires to be installed in each raceway and the size of each raceway shall be in accordance with the manufacturer's Drawings.
2. Initiating circuits shall be addressable type.
3. Addressable loop wiring shall support all devices shown and allow for a minimum of 25% spare capacity and be wired in a Class X style.
4. As a minimum, power supplies and notification appliance circuits shall operate all devices shown plus 25% spare capacity, and be wired in a Class A style.

G. System shall be addressable microprocessor based and shall provide the following features:

1. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.
2. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.
3. Capability of each addressable device being individually disabled or enabled from the panel.

H. Devices located within the chemical areas shall be weatherproof type of corrosion resistant material.

## PART 2 –PRODUCTS

### 2.1 FIRE ALARM CONTROL PANEL

- A. Provide and install a Fire Alarm Control Panel (FACP). The system shall support up to 390 analog/addressable devices, expandable to 1950 points in a true peer-to-peer network (multi-panel) configuration. The FACP shall provide the following functions:
1. Monitor all initiating devices, report to each network node, annunciate the alarmed device and its' location, capture elevators, conduct smoke control functions, and

initiate the audio/visual evacuation signaling and control sequences as described herein.

2. Conduct municipal notification as described herein.
  3. Initiating devices shall respond with their condition. Control relays shall be individually addressable by the system to respond automatically in the event of an alarm of related sensors. Manual override of control relays shall be individually addressable by the operator.
- B. Control Configuration: All fire alarm control portions of the system shall be housed in red locking, semi-flush mounted enclosures. All panel initiating and control status indicators shall be visible through a clear Lexan window. Access to the control panel shall be by keys issued to the Fire Department and authorized personnel. Each panel shall incorporate an operator interface, CPU, addressable loop interface cards, audio control/microphone, amplifiers, power supply and batteries to perform the system operation as described herein.
- C. Primary Operator Control: The FACP shall provide an operator interface module consisting of a 180 character backlit LCD display to display all system alarm, trouble and supervisory conditions, and shall provide common control switches for system status scrolling, alarm acknowledge, trouble acknowledge, reset, and system drill. The unit shall have LED indicators for Normal Power Status, Alarm, Supervisory, Trouble and Test/Program.
- D. Addressable Loop Interface: Provide an addressable loop interface card for each addressable signaling line circuit. Each circuit shall support digital communications with up to 196 addressable field devices, with loop distances in excess of 6,000 ft. The addressable loop interface shall support the following features and functions:
1. Provide full digital communications with analog field devices.
  2. An integral alarm relay which will support alarm operation in the event of a failure of addressable loop data communications.
  3. The interface card shall support the retrieval of the following information from each individual analog system device:
    - i. Device serial number
    - ii. Device address
    - iii. Device type and personality code
    - iv. Date of manufacture
    - v. Hours in use
    - vi. Number of alarms and troubles
    - vii. Time and date of last alarm
    - viii. Amount of environmental compensation left/used
    - ix. Last maintenance date
    - x. Current detector sensitivity values
    - xi. Diagnostic information (trouble codes)



- E. Auxiliary Control / Annunciation: Provide auxiliary annunciator switch and LED modules for simple LED annunciation, zone disconnect, HVAC override, or other related monitoring and control functions. These are intended for use by the Fire Department during an event, or by authorized personnel during testing periods. Keypad entered commands for these functions shall not be an acceptable substitute. Alarm LEDs and zone disconnect switches shall be provided by type of device on a per floor/zone basis. Provide a minimum of 64 discreet programmable alarm LEDs, and 32 discreet programmable 2-position control switches with corresponding LED indicators.
- F. System Power Supplies: Integral system 120VAC input power supplies shall provide 12amps of 24VDC operating and emergency power to each panel. Each supply shall contain brownout, low battery detection, system ground fault, and LED indicators for loss of AC or CPU failure.

## 2.2 INTELLIGENT SYSTEM DEVICES

- A. Provide intelligent analog devices where shown and required. Each device shall retain operating characteristics in non-volatile memory and conduct algorithms to distinguish real fire conditions from unwanted nuisance alarms. All analog devices shall provide dual LED indicators, a green LED shall flash to denote active communication, and a red LED shall flash to denote an alarm condition. Devices shall be interchangeable with twist-lock bases which may include a supervised remote LED output, fault isolation circuitry, or an auxiliary relay contact. In the event of an addressable loop communications failure, devices shall remain capable of initiating an alarm sequence.
- B. Multi-sensing Smoke Detector: Provide multi sensing analog smoke detectors where shown on Contract Drawings and required. Each detector shall employ photoelectric, ionization and thermal sensing principles.
- C. Heat Detectors: Provide fixed temperature 135 degrees F vapor-tight industrial grade units connected to monitor modules installed in all NEMA 4 and NEMA 4X areas.
- D. Analog Duct Smoke Detector: Provide analog photoelectric duct smoke detectors mounted in air ducts where shown on Contract Drawings and required. Each detector shall be supplied with duct mounting plate, remote test station/indicator and sampling tubes sized according to duct width. Provide the required auxiliary relay outputs or addressable relay control modules with each detector in order to accomplish the required HVAC control and override functions.
- E. Carbon Monoxide Detector: Provide analog carbon monoxide detectors shall employ an electrochemical sensing cell. The detector shall have a red LED alarm notification and audio sounder base.
- F. Intelligent Manual Pull Stations: Provide intelligent addressable manual stations where shown on Contract Drawings and required. The station shall be double action type with screw terminals, toggle switch, and integral addressable electronics. The station shall be constructed of red Lexan with white raised letters and a key reset switch. The station shall be keyed alike to the FACP.

- G. Monitor Module: Provide addressable input monitor modules to monitor related systems or integrate conventional initiating devices onto the addressable loop.
- H. Control Module: Provide addressable output control modules to supervise and control conventional devices (indicating circuits, AHUs, SCADA interface. etc.) over the addressable loop. Control modules shall provide a supervised output rated for 1, 2 or 5 amps @ 24VDC and 120VAC, as required by the conventional device.
- I. Isolation Modules: Provide Isolator Modules to protect circuit integrity in the event of a wiring fault. Provide a minimum of one module per floor/zone, or one for every 25 devices; whichever is greater.

### 2.3 PRIMARY NOTIFICATION APPLIANCES

- A. Primary Notification Appliances: Flush mounted combination Audio/Visual Horn/Strobe type signaling appliances. Stand alone devices may be used to augment combination units when necessary. Specific audible and visual characteristics shall be as follows:
  - 1. Visual Signals shall be self-synchronizing xenon strobes in compliance with NFPA 72. Strobes shall have an effective intensity rating of 15 candela in corridors and other areas up to 20' x 20', 30 candela in areas up to 30' x 30' and 110 candela in areas up to 50' x 50'.
  - 2. Audible Signals shall be horns in compliance with NFPA 72, 24 Volt dc polarized type with a minimum sound output shall be 90 db at 10 feet
- B. Exterior Strobe: Provide a flashing weatherproof strobe with a minimum 150,000 candlepower output were shown. The strobe shall be properly installed on a weatherproof backbox.

### 2.4 SYSTEM ACCESSORIES

- A. Monitoring Connection: Provide a Digital Alarm Communicator/Transmitter (DACT) with cellular communications to an approved Central watch station. The DACT shall be housed in a wall mounted red enclosure with a 120VAC input power supply, 24 hour back up power, battery charger, and a 3dBA cellular antenna.
- B. Sprinkler System Devices: The Electrical FSB shall coordinate the following to ensure that the required installation and wiring of all waterflow and tamper switches is accomplished in a manner that will result in a complete operable and tested sprinkler system. Each device shall be monitored as a separate and distinct point.
  - 1. Waterflow will activate the alarm sequence.
  - 2. Tamper switch will activate a supervisory trouble.
- C. Terminal Cabinets: Provide fire alarm terminal cabinets where necessary. The cabinets, which shall have a removable hinged cover with key lock and red finish are intended to house analog/addressable modules and facilitate field wiring junctions.

- D. Auxiliary Power Supplies: Where the power requirements exceed that which is supplied by the FACP, auxiliary power supplies may be used. Each auxiliary power supply shall be supervised for loss of AC power and Battery Fail, and each notification circuit served shall be individually supervised.
- E. Key Repository: Provide an approved key repository where shown and required in accordance with local requirements. Key repository as required by the Sharon Fire Department for the main entrance door shall be a Knox Box 3200 hinged box.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation shall be supervised and tested by the system supplier. The work shall be performed by skilled technicians under the direction of experienced engineers, all of whom are properly trained and qualified.
- B. All wiring for the system shall be in accordance with Articles 760, 725, and 800 of the National Electrical Code and local electrical codes.
- C. Wiring shall be No. 14AWG Type XHHW copper type. All wiring shall be color coded. All wiring shall be tagged at each junction point. Proper connectors shall be installed at terminations to accept the No. 14 AWG wiring.
- D. Provide complete wiring and conduit between all equipment. All devices shall be mounted upon and splices made in UL listed boxes. Wiring splices and transposing or changing of colors will not be permitted. All wiring shall be installed in raceway as specified in SECTION 16130, RACEWAYS AND FITTINGS
- E. No conduit smaller than 3/4 inch shall be installed.
- F. All fire alarm raceway system including junction boxes shall be factory painted red conduit and box covers.
- G. Conduit sizes and wire quantities shall be suitable for the equipment furnished. The Electrical FSB shall review the proper installation of each type of device with the equipment supplier.
- H. Fire Alarm control systems and equipment shall be connected to separate dedicated branch circuits, sized as required for proper service. Circuits shall be labeled 'FIRE ALARM'.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Training

1. Provide the services of the manufacturer's representative for a period of 4 hours, during normal business hours, to instruct the owner's designated personnel and fire department response teams on the operation of the system.

### 3.3 SPARE PARTS

- A. Provide one detector, pull station and one audio/visual device of each type to the Owner at the conclusion of all work.

### 3.4 MANUAL ALARM TEST AND INSPECTION CONTRACT

- A. The Electrical FSB shall include as part of their base bid the cost of a one-year test and inspection contract. This contract shall provide for quarterly tests according to UL, NFPA 72 and local requirements. Upon its expiration, the contract shall be renewable by the town.

END OF SECTION 16721

## SECTION 16722

### MANUAL ALARM SYTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The work of this subsection includes the furnishing and installing of a complete manual alarm system for the chemical rooms utilizing a 4-zone conventional fire alarm system as specified herein and as shown on the Drawings. The system shall be electrically supervised, connected, tested and left in first class operating condition.
- B. The system shall consist of, but shall not be limited to a chemical alarm control panel, manual pull stations, audible/visual alarms, alarm annunciator, conduit, fittings, outlet boxes, wire, operating instructions and maintenance instructions.
- C. Chemical Alarm Control Panel and all initiating devices and indicating devices shall be provided by one manufacturer, no exceptions.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. The system riser diagram shall indicate every alarm control panel, terminal panel, actuating device, annunciator panel and the required interconnecting wiring with wire type, quantity and raceways sizes.
  - 2. Description of system operation, of each panel and device.
  - 3. Original copies of catalog cuts of all devices, modules, batteries, battery chargers, etc. Copies of internet based data shall not be acceptable.
  - 4. Battery load calculations for each panel.
  - 5. Operating instructions and maintenance procedures. Operating instructions shall be furnished separate from manufacturers standard catalog literature and shall include recommended customer troubleshooting procedures. Maintenance procedures shall be furnished separate from manufacturer's standard catalog

literature and shall include battery maintenance, lamp and fuse replacement, detector periodic checking and reset procedures, and other applicable procedures.

#### 1.4 QUALITY ASSURANCE

##### A. Testing

1. The system shall be fully tested by a UL certified testing company, in accordance with UL guidelines and NFPA standards. Each and every device shall be tested.
2. A copy of the final test report and UL certificate shall be submitted indicating proper functioning of the system and conformance to the specifications. The test shall be performed by UL certified and factory-trained qualified technicians. Each and every device shall be tested, and standalone operation of remote panels shall be verified. Final testing and UL certification shall be performed by the same company that will hold and execute the Test and Inspection contract.

##### B. WARRANTY

1. The manufacturer shall guarantee all system equipment for a period of three (3) years from the date of final acceptance.
2. The Electrical FSB shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from the date of final acceptance of the system.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

#### 1.6 DESIGN CRITERIA

- A. The equipment and completed installation shall be in compliance with local and national codes, authorities having jurisdiction, the local Fire Department, and in accordance with applicable sections of the latest edition of NFPA 72 for Fire Alarm Systems.
- B. All equipment shall be listed by National Fire Protection Association, Underwriters Laboratories and/or the Factory Mutual System.
- C. The equipment manufacturer shall have a local branch office within 75 miles staffed with trained, full time employees who are capable of performing testing, inspecting, repair and maintenance services for the life of the manual alarm system.
- D. All components of the system shall have been tested for compatibility with each other to ensure the system performs all intended functions.
- E. The system shall be have the following alarm zones

1. KOH & NaOCL Room
2. NaHS03 Room
3. Spare
4. Spare

F. System Operation

1. The operation of a manual station outside in a zone shall automatically:
  - i. Sound a temporal signal over all audio circuits, signal shall not be a temporal code 3 or code 4.
  - ii. Flash all visual signals associated with the zone in a synchronized manner.
  - iii. Flash an alarm LED and sound an audible signal at the Chemical Alarm Control Panel (CACP). Upon Acknowledgment, the alarm LED shall light steadily and the audible shall silence. Subsequent alarms shall re-initiate this sequence.
  - iv. Visually indicate the zone via the LCD display located at the CACP.
  - v. Close a dry contact for interconnection to the Fire Alarm system.
  - vi. Close a dry contact for interconnection to the SCADA system.
2. The activation of a system trouble condition (system battery, broken circuit, ground fault, device failure, communication failure ect.)
  - i. Initiate the transmission of the trouble condition to an approved private monitoring station via a Digital Alarm Communicator/Transmitter (DACT).
  - ii. Indicate the trouble condition and sound an audible signal at the FACP

G. System Wiring

1. The system shall be wired, connected, and left in first class operating condition. Wiring shall be provided and installed in accordance with the manufacturers Drawings. The Contract Drawings indicate the devices required for each building, the types of devices to be installed, and the general method for connecting the system devices together. The actual number of wires to be installed in each raceway and the size of each raceway shall be in accordance with the manufacturer's Drawings.
2. As a minimum, power supplies and notification appliance circuits shall operate all devices shown plus 25% spare capacity, and be wired in a Class A style.

H. System shall be addressable microprocessor based and shall provide the following features:

1. Individual identity of each zone for the following conditions: alarm; trouble; open; short; and appliances missing/failed.

## PART 2 –PRODUCTS

### 2.1 MANUAL ALARM CONTROL PANEL

- A. Provide micro-processor based modular components to make up a complete control system. The panel shall have the following features:
1. Alarm output relays.
  2. Zone modules, number as required for proper functionality for each system, access lamps, secure lamps, access/secure key switches for each.
  3. Earth detection module.
  4. Sealed lead acid battery standby power shall be supplied. It shall be under lock and key within this supervised cabinet to prevent deliberate tampering.
  5. Solid state battery charger.
  6. Alarm resound module.
  7. Total system supervision by a micro-processor which will supervise all wiring regardless whether or not the area of protection is bypassed or not.
  8. Quantity three normally open dry contacts which close on alarm conditions.
- B. Electrical power shall be obtained by the normal electrical distribution system. Power shall be continuously monitored and, if interrupted, automatic switching from primary to emergency backup source shall be accomplished without interruption or degradation of critical system function.
- C. Furnish 120 volt AC service, transformed through a two-winding isolation transformer and rectified to low-voltage DC for system operation. Obtain primary power at the 120V breaker as indicated in the Contract Documents.
- D. Provide lockable device at circuit breaker and label the circuit breaker in that panelboard: “Alarm System Do Not Turn Off”.
- E. Provide backup power to the primary power by dedicated batteries in the Control Panel. Batteries shall be capable of operation in any position and shall be protected against venting caustic chemicals or fumes within an equipment cabinet. Batteries shall also be capable of continuous operation for up to 4 hours without recharge or replacement. If the sensors power requirements exceed the allowable UL rated capacity of the control communicator battery, provide the number of separate power supplies required to power the sensors. Provide each power supply with its own rechargeable battery and charger.
- F. Provide system components to facilitate modular subassembly and part replacement. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed



as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state or hermetically sealed electromechanical type.

- G. Provide only components in current manufacturing production. Components shall be manufactured to meet requirements specified herein and shall be free from characteristics and defects which affect appearance or serviceability or which render equipment unsuitable for the intended purpose. Provide components designed for continuous operation at specified conditions.
- H. Alarm detection, communication, and power circuits shall be protected against lightning and voltage transients. Surge suppression device shall conform to UL 1449, rated single pulse transient energy by metal oxide varistor (MOV). The protective device shall be automatic and resettable and shall be active at all times. Fuses shall not be permitted as protection devices.
- I. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices, input and output connectors, terminals, and test points shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location. Terminal markings and labels shall be of a permanent and legible type and located to be visible when the associated system wiring is in place. Identification markings shall be associated with each adjustment device or item requiring periodic maintenance. Safety warning or cautions shall be marked in conspicuous red letters. Controls not required for operation of the system shall be inaccessible to the system operator.
- J. Cabinets, control communicators, wiring gutters, and other component housings, collectively referred to as enclosures, shall be formed and assembled to be sturdy and rigid. Metal thickness shall not be less than those in Tables 8.1, 8.2, and 8.3 of UL 1610 for alarm components, and NEMA ICS 2 and NEMA ICS 6 for other enclosures.
- K. Doors and covers shall be flanged. Where doors are mounted on hinges with exposed pins, hinges shall be of the tight-pin type, or ends of hinge pins shall be tack welded to prevent ready removal. Provide doors having a latch edge length of less than 24 inches with a single lock. Covers of junction boxes provided to facilitate initial installation of the system shall be held in place by tack welding, brazing, or one-way screws.
- L. Ventilation openings in enclosures and cabinets shall conform to the requirements of UL 1610. Sheet metal enclosures shall be designed for surface or recessed wall mounting with top hole slotted.
- M. Locks and key-lock-operated switches required to be installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "DO NOT DUP". Key-lock-operated switches shall be keyed differently.

## 2.2 SYSTEM DEVICES

- A. Surface mounted combination horn/strobe Audio/Visual signaling appliances with a white housing and amber colored lens. Specific audible and visual characteristics shall be as follows:
  - 1. Visual Signals: Furnish and install self-synchronizing xenon strobes in compliance with NFPA 72 chapter 6. Strobes shall have an effective intensity rating of 15 candela in corridors and other areas up to 20' x 20', 30 candela in areas up to 30' x 30' and 110 candela in areas up to 50' x 50'.
  - 2. Audible Signals: Provide multi-tapped horns. Each horn shall have selective 3, 2, 1, or 2 watt taps to produce a minimum sound output of 87dbA at 10'. Provide re-entrant speakers in high ambient noise areas or where weatherproof devices are required.
- B. Manual Pull Stations: Provide manual stations where shown on Contract Drawings and required. The station shall be double action type with screw terminals, toggle switch, and integral addressable electronics. The station shall be constructed of yellow Lexan with white raised letters and a key reset switch. The station shall be keyed alike to the control panel.
- C. Devices located within the chemical areas shall be weatherproof type of corrosion resistant material.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation shall be supervised and tested by the system supplier. The work shall be performed by skilled technicians under the direction of experienced engineers, all of whom are properly trained and qualified.
- B. All wiring for the system shall be in accordance with Articles 760, 725, and 800 of the National Electrical Code and local electrical codes.
- C. Wiring shall be No. 14AWG Type XHHW copper type. All wiring shall be color coded. All wiring shall be tagged at each junction point. Proper connectors shall be installed at terminations to accept the No. 14 AWG wiring.
- D. Provide complete wiring and conduit between all equipment. All devices shall be mounted upon and splices made in UL listed boxes. Wiring splices and transposing or changing of colors will not be permitted. All wiring shall be installed in raceway as specified in SECTION 16130, RACEWAYS AND FITTINGS
- E. No conduit smaller than 3/4 inch shall be installed.
- F. Conduit sizes and wire quantities shall be suitable for the equipment furnished. The Electrical FSB shall review the proper installation of each type of device with the equipment supplier.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout
- B. Training

- 1. Provide the services of the manufacturer's representative for a period of 4 hours, during normal business hours, to instruct the owner's designated personnel and fire department response teams on the operation of the system.

### 3.3 SPARE PARTS

- A. Provide one pull station and one audio/visual device of each type to the Owner at the conclusion of all work.

### 3.4 MANUAL ALARM TEST AND INSPECTION CONTRACT

- A. The Electrical FSB shall include as part of their base bid the cost of a one-year test and inspection contract. This contract shall provide for quarterly tests according to UL, NFPA and local requirements. Upon its expiration, the contract shall be renewable by the town.

END OF SECTION 16722



## SECTION 16740

### COMMUNICATION SYSTEM

(Part of Filed Sub-Bid Section 16001 – ELECTRICAL WORK – Filed Sub-Bid Required)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY OF WORK

- A. The Work of this Section includes the furnishing and installing of complete telephone and data system as specified in the Contract Documents.
- B. The system shall include, but not be limited to plywood backboards, conduit, cable, back boxes, jacks, wall plates, fittings, terminations, equipment rack, patch panels, punch down panels, PoE Ethernet switch, UPS, patch cords, and all other appurtenances leaving the entire installation complete.
- C. Terminate all CAT 6E cable at patch panel (Data, Camera, and control panels) and punch down panels (Telephone) mounted in equipment rack.
- D. Provide all required coordination with Owner's service provider and Owner.

##### 1.3 SUBMITTALS

- A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 – Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. CAT 6E Cable and Jacks
  - 2. Fiber Optic Cable and Terminations.
  - 3. Equipment Rack
  - 4. Patch Panels
  - 5. Punch Down Panel
  - 6. PoE Ethernet Switch
  - 7. Uninterrupted power supply (UPS).
  - 8. Patch Cords

## 1.4 QUALITY ASSURANCE

### A. Testing

1. All cables shall be tested for continuity per manufacturer's specifications.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- ### A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

## PART 2 –PRODUCTS

### 2.1 CAT 6E CABLE AND JACKS

- #### A. Cable shall be CAT 6E type having four each individually twisted pair, 23 AWG conductors with a blue PVC jacket.
- #### B. Jacks and Jack Assemblies shall be Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Provide device wall plates for each jack, wall plates shall be as specified under SECTION 16500, LIGHTING SYSTEMS.

### 2.2 FIBER OPTIC CABLE

- #### A. 50uM Multi Mode OM3 Type, ANSI/ICEA S-104-696 listed, Loose Tube, Gel-Free Plenum Cable, 6-Strand and 12-Strand (OM3).
- #### B. Provide all end connectors and test complete cable end to end, all terminations and testing shall be by a certified fiber optic technician.

### 2.3 EQUIPMENT RACK

- #### A. Provide a Steel equipment rack enclosure with uniform, baked-enamel factory finish over rust-inhibiting primer.
- #### B. Rack shall be wall Mounted, 36 inches high, 22” inches wide (19” wide equipment mounting), 30 inches deep with center swing section and plexiglas front door.
- #### C. Rack to have universal hole pattern on front and rear flanges, and mounting 10-32 threaded mounting holes on both sides of rack assembly.
- #### D. Rack to have grounding bus bar and is to be grounded building grounding system.
- #### E. Rack to have top mounted plug in type ventilation fan.
- #### F. Provide with full vertical mounted power distribution strip consisting of grounded receptacles a master power on/off switch, pilot light and surge protection.

## 2.4 PoE ETHERNET SWITCH

- A. The PoE Ethernet switch shall be rack mounted Layer-3 Managed type with 24 auto sensing 10/100/1000BASE-T PoE ports and two GbE fiber ports. All ports shall support auto negotiation or manual configuration for 10/100/1000 MHz or full/half duplex.
- B. The Ethernet switches shall be full IEEE 802.1 and full IEEE 802.3 compliant. The switch shall support 10/100/1000BASE-T and 1000BASE-SX standards. The switch shall support IEEE flow control, LACP port trunk, and energy efficient ethernet. Port setting controls shall include enable/disable and speed selection. The switch shall use store-and-forward switching mode.
- C. The Ethernet switches shall have an LED power indicator and shall operate from a 120VAC power source. The switch MSR LED, PoE LED, and port link status LED. The switches shall be suitable for operating from -25°C to 65°C fan less and from 5 percent to 95 percent non-condensing relative humidity. The switch shall be UL approved.
- D. Ports to support both 15.4 W and 30W high power with a total power budget of 720W.
- E. Layer 3 managed routing shall support IPv4/IPv6, RIP v1.v2 OSPF-v2 routing, VRRP routing redundancy and IGMPv1/v2/v3, DVMRP, PIM-SM, SIM-SSM Multicasting.
- F. The Ethernet switch shall support a tree or ring network topology. The switch shall support SNMPv3 and IP addressing via BootP/DHCP. The port configurations shall be accessible through a standard Web browser.
- G. The Ethernet switch security features shall include capability to disable ports and password security for configuration. The switch shall support multicast messaging via IGMP protocol and shall utilize IGMP snooping. The switch shall support port based virtual LAN (VLAN) configuration. The switch shall support the IEEE 802.1p standard for QoS traffic prioritization. The switch shall come supplied with configuration and management software for installation on a Windows-based PC. The switch shall come supplied with all necessary cables to connect the switch to a Windows-based PC for configuration.

## 2.5 UNINTERRUPTABLE POWER SUPPLIES (UPS)

- A. For each equipment rack provide a 2200VA 19" wide rack mounted UPS with LCD display and LED status indicators for battery status.
- B. Input Power: 120VAC, single phase via 8 foot cord with a NEMA 5-20P plug.
- C. Output Power: 120VAC, single phase via (6) NEMA 5-15R and (2) NEMA 5-20R rear mounted receptacles.
- D. Interface ports: Serial (RJ45), USB, and SmartSlot.
- E. Surge Energy Rating: 480J

- F. Filtering: Full-time multi-pole noise filtering with 0.3% IEEE surge let-through, zero clamping response time and meets UL 1449.

## 2.6 PATCH PANEL

- A. Provide a 19” wide rack mounted high density patch panel with a minimum 48 port with integral cable management panel located below the patch panel.
- B. Provide a wall mounted patch down panel with 12 ports for mounting on Tele/Comm backboard for interface to service provider’s telephone and internet equipment.
- C. Wiring shall conform with T568B wiring.

## 2.7 PATCH PANEL – FIBER OPTIC CABLE

- A. Provide wall mounted enclosed pre-loaded patch panels with a minimum 12 ports, SC connectors, cable spools, and hinged lockable door.

## 2.8 PUNCH DOWN PANELS

- A. Provide a 19” wide 110 rack mounted punch down panel with minimum 50 pair blocks and integral cable management panel located below the punch down panel.

## 2.9 PATCH CORDS

- A. Provide 20 factory manufactured CAT 6E, 3’ long patch cords ETL verified to TIA-568-B for interconnections between patch panels and ethernet switch.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Coordinate location of rack mounted equipment with owner prior to making any terminations.
- B. Coordinate type of jack module in each tele/data wall plate with owner prior to making any terminations.
- C. Cables shall be terminated with connecting hardware of same category or higher that shall comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools.
- D. All cables and wall jacks shall be labeled, comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

### 3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout



END OF SECTION 16740

## APPENDIX A

### Massachusetts State Prevailing Wage Rates





MAURA HEALEY  
Governor

KIM DRISCOLL  
Lt. Governor

THE COMMONWEALTH OF MASSACHUSETTS  
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT  
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the  
Massachusetts General Laws, Chapter 149, Sections 26 to 27H

LAUREN JONES  
Secretary

MICHAEL FLANAGAN  
Director

**Awarding Authority:** Town of Sharon  
**Contract Number:** **City/Town:** SHARON  
**Description of Work:** Construction of the Wells 2, 3, and 4 Water Treatment Plant and modifications to existing Well Stations.  
**Job Location:** 15 Tree Lane, Sharon, Massachusetts

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Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- **The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor.** For multi-year CM AT RISK projects, the awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. The annual update requirement is not applicable to 27F "rental of equipment" contracts. **The updated wage schedule must be provided to all contractors, including general and sub-contractors, working on the construction project.**
- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or a sub-contractor.
- Apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (DAS). Apprentices must keep their apprentice identification card on their persons during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DAS regardless of whether they are registered with another federal, state, local, or private agency must be paid the journeyworker's rate.**
- Every contractor or subcontractor working on the construction project must submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. For a sample payroll reporting form go to <http://www.mass.gov/dols/pw>.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Contractors must obtain the wage schedules from awarding authorities. Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may file a complaint with the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
<b>Construction</b>						
(2 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$38.95	\$15.07	\$18.67	\$0.00	\$72.69
	06/01/2024	\$39.95	\$15.07	\$18.67	\$0.00	\$73.69
	12/01/2024	\$39.95	\$15.07	\$20.17	\$0.00	\$75.19
	01/01/2025	\$39.95	\$15.57	\$20.17	\$0.00	\$75.69
	06/01/2025	\$40.95	\$15.57	\$20.17	\$0.00	\$76.69
	12/01/2025	\$40.95	\$15.57	\$21.78	\$0.00	\$78.30
	01/01/2026	\$40.95	\$16.17	\$21.78	\$0.00	\$78.90
	06/01/2026	\$41.95	\$16.17	\$21.78	\$0.00	\$79.90
	12/01/2026	\$41.95	\$16.17	\$23.52	\$0.00	\$81.64
	01/01/2027	\$41.95	\$16.77	\$23.52	\$0.00	\$82.24
(3 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$39.02	\$15.07	\$18.67	\$0.00	\$72.76
	06/01/2024	\$40.02	\$15.07	\$18.67	\$0.00	\$73.76
	12/01/2024	\$40.02	\$15.07	\$20.17	\$0.00	\$75.26
	01/01/2025	\$40.02	\$15.57	\$20.17	\$0.00	\$75.76
	06/01/2025	\$41.02	\$15.57	\$20.17	\$0.00	\$76.76
	12/01/2025	\$41.02	\$15.57	\$21.78	\$0.00	\$78.37
	01/01/2026	\$41.02	\$16.17	\$21.78	\$0.00	\$78.97
	06/01/2026	\$42.02	\$16.17	\$21.78	\$0.00	\$79.97
	12/01/2026	\$42.02	\$16.17	\$23.52	\$0.00	\$81.71
	01/01/2027	\$42.02	\$16.77	\$23.52	\$0.00	\$82.31
(4 & 5 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$39.14	\$15.07	\$18.67	\$0.00	\$72.88
	06/01/2024	\$40.14	\$15.07	\$18.67	\$0.00	\$73.88
	12/01/2024	\$40.14	\$15.07	\$20.17	\$0.00	\$75.38
	01/01/2025	\$40.14	\$15.57	\$20.17	\$0.00	\$75.88
	06/01/2025	\$41.14	\$15.57	\$20.17	\$0.00	\$76.88
	12/01/2025	\$41.14	\$15.57	\$21.78	\$0.00	\$78.49
	01/01/2026	\$41.14	\$16.17	\$21.78	\$0.00	\$79.09
	06/01/2026	\$42.14	\$16.17	\$21.78	\$0.00	\$80.09
	12/01/2026	\$42.14	\$16.17	\$23.52	\$0.00	\$81.83
	01/01/2027	\$42.14	\$16.77	\$23.52	\$0.00	\$82.43
ADS/SUBMERSIBLE PILOT <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$103.05	\$9.40	\$23.12	\$0.00	\$135.57
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
For apprentice rates see "Apprentice- LABORER"						
AIR TRACK OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
	06/01/2024	\$39.94	\$9.65	\$17.14	\$0.00	\$66.73
	12/01/2024	\$41.27	\$9.65	\$17.14	\$0.00	\$68.06
	06/01/2025	\$42.66	\$9.65	\$17.14	\$0.00	\$69.45
	12/01/2025	\$44.04	\$9.65	\$17.14	\$0.00	\$70.83
	06/01/2026	\$45.48	\$9.65	\$17.14	\$0.00	\$72.27
	12/01/2026	\$46.92	\$9.65	\$17.14	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

<b>Classification</b>	<b>Effective Date</b>	<b>Base Wage</b>	<b>Health</b>	<b>Pension</b>	<b>Supplemental Unemployment</b>	<b>Total Rate</b>
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. <i>HEAT &amp; FROST INSULATORS LOCAL 6 (BOSTON)</i>	12/01/2023	\$40.80	\$14.50	\$11.05	\$0.00	\$66.35
	06/01/2024	\$41.80	\$14.50	\$11.05	\$0.00	\$67.35
	12/01/2024	\$42.80	\$14.50	\$11.05	\$0.00	\$68.35
	06/01/2025	\$43.80	\$14.50	\$11.05	\$0.00	\$69.35
	12/01/2025	\$44.80	\$14.50	\$11.05	\$0.00	\$70.35
ASPHALT RAKER <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
ASPHALT RAKER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
	06/01/2024	\$39.94	\$9.65	\$17.14	\$0.00	\$66.73
	12/01/2024	\$41.27	\$9.65	\$17.14	\$0.00	\$68.06
	06/01/2025	\$42.66	\$9.65	\$17.14	\$0.00	\$69.45
	12/01/2025	\$44.04	\$9.65	\$17.14	\$0.00	\$70.83
	06/01/2026	\$45.48	\$9.65	\$17.14	\$0.00	\$72.27
	12/01/2026	\$46.92	\$9.65	\$17.14	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
BOILER MAKER <i>BOILERMAKERS LOCAL 29</i>	01/01/2024	\$48.12	\$7.07	\$20.60	\$0.00	\$75.79

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - BOILERMAKER - Local 29**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	\$31.28	\$7.07	\$13.22	\$0.00	\$51.57
2	65	\$31.28	\$7.07	\$13.22	\$0.00	\$51.57
3	70	\$33.68	\$7.07	\$14.23	\$0.00	\$54.98
4	75	\$36.09	\$7.07	\$15.24	\$0.00	\$58.40
5	80	\$38.50	\$7.07	\$16.25	\$0.00	\$61.82
6	85	\$40.90	\$7.07	\$17.28	\$0.00	\$65.25
7	90	\$43.31	\$7.07	\$18.28	\$0.00	\$68.66
8	95	\$45.71	\$7.07	\$19.32	\$0.00	\$72.10

**Notes:**

**Apprentice to Journeyworker Ratio:1:4**

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)	02/01/2024	\$60.26	\$11.49	\$22.90	\$0.00	\$94.65
BRICKLAYERS LOCAL 3 (FOXBORO)	08/01/2024	\$62.36	\$11.49	\$22.90	\$0.00	\$96.75
	02/01/2025	\$63.66	\$11.49	\$22.90	\$0.00	\$98.05
	08/01/2025	\$65.81	\$11.49	\$22.90	\$0.00	\$100.20
	02/01/2026	\$67.16	\$11.49	\$22.90	\$0.00	\$101.55
	08/01/2026	\$69.36	\$11.49	\$22.90	\$0.00	\$103.75
	02/01/2027	\$70.76	\$11.49	\$22.90	\$0.00	\$105.15

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - BRICK/PLASTER/CEMENT MASON - Local 3 Foxboro**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$30.13	\$11.49	\$22.90	\$0.00	\$64.52
2	60	\$36.16	\$11.49	\$22.90	\$0.00	\$70.55
3	70	\$42.18	\$11.49	\$22.90	\$0.00	\$76.57
4	80	\$48.21	\$11.49	\$22.90	\$0.00	\$82.60
5	90	\$54.23	\$11.49	\$22.90	\$0.00	\$88.62

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.18	\$11.49	\$22.90	\$0.00	\$65.57
2	60	\$37.42	\$11.49	\$22.90	\$0.00	\$71.81
3	70	\$43.65	\$11.49	\$22.90	\$0.00	\$78.04
4	80	\$49.89	\$11.49	\$22.90	\$0.00	\$84.28
5	90	\$56.12	\$11.49	\$22.90	\$0.00	\$90.51

**Notes:**

**Apprentice to Journeyworker Ratio:1:5**

<b>BULLDOZER/GRADER/SCRAPER</b>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<b>CAISSON &amp; UNDERPINNING BOTTOM MAN</b>	12/01/2023	\$45.48	\$9.65	\$18.22	\$0.00	\$73.35
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2024	\$46.96	\$9.65	\$18.22	\$0.00	\$74.83
	12/01/2024	\$48.43	\$9.65	\$18.22	\$0.00	\$76.30
	06/01/2025	\$49.93	\$9.65	\$18.22	\$0.00	\$77.80
	12/01/2025	\$51.43	\$9.65	\$18.22	\$0.00	\$79.30
	06/01/2026	\$52.98	\$9.65	\$18.22	\$0.00	\$80.85
	12/01/2026	\$54.48	\$9.65	\$18.22	\$0.00	\$82.35

For apprentice rates see "Apprentice- LABORER"

<b>CAISSON &amp; UNDERPINNING LABORER</b>	12/01/2023	\$44.33	\$9.65	\$18.22	\$0.00	\$72.20
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2024	\$45.81	\$9.65	\$18.22	\$0.00	\$73.68
	12/01/2024	\$47.28	\$9.65	\$18.22	\$0.00	\$75.15
	06/01/2025	\$48.78	\$9.65	\$18.22	\$0.00	\$76.65
	12/01/2025	\$50.28	\$9.65	\$18.22	\$0.00	\$78.15
	06/01/2026	\$51.83	\$9.65	\$18.22	\$0.00	\$79.70
	12/01/2026	\$53.33	\$9.65	\$18.22	\$0.00	\$81.20

For apprentice rates see "Apprentice- LABORER"



Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2023	\$44.33	\$9.65	\$18.22	\$0.00	\$72.20
	06/01/2024	\$45.81	\$9.65	\$18.22	\$0.00	\$73.68
	12/01/2024	\$47.28	\$9.65	\$18.22	\$0.00	\$75.15
	06/01/2025	\$48.78	\$9.65	\$18.22	\$0.00	\$76.65
	12/01/2025	\$50.28	\$9.65	\$18.22	\$0.00	\$78.15
	06/01/2026	\$51.83	\$9.65	\$18.22	\$0.00	\$79.70
	12/01/2026	\$53.33	\$9.65	\$18.22	\$0.00	\$81.20
For apprentice rates see "Apprentice- LABORER"						

CARBIDE CORE DRILL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						

CARPENTER <i>CARPENTERS -ZONE 2 (Eastern Massachusetts)</i>	03/01/2024	\$47.12	\$9.83	\$19.97	\$0.00	\$76.92
	09/01/2024	\$48.37	\$9.83	\$19.97	\$0.00	\$78.17
	03/01/2025	\$49.62	\$9.83	\$19.97	\$0.00	\$79.42
	09/01/2025	\$50.87	\$9.83	\$19.97	\$0.00	\$80.67
	03/01/2026	\$52.12	\$9.83	\$19.97	\$0.00	\$81.92
	09/01/2026	\$53.37	\$9.83	\$19.97	\$0.00	\$83.17
	03/01/2027	\$54.62	\$9.83	\$19.97	\$0.00	\$84.42

**Apprentice - CARPENTER - Zone 2 Eastern MA**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$21.20	\$9.83	\$1.73	\$0.00	\$32.76
2	45	\$21.20	\$9.83	\$1.73	\$0.00	\$32.76
3	55	\$25.92	\$9.83	\$3.40	\$0.00	\$39.15
4	55	\$25.92	\$9.83	\$3.40	\$0.00	\$39.15
5	70	\$32.98	\$9.83	\$16.51	\$0.00	\$59.32
6	70	\$32.98	\$9.83	\$16.51	\$0.00	\$59.32
7	80	\$37.70	\$9.83	\$18.24	\$0.00	\$65.77
8	80	\$37.70	\$9.83	\$18.24	\$0.00	\$65.77

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$21.77	\$9.83	\$1.73	\$0.00	\$33.33
2	45	\$21.77	\$9.83	\$1.73	\$0.00	\$33.33
3	55	\$26.60	\$9.83	\$3.40	\$0.00	\$39.83
4	55	\$26.60	\$9.83	\$3.40	\$0.00	\$39.83
5	70	\$33.86	\$9.83	\$16.51	\$0.00	\$60.20
6	70	\$33.86	\$9.83	\$16.51	\$0.00	\$60.20
7	80	\$38.70	\$9.83	\$18.24	\$0.00	\$66.77
8	80	\$38.70	\$9.83	\$18.24	\$0.00	\$66.77

**Notes:**

**Apprentice to Journeyworker Ratio:1:5**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARPENTER WOOD FRAME	10/01/2023	\$25.55	\$7.02	\$4.80	\$0.00	\$37.37
<i>CARPENTERS-ZONE 3 (Wood Frame)</i>	10/01/2024	\$26.65	\$7.02	\$4.80	\$0.00	\$38.47
	10/01/2025	\$27.75	\$7.02	\$4.80	\$0.00	\$39.57
	10/01/2026	\$28.85	\$7.02	\$4.80	\$0.00	\$40.67

All Aspects of New Wood Frame Work

**Apprentice - CARPENTER (Wood Frame) - Zone 3**

**Effective Date - 10/01/2023**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$15.33	\$7.02	\$0.00	\$0.00	\$22.35
2	60	\$15.33	\$7.02	\$0.00	\$0.00	\$22.35
3	65	\$16.61	\$7.02	\$1.00	\$0.00	\$24.63
4	70	\$17.89	\$7.02	\$1.00	\$0.00	\$25.91
5	75	\$19.16	\$7.02	\$4.80	\$0.00	\$30.98
6	80	\$20.44	\$7.02	\$4.80	\$0.00	\$32.26
7	85	\$21.72	\$7.02	\$4.80	\$0.00	\$33.54
8	90	\$23.00	\$7.02	\$4.80	\$0.00	\$34.82

**Effective Date - 10/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$15.99	\$7.02	\$0.00	\$0.00	\$23.01
2	60	\$15.99	\$7.02	\$0.00	\$0.00	\$23.01
3	65	\$17.32	\$7.02	\$1.00	\$0.00	\$25.34
4	70	\$18.66	\$7.02	\$1.00	\$0.00	\$26.68
5	75	\$19.99	\$7.02	\$4.80	\$0.00	\$31.81
6	80	\$21.32	\$7.02	\$4.80	\$0.00	\$33.14
7	85	\$22.65	\$7.02	\$4.80	\$0.00	\$34.47
8	90	\$23.99	\$7.02	\$4.80	\$0.00	\$35.81

**Notes:**

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80  
 Step 1&2 \$18.52/ 3&4 \$21.07/ 5&6 \$28.70/ 7&8 \$31.26

**Apprentice to Journeyworker Ratio:1:5**

CEMENT MASONRY/PLASTERING	01/01/2024	\$49.33	\$13.00	\$23.57	\$1.30	\$87.20
<i>BRICKLAYERS LOCAL 3 (FOXBORO)</i>						

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - CEMENT MASONRY/PLASTERING - Foxboro**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.67	\$13.00	\$15.93	\$0.00	\$53.60
2	60	\$29.60	\$13.00	\$18.57	\$1.30	\$62.47
3	65	\$32.06	\$13.00	\$19.57	\$1.30	\$65.93
4	70	\$34.53	\$13.00	\$20.57	\$1.30	\$69.40
5	75	\$37.00	\$13.00	\$21.57	\$1.30	\$72.87
6	80	\$39.46	\$13.00	\$22.57	\$1.30	\$76.33
7	90	\$44.40	\$13.00	\$23.57	\$1.30	\$82.27

**Notes:**  
Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

**Apprentice to Journeyworker Ratio:1:3**

<b>CHAIN SAW OPERATOR</b> <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						

<b>CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES</b> <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$56.13	\$15.00	\$16.40	\$0.00	\$87.53
	06/01/2024	\$57.45	\$15.00	\$16.40	\$0.00	\$88.85
	12/01/2024	\$58.93	\$15.00	\$16.40	\$0.00	\$90.33
	06/01/2025	\$60.26	\$15.00	\$16.40	\$0.00	\$91.66
	12/01/2025	\$61.73	\$15.00	\$16.40	\$0.00	\$93.13
	06/01/2026	\$63.06	\$15.00	\$16.40	\$0.00	\$94.46
	12/01/2026	\$64.54	\$15.00	\$16.40	\$0.00	\$95.94
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

<b>COMPRESSOR OPERATOR</b> <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$35.62	\$15.00	\$16.40	\$0.00	\$67.02
	06/01/2024	\$36.47	\$15.00	\$16.40	\$0.00	\$67.87
	12/01/2024	\$37.42	\$15.00	\$16.40	\$0.00	\$68.82
	06/01/2025	\$38.27	\$15.00	\$16.40	\$0.00	\$69.67
	12/01/2025	\$39.22	\$15.00	\$16.40	\$0.00	\$70.62
	06/01/2026	\$40.08	\$15.00	\$16.40	\$0.00	\$71.48
	12/01/2026	\$41.03	\$15.00	\$16.40	\$0.00	\$72.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

<b>DELEADER (BRIDGE)</b> <i>PAINTERS LOCAL 35 - ZONE 2</i>	01/01/2024	\$56.06	\$9.95	\$23.95	\$0.00	\$89.96
	07/01/2024	\$57.26	\$9.95	\$23.95	\$0.00	\$91.16
	01/01/2025	\$58.46	\$9.95	\$23.95	\$0.00	\$92.36

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PAINTER Local 35 - BRIDGES/TANKS**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.03	\$9.95	\$0.00	\$0.00	\$37.98
2	55	\$30.83	\$9.95	\$6.66	\$0.00	\$47.44
3	60	\$33.64	\$9.95	\$7.26	\$0.00	\$50.85
4	65	\$36.44	\$9.95	\$7.87	\$0.00	\$54.26
5	70	\$39.24	\$9.95	\$20.32	\$0.00	\$69.51
6	75	\$42.05	\$9.95	\$20.93	\$0.00	\$72.93
7	80	\$44.85	\$9.95	\$21.53	\$0.00	\$76.33
8	90	\$50.45	\$9.95	\$22.74	\$0.00	\$83.14

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.63	\$9.95	\$0.00	\$0.00	\$38.58
2	55	\$31.49	\$9.95	\$6.66	\$0.00	\$48.10
3	60	\$34.36	\$9.95	\$7.26	\$0.00	\$51.57
4	65	\$37.22	\$9.95	\$7.87	\$0.00	\$55.04
5	70	\$40.08	\$9.95	\$20.32	\$0.00	\$70.35
6	75	\$42.95	\$9.95	\$20.93	\$0.00	\$73.83
7	80	\$45.81	\$9.95	\$21.53	\$0.00	\$77.29
8	90	\$51.53	\$9.95	\$22.74	\$0.00	\$84.22

**Notes:**  
Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

DEMO: ADZEMAN LABORERS - ZONE 2	12/01/2023	\$44.48	\$9.65	\$18.07	\$0.00	\$72.20
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For apprentice rates see "Apprentice- LABORER"

DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS - ZONE 2	12/01/2023	\$45.48	\$9.65	\$18.07	\$0.00	\$73.20
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For apprentice rates see "Apprentice- LABORER"

DEMO: BURNERS LABORERS - ZONE 2	12/01/2023	\$45.23	\$9.65	\$18.07	\$0.00	\$72.95
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For apprentice rates see "Apprentice- LABORER"

DEMO: CONCRETE CUTTER/SAWYER LABORERS - ZONE 2	12/01/2023	\$45.48	\$9.65	\$18.07	\$0.00	\$73.20
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For apprentice rates see "Apprentice- LABORER"

DEMO: JACKHAMMER OPERATOR LABORERS - ZONE 2	12/01/2023	\$45.23	\$9.65	\$18.07	\$0.00	\$72.95
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For apprentice rates see "Apprentice- LABORER"

DEMO: WRECKING LABORER LABORERS - ZONE 2	12/01/2023	\$44.48	\$9.65	\$18.07	\$0.00	\$72.20
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For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DIRECTIONAL DRILL MACHINE OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$68.70	\$9.40	\$23.12	\$0.00	\$101.22
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$49.07	\$9.40	\$23.12	\$0.00	\$81.59
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$73.60	\$9.40	\$23.12	\$0.00	\$106.12
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$103.05	\$9.40	\$23.12	\$0.00	\$135.57
For apprentice rates see "Apprentice- PILE DRIVER"						
DRAWBRIDGE OPERATOR (Construction) <i>DRAWBRIDGE - SEIU LOCAL 888</i>	07/01/2020	\$26.77	\$6.67	\$3.93	\$0.16	\$37.53
ELECTRICIAN <i>ELECTRICIANS LOCAL 103</i>	03/01/2024	\$61.86	\$13.00	\$22.21	\$0.00	\$97.07
	09/01/2024	\$63.78	\$13.00	\$22.26	\$0.00	\$99.04
	03/01/2025	\$64.98	\$13.00	\$22.30	\$0.00	\$100.28
	09/01/2025	\$66.89	\$13.00	\$22.36	\$0.00	\$102.25
	03/01/2026	\$68.09	\$13.00	\$22.39	\$0.00	\$103.48
	09/01/2026	\$70.00	\$13.00	\$22.45	\$0.00	\$105.45
	03/01/2027	\$71.19	\$13.00	\$22.49	\$0.00	\$106.68
	09/01/2027	\$73.11	\$13.00	\$22.54	\$0.00	\$108.65
	03/01/2028	\$74.31	\$13.00	\$22.58	\$0.00	\$109.89

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - ELECTRICIAN - Local 103**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$24.74	\$13.00	\$0.74	\$0.00	\$38.48
2	40	\$24.74	\$13.00	\$0.74	\$0.00	\$38.48
3	45	\$27.84	\$13.00	\$16.67	\$0.00	\$57.51
4	45	\$27.84	\$13.00	\$16.67	\$0.00	\$57.51
5	50	\$30.93	\$13.00	\$17.17	\$0.00	\$61.10
6	55	\$34.02	\$13.00	\$17.67	\$0.00	\$64.69
7	60	\$37.12	\$13.00	\$18.17	\$0.00	\$68.29
8	65	\$40.21	\$13.00	\$18.68	\$0.00	\$71.89
9	70	\$43.30	\$13.00	\$19.18	\$0.00	\$75.48
10	75	\$46.40	\$13.00	\$19.69	\$0.00	\$79.09

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$25.51	\$13.00	\$0.77	\$0.00	\$39.28
2	40	\$25.51	\$13.00	\$0.77	\$0.00	\$39.28
3	45	\$28.70	\$13.00	\$16.69	\$0.00	\$58.39
4	45	\$28.70	\$13.00	\$16.69	\$0.00	\$58.39
5	50	\$31.89	\$13.00	\$17.20	\$0.00	\$62.09
6	55	\$35.08	\$13.00	\$17.70	\$0.00	\$65.78
7	60	\$38.27	\$13.00	\$18.21	\$0.00	\$69.48
8	65	\$41.46	\$13.00	\$18.71	\$0.00	\$73.17
9	70	\$44.65	\$13.00	\$19.22	\$0.00	\$76.87
10	75	\$47.84	\$13.00	\$19.74	\$0.00	\$80.58

**Notes :**  
App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80

**Apprentice to Journeyworker Ratio:2:3\*\*\***

ELEVATOR CONSTRUCTOR	01/01/2022	\$65.62	\$16.03	\$20.21	\$0.00	\$101.86
ELEVATOR CONSTRUCTORS LOCAL 4						

**Apprentice - ELEVATOR CONSTRUCTOR - Local 4**

**Effective Date - 01/01/2022**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$32.81	\$16.03	\$0.00	\$0.00	\$48.84
2	55	\$36.09	\$16.03	\$20.21	\$0.00	\$72.33
3	65	\$42.65	\$16.03	\$20.21	\$0.00	\$78.89
4	70	\$45.93	\$16.03	\$20.21	\$0.00	\$82.17
5	80	\$52.50	\$16.03	\$20.21	\$0.00	\$88.74

**Notes:**  
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

**Apprentice to Journeyworker Ratio:1:1**

ELEVATOR CONSTRUCTOR HELPER <i>ELEVATOR CONSTRUCTORS LOCAL 4</i>	01/01/2022	\$45.93	\$16.03	\$20.21	\$0.00	\$82.17
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For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2023	\$50.30	\$14.50	\$16.15	\$0.00	\$80.95
	05/01/2024	\$51.54	\$14.50	\$16.15	\$0.00	\$82.19
	11/01/2024	\$52.83	\$14.50	\$16.15	\$0.00	\$83.48
	05/01/2025	\$54.27	\$14.50	\$16.15	\$0.00	\$84.92
	11/01/2025	\$55.56	\$14.50	\$16.15	\$0.00	\$86.21
	05/01/2026	\$57.00	\$14.50	\$16.15	\$0.00	\$87.65
	11/01/2026	\$58.29	\$14.50	\$16.15	\$0.00	\$88.94
	05/01/2027	\$59.72	\$14.50	\$16.15	\$0.00	\$90.37

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2023	\$51.87	\$14.50	\$16.15	\$0.00	\$82.52
	05/01/2024	\$53.12	\$14.50	\$16.15	\$0.00	\$83.77
	11/01/2024	\$54.42	\$14.50	\$16.15	\$0.00	\$85.07
	05/01/2025	\$55.87	\$14.50	\$16.15	\$0.00	\$86.52
	11/01/2025	\$57.17	\$14.50	\$16.15	\$0.00	\$87.82
	05/01/2026	\$58.62	\$14.50	\$16.15	\$0.00	\$89.27
	11/01/2026	\$59.92	\$14.50	\$16.15	\$0.00	\$90.57
	05/01/2027	\$61.37	\$14.50	\$16.15	\$0.00	\$92.02

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2023	\$24.93	\$14.50	\$16.15	\$0.00	\$55.58
	05/01/2024	\$25.66	\$14.50	\$16.15	\$0.00	\$56.31
	11/01/2024	\$26.42	\$14.50	\$16.15	\$0.00	\$57.07
	05/01/2025	\$27.27	\$14.50	\$16.15	\$0.00	\$57.92
	11/01/2025	\$28.03	\$14.50	\$16.15	\$0.00	\$58.68
	05/01/2026	\$28.88	\$14.50	\$16.15	\$0.00	\$59.53
	11/01/2026	\$29.64	\$14.50	\$16.15	\$0.00	\$60.29
	05/01/2027	\$30.49	\$14.50	\$16.15	\$0.00	\$61.14
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER <i>ELECTRICIANS LOCAL 103</i>	03/01/2024	\$61.86	\$13.00	\$22.21	\$0.00	\$97.07
	09/01/2024	\$63.78	\$13.00	\$22.26	\$0.00	\$99.04
	03/01/2025	\$64.98	\$13.00	\$22.30	\$0.00	\$100.28
	09/01/2025	\$66.89	\$13.00	\$22.36	\$0.00	\$102.25
	03/01/2026	\$68.09	\$13.00	\$22.39	\$0.00	\$103.48
	09/01/2026	\$70.00	\$13.00	\$22.45	\$0.00	\$105.45
	03/01/2027	\$71.19	\$13.00	\$22.49	\$0.00	\$106.68
	09/01/2027	\$73.11	\$13.00	\$22.54	\$0.00	\$108.65
	03/01/2028	\$74.31	\$13.00	\$22.58	\$0.00	\$109.89
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING <i>ELECTRICIANS LOCAL 103</i>	03/01/2024	\$49.49	\$13.00	\$20.19	\$0.00	\$82.68
	09/01/2024	\$51.02	\$13.00	\$20.24	\$0.00	\$84.26
	03/01/2025	\$51.98	\$13.00	\$20.27	\$0.00	\$85.25
	09/01/2025	\$53.51	\$13.00	\$20.32	\$0.00	\$86.83
	03/01/2026	\$54.47	\$13.00	\$20.34	\$0.00	\$87.81
	09/01/2026	\$56.00	\$13.00	\$20.39	\$0.00	\$89.39
	03/01/2027	\$56.95	\$13.00	\$20.42	\$0.00	\$90.37
	09/01/2027	\$58.49	\$13.00	\$20.46	\$0.00	\$91.95
03/01/2028	\$59.45	\$13.00	\$20.49	\$0.00	\$92.94	
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$44.47	\$15.00	\$16.40	\$0.00	\$75.87
	06/01/2024	\$45.53	\$15.00	\$16.40	\$0.00	\$76.93
	12/01/2024	\$46.71	\$15.00	\$16.40	\$0.00	\$78.11
	06/01/2025	\$47.77	\$15.00	\$16.40	\$0.00	\$79.17
	12/01/2025	\$48.94	\$15.00	\$16.40	\$0.00	\$80.34
	06/01/2026	\$50.00	\$15.00	\$16.40	\$0.00	\$81.40
	12/01/2026	\$51.18	\$15.00	\$16.40	\$0.00	\$82.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$25.48	\$9.65	\$17.14	\$0.00	\$52.27
	06/01/2024	\$26.51	\$9.65	\$17.14	\$0.00	\$53.30
	12/01/2024	\$26.51	\$9.65	\$17.14	\$0.00	\$53.30
	06/01/2025	\$27.59	\$9.65	\$17.14	\$0.00	\$54.38
	12/01/2025	\$27.59	\$9.65	\$17.14	\$0.00	\$54.38
	06/01/2026	\$28.71	\$9.65	\$17.14	\$0.00	\$55.50
	12/01/2026	\$28.71	\$9.65	\$17.14	\$0.00	\$55.50
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						



Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FLOORCOVERER	03/01/2024	\$54.73	\$8.83	\$20.27	\$0.00	\$83.83
<i>FLOORCOVERERS LOCAL 2168 ZONE I</i>	09/01/2024	\$56.23	\$8.83	\$20.27	\$0.00	\$85.33
	03/01/2025	\$57.73	\$8.83	\$20.27	\$0.00	\$86.83
	09/01/2025	\$59.23	\$8.83	\$20.27	\$0.00	\$88.33
	03/01/2026	\$60.73	\$8.83	\$20.27	\$0.00	\$89.83
	09/01/2026	\$62.23	\$8.83	\$20.27	\$0.00	\$91.33
	03/01/2027	\$63.73	\$8.83	\$20.27	\$0.00	\$92.83

**Apprentice - FLOORCOVERER - Local 2168 Zone I**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$24.63	\$8.83	\$1.76	\$0.00	\$35.22
2	45	\$24.63	\$8.83	\$1.76	\$0.00	\$35.22
3	55	\$30.10	\$8.83	\$3.52	\$0.00	\$42.45
4	55	\$30.10	\$8.83	\$3.52	\$0.00	\$42.45
5	70	\$38.31	\$8.83	\$16.75	\$0.00	\$63.89
6	70	\$38.31	\$8.83	\$16.75	\$0.00	\$63.89
7	80	\$43.78	\$8.83	\$18.51	\$0.00	\$71.12
8	80	\$43.78	\$8.83	\$18.51	\$0.00	\$71.12

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$25.30	\$8.83	\$1.76	\$0.00	\$35.89
2	45	\$25.30	\$8.83	\$1.76	\$0.00	\$35.89
3	55	\$30.93	\$8.83	\$3.52	\$0.00	\$43.28
4	55	\$30.93	\$8.83	\$3.52	\$0.00	\$43.28
5	70	\$39.36	\$8.83	\$16.75	\$0.00	\$64.94
6	70	\$39.36	\$8.83	\$16.75	\$0.00	\$64.94
7	80	\$44.98	\$8.83	\$18.51	\$0.00	\$72.32
8	80	\$44.98	\$8.83	\$18.51	\$0.00	\$72.32

**Notes:** Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

FORK LIFT/CHERRY PICKER	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
GENERATOR/LIGHTING PLANT/HEATERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$35.62	\$15.00	\$16.40	\$0.00	\$67.02
	06/01/2024	\$36.47	\$15.00	\$16.40	\$0.00	\$67.87
	12/01/2024	\$37.42	\$15.00	\$16.40	\$0.00	\$68.82
	06/01/2025	\$38.27	\$15.00	\$16.40	\$0.00	\$69.67
	12/01/2025	\$39.22	\$15.00	\$16.40	\$0.00	\$70.62
	06/01/2026	\$40.08	\$15.00	\$16.40	\$0.00	\$71.48
	12/01/2026	\$41.03	\$15.00	\$16.40	\$0.00	\$72.43

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) <i>GLAZIERS LOCAL 35 (ZONE 2)</i>	01/01/2024	\$45.56	\$9.95	\$23.95	\$0.00	\$79.46
	07/01/2024	\$46.76	\$9.95	\$23.95	\$0.00	\$80.66
	01/01/2025	\$47.96	\$9.95	\$23.95	\$0.00	\$81.86

**Apprentice - GLAZIER - Local 35 Zone 2**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.78	\$9.95	\$0.00	\$0.00	\$32.73
2	55	\$25.06	\$9.95	\$6.66	\$0.00	\$41.67
3	60	\$27.34	\$9.95	\$7.26	\$0.00	\$44.55
4	65	\$29.61	\$9.95	\$7.87	\$0.00	\$47.43
5	70	\$31.89	\$9.95	\$20.32	\$0.00	\$62.16
6	75	\$34.17	\$9.95	\$20.93	\$0.00	\$65.05
7	80	\$36.45	\$9.95	\$21.53	\$0.00	\$67.93
8	90	\$41.00	\$9.95	\$22.74	\$0.00	\$73.69

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$9.95	\$0.00	\$0.00	\$33.33
2	55	\$25.72	\$9.95	\$6.66	\$0.00	\$42.33
3	60	\$28.06	\$9.95	\$7.26	\$0.00	\$45.27
4	65	\$30.39	\$9.95	\$7.87	\$0.00	\$48.21
5	70	\$32.73	\$9.95	\$20.32	\$0.00	\$63.00
6	75	\$35.07	\$9.95	\$20.93	\$0.00	\$65.95
7	80	\$37.41	\$9.95	\$21.53	\$0.00	\$68.89
8	90	\$42.08	\$9.95	\$22.74	\$0.00	\$74.77

**Notes:**

Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

HOISTING ENGINEER/CRANES/GRADALLS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - OPERATING ENGINEERS - Local 4**

**Effective Date - 12/01/2023**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$30.27	\$15.00	\$0.00	\$0.00	\$45.27
2	60	\$33.02	\$15.00	\$16.40	\$0.00	\$64.42
3	65	\$35.77	\$15.00	\$16.40	\$0.00	\$67.17
4	70	\$38.52	\$15.00	\$16.40	\$0.00	\$69.92
5	75	\$41.27	\$15.00	\$16.40	\$0.00	\$72.67
6	80	\$44.02	\$15.00	\$16.40	\$0.00	\$75.42
7	85	\$46.78	\$15.00	\$16.40	\$0.00	\$78.18
8	90	\$49.53	\$15.00	\$16.40	\$0.00	\$80.93

**Effective Date - 06/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$30.98	\$15.00	\$0.00	\$0.00	\$45.98
2	60	\$33.80	\$15.00	\$16.40	\$0.00	\$65.20
3	65	\$36.61	\$15.00	\$16.40	\$0.00	\$68.01
4	70	\$39.43	\$15.00	\$16.40	\$0.00	\$70.83
5	75	\$42.25	\$15.00	\$16.40	\$0.00	\$73.65
6	80	\$45.06	\$15.00	\$16.40	\$0.00	\$76.46
7	85	\$47.88	\$15.00	\$16.40	\$0.00	\$79.28
8	90	\$50.70	\$15.00	\$16.40	\$0.00	\$82.10

**Notes:**

**Apprentice to Journeyworker Ratio:1:6**

HVAC (DUCTWORK)	02/01/2024	\$57.22	\$14.59	\$27.50	\$2.98	\$102.29
SHEETMETAL WORKERS LOCAL 17 - A	08/01/2024	\$58.97	\$14.59	\$27.50	\$2.98	\$104.04
	02/01/2025	\$60.72	\$14.59	\$27.50	\$2.98	\$105.79
	08/01/2025	\$62.57	\$14.59	\$27.50	\$2.98	\$107.64
	02/01/2026	\$64.52	\$14.59	\$27.50	\$2.98	\$109.59

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS)	03/01/2024	\$61.86	\$13.00	\$22.21	\$0.00	\$97.07
ELECTRICIANS LOCAL 103	09/01/2024	\$63.78	\$13.00	\$22.26	\$0.00	\$99.04
	03/01/2025	\$64.98	\$13.00	\$22.30	\$0.00	\$100.28
	09/01/2025	\$66.89	\$13.00	\$22.36	\$0.00	\$102.25
	03/01/2026	\$68.09	\$13.00	\$22.39	\$0.00	\$103.48
	09/01/2026	\$70.00	\$13.00	\$22.45	\$0.00	\$105.45
	03/01/2027	\$71.19	\$13.00	\$22.49	\$0.00	\$106.68
	09/01/2027	\$73.11	\$13.00	\$22.54	\$0.00	\$108.65
	03/01/2028	\$74.31	\$13.00	\$22.58	\$0.00	\$109.89

For apprentice rates see "Apprentice- ELECTRICIAN"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (TESTING AND BALANCING - AIR) <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2024	\$57.22	\$14.59	\$27.50	\$2.98	\$102.29
	08/01/2024	\$58.97	\$14.59	\$27.50	\$2.98	\$104.04
	02/01/2025	\$60.72	\$14.59	\$27.50	\$2.98	\$105.79
	08/01/2025	\$62.57	\$14.59	\$27.50	\$2.98	\$107.64
	02/01/2026	\$64.52	\$14.59	\$27.50	\$2.98	\$109.59
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) <i>PIPEFITTERS LOCAL 537</i>	03/01/2024	\$65.28	\$12.70	\$21.80	\$0.00	\$99.78
	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC <i>PIPEFITTERS LOCAL 537</i>	03/01/2024	\$65.28	\$12.70	\$21.80	\$0.00	\$99.78
	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
For apprentice rates see "Apprentice- LABORER"						
HYDRAULIC DRILLS (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.61	\$9.65	\$17.14	\$0.00	\$65.40
	06/01/2024	\$39.94	\$9.65	\$17.14	\$0.00	\$66.73
	12/01/2024	\$41.27	\$9.65	\$17.14	\$0.00	\$68.06
	06/01/2025	\$42.66	\$9.65	\$17.14	\$0.00	\$69.45
	12/01/2025	\$44.04	\$9.65	\$17.14	\$0.00	\$70.83
	06/01/2026	\$45.48	\$9.65	\$17.14	\$0.00	\$72.27
	12/01/2026	\$46.92	\$9.65	\$17.14	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
INSULATOR (PIPES & TANKS) <i>HEAT &amp; FROST INSULATORS LOCAL 6 (BOSTON)</i>	09/01/2023	\$53.50	\$14.75	\$19.61	\$0.00	\$87.86
	09/01/2024	\$56.92	\$14.75	\$19.61	\$0.00	\$91.28
	09/01/2025	\$60.34	\$14.75	\$19.61	\$0.00	\$94.70
	09/01/2026	\$63.76	\$14.75	\$19.61	\$0.00	\$98.12

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston**

**Effective Date - 09/01/2023**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.75	\$14.75	\$14.32	\$0.00	\$55.82
2	60	\$32.10	\$14.75	\$15.37	\$0.00	\$62.22
3	70	\$37.45	\$14.75	\$16.43	\$0.00	\$68.63
4	80	\$42.80	\$14.75	\$17.49	\$0.00	\$75.04

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.46	\$14.75	\$14.32	\$0.00	\$57.53
2	60	\$34.15	\$14.75	\$15.37	\$0.00	\$64.27
3	70	\$39.84	\$14.75	\$16.43	\$0.00	\$71.02
4	80	\$45.54	\$14.75	\$17.49	\$0.00	\$77.78

**Notes:**

Steps are 1 year

**Apprentice to Journeyworker Ratio:1:4**

IRONWORKER/WELDER IRONWORKERS LOCAL 7 (BOSTON AREA)	03/16/2024	\$53.97	\$8.35	\$26.70	\$0.00	\$89.02
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**Apprentice - IRONWORKER - Local 7 Boston**

**Effective Date - 03/16/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$32.38	\$8.35	\$26.70	\$0.00	\$67.43
2	70	\$37.78	\$8.35	\$26.70	\$0.00	\$72.83
3	75	\$40.48	\$8.35	\$26.70	\$0.00	\$75.53
4	80	\$43.18	\$8.35	\$26.70	\$0.00	\$78.23
5	85	\$45.87	\$8.35	\$26.70	\$0.00	\$80.92
6	90	\$48.57	\$8.35	\$26.70	\$0.00	\$83.62

**Notes:**

**Apprentice to Journeyworker Ratio:1:4**

JACKHAMMER & PAVING BREAKER OPERATOR LABORERS - ZONE 2	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
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For apprentice rates see "Apprentice- LABORER"

LABORER LABORERS - ZONE 2	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
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**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - LABORER - Zone 2**

**Effective Date - 12/01/2023**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$22.72	\$9.65	\$16.89	\$0.00	\$49.26
2	70	\$26.50	\$9.65	\$16.89	\$0.00	\$53.04
3	80	\$30.29	\$9.65	\$16.89	\$0.00	\$56.83
4	90	\$34.07	\$9.65	\$16.89	\$0.00	\$60.61

**Notes:**

**Apprentice to Journeyworker Ratio:1:5**

LABORER (HEAVY & HIGHWAY)	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	06/01/2024	\$39.19	\$9.65	\$17.14	\$0.00	\$65.98
	12/01/2024	\$40.52	\$9.65	\$17.14	\$0.00	\$67.31
	06/01/2025	\$41.91	\$9.65	\$17.14	\$0.00	\$68.70
	12/01/2025	\$43.29	\$9.65	\$17.14	\$0.00	\$70.08
	06/01/2026	\$44.73	\$9.65	\$17.14	\$0.00	\$71.52
	12/01/2026	\$46.17	\$9.65	\$17.14	\$0.00	\$72.96

**Apprentice - LABORER (Heavy & Highway) - Zone 2**

**Effective Date - 12/01/2023**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$22.72	\$9.65	\$17.14	\$0.00	\$49.51
2	70	\$26.50	\$9.65	\$17.14	\$0.00	\$53.29
3	80	\$30.29	\$9.65	\$17.14	\$0.00	\$57.08
4	90	\$34.07	\$9.65	\$17.14	\$0.00	\$60.86

**Effective Date - 06/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$23.51	\$9.00	\$16.89	\$0.00	\$49.40
2	70	\$27.43	\$9.00	\$16.89	\$0.00	\$53.32
3	80	\$31.35	\$9.00	\$16.89	\$0.00	\$57.24
4	90	\$35.27	\$9.00	\$16.89	\$0.00	\$61.16

**Notes:**

**Apprentice to Journeyworker Ratio:1:5**

LABORER: CARPENTER TENDER	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
LABORERS - ZONE 2						

For apprentice rates see "Apprentice- LABORER"

LABORER: CEMENT FINISHER TENDER	12/01/2023	\$38.36	\$9.40	\$16.89	\$0.00	\$64.65
LABORERS - ZONE 2						

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER <i>LABORERS - ZONE 2</i>	12/01/2023	\$37.95	\$9.65	\$17.20	\$0.00	\$64.80
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
LABORER: MULTI-TRADE TENDER <i>LABORERS - ZONE 2</i>	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER <i>LABORERS - ZONE 2</i>	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
MARBLE & TILE FINISHERS <i>BRICKLAYERS LOCAL 3 - MARBLE &amp; TILE</i>	02/01/2024	\$47.89	\$11.49	\$21.37	\$0.00	\$80.75
	08/01/2024	\$49.57	\$11.49	\$21.37	\$0.00	\$82.43
	02/01/2025	\$50.61	\$11.49	\$21.37	\$0.00	\$83.47
	08/01/2025	\$52.33	\$11.49	\$21.37	\$0.00	\$85.19
	02/01/2026	\$53.41	\$11.49	\$21.37	\$0.00	\$86.27
	08/01/2026	\$55.17	\$11.49	\$21.37	\$0.00	\$88.03
	02/01/2027	\$56.29	\$11.49	\$21.37	\$0.00	\$89.15

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - MARBLE & TILE FINISHER - Local 3 Marble & Tile**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.95	\$11.49	\$21.37	\$0.00	\$56.81
2	60	\$28.73	\$11.49	\$21.37	\$0.00	\$61.59
3	70	\$33.52	\$11.49	\$21.37	\$0.00	\$66.38
4	80	\$38.31	\$11.49	\$21.37	\$0.00	\$71.17
5	90	\$43.10	\$11.49	\$21.37	\$0.00	\$75.96

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.79	\$11.49	\$21.37	\$0.00	\$57.65
2	60	\$29.74	\$11.49	\$21.37	\$0.00	\$62.60
3	70	\$34.70	\$11.49	\$21.37	\$0.00	\$67.56
4	80	\$39.66	\$11.49	\$21.37	\$0.00	\$72.52
5	90	\$44.61	\$11.49	\$21.37	\$0.00	\$77.47

**Notes:**

**Apprentice to Journeyworker Ratio:1:3**

MARBLE MASONS, TILELAYERS & TERRAZZO MECH	02/01/2024	\$62.42	\$11.49	\$23.56	\$0.00	\$97.47
BRICKLAYERS LOCAL 3 - MARBLE & TILE	08/01/2024	\$64.52	\$11.49	\$23.56	\$0.00	\$99.57
	02/01/2025	\$65.82	\$11.49	\$23.56	\$0.00	\$100.87
	08/01/2025	\$67.97	\$11.49	\$23.56	\$0.00	\$103.02
	02/01/2026	\$69.32	\$11.49	\$23.56	\$0.00	\$104.37
	08/01/2026	\$71.52	\$11.49	\$23.56	\$0.00	\$106.57
	02/01/2027	\$72.92	\$11.49	\$23.56	\$0.00	\$107.97



**Classification**

**Effective Date   Base Wage   Health   Pension   Supplemental Unemployment   Total Rate**

**Apprentice - MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.21	\$11.49	\$23.56	\$0.00	\$66.26
2	60	\$37.45	\$11.49	\$23.56	\$0.00	\$72.50
3	70	\$43.69	\$11.49	\$23.56	\$0.00	\$78.74
4	80	\$49.94	\$11.49	\$23.56	\$0.00	\$84.99
5	90	\$56.18	\$11.49	\$23.56	\$0.00	\$91.23

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$32.26	\$11.49	\$23.56	\$0.00	\$67.31
2	60	\$38.71	\$11.49	\$23.56	\$0.00	\$73.76
3	70	\$45.16	\$11.49	\$23.56	\$0.00	\$80.21
4	80	\$51.62	\$11.49	\$23.56	\$0.00	\$86.67
5	90	\$58.07	\$11.49	\$23.56	\$0.00	\$93.12

**Notes:**

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**Apprentice to Journeyworker Ratio:1:5**

MECH. SWEEPER OPERATOR (ON CONST. SITES) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 2) <i>MILLWRIGHTS LOCAL 1121 - Zone 2</i>	01/01/2024	\$42.76	\$10.08	\$21.47	\$0.00	\$74.31
	01/06/2025	\$45.09	\$10.08	\$21.47	\$0.00	\$76.64
	01/05/2026	\$47.42	\$10.08	\$21.47	\$0.00	\$78.97

**Apprentice - MILLWRIGHT - Local 1121 Zone 2**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$23.52	\$10.08	\$5.50	\$0.00	\$39.10
2	65	\$27.79	\$10.08	\$6.50	\$0.00	\$44.37
3	75	\$32.07	\$10.08	\$18.97	\$0.00	\$61.12
4	85	\$36.35	\$10.08	\$19.97	\$0.00	\$66.40

**Effective Date - 01/06/2025**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$24.80	\$10.08	\$5.50	\$0.00	\$40.38
2	65	\$29.31	\$10.08	\$6.50	\$0.00	\$45.89
3	75	\$33.82	\$10.08	\$18.97	\$0.00	\$62.87
4	85	\$38.33	\$10.08	\$19.97	\$0.00	\$68.38

**Notes:** Step 1&2 Appr. indentured after 1/6/2020 receive no pension, but do receive annuity. (Step 1 \$5.72, Step 2 \$6.66)  
Steps are 2,000 hours

**Apprentice to Journeyworker Ratio:1:4**

<b>MORTAR MIXER</b> <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
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For apprentice rates see "Apprentice- LABORER"

<b>OILER (OTHER THAN TRUCK CRANES,GRADALLS)</b> <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$24.41	\$15.00	\$16.40	\$0.00	\$55.81
	06/01/2024	\$25.01	\$15.00	\$16.40	\$0.00	\$56.41
	12/01/2024	\$25.67	\$15.00	\$16.40	\$0.00	\$57.07
	06/01/2025	\$26.27	\$15.00	\$16.40	\$0.00	\$57.67
	12/01/2025	\$26.93	\$15.00	\$16.40	\$0.00	\$58.33
	06/01/2026	\$27.52	\$15.00	\$16.40	\$0.00	\$58.92
	12/01/2026	\$28.19	\$15.00	\$16.40	\$0.00	\$59.59

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<b>OILER (TRUCK CRANES, GRADALLS)</b> <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$29.86	\$15.00	\$16.40	\$0.00	\$61.26
	06/01/2024	\$30.58	\$15.00	\$16.40	\$0.00	\$61.98
	12/01/2024	\$31.38	\$15.00	\$16.40	\$0.00	\$62.78
	06/01/2025	\$32.10	\$15.00	\$16.40	\$0.00	\$63.50
	12/01/2025	\$32.90	\$15.00	\$16.40	\$0.00	\$64.30
	06/01/2026	\$33.62	\$15.00	\$16.40	\$0.00	\$65.02
	12/01/2026	\$34.42	\$15.00	\$16.40	\$0.00	\$65.82

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<b>OTHER POWER DRIVEN EQUIPMENT - CLASS II</b> <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER (BRIDGES/TANKS) <i>PAINTERS LOCAL 35 - ZONE 2</i>	01/01/2024	\$56.06	\$9.95	\$23.95	\$0.00	\$89.96
	07/01/2024	\$57.26	\$9.95	\$23.95	\$0.00	\$91.16
	01/01/2025	\$58.46	\$9.95	\$23.95	\$0.00	\$92.36

**Apprentice - PAINTER Local 35 - BRIDGES/TANKS**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.03	\$9.95	\$0.00	\$0.00	\$37.98
2	55	\$30.83	\$9.95	\$6.66	\$0.00	\$47.44
3	60	\$33.64	\$9.95	\$7.26	\$0.00	\$50.85
4	65	\$36.44	\$9.95	\$7.87	\$0.00	\$54.26
5	70	\$39.24	\$9.95	\$20.32	\$0.00	\$69.51
6	75	\$42.05	\$9.95	\$20.93	\$0.00	\$72.93
7	80	\$44.85	\$9.95	\$21.53	\$0.00	\$76.33
8	90	\$50.45	\$9.95	\$22.74	\$0.00	\$83.14

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.63	\$9.95	\$0.00	\$0.00	\$38.58
2	55	\$31.49	\$9.95	\$6.66	\$0.00	\$48.10
3	60	\$34.36	\$9.95	\$7.26	\$0.00	\$51.57
4	65	\$37.22	\$9.95	\$7.87	\$0.00	\$55.04
5	70	\$40.08	\$9.95	\$20.32	\$0.00	\$70.35
6	75	\$42.95	\$9.95	\$20.93	\$0.00	\$73.83
7	80	\$45.81	\$9.95	\$21.53	\$0.00	\$77.29
8	90	\$51.53	\$9.95	\$22.74	\$0.00	\$84.22

**Notes:**

Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2024	\$46.96	\$9.95	\$23.95	\$0.00	\$80.86
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. <i>PAINTERS LOCAL 35 - ZONE 2</i>	07/01/2024	\$48.16	\$9.95	\$23.95	\$0.00	\$82.06
	01/01/2025	\$49.36	\$9.95	\$23.95	\$0.00	\$83.26

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - New**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.48	\$9.95	\$0.00	\$0.00	\$33.43
2	55	\$25.83	\$9.95	\$6.66	\$0.00	\$42.44
3	60	\$28.18	\$9.95	\$7.26	\$0.00	\$45.39
4	65	\$30.52	\$9.95	\$7.87	\$0.00	\$48.34
5	70	\$32.87	\$9.95	\$20.32	\$0.00	\$63.14
6	75	\$35.22	\$9.95	\$20.93	\$0.00	\$66.10
7	80	\$37.57	\$9.95	\$21.53	\$0.00	\$69.05
8	90	\$42.26	\$9.95	\$22.74	\$0.00	\$74.95

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.08	\$9.95	\$0.00	\$0.00	\$34.03
2	55	\$26.49	\$9.95	\$6.66	\$0.00	\$43.10
3	60	\$28.90	\$9.95	\$7.26	\$0.00	\$46.11
4	65	\$31.30	\$9.95	\$7.87	\$0.00	\$49.12
5	70	\$33.71	\$9.95	\$20.32	\$0.00	\$63.98
6	75	\$36.12	\$9.95	\$20.93	\$0.00	\$67.00
7	80	\$38.53	\$9.95	\$21.53	\$0.00	\$70.01
8	90	\$43.34	\$9.95	\$22.74	\$0.00	\$76.03

**Notes:**  
Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

PAINTER (SPRAY OR SANDBLAST, REPAINT)	01/01/2024	\$45.02	\$9.95	\$23.95	\$0.00	\$78.92
PAINTERS LOCAL 35 - ZONE 2	07/01/2024	\$46.22	\$9.95	\$23.95	\$0.00	\$80.12
	01/01/2025	\$47.42	\$9.95	\$23.95	\$0.00	\$81.32

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.51	\$9.95	\$0.00	\$0.00	\$32.46
2	55	\$24.76	\$9.95	\$6.66	\$0.00	\$41.37
3	60	\$27.01	\$9.95	\$7.26	\$0.00	\$44.22
4	65	\$29.26	\$9.95	\$7.87	\$0.00	\$47.08
5	70	\$31.51	\$9.95	\$20.32	\$0.00	\$61.78
6	75	\$33.77	\$9.95	\$20.93	\$0.00	\$64.65
7	80	\$36.02	\$9.95	\$21.53	\$0.00	\$67.50
8	90	\$40.52	\$9.95	\$22.74	\$0.00	\$73.21

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.11	\$9.95	\$0.00	\$0.00	\$33.06
2	55	\$25.42	\$9.95	\$6.66	\$0.00	\$42.03
3	60	\$27.73	\$9.95	\$7.26	\$0.00	\$44.94
4	65	\$30.04	\$9.95	\$7.87	\$0.00	\$47.86
5	70	\$32.35	\$9.95	\$20.32	\$0.00	\$62.62
6	75	\$34.67	\$9.95	\$20.93	\$0.00	\$65.55
7	80	\$36.98	\$9.95	\$21.53	\$0.00	\$68.46
8	90	\$41.60	\$9.95	\$22.74	\$0.00	\$74.29

**Notes:**  
Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

PAINTER / TAPER (BRUSH, NEW) *	01/01/2024	\$45.56	\$9.95	\$23.95	\$0.00	\$79.46
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 2	07/01/2024	\$46.76	\$9.95	\$23.95	\$0.00	\$80.66
	01/01/2025	\$47.96	\$9.95	\$23.95	\$0.00	\$81.86

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PAINTER - Local 35 Zone 2 - BRUSH NEW**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.78	\$9.95	\$0.00	\$0.00	\$32.73
2	55	\$25.06	\$9.95	\$6.66	\$0.00	\$41.67
3	60	\$27.34	\$9.95	\$7.26	\$0.00	\$44.55
4	65	\$29.61	\$9.95	\$7.87	\$0.00	\$47.43
5	70	\$31.89	\$9.95	\$20.32	\$0.00	\$62.16
6	75	\$34.17	\$9.95	\$20.93	\$0.00	\$65.05
7	80	\$36.45	\$9.95	\$21.53	\$0.00	\$67.93
8	90	\$41.00	\$9.95	\$22.74	\$0.00	\$73.69

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$9.95	\$0.00	\$0.00	\$33.33
2	55	\$25.72	\$9.95	\$6.66	\$0.00	\$42.33
3	60	\$28.06	\$9.95	\$7.26	\$0.00	\$45.27
4	65	\$30.39	\$9.95	\$7.87	\$0.00	\$48.21
5	70	\$32.73	\$9.95	\$20.32	\$0.00	\$63.00
6	75	\$35.07	\$9.95	\$20.93	\$0.00	\$65.95
7	80	\$37.41	\$9.95	\$21.53	\$0.00	\$68.89
8	90	\$42.08	\$9.95	\$22.74	\$0.00	\$74.77

**Notes:**  
Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

PAINTER / TAPER (BRUSH, REPAINT)	01/01/2024	\$43.62	\$9.95	\$23.95	\$0.00	\$77.52
PAINTERS LOCAL 35 - ZONE 2	07/01/2024	\$44.82	\$9.95	\$23.95	\$0.00	\$78.72
	01/01/2025	\$46.02	\$9.95	\$23.95	\$0.00	\$79.92

**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PAINTER Local 35 Zone 2 - BRUSH REPAINT**

**Effective Date - 01/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.81	\$9.95	\$0.00	\$0.00	\$31.76
2	55	\$23.99	\$9.95	\$6.66	\$0.00	\$40.60
3	60	\$26.17	\$9.95	\$7.26	\$0.00	\$43.38
4	65	\$28.35	\$9.95	\$7.87	\$0.00	\$46.17
5	70	\$30.53	\$9.95	\$20.32	\$0.00	\$60.80
6	75	\$32.72	\$9.95	\$20.93	\$0.00	\$63.60
7	80	\$34.90	\$9.95	\$21.53	\$0.00	\$66.38
8	90	\$39.26	\$9.95	\$22.74	\$0.00	\$71.95

**Effective Date - 07/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.41	\$9.95	\$0.00	\$0.00	\$32.36
2	55	\$24.65	\$9.95	\$6.66	\$0.00	\$41.26
3	60	\$26.89	\$9.95	\$7.26	\$0.00	\$44.10
4	65	\$29.13	\$9.95	\$7.87	\$0.00	\$46.95
5	70	\$31.37	\$9.95	\$20.32	\$0.00	\$61.64
6	75	\$33.62	\$9.95	\$20.93	\$0.00	\$64.50
7	80	\$35.86	\$9.95	\$21.53	\$0.00	\$67.34
8	90	\$40.34	\$9.95	\$22.74	\$0.00	\$73.03

**Notes:**

Steps are 750 hrs.

**Apprentice to Journeyworker Ratio:1:1**

<b>PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY)</b>	12/01/2023	\$37.86	\$9.65	\$17.14	\$0.00	\$64.65
<i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	06/01/2024	\$39.19	\$9.65	\$17.14	\$0.00	\$65.98
	12/01/2024	\$40.52	\$9.65	\$17.14	\$0.00	\$67.31
	06/01/2025	\$41.91	\$9.65	\$17.14	\$0.00	\$68.70
	12/01/2025	\$43.29	\$9.65	\$17.14	\$0.00	\$70.08
	06/01/2026	\$44.73	\$9.65	\$17.14	\$0.00	\$71.52
	12/01/2026	\$46.17	\$9.65	\$17.14	\$0.00	\$72.96

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)

<b>PANEL &amp; PICKUP TRUCKS DRIVER</b>	01/01/2024	\$38.78	\$15.07	\$18.67	\$0.00	\$72.52
<i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	06/01/2024	\$39.78	\$15.07	\$18.67	\$0.00	\$73.52
	12/01/2024	\$39.78	\$15.07	\$20.17	\$0.00	\$75.02
	01/01/2025	\$39.78	\$15.57	\$20.17	\$0.00	\$75.52
	06/01/2025	\$40.78	\$15.57	\$20.17	\$0.00	\$76.52
	12/01/2025	\$40.78	\$15.57	\$21.78	\$0.00	\$78.13
	01/01/2026	\$40.78	\$16.17	\$21.78	\$0.00	\$78.73
	06/01/2026	\$41.78	\$16.17	\$21.78	\$0.00	\$79.73
	12/01/2026	\$41.78	\$16.17	\$23.52	\$0.00	\$81.47
	01/01/2027	\$41.78	\$16.77	\$23.52	\$0.00	\$82.07

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i> For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2020	\$49.07	\$9.40	\$23.12	\$0.00	\$81.59
PILE DRIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2020	\$49.07	\$9.40	\$23.12	\$0.00	\$81.59

**Apprentice - PILE DRIVER - Local 56 Zone 1**

**Effective Date - 08/01/2020**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.54	\$9.40	\$23.12	\$0.00	\$57.06
2	60	\$29.44	\$9.40	\$23.12	\$0.00	\$61.96
3	70	\$34.35	\$9.40	\$23.12	\$0.00	\$66.87
4	75	\$36.80	\$9.40	\$23.12	\$0.00	\$69.32
5	80	\$39.26	\$9.40	\$23.12	\$0.00	\$71.78
6	80	\$39.26	\$9.40	\$23.12	\$0.00	\$71.78
7	90	\$44.16	\$9.40	\$23.12	\$0.00	\$76.68
8	90	\$44.16	\$9.40	\$23.12	\$0.00	\$76.68

**Notes:**

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80  
Step 1&2 \$34.01/ 3&4 \$41.46/ 5&6 \$62.80/ 7&8 \$69.25

**Apprentice to Journeyworker Ratio:1:5**

PIPEFITTER & STEAMFITTER <i>PIPEFITTERS LOCAL 537</i>	03/01/2024	\$65.28	\$12.70	\$21.80	\$0.00	\$99.78
	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38



**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - PIPEFITTER - Local 537**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$26.11	\$12.70	\$9.05	\$0.00	\$47.86
2	45	\$29.38	\$12.70	\$21.80	\$0.00	\$63.88
3	60	\$39.17	\$12.70	\$21.80	\$0.00	\$73.67
4	70	\$45.70	\$12.70	\$21.80	\$0.00	\$80.20
5	80	\$52.22	\$12.70	\$21.80	\$0.00	\$86.72

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$26.83	\$12.70	\$9.05	\$0.00	\$48.58
2	45	\$30.19	\$12.70	\$21.80	\$0.00	\$64.69
3	60	\$40.25	\$12.70	\$21.80	\$0.00	\$74.75
4	70	\$46.96	\$12.70	\$21.80	\$0.00	\$81.46
5	80	\$53.66	\$12.70	\$21.80	\$0.00	\$88.16

**Notes:**

\*\* 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.  
 Refrig/AC Mechanic \*\*1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

**Apprentice to Journeyworker Ratio:\*\***

PIPELAYER LABORERS - ZONE 2	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
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For apprentice rates see "Apprentice- LABORER"

PIPELAYER (HEAVY & HIGHWAY) LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

PLUMBERS & GASFITTERS PLUMBERS & GASFITTERS LOCAL 12	03/03/2024	\$67.74	\$14.32	\$19.11	\$0.00	\$101.17
	09/01/2024	\$69.54	\$14.32	\$19.11	\$0.00	\$102.97
	03/02/2025	\$71.34	\$14.32	\$19.11	\$0.00	\$104.77

**Apprentice - PLUMBER/GASFITTER - Local 12**

**Effective Date - 03/03/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$23.71	\$14.32	\$6.88	\$0.00	\$44.91
2	40	\$27.10	\$14.32	\$7.82	\$0.00	\$49.24
3	55	\$37.26	\$14.32	\$10.65	\$0.00	\$62.23
4	65	\$44.03	\$14.32	\$12.53	\$0.00	\$70.88
5	75	\$50.81	\$14.32	\$14.41	\$0.00	\$79.54

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$24.34	\$14.32	\$6.88	\$0.00	\$45.54
2	40	\$27.82	\$14.32	\$7.82	\$0.00	\$49.96
3	55	\$38.25	\$14.32	\$10.65	\$0.00	\$63.22
4	65	\$45.20	\$14.32	\$12.53	\$0.00	\$72.05
5	75	\$52.16	\$14.32	\$14.41	\$0.00	\$80.89

**Notes:**

\*\* 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr  
Step4 with lic\$69.00, Step5 with lic\$76.87

**Apprentice to Journeyworker Ratio:\*\***

PNEUMATIC CONTROLS (TEMP.) <i>PIPEFITTERS LOCAL 537</i>	03/01/2024	\$65.28	\$12.70	\$21.80	\$0.00	\$99.78
	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

PNEUMATIC DRILL/TOOL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
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For apprentice rates see "Apprentice- LABORER"

PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

POWDERMAN & BLASTER <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.86	\$9.65	\$17.14	\$0.00	\$65.65
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For apprentice rates see "Apprentice- LABORER"

POWDERMAN & BLASTER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$39.36	\$9.40	\$16.89	\$0.00	\$65.65
	06/01/2024	\$40.69	\$9.40	\$16.89	\$0.00	\$66.98
	12/01/2024	\$42.02	\$9.40	\$16.89	\$0.00	\$68.31
	06/01/2025	\$43.41	\$9.40	\$16.89	\$0.00	\$69.70
	12/01/2025	\$44.79	\$9.40	\$16.89	\$0.00	\$71.08
	06/01/2026	\$46.23	\$9.40	\$16.89	\$0.00	\$72.52
	12/01/2026	\$47.67	\$9.40	\$16.89	\$0.00	\$73.96

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
POWER SHOVEL/DERRICK/TRENCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$35.62	\$15.00	\$16.40	\$0.00	\$67.02
	06/01/2024	\$36.47	\$15.00	\$16.40	\$0.00	\$67.87
	12/01/2024	\$37.42	\$15.00	\$16.40	\$0.00	\$68.82
	06/01/2025	\$38.27	\$15.00	\$16.40	\$0.00	\$69.67
	12/01/2025	\$39.22	\$15.00	\$16.40	\$0.00	\$70.62
	06/01/2026	\$40.08	\$15.00	\$16.40	\$0.00	\$71.48
	12/01/2026	\$41.03	\$15.00	\$16.40	\$0.00	\$72.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER <i>TEAMSTERS 170 - Dauphinais (Bellingham)</i>	01/01/2024	\$27.00	\$10.76	\$5.45	\$0.00	\$43.21
	12/01/2024	\$27.60	\$11.26	\$6.15	\$0.00	\$45.01
	01/01/2025	\$27.60	\$11.26	\$6.15	\$0.00	\$45.01
RECLAIMERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROOFER (Inc.Roofer Waterproofing &Roofer Damproofg) ROOFERS LOCAL 33	02/01/2024	\$50.03	\$12.78	\$21.45	\$0.00	\$84.26
	08/01/2024	\$51.53	\$12.78	\$21.45	\$0.00	\$85.76
	02/01/2025	\$52.78	\$12.78	\$21.45	\$0.00	\$87.01
	08/01/2025	\$54.28	\$12.78	\$21.45	\$0.00	\$88.51
	02/01/2026	\$55.53	\$12.78	\$21.45	\$0.00	\$89.76

**Apprentice - ROOFER - Local 33**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.02	\$12.78	\$6.21	\$0.00	\$44.01
2	60	\$30.02	\$12.78	\$21.45	\$0.00	\$64.25
3	65	\$32.52	\$12.78	\$21.45	\$0.00	\$66.75
4	75	\$37.52	\$12.78	\$21.45	\$0.00	\$71.75
5	85	\$42.53	\$12.78	\$21.45	\$0.00	\$76.76

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.77	\$12.78	\$6.21	\$0.00	\$44.76
2	60	\$30.92	\$12.78	\$21.45	\$0.00	\$65.15
3	65	\$33.49	\$12.78	\$21.45	\$0.00	\$67.72
4	75	\$38.65	\$12.78	\$21.45	\$0.00	\$72.88
5	85	\$43.80	\$12.78	\$21.45	\$0.00	\$78.03

**Notes:** \*\* 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1  
 Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.  
 (Hot Pitch Mechanics' receive \$1.00 hr. above ROOFER)

**Apprentice to Journeyworker Ratio:\*\***

ROOFER SLATE / TILE / PRECAST CONCRETE ROOFERS LOCAL 33	02/01/2024	\$50.28	\$12.78	\$21.45	\$0.00	\$84.51
	08/01/2024	\$51.78	\$12.78	\$21.45	\$0.00	\$86.01
	02/01/2025	\$53.03	\$12.78	\$21.45	\$0.00	\$87.26
	08/01/2025	\$54.53	\$12.78	\$21.45	\$0.00	\$88.76
	02/01/2026	\$55.78	\$12.78	\$21.45	\$0.00	\$90.01

For apprentice rates see "Apprentice- ROOFER"

SHEETMETAL WORKER SHEETMETAL WORKERS LOCAL 17 - A	02/01/2024	\$57.22	\$14.59	\$27.50	\$2.98	\$102.29
	08/01/2024	\$58.97	\$14.59	\$27.50	\$2.98	\$104.04
	02/01/2025	\$60.72	\$14.59	\$27.50	\$2.98	\$105.79
	08/01/2025	\$62.57	\$14.59	\$27.50	\$2.98	\$107.64
	02/01/2026	\$64.52	\$14.59	\$27.50	\$2.98	\$109.59

**Apprentice - SHEET METAL WORKER - Local 17-A**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$24.03	\$14.59	\$6.13	\$0.00	\$44.75
2	42	\$24.03	\$14.59	\$6.13	\$0.00	\$44.75
3	47	\$26.89	\$14.59	\$12.11	\$1.61	\$55.20
4	47	\$26.89	\$14.59	\$12.11	\$1.61	\$55.20
5	52	\$29.75	\$14.59	\$13.09	\$1.72	\$59.15
6	52	\$29.75	\$14.59	\$13.34	\$1.73	\$59.41
7	60	\$34.33	\$14.59	\$14.75	\$1.91	\$65.58
8	65	\$37.19	\$14.59	\$15.73	\$2.03	\$69.54
9	75	\$42.92	\$14.59	\$17.69	\$2.26	\$77.46
10	85	\$48.64	\$14.59	\$19.15	\$2.47	\$84.85

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$24.77	\$14.59	\$6.13	\$0.00	\$45.49
2	42	\$24.77	\$14.59	\$6.13	\$0.00	\$45.49
3	47	\$27.72	\$14.59	\$12.11	\$1.63	\$56.05
4	47	\$27.72	\$14.59	\$12.11	\$1.63	\$56.05
5	52	\$30.66	\$14.59	\$13.09	\$1.75	\$60.09
6	52	\$30.66	\$14.59	\$13.34	\$1.76	\$60.35
7	60	\$35.38	\$14.59	\$14.75	\$1.94	\$66.66
8	65	\$38.33	\$14.59	\$15.73	\$2.06	\$70.71
9	75	\$44.23	\$14.59	\$17.69	\$2.30	\$78.81
10	85	\$50.12	\$14.59	\$19.15	\$2.52	\$86.38

**Notes:**  
Steps are 6 mos.

**Apprentice to Journeyworker Ratio:1:4**

SPECIALIZED EARTH MOVING EQUIP < 35 TONS	01/01/2024	\$39.24	\$15.07	\$18.67	\$0.00	\$72.98
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	06/01/2024	\$40.24	\$15.07	\$18.67	\$0.00	\$73.98
	12/01/2024	\$40.24	\$15.07	\$20.17	\$0.00	\$75.48
	01/01/2025	\$40.24	\$15.57	\$20.17	\$0.00	\$75.98
	06/01/2025	\$41.24	\$15.57	\$20.17	\$0.00	\$76.98
	12/01/2025	\$41.24	\$15.57	\$21.78	\$0.00	\$78.59
	01/01/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$79.19
	06/01/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$80.19
	12/01/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$81.93
	01/01/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$82.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP > 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$39.53	\$15.07	\$18.67	\$0.00	\$73.27
	06/01/2024	\$40.53	\$15.07	\$18.67	\$0.00	\$74.27
	12/01/2024	\$40.53	\$15.07	\$20.17	\$0.00	\$75.77
	01/01/2025	\$40.53	\$15.57	\$20.17	\$0.00	\$76.27
	06/01/2025	\$41.53	\$15.57	\$20.17	\$0.00	\$77.27
	12/01/2025	\$41.53	\$15.57	\$21.78	\$0.00	\$78.88
	01/01/2026	\$41.53	\$16.17	\$21.78	\$0.00	\$79.48
	06/01/2026	\$42.53	\$16.17	\$21.78	\$0.00	\$80.48
	12/01/2026	\$42.53	\$16.17	\$23.52	\$0.00	\$82.22
	01/01/2027	\$42.53	\$16.77	\$23.52	\$0.00	\$82.82
SPRINKLER FITTER <i>SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1</i>	03/01/2024	\$69.75	\$10.90	\$23.20	\$0.00	\$103.85
	10/01/2024	\$71.55	\$10.90	\$23.20	\$0.00	\$105.65
	03/01/2025	\$73.35	\$10.90	\$23.20	\$0.00	\$107.45

**Apprentice - SPRINKLER FITTER - Local 550 (Section A) Zone 1**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$24.41	\$10.90	\$12.80	\$0.00	\$48.11
2	40	\$27.90	\$10.90	\$13.60	\$0.00	\$52.40
3	45	\$31.39	\$10.90	\$14.40	\$0.00	\$56.69
4	50	\$34.88	\$10.90	\$15.20	\$0.00	\$60.98
5	55	\$38.36	\$10.90	\$16.00	\$0.00	\$65.26
6	60	\$41.85	\$10.90	\$16.80	\$0.00	\$69.55
7	65	\$45.34	\$10.90	\$17.60	\$0.00	\$73.84
8	70	\$48.83	\$10.90	\$18.40	\$0.00	\$78.13
9	75	\$52.31	\$10.90	\$19.20	\$0.00	\$82.41
10	80	\$55.80	\$10.90	\$20.00	\$0.00	\$86.70

**Effective Date - 10/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$25.04	\$10.90	\$12.80	\$0.00	\$48.74
2	40	\$28.62	\$10.90	\$13.60	\$0.00	\$53.12
3	45	\$32.20	\$10.90	\$14.40	\$0.00	\$57.50
4	50	\$35.78	\$10.90	\$15.20	\$0.00	\$61.88
5	55	\$39.35	\$10.90	\$16.00	\$0.00	\$66.25
6	60	\$42.93	\$10.90	\$16.80	\$0.00	\$70.63
7	65	\$46.51	\$10.90	\$17.60	\$0.00	\$75.01
8	70	\$50.09	\$10.90	\$18.40	\$0.00	\$79.39
9	75	\$53.66	\$10.90	\$19.20	\$0.00	\$83.76
10	80	\$57.24	\$10.90	\$20.00	\$0.00	\$88.14

Notes: Apprentice entered prior 9/30/10:  
40/45/50/55/60/65/70/75/80/85  
Steps are 850 hours

**Apprentice to Journeyworker Ratio:1:3**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
STEAM BOILER OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN <i>ELECTRICIANS LOCAL 103</i>	03/01/2024	\$49.49	\$13.00	\$20.19	\$0.00	\$82.68
	09/01/2024	\$51.02	\$13.00	\$20.24	\$0.00	\$84.26
	03/01/2025	\$51.98	\$13.00	\$20.27	\$0.00	\$85.25
	09/01/2025	\$53.51	\$13.00	\$20.32	\$0.00	\$86.83
	03/01/2026	\$54.47	\$13.00	\$20.34	\$0.00	\$87.81
	09/01/2026	\$56.00	\$13.00	\$20.39	\$0.00	\$89.39
	03/01/2027	\$56.95	\$13.00	\$20.42	\$0.00	\$90.37
	09/01/2027	\$58.49	\$13.00	\$20.46	\$0.00	\$91.95
	03/01/2028	\$59.45	\$13.00	\$20.49	\$0.00	\$92.94

**Apprentice - TELECOMMUNICATION TECHNICIAN - Local 103**

**Effective Date - 03/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$22.27	\$13.00	\$0.67	\$0.00	\$35.94
2	45	\$22.27	\$13.00	\$0.67	\$0.00	\$35.94
3	50	\$24.75	\$13.00	\$16.16	\$0.00	\$53.91
4	50	\$24.75	\$13.00	\$16.16	\$0.00	\$53.91
5	55	\$27.22	\$13.00	\$16.57	\$0.00	\$56.79
6	60	\$29.69	\$13.00	\$16.97	\$0.00	\$59.66
7	65	\$32.17	\$13.00	\$17.38	\$0.00	\$62.55
8	70	\$34.64	\$13.00	\$17.78	\$0.00	\$65.42
9	75	\$37.12	\$13.00	\$18.18	\$0.00	\$68.30
10	80	\$39.59	\$13.00	\$18.58	\$0.00	\$71.17

**Effective Date - 09/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$22.96	\$13.00	\$0.69	\$0.00	\$36.65
2	45	\$22.96	\$13.00	\$0.69	\$0.00	\$36.65
3	50	\$25.51	\$13.00	\$16.16	\$0.00	\$54.67
4	50	\$25.51	\$13.00	\$16.16	\$0.00	\$54.67
5	55	\$28.06	\$13.00	\$16.57	\$0.00	\$57.63
6	60	\$30.61	\$13.00	\$16.97	\$0.00	\$60.58
7	65	\$33.16	\$13.00	\$17.38	\$0.00	\$63.54
8	70	\$35.71	\$13.00	\$17.78	\$0.00	\$66.49
9	75	\$38.27	\$13.00	\$18.18	\$0.00	\$69.45
10	80	\$40.82	\$13.00	\$18.58	\$0.00	\$72.40

**Notes:**

**Apprentice to Journeyworker Ratio:1:1**

TERRAZZO FINISHERS	02/01/2024	\$61.34	\$11.49	\$23.59	\$0.00	\$96.42
BRICKLAYERS LOCAL 3 - MARBLE & TILE	08/01/2024	\$63.44	\$11.49	\$23.59	\$0.00	\$98.52
	02/01/2025	\$64.74	\$11.49	\$23.59	\$0.00	\$99.82
	08/01/2025	\$66.89	\$11.49	\$23.59	\$0.00	\$101.97
	02/01/2026	\$68.24	\$11.49	\$23.59	\$0.00	\$103.32
	08/01/2026	\$70.44	\$11.49	\$23.59	\$0.00	\$105.52
	02/01/2027	\$71.84	\$11.49	\$23.59	\$0.00	\$106.92



**Classification**

**Effective Date    Base Wage    Health    Pension    Supplemental Unemployment    Total Rate**

**Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile**

**Effective Date - 02/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$30.67	\$11.49	\$23.59	\$0.00	\$65.75
2	60	\$36.80	\$11.49	\$23.59	\$0.00	\$71.88
3	70	\$42.94	\$11.49	\$23.59	\$0.00	\$78.02
4	80	\$49.07	\$11.49	\$23.59	\$0.00	\$84.15
5	90	\$55.21	\$11.49	\$23.59	\$0.00	\$90.29

**Effective Date - 08/01/2024**

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.72	\$11.49	\$23.59	\$0.00	\$66.80
2	60	\$38.06	\$11.49	\$23.59	\$0.00	\$73.14
3	70	\$44.41	\$11.49	\$23.59	\$0.00	\$79.49
4	80	\$50.75	\$11.49	\$23.59	\$0.00	\$85.83
5	90	\$57.10	\$11.49	\$23.59	\$0.00	\$92.18

**Notes:**

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**Apprentice to Journeyworker Ratio:1:3**

<b>TEST BORING DRILLER</b>	12/01/2023	\$48.33	\$9.65	\$18.22	\$0.00	\$76.20
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2024	\$49.81	\$9.65	\$18.22	\$0.00	\$77.68
	12/01/2024	\$51.28	\$9.65	\$18.22	\$0.00	\$79.15
	06/01/2025	\$52.78	\$9.65	\$18.22	\$0.00	\$80.65
	12/01/2025	\$54.28	\$9.65	\$18.22	\$0.00	\$82.15
	06/01/2026	\$55.83	\$9.65	\$18.22	\$0.00	\$83.70
	12/01/2026	\$57.33	\$9.65	\$18.22	\$0.00	\$85.20

For apprentice rates see "Apprentice- LABORER"

<b>TEST BORING DRILLER HELPER</b>	12/01/2023	\$44.45	\$9.65	\$18.22	\$0.00	\$72.32
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2024	\$45.93	\$9.65	\$18.22	\$0.00	\$73.80
	12/01/2024	\$47.40	\$9.65	\$18.22	\$0.00	\$75.27
	06/01/2025	\$48.90	\$9.65	\$18.22	\$0.00	\$76.77
	12/01/2025	\$50.40	\$9.65	\$18.22	\$0.00	\$78.27
	06/01/2026	\$51.95	\$9.65	\$18.22	\$0.00	\$79.82
	12/01/2026	\$53.45	\$9.65	\$18.22	\$0.00	\$81.32

For apprentice rates see "Apprentice- LABORER"

<b>TEST BORING LABORER</b>	12/01/2023	\$44.33	\$9.65	\$18.22	\$0.00	\$72.20
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2024	\$45.81	\$9.65	\$18.22	\$0.00	\$73.68
	12/01/2024	\$47.28	\$9.65	\$18.22	\$0.00	\$75.15
	06/01/2025	\$48.78	\$9.65	\$18.22	\$0.00	\$76.65
	12/01/2025	\$50.28	\$9.65	\$18.22	\$0.00	\$78.15
	06/01/2026	\$51.83	\$9.65	\$18.22	\$0.00	\$79.70
	12/01/2026	\$53.33	\$9.65	\$18.22	\$0.00	\$81.20

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$54.43	\$15.00	\$16.40	\$0.00	\$85.83
	06/01/2024	\$55.71	\$15.00	\$16.40	\$0.00	\$87.11
	12/01/2024	\$57.15	\$15.00	\$16.40	\$0.00	\$88.55
	06/01/2025	\$58.43	\$15.00	\$16.40	\$0.00	\$89.83
	12/01/2025	\$59.87	\$15.00	\$16.40	\$0.00	\$91.27
	06/01/2026	\$61.15	\$15.00	\$16.40	\$0.00	\$92.55
	12/01/2026	\$62.59	\$15.00	\$16.40	\$0.00	\$93.99
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$39.82	\$15.07	\$18.67	\$0.00	\$73.56
	06/01/2024	\$40.82	\$15.07	\$18.67	\$0.00	\$74.56
	12/01/2024	\$40.82	\$15.07	\$20.17	\$0.00	\$76.06
	01/01/2025	\$40.82	\$15.57	\$20.17	\$0.00	\$76.56
	06/01/2025	\$41.82	\$15.57	\$20.17	\$0.00	\$77.56
	12/01/2025	\$41.82	\$15.57	\$21.78	\$0.00	\$79.17
	01/01/2026	\$41.82	\$16.17	\$21.78	\$0.00	\$79.77
	06/01/2026	\$42.82	\$16.17	\$21.78	\$0.00	\$80.77
	12/01/2026	\$42.82	\$16.17	\$23.52	\$0.00	\$82.51
	01/01/2027	\$42.82	\$16.77	\$23.52	\$0.00	\$83.11
TUNNEL WORK - COMPRESSED AIR <i>LABORERS (COMPRESSED AIR)</i>	12/01/2023	\$56.56	\$9.65	\$18.67	\$0.00	\$84.88
	06/01/2024	\$58.04	\$9.65	\$18.67	\$0.00	\$86.36
	12/01/2024	\$59.51	\$9.65	\$18.67	\$0.00	\$87.83
	06/01/2025	\$61.01	\$9.65	\$18.67	\$0.00	\$89.33
	12/01/2025	\$62.51	\$9.65	\$18.67	\$0.00	\$90.83
	06/01/2026	\$64.06	\$9.65	\$18.67	\$0.00	\$92.38
	12/01/2026	\$65.56	\$9.65	\$18.67	\$0.00	\$93.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) <i>LABORERS (COMPRESSED AIR)</i>	12/01/2023	\$58.56	\$9.65	\$18.67	\$0.00	\$86.88
	06/01/2024	\$60.04	\$9.65	\$18.67	\$0.00	\$88.36
	12/01/2024	\$61.51	\$9.65	\$18.67	\$0.00	\$89.83
	06/01/2025	\$63.01	\$9.65	\$18.67	\$0.00	\$91.33
	12/01/2025	\$64.51	\$9.65	\$18.67	\$0.00	\$92.83
	06/01/2026	\$66.06	\$9.65	\$18.67	\$0.00	\$94.38
	12/01/2026	\$67.56	\$9.65	\$18.67	\$0.00	\$95.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2023	\$48.63	\$9.65	\$18.67	\$0.00	\$76.95
	06/01/2024	\$50.11	\$9.65	\$18.67	\$0.00	\$78.43
	12/01/2024	\$51.58	\$9.65	\$18.67	\$0.00	\$79.90
	06/01/2025	\$53.08	\$9.65	\$18.67	\$0.00	\$81.40
	12/01/2025	\$54.58	\$9.65	\$18.67	\$0.00	\$82.90
	06/01/2026	\$56.13	\$9.65	\$18.67	\$0.00	\$84.45
	12/01/2026	\$57.63	\$9.65	\$18.67	\$0.00	\$85.95
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2023	\$50.63	\$9.65	\$18.67	\$0.00	\$78.95
	06/01/2024	\$52.11	\$9.65	\$18.67	\$0.00	\$80.43
	12/01/2024	\$53.58	\$9.65	\$18.67	\$0.00	\$81.90
	06/01/2025	\$55.08	\$9.65	\$18.67	\$0.00	\$83.40
	12/01/2025	\$56.58	\$9.65	\$18.67	\$0.00	\$84.90
	06/01/2026	\$58.13	\$9.65	\$18.67	\$0.00	\$86.45
	12/01/2026	\$59.63	\$9.65	\$18.67	\$0.00	\$87.95
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	01/01/2024	\$39.24	\$15.07	\$18.67	\$0.00	\$72.98
	06/01/2024	\$40.24	\$15.07	\$18.67	\$0.00	\$73.98
	12/01/2024	\$40.24	\$15.07	\$20.17	\$0.00	\$75.48
	01/01/2025	\$40.24	\$15.57	\$20.17	\$0.00	\$75.98
	06/01/2025	\$41.24	\$15.57	\$20.17	\$0.00	\$76.98
	12/01/2025	\$41.24	\$15.57	\$21.78	\$0.00	\$78.59
	01/01/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$79.19
	06/01/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$80.19
	12/01/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$81.93
	01/01/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$82.53
WAGON DRILL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
For apprentice rates see "Apprentice- LABORER"						
WAGON DRILL OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY &amp; HIGHWAY)</i>	12/01/2023	\$38.11	\$9.65	\$17.14	\$0.00	\$64.90
	06/01/2024	\$39.44	\$9.65	\$17.14	\$0.00	\$66.23
	12/01/2024	\$40.77	\$9.65	\$17.14	\$0.00	\$67.56
	06/01/2025	\$42.16	\$9.65	\$17.14	\$0.00	\$68.95
	12/01/2025	\$43.54	\$9.65	\$17.14	\$0.00	\$70.33
	06/01/2026	\$44.98	\$9.65	\$17.14	\$0.00	\$71.77
	12/01/2026	\$46.42	\$9.65	\$17.14	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
WASTE WATER PUMP OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2023	\$55.03	\$15.00	\$16.40	\$0.00	\$86.43
	06/01/2024	\$56.33	\$15.00	\$16.40	\$0.00	\$87.73
	12/01/2024	\$57.78	\$15.00	\$16.40	\$0.00	\$89.18
	06/01/2025	\$59.08	\$15.00	\$16.40	\$0.00	\$90.48
	12/01/2025	\$60.53	\$15.00	\$16.40	\$0.00	\$91.93
	06/01/2026	\$61.83	\$15.00	\$16.40	\$0.00	\$93.23
	12/01/2026	\$63.28	\$15.00	\$16.40	\$0.00	\$94.68
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER <i>PLUMBERS &amp; GASFITTERS LOCAL 12</i>	03/03/2024	\$67.74	\$14.32	\$19.11	\$0.00	\$101.17
	09/01/2024	\$69.54	\$14.32	\$19.11	\$0.00	\$102.97
	03/02/2025	\$71.34	\$14.32	\$19.11	\$0.00	\$104.77
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						

Additional Apprentices Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentices ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.)

Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

\*\* Multiple ratios are listed in the comment field.

\*\*\* APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.

\*\*\*\* APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.



## APPENDIX B

### Davis Bacon Act Requirements



## **APPENDIX G**

### **Davis Bacon Act Requirements**

All construction projects are subject to the Davis Bacon wage rate requirements and must include the appropriate sections of the following document in its entirety in the contract documents.

**The vast majority of SRF projects will be bid by Governmental Entities (i.e., Cities, Towns, Authorities, Water Districts, Wastewater Districts). These projects must include the following language in construction contracts:**

**I.3. Contract and Subcontract Provisions**

**I.4. Contract Provisions for Contracts in Excess of \$100,000 (if applicable)**

**I.5. Compliance Verification**

**This language may be found on pages DB-3-DB-11.**

**In certain cases, SRF projects may be bid by non-Governmental Entities (i.e., private water companies, private PWSs, etc.). These projects must include the following language in construction contracts:**

**II.3. Contract and Subcontract Provisions**

**II.4. Contract Provisions for Contracts in Excess of \$100,000 (if applicable)**

**II.5. Compliance Verification**

**This language may be found on pages DB-11-DB-21**

#### **Preamble**

With respect to the Clean Water and Safe Drinking Water State revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), below and for compliance as described in Section II-5.

#### **I. Requirements For Subrecipients That Are Governmental Entities:**

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has



questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Valerie Marshall at EPA Region 1 (617-918-1674) for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <https://www.dol.gov/whd/govcontracts/dbra.htm>

## **1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.**

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

## **2. Obtaining Wage Determinations.**

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from [www.wdol.gov](http://www.wdol.gov) into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

### **3. Contract and Subcontract provisions.**

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2012 Appropriations Act, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein:

Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, [www.dol.gov](http://www.dol.gov).

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/whd/forms/wh347.pdf> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

- (5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.
- (7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.
- (8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29

CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

**4. Contract Provision for Contracts in Excess of \$100,000.**

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other



Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

## **5. Compliance Verification**

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its

assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at [https://www.dol.gov/whd/whd\\_district\\_offices.pdf](https://www.dol.gov/whd/whd_district_offices.pdf).

## **II. Requirements For Subrecipients That Are Not Governmental Entities**

The following terms and conditions specify how recipients will assist EPA in meeting its DB responsibilities when DB applies to EPA awards of financial assistance with respect to subrecipients that are not governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient for guidance. If a State recipient needs guidance, the recipient may contact Valerie Marshall at EPA Region 1 (617-918-1674) for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <https://www.dol.gov/whd/govcontracts/dbra.htm>

**Under these terms and conditions, the subrecipient must submit its proposed DB wage determinations to the State recipient for approval prior to including the wage determination in any solicitation, contract task orders, work assignments, or similar instruments to existing contractors.**

### **1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.**

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

### **2. Obtaining Wage Determinations.**

(a) Subrecipients must obtain proposed wage determinations for specific localities at [www.wdol.gov](http://www.wdol.gov). After the Subrecipient obtains its proposed wage determination, it must submit the wage determination to (insert contact information for State recipient DB point of contact for wage determination) for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing contractors (ordering instruments unless subsequently directed otherwise by the State recipient Award Official).

(b) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(c) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from [www.wdol.gov](http://www.wdol.gov) into the ordering instrument.

(d) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(e) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

### 3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2011 Full-Year Continuing Appropriation, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3) ), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, [www.dol.gov](http://www.dol.gov).

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request, and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s) shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is

available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/whd/forms/wh347.pdf> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

- (1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;
- (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
- (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of



fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

#### **4. Contract Provision for Contracts in Excess of \$100,000.**

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The subrecipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

## **5. Compliance Verification**

(a). The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c). The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB . In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d). The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at [https://www.dol.gov/whd/whd\\_district\\_offices.pdf](https://www.dol.gov/whd/whd_district_offices.pdf).



"General Decision Number: MA20240008 03/22/2024

Superseded General Decision Number: MA20230008

State: Massachusetts

Construction Types: Heavy (Heavy and Marine)

Counties: Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth and Suffolk Counties in Massachusetts.

HEAVY AND MARINE CONTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> <li>. Executive Order 14026 generally applies to the contract.</li> <li>. The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.</li> </ul>
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> <li>. Executive Order 13658 generally applies to the contract.</li> <li>. The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.</li> </ul>

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number      Publication Date

0	01/05/2024
1	01/19/2024
2	02/09/2024
3	03/01/2024
4	03/22/2024

BOIL0029-001 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 45.87	29.02

BRMA0001-011 02/01/2023

FOXBORO CHAPTER

BRISTOL (Attleboro, Berkley, Dighton, Mansfield, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Taunton); NORFOLK, (Bellingham, Canton, Dedham, Foxboro, Franklin, Norfolk, Norwood, Plainville, Sharon, Walpole, Westwood, Wrentham); and PLYMOUTH (Lakeville)

	Rates	Fringes
Bricklayer/Cement Mason.....	\$ 60.35	34.40

BRMA0001-012 02/01/2023

LOWELL CHAPTER

MIDDLESEX (Acton, Ashby, Ayer, Bedford, Billerica, Boxboro, Carlisle, Chemsford, Dracut, Dunstabale, Ft Devens, Groton, Littleton, Lowell, North Acton, Pepperell, Shirley, South Acton, Tewksbury, Townsend, Tyngsboro, West Acton, Westford, Wilmington)

	Rates	Fringes
BRICKLAYER.....	\$ 58.21	33.71

BRMA0001-013 08/01/2023

LOWELL CHAPTER

MIDDLESEX (Ashland, Framingham, Holliston, Hopkinton, Hudson, Maynard, Natick, Sherbvorn, Stow); and NORFOLK (Medfield, Medway, Millis)

	Rates	Fringes
BRICKLAYER.....	\$ 62.40	34.40

BRMA0003-001 08/01/2023

	Rates	Fringes
Marble & Tile Finisher.....	\$ 47.89	32.43
Marble, Tile & Terrazzo Workers.....	\$ 62.42	34.37
TERRAZZO FINISHER.....	\$ 61.34	34.21

BRMA0003-003 08/01/2023

BOSTON CHAPTER

MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Somerville); NORFOLK (Brookline, Milton); and SUFFOLK

Rates Fringes

BRICKLAYER.....\$ 62.40 34.40

BRMA0003-011 08/01/2023

LYNN CHAPTER

ESSEX (Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salisbury, Salem, Saugus, Swampscott, Topsfield, Wakefield, Wenham, West Newbury); and MIDDLESEX (North Reading, Reading, Wakefield)

Rates Fringes

Bricklayer/Cement Mason.....\$ 62.40 34.40

BRMA0003-012 08/01/2023

Rates Fringes

BRICKLAYER

WALTHAM CHAPTER - MIDDLESEX (Belmont, Burlington, Concord, Lexington, Lincoln, Stoneham, Sudbury, Waltham, Watertown, Wayland, Weston, Winchester, Woburn).....\$ 62.40

34.40

BRMA0003-014 08/01/2023

QUINCY CHAPTER

PLYMOUTH COUNTY (Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Middleboro, Norwell, Pembroke, Plymouth, Rockland, Scituate, West Bridgewater, Whitman)

Rates Fringes

Bricklayer/Cement Mason.....\$ 62.40 34.40

BRMA0003-025 08/01/2023

NEW BEDFORD CHAPTER

BARNSTABLE; BRISTOL (Acushnet, Darmouth, Fairhaven, Fall River, Freetown, New Bedford, Somerset, Swansea, Westport); DUKES; NANTUCKET; PLYMOUTH (Marion, Mattapoisett, Rochester, Wareham)

Rates Fringes



Bricklayer/Cement Mason.....\$ 62.40 34.40

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BRMA0003-033 08/01/2023

NEWTON CHAPTER  
MIDDLESEX (Newton); NORFOLK (Dover, Needham, Wellesley)

Rates Fringes  
Bricklayer, Plasterer.....\$ 62.40 34.40

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CARP0056-001 08/01/2023

All of SUFFOLK COUNTY; and those areas of BARNSTABLE, BRISTOL, ESSEX, MIDDLESEX, NORFOLK, and PLYMOUTH COUNTIES situated INSIDE Boston Beltway (I-495) and North of Cape Cod Canal. ALL of DUKES and NANTUCKET COUNTIES

Rates Fringes  
PILEDRIVERMAN.....\$ 53.11 35.10

-----  
CARP0056-002 08/01/2022

The areas of BARNSTABLE, BRISTOL, PLYMOUTH, and NORFOLK COUNTIES situated OUTSIDE Boston Beltway (I-495) and South of Cape Cod Canal

Rates Fringes  
PILEDRIVERMAN.....\$ 48.34 34.10

-----  
CARP0056-003 08/01/2022

Those areas of ESSEX and MIDDLESEX COUNTIES situated OUTSIDE Boston Beltway (I-495)

Rates Fringes  
PILEDRIVERMAN.....\$ 45.74 34.10

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CARP0056-004 08/01/2022

Rates Fringes  
DIVER TENDER.....\$ 52.15 34.10  
DIVER.....\$ 68.70 35.57

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\* CARP0327-002 03/01/2024

MIDDLESEX (Belmont, Cambridge, Everett, Malden, Medford, Somerville); NORFOLK (Brookline, Dedham, Milton); AND SUFFOLK COUNTIES

Rates Fringes  
CARPENTER.....\$ 57.20 31.04

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\* CARP0339-002 03/01/2024

BRISTOL (Attleborough, North Attleborough); ESSEX; MIDDLESEX (Except Belmont, Cambridge, Everett, Malden, Medford, Somerville); AND NORFOLK (Bellingham, Braintree, Canton, Cohasset, Foxboro, Franklin, Medfield, Medway, Millis, Needham, Norfolk, Norwood, Plainville, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham) COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 46.86	30.94
-----		
* CARP0346-001 03/01/2024		

NORFOLK (Braintree, Quincy, Cohasset, Weymouth, etc.) PLYMOUTH (Duxbury, Hanover, Hull, Hingham, Marshfield, Norwell, Pembroke Rockland, Scituate)

	Rates	Fringes
CARPENTER.....	\$ 46.86	30.94
-----		
CARP0624-002 09/01/2017		

DUKES; NANTUCKET

	Rates	Fringes
CARPENTER.....	\$ 46.43	28.35
-----		
CARP0624-006 09/01/2017		

BARNSTABLE; BRISTOL (Except Attleboro & North Attleboro); NORFOLK (Avon, Holbrook, Randolph, Stoughton); PLYMOUTH (Bridgewater, Kingston, Lakeville, Middleboro, Plymouth, S. Hanover, Whitman)

	Rates	Fringes
CARPENTER.....	\$ 39.28	27.90
-----		
CARP1121-001 01/01/2024		

SUFFOLK COUNTY

	Rates	Fringes
MILLWRIGHT.....	\$ 48.03	33.49
-----		
CARP1121-005 01/01/2024		

BARNSTABLE, BRISTOL, DUKES, ESSEX, MIDDLESEX, NANTUCKET, NORFOLK and PLYMOUTH COUNTIES

	Rates	Fringes
MILLWRIGHT.....	\$ 42.76	33.24
-----		
ELEC0096-001 09/03/2023		

MIDDLESEX (Ashby, Ashland, Ayer, Ft. Devens, Groton, Hopkinton, Hudson, Marlboro, Pepperell, Shirley, Stow, Townsend)

	Rates	Fringes
ELECTRICIAN.....	\$ 45.99	33.06
Teledata System Installer.....	\$ 34.49	31.44

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ELEC0099-001 06/01/2021

BRISTOL (Attleboro, North Attleboro, Seekonk)

	Rates	Fringes
ELECTRICIAN.....	\$ 43.61	54.71%
Teledata System Installer.....	\$ 31.21	13.1%+14.93

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\* ELEC0103-002 03/01/2024

ESSEX (Amesbury, Andover, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, West Newbury); MIDDLESEX (Bedford, Billerica, Boxboro, Burlington, Carlisle, Chelmsford, Dracut, Dunstable littleton, Lowell, North Reading, Tewksbury, Tyngsboro, Westford, Wilmington)

	Rates	Fringes
ELECTRICIAN.....	\$ 61.86	36.14

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\* ELEC0103-004 03/01/2024

ESSEX (Beverly, Danvers, Essex, Gloucester, Hamilton, Ipswich, Manchester, Marblehead, Middleton, Peabody, Rockport, Salem, Topsfield, Wenham)

	Rates	Fringes
ELECTRICIAN.....	\$ 61.86	36.14

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\* ELEC0103-005 03/01/2024

ESSEX (Lynn, Lynnfield, Nahant, Saugus, Swampscott); MIDDLESEX (Acton, Arlington, Belmont, Cambridge, Concord, Everett, Framingham, Holliston, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown, Wayland, Weston, Winchester, Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Franklino, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham); PLYMOUTH (Hingham and Hull);SUFFOLK

	Rates	Fringes
ELECTRICIAN.....	\$ 61.86	36.14

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ELEC0104-001 08/29/2022

	Rates	Fringes
Line Construction:		
Cableman.....	\$ 53.06	28.49+A

Equipment Operator.....	\$ 45.10	25.20+A
Groundman.....	\$ 29.18	12.10+A
Lineman.....	\$ 53.06	28.49+A

A. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Christmas Day and Columbus Day, provided the employee has been employed 5 working days prior to any one of the listed holidays.

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 ELEC0223-002 09/01/2023

BARNSTABLE, BRISTOL (Except Attleboro, North Attleboro, Seekonk); DUKES; NANTUCKET; PLYMOUTH (Except Hingham and Hull Twps); NORFOLK (Avon, Halbrook, Randolph, Sloughton)

	Rates	Fringes
ELECTRICIAN.....	\$ 47.87	29.92

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 ENGI0004-009 12/01/2023

	Rates	Fringes
Power equipment operators:		
Group 1.....	\$ 55.03	32.45
Group 2.....	\$ 54.43	32.45
Group 3.....	\$ 35.62	32.45
Group 4.....	\$ 43.96	32.45
Group 5.....	\$ 24.41	32.45
Group 6.....	\$ 29.86	32.45

HOURLY PREMIUM FOR BOOM LENGTHS (Including Jib):

Over 150 ft.	+2.18
Over 185 ft.	+3.84
Over 210 ft.	+5.39
Over 250 ft.	+8.16
Over 295 ft.	+11.29
Over 350 ft.	+13.14

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:

A. PAID HOLIDAYS: New Year's Day, Washington,s Birthday, Labor Day, Memorial Day, Independence Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

POWER EQUIPMENT OPERATORS CLASSIFICATIONS [HEAVY CONSTRUCTION]

GROUP 1: Power shovel; crane; truck crane; derrick; pile driver; trenching machine; mechanical hoist pavement breaker; cement concrete paver; dragline; hoisting engine; three drum machine; pumpcrete machine; loaders; shovel dozer; front end loader; mucking machine; shaft hoist; steam engine; backhoe; gradall; cable way; fork lift; cherry picker; boring machine; rotary drill; post hole hammer; post hole digger; asphalt plant on job site; concrete batching and/or mixing plant on job site; crusher plant on job site; paving concrete mixer; timber jack  
 GROUP 2: Sonic or vibratory hammer; grader; scraper; tandem scraper; bulldozer; tractor; mechanic - maintenance; York rake; mulching machine; paving screed machine;stationary steam boiler; paving concrete finishing machine; grout pump; portable steam boiler; portable steam generator; roller; spreader; asphalt paver; locomotives or machines

used in place thereof; tamper (self propelled or tractor-draw); cal tracks; ballast regulator;rail anchor machine; switch tamper; tire truck

GROUP 3: Pumps (1-3 grouped); compressor; welding machines (1-3 grouped); generator; sighting plant; heaters (power driven, 1- 5); syphon-pulsometer; concrete mixer; valves controlling permanent plant air steam, conveyor, wellpoint system (operating)

GROUP 4: Assitant engineer (fireman)

GROUP 5: Oiler (other than truck cranes and gradalls)

GROUP 6: Oiler (on truck cranes and gradalls)

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IRON0007-001 09/16/2023

AREA 1: BRISTOL (Easton); ESSEX (Beverly,Gloucester,Lynn, Lynnfield, Manchester,Marblehead, Nahant, Rockport, Salem, Saugus, Swampscott); MIDDLESEX (Arlington, Bedford, Belmont, Burlington, Cambridge, Carlisle, Concord, Dunstable, Everett, Framingham, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown, Wayland, Weston, Winchester, Woburn); NORFOLK (Except Medway); PLYMOUTH (Abington, Bridgewater, Brocton, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Norwell, Pembroke, Plymouth, Plympton, Rockland, Scituate, West Bridgewater, Whitman); SUFFOLK

AREA 2: ESSEX (Amesbury, Andover, Boxford, Danvers, Essex, Georgetown, Hamilton, Haverhill, Ipswich, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, Topsfield, Wenham, West Newbury); MIDDLESEX (Action,Billerica, Chelmsford, Dracut, Groton, Groveland, Littleton, Lowell, Middleton, North Reading, Pepperell, Tewksbury, Tyngsboro, Westford, Wilinton)

	Rates	Fringes
IRONWORKER		
AREA 1.....	\$ 53.70	36.21
AREA 2.....	\$ 49.29	36.21

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IRON0007-010 09/16/2023

MIDDLESEX (Ashby, Ashland, Ayer, Boxboro, Holliston, Hopkinton, Hudson, Marlboro, Shirley, Stow, Townsend); NORFOLK (Medway)

	Rates	Fringes
IRONWORKER.....	\$ 53.40	36.21

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IRON0037-002 09/16/2023

BARNSTABLE; BRISTOL (Acushnet, Attleboro, Berkley, Dartmouth, Dighton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Somerset, Swansea, Taunton, Westport); DUKES; NANTUCKET; NORFOLK (Billingham, Franklin, Plainville, Wrentham); PLYMOUTH (Lakeville, Marion, Mattapoisett, Middleboro, Rochester, Wareham)

Rates	Fringes
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IRONWORKER.....\$ 40.00 32.58

LAB00022-006 12/01/2021

SUFFOLK COUNTY (Boston, Chelsea, Revere, Winthrop, Deer & Nut Islands); MIDDLESEX COUNTY (Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn only); NORFOLK COUNTY (Brookline, Dedham, and Milton only)

Rates Fringes

Laborers:

GROUP 1.....	\$ 41.18	27.52
GROUP 2.....	\$ 41.43	27.52
GROUP 3.....	\$ 41.93	27.52
GROUP 4.....	\$ 42.18	27.52
GROUP 5.....	\$ 24.50	27.52
GROUP 6.....	\$ 43.18	27.52

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drill operator

GROUP 3: Air track operator; block paver; rammer; curb setter

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

LAB00022-012 12/01/2021

Counties of BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH; MIDDLESEX (With the exception of Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn); NORFOLK (With the exception of Brookline, Dedham, and Milton)

Rates Fringes

Laborers:

GROUP 1.....	\$ 35.41	26.59
GROUP 2.....	\$ 35.66	26.59
GROUP 3.....	\$ 36.16	26.59
GROUP 4.....	\$ 36.41	26.59
GROUP 5.....	\$ 24.50	26.59
GROUP 6.....	\$ 37.41	26.59

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drillperator

GROUP 3: Air track operator; block paver; rammer; curb setter; hydraulic & similar self powere drills

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

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LAB0022-013 12/01/2021

	Rates	Fringes
Laborers:		
(FREE AIR OPERATION):		
SHIELD DRIVEN AND LINER		
PLATE IN FREE AIR)		
GROUP 1.....	\$ 45.48	28.02
GROUP 2.....	\$ 45.48	28.02
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
TEST BORING & WELL DRILLING		
Driller.....	\$ 42.58	27.67
Laborer.....	\$ 41.18	27.67
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
OPEN AIR CASSON, UNDERPINNING WORK & BORING CREW		
Bottom man.....	\$ 42.33	27.67
Laborers; Top man.....	\$ 41.18	27.67
(TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR)		
GROUP 1.....	\$ 42.93	28.02
GROUP 2.....	\$ 53.41	28.02
GROUP 3.....	\$ 53.41	28.02
GROUP 4.....	\$ 53.41	28.02
GROUP 5.....	\$ 53.41	28.02
GROUP 6.....	\$ 55.41	28.02
CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)		
GROUP 1.....	\$ 45.48	28.02
GROUP 2.....	\$ 45.48	28.02
ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNEL IN FREE AIR		
GROUP 1.....	\$ 42.93	28.02
GROUP 2.....	\$ 45.48	28.02
GROUP 3.....	\$ 45.48	28.02
GROUP 4.....	\$ 45.48	28.02

GROUP 5.....\$ 47.48

28.02

LABORERS CLASSIFICATIONS for TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR

GROUP 1: Powder watchman; Top man on iron bolt; change house attendant

GROUP 2: Brakeman; trackman; groutman; tunnel laborer; outside lock tender; lock tender; guage tender

GROUP 3: Motorman, miner

GROUP 4: Blaster

GROUP 5: Mucking machine operator

GROUP 6: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars \$2.00 per hour over the basic wage rate.

LABORERS CLASSIFICATIONS for (FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR

GROUP 1: Miner; miner welder; conveyor operator; motorman; mucking machine operator; nozzle man; grout man-; pumps, shaft and tunnel steel and rodman; shield and erector arm operators, mole nipper, outside motorman, burner, TBM operator, safety miner; laborer topside; heading motormen; erecting operators; top signal men

GROUP 2: Brakeman; trackman

LABORERS CLASSIFICATIONS FOR CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)

GROUP 1: Concrete workers; strippers and form movers (wood & steel), cement finisher

GROUP 2: Form erector (wood & steel and all accessories)

LABORERS CLASSIFICATIONS for ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNE IN FREE AIR

GROUP 1: Change house attendants

GROUP 2: Laborers, topside, bottom men (when heading is 50 ft. from shaft) and all other laborers

GROUP 3: Brakeman; trackman; tunnel laborers; shaft laborers

GROUP 4: Miner; cage tender; bellman

GROUP 5: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars \$2.00 per hour over the basic wage rate)

FOOTNOTE FOR LABORERS:



A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

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LAB01421-001 12/01/2023

WRECKING LABORERS:

	Rates	Fringes
Laborers: (Wrecking)		
Group 1.....	\$ 44.48	28.52
Group 2.....	\$ 45.23	28.52
Group 3.....	\$ 45.48	28.52
Group 4.....	\$ 40.48	28.52
Group 5.....	\$ 43.58	28.52
Group 6.....	\$ 44.48	28.52

Group 1: Adzeman, Wrecking Laborer.

Group 2: Burners, Jackhammers.

Group 3: Small Backhoes, Loaders on tracks, Bobcat Type Loaders, Hydraulic ""Brock"" Type Hammer Operators, Concrete Cutting Saws.

Group 4: Yardman (Salvage Yard Only).

Group 5: Yardman, Burners, Sawyers.

Group 6: Asbestos, Lead Paint, Toxic and Hazardous Waste.

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PAIN0035-001 07/01/2019

BARNSTABLE BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH  
(Remainder of NORFOLK; MIDDLESEX AND SUFFOLK COUNTIES)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Bridge.....	\$ 50.36	30.25
Brush, Taper.....	\$ 39.86	30.25
Spray, Sandblast.....	\$ 41.26	30.25
REPAINT:		
Bridge.....	\$ 50.66	30.90
Brush, Taper.....	\$ 37.92	30.25
Spray, Sandblast.....	\$ 39.32	30.25

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PAIN0035-015 07/01/2023

MIDDLESEX (Cambridge, Everett, Malden, Medford, Somerville)  
SUFFOLK COUNTY (Boston, Chelsea) NORFOLK COUNTY (Brookline)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Brush, Taper.....	\$ 45.01	35.10
Spay, Sandblast.....	\$ 46.41	35.10
Spray, Sandblast.....	\$ 47.05	30.25
REPAINT:		
Bridge.....	\$ 55.51	35.10
Brush, Taper.....	\$ 43.07	35.10
Spray, Sandblast.....	\$ 44.47	35.10

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PLAS0534-001 07/01/2023

ESSEX; MIDDLESEX; NORFOLK AND SUFFOLK COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 48.19	39.37

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\* PLUM0004-001 03/01/2024

MIDDLESEX (Ashby, Ayer-West of Greenville branch of Boston and  
Maine Railroad, Ft. Devens, Groton, Shirley, Townsend)

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 53.95	28.42

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\* PLUM0012-001 03/03/2024

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers,  
Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill,  
Ipswich, Lawrence,Manchester, Marblehead, Merrimac, Methuem,  
Middleton, Newbury, Newburyport, North Andover, Peabody,  
Rockport, Rowley, Salem, Salisbury, Topsfieild, Wenham, West  
Newbury)

	Rates	Fringes
PLUMBER.....	\$ 67.74	35.03

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\* PLUM0012-003 03/03/2024

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers,  
Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill,  
Ipswich, Lawrence, Manchester, Marblehead, Merrimac, Methuen,  
Middleton, Newbury, Newburyport, North Andover, Peabody,  
Rockport, Rowley, Salem, Salisbury, Topsfield, Wenham, West  
Newbury)

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 67.74	35.03

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\* PLUM0012-006 03/03/2024

ESSEX (Lynn, Lynnfield, Nahant, Saugus, and Swampscott);  
MIDDLESEX (Acton, Arlington, Ashland, Ayer - except W. of  
Greenville Branch of Boston & Maine RR, Bedford, Belmont,  
Billerica, Boxboro, Burlington, Cambridge, Carlisle,  
Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham,  
Hudson, Holliston, Hopkinton, Lexington, Lincoln, Littleton,  
Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick,  
Newton, North Reading, Pepperell, Reading, Sherborn,  
Somerville, Stoneham, Stow, Sudbury, Tewksbury, Tyngsboro,  
Wakefield, Waltham, Watertown, Wayland, Westford, Wilmington,  
Winchester, Woburn); NORFOLK (Bellingham, Braintree,  
Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Franklin,  
Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood,  
Plainville, Quincy, Sharon, Walpole, Wellesley, Westwood,  
Weymouth, Wrentham); PLYMOUTH (Hingham, Hull, Scituate);

SUFFOLK

	Rates	Fringes
PLUMBER.....	\$ 67.74	35.03

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PLUM0051-005 09/01/2018

BARNSTABLE; BRISTOL; DUKES; NANTUCKET; NORFOLK (Avon, Holbrook, Randolph, Stoughton) PLYMOUTH(Remainder of County)

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 42.04	29.91

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PLUM0537-001 09/01/2023

MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Wakefield, Winchester and Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton Cashasset, Dedham, Foxboro, Franklin, Millis, Milton, Sharon, Walpole, Westwood, and Wrentham); PLYMOUTH (Hingham, Hull, Scituate); ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham, West Newbury)

	Rates	Fringes
PIPEFITTER.....	\$ 63.48	36.67

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TEAM0379-001 06/01/2023

	Rates	Fringes
Truck drivers:		
Group 1.....	\$ 38.78	31.86+a+b
Group 2.....	\$ 38.95	31.86+a+b
Group 3.....	\$ 39.02	31.86+a+b
Group 4.....	\$ 39.14	31.86+a+b
Group 5.....	\$ 39.24	31.86+a+b
Group 6.....	\$ 39.53	31.86+a+b
Group 7.....	\$ 39.82	31.86+a+b

POWER TRUCKS \$.25 DIFFERENTIAL BY AXLE  
TUNNEL WORK (UNDERGROUND ONLY) \$.40 DIFFERENTIAL BY AXLE  
HAZARDOUS MATERIALS (IN HOT ZONE ONLY) \$2.00 PREMIUM

TRUCK DRIVERS CLASSIFICATIONS

- Group 1: Station wagons; panel trucks; and pickup trucks
- Group 2: Two axle equipment; & forklift operator
- Group 3: Three axle equipment and tireman
- Group 4: Four and Five Axle equipment
- Group 5: Specialized earth moving equipment under 35 tons

other than conventional type trucks; low bed; vachual;  
mechanics, paving restoration equipment

Group 6: Specialized earth moving equipment over 35 tons

Group 7: Trailers for earth moving equipment (double hookup)

FOOTNOTES:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday,  
Memorial Day, Independence Day, Labor Day, Patriot's Day,  
Columbus Day, Veteran's Day, Thanksgiving Day and Christmas  
Day

B. PAID VACATION: Employees with 4 months to 1 year of  
service receive 1/2 day's pay per month; 1 week vacation  
for 1 - 5 years of service; 2 weeks vacation for 5 - 10  
years of service; and 3 weeks vacation for more than 10  
years of service

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WELDERS - Receive rate prescribed for craft performing  
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave  
for Federal Contractors applies to all contracts subject to the  
Davis-Bacon Act for which the contract is awarded (and any  
solicitation was issued) on or after January 1, 2017. If this  
contract is covered by the EO, the contractor must provide  
employees with 1 hour of paid sick leave for every 30 hours  
they work, up to 56 hours of paid sick leave each year.  
Employees must be permitted to use paid sick leave for their  
own illness, injury or other health-related needs, including  
preventive care; to assist a family member (or person who is  
like family to the employee) who is ill, injured, or has other  
health-related needs, including preventive care; or for reasons  
resulting from, or to assist a family member (or person who is  
like family to the employee) who is a victim of, domestic  
violence, sexual assault, or stalking. Additional information  
on contractor requirements and worker protections under the EO  
is available at  
<https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within  
the scope of the classifications listed may be added after  
award only as provided in the labor standards contract clauses  
(29CFR 5.5 (a) (1) (iii)).

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The body of each wage determination lists the classification  
and wage rates that have been found to be prevailing for the  
cited type(s) of construction in the area covered by the wage  
determination. The classifications are listed in alphabetical  
order of ""identifiers"" that indicate whether the particular  
rate is a union rate (current union negotiated rate for local),  
a survey rate (weighted average rate) or a union average rate  
(weighted union average rate).

### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

### Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
 Wage and Hour Division  
 U.S. Department of Labor  
 200 Constitution Avenue, N.W.  
 Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
 U.S. Department of Labor  
 200 Constitution Avenue, N.W.  
 Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
 U.S. Department of Labor  
 200 Constitution Avenue, N.W.  
 Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"



## APPENDIX C

### Massachusetts General Laws





## **APPENDIX B**

### **APPLICABLE COMMONWEALTH OF MASSACHUSETTS STATUTES**

**These following amend or supplement the Standard General Conditions of the Construction Contract (No. C-700, 2013 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.**

#### **M.G.L c.30 s 39F Payment to Subcontractor**

Section 39F. (1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the

subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that

same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction..

**M.G.L c.30 S 39I Deviation from Plans and Specifications**

**M.G.L c.30 s 39J No Arbitrary Decisions are Final**

**M.G.L c.30 s 39L Construction Work by Foreign Corporations**

**M.G.L c.30 s 39M(b) Substitution of Equal Products**

**M.G.L c.30 s 39N Differing Site Conditions**

Section 39N. Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

**M.G.L c.30 s 39O Equitable Adjustments for Delays**

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

**M.G.L c.30 s 39P Decision on Interpretation of Specifications**

**M.G.L c.30 s 39R Contractor's Records**

**M.G.L c.149 s 34 Limitations on Hours of Work**

**M.G.L c.149 s 44J Advertising Invitations to Bid**

**M.G.L c.82 s 40 Excavations; Notice; Penalties**

**M.G.L c.30 s 38A Price Adjustments for Certain Materials in Construction Projects**



## APPENDIX D

### Boring Logs and Geotechnical Reports





# TECHNICAL MEMORANDUM

**Date:** March 24, 2023

**To** Town of Sharon Department of Public Works

**From** Environmental Partners

**CC** File

**Subject** Wells 2, 3, and 4 Water Treatment Plant  
Town of Sharon, Massachusetts  
Geotechnical Technical Memorandum

This technical memorandum presents design information and details regarding the geotechnical investigation and construction considerations for the Wells 2, 3, and 4 Water Treatment Plant (WTP). This technical memorandum includes a description of the geotechnical drilling methods used, subsurface conditions observed, foundation design parameters, and construction considerations.

## SITE LOCATION AND DESCRIPTION

The project site is located on a property owned by the Town of Sharon (Town). The Sharon Water Department operates and manages the site at 15 Tree lane and 000 Upland Road (Town parcel IDs 101-10 and 101-11). The existing site hosts Well 4 and a small treatment building. The proposed design will include a water treatment plant (WTP) for treatment of raw water from Wells 2, 3, and 4 as well as an access road, parking area, below grade storage tanks, stormwater bioretention areas, retaining wall, and wrap around driveway. The current preliminary design for the 7,500 square-foot-building includes an administrative area; large process area for three iron and manganese removal vertical pressure filters, four per- and polyfluoroalkyl substances (PFAS) removal vertical pressure filters, chemical feed and storage areas, and an open space for future nitrate treatment; and a lower level area that includes a backwash waste storage tank, finished water wet well, and pipe gallery below the proposed process area. The administrative area will include a laboratory/control room, toilet room, electrical room, and mechanical room. Lastly, the proposed site will include a subsurface tight tank to collect wastewater. Backwash water from the iron and manganese removal and PFAS removal treatment systems will be piped to the backwash waste tank for recycle and residuals management where the settled recycle water will be pumped to the raw water inlet.

Personnel from Environmental Partners collected the ground surface elevations at the test boring locations using a hand-held GPS unit. A figure depicting the test boring locations is included as Appendix A. Site coordinates of the center of the proposed building are provided below.

*Table 1: Site Location*

Site Location	Site Coordinates in Latitude and Longitude
Well 4 (Tree Lane)	42° 07' 36.2" N 71° 11' 04.2" W

## Regional Geology

The site is in the Avalon Belt Geologic Province. The United States Geological Survey (USGS) defines the Avalon Belt Geologic Province as "Localized in eastern Massachusetts, Rhode Island, and coastal Connecticut. Principally Precambrian Z granite and granitic gneiss and metasedimentary rocks of Precambrian Z to Ordovician age. Intruded by Ordovician to Devonian granites. Cretaceous sediments and thick areas of Quaternary glacial sediments occur in southern coastal areas."

## Surface Conditions

The site topography has a local high point near Tree Lane at 240 feet North American Vertical Datum of 1988 (NAVD88) and then slopes to the west toward the existing access road and south to Well 4 and Beaver Brook, which is at an elevation of 205 feet NAVD88. It is anticipated that clearing and excavation will be required for site and subgrade preparation.

The proposed location of the WTP is wooded and abutted by Tree Lane, the existing treatment building, and the existing access road. The proposed 7,500 square foot WTP will be comprised of a pre-engineered metal building with a concrete base slab located on a parcel owned by the Town. The building will have below grade pipe gallery, backwash waste tank, and finished water wet well. A new access driveway is proposed on the east side of Tree Lane to provide access to the facility; the Town's existing private, gated road that provides access to the existing Well 4 infrastructure will remain.

The proposed WTP finished floor elevation is 226 feet NAVD88. The paved WTP access driveway shall slope up from Tree Lane to an elevation of 225 feet NAVD88, at a pitch of approximately 4%. The proposed WTP will be built partially into and on an existing hill, requiring both excavation and fill. The WTP lower level, which includes a finished water wet well, backwash waste tank, and pipe gallery, will be at approximately 214 feet or 12 feet below the FFE of the building. A wastewater tight tank will be installed outside the building footprint. The depth of the tight tank will be determined during final design based on the anticipated usage.

## SUBSURFACE EXPLORATION PROCEDURES

### Test Borings

On February 21, 22, 23, and 24, 2023, Environmental Partners retained the services of Northern Drilling Services of Northborough, MA to perform seven (7) standard penetration test (SPT) borings with an all-terrain vehicle (ATV) drilling rig. The borings were advanced via drive and wash method to predetermined depths to advance the boreholes. Wash borings consist of simultaneous drilling and jetting action. A casing is driven into the ground initially and a chopping bit attached at the end of a drilling rod is driven by a hammer and breaks up the soil in the casing. Jetting action is accomplished by pumping water downward through the drilling bit. Water emerges at the chopping bit and further serves to break up the soil. Returning water transports soil to the ground surface, where samples can be collected for further examination and classification. Such samples are disturbed samples as their water content has been increased. Soil samples were obtained at selected intervals in the soil test borings. Disturbed soil samples were obtained in general accordance with ASTM D-1587 (Thin-Walled Tube Sampling of Soils) using a standard split-spoon sampler. A split spoon sampler is a 2-inch O.D. tube that is driven into the soil to be sampled that can be split open lengthwise for easy removal and visual inspection of the soil obtained.

During the sampling procedures, standard penetration tests were performed in the borings in conjunction with the split-barrel sampling. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling thirty inches, is required to advance the split spoon sampler one foot into the soil (ASTM D-1585). The sampler is lowered to the bottom of the drill hole and the number of blows is recorded for each of the four successive increments of six-inch penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating relative strength and compressibility of the soil profile components.

Borings were advanced at each corner of the proposed WTP and in the vicinity of the proposed wet well and stormwater management basin. Approximate boring locations are indicated on Figure 1 in Appendix A of this report. These borings are identified as follows:

*Table 2: Boring Description*

Boring ID	Boring Location	Boring Depth	Boring Method	Notes
B-1	Southern Corner of Building	30 Feet	Drive & Wash	Terminated at a Predetermined Depth
B-2	Location of Wet Well / Center of Building	30 Feet		
B-3	Northern Corner of Building	41 Feet		

Boring ID	Boring Location	Boring Depth	Boring Method	Notes
B-4	Northeastern Corner of Building	41 Feet		
B-5	Southwestern Corner of Building	41 Feet		
B-6	Location of Proposed Stormwater Management Basin	21 Feet		
B-7	Northwestern Side of Building / Along Tree Lane	21 Feet		

## Soil Classification

Samples obtained during drilling operation were visually and manually classified in the field in accordance with ASTM D2488. Representative portions of the samples were collected in sample jars and selective samples were sent out to the laboratory for further examination and verification of field classifications such as gradation analysis and soil classification have been performed. Boring logs indicating depth of borings, N values, penetration and recovery depths, water levels, and soil description, can be found in Appendix B of this report.

## Loam

Topsoil and loam layers were encountered in all the borings and consisted of the upper approximately two to six inches. The loam layer was described as sandy dark brown organic layer. For planning purposes, stripping of loam and topsoil during excavation and subgrade preparation can be stockpiled and re-used as topsoil provided it meets the specifications for topsoil.

## Fill

The fill layer encountered during the subsurface program was a mix of coarse and fine sediment. The coarse sediment was characterized as brown poorly graded sand or gravel, and the fine sediment was characterized as light brown silt/sandy silt. Borings B-1 and B-5 (both southwest) were predominantly light brown silt. Boring B-3 (northeast) was predominantly poorly graded sand. The other borings located in the middle all had profiles of both coarse and fine material.

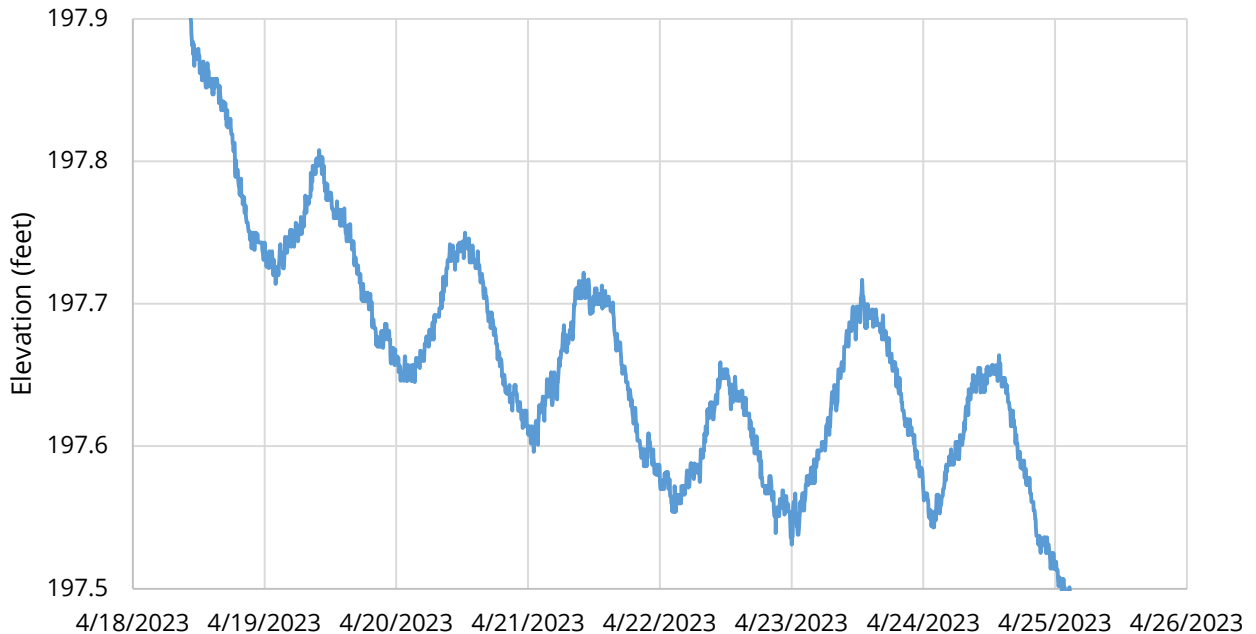
The depth of the fill layer extended from the bottom of loam (two to six inches below existing grade) to the depth of the borings. No refusal was encountered in any boring, and the pre-determined boring depths ranged from 21 to 41 feet below grade.

## Water Level Measurements

Ground water levels were measured in all borings at the completion of the boreholes. The borings encountered water at between approximately nine and 25 feet below grade (at borings B-1 and B-2, respectively). Following the completion of drilling, boring B-2 was converted into a two-inch

monitoring well for future observation and monitoring. The monitoring well was installed with a slotted screen between 25 and 30 feet below grade.

On February 24, 2023, field staff measured the depth to water at the B-2 monitoring well as 25.7 feet below grade, which corresponds to a groundwater elevation of approximately 200 feet. Environmental Partners returned to the monitoring well on April 18, 2023 and measured the depth to water at 27.2 feet below grade or 197.9 feet in elevation. Staff installed a pressure transducer to record water levels for one week. The information recorded is summarized in Figure 1, below. During the week, water levels dropped from 197.9 to 197.5 feet, or 0.4 feet.



*Figure 1: Water Table Elevation in Monitoring Well, B-2*

It should be noted however that subsurface groundwater levels can be expected to fluctuate with time, amount of precipitation, snowmelt and seasonal variations. It is a possibility that subsurface ground water levels could be significantly different than the time the borings were performed.

## Laboratory Analysis

During the subsurface investigation, EP collected soil samples at selective intervals throughout the borings for visual classifications. Laboratory tests were carried out for a number of selected soil samples to confirm the visual classification and to acquire necessary information with regards to the physical and mechanical properties of the soil layers and to evaluate and determine parameters required for soil calculations and foundation design recommendations. All phases of the laboratory-testing program were performed in general accordance with the applicable ASTM Specifications.

The following tests were conducted on the selected soil samples:

- Grain Size Distribution Tests (ASTM D6913)
- USCS Classification (ASTM D2487)

- Atterberg Limits (ASTM D4318)

Samples obtained during the field exploration were observed and visually classified in general accordance with ASTM D2488, which is based on the Unified Soil Classification System. Selective samples were sent out to Thielsch Engineering Laboratories in Cranston, Rhode Island for further testing to determine their engineering and physical properties in general accordance with ASTM standards and other approved procedures.

The laboratory testing program for this project consisted of 7 grain size distributions, and classification.

*Table 3: Laboratory Testing Program*

<b>Boring ID / Sample Depth</b>	<b>Test Type</b>	<b>ASTM Designation</b>
B-1 / 4-6'	Grain Size, Classification	D6913, D2487
B-2 / 9-11'		
B-2 / 14-16'		
B-4 / 4-6'		
B-5 / 14-16'		
B-6 / 9-11'		
B-6 / 19-21'		

A summary of the laboratory test results is presented in Appendix C. In general, the laboratory analysis confirmed the visual interpretation of the soil samples. The gravel percentage ranged from 0 to 49.7% and the fines ranges from 0.2 to 78.8%. All samples were determined to be non-plastic.

The samples collected will be stored for 30 days from the date of issue of this report, and then disposed of unless otherwise instructed in writing by the client. All phases of the laboratory testing were performed in general accordance with the applicable ASTM Standards.

## GEOTECHNICAL ANALYSIS

### Settlement Analysis

The borings advanced at the proposed building site encountered layers of medium dense soil (for predominantly coarse sediment) and stiff or very stiff soil (for predominantly fine sediment). Based on our estimates of the current site grades, excavation will be required to install the building and underground storage tank foundations. Settlements under the building are expected to be within the tolerable range for the proposed structure. Our settlement estimate indicates that settlements less than 1/2-inch should be anticipated by end of construction activities and post construction settlements should be negligible.

### Seismic Conditions

Seismic design conditions for this project should utilize a Site Class "D" according to 2009 International Building Code. The IBC Site Class determination is based on the top 100 feet of rock and soil profile. Although the borings performed at the site are much shallower than 100 feet, generalized information of the site and the site conditions suggest this Site Class. Generally, soils most susceptible to liquefaction are saturated, loose sandy soils including granular silts. Soils encountered at the site are not considered to be liquefiable given that the underlying soils are medium dense in nature combined with the non-presence of groundwater at shallow depths. Based on the USGS maps, there are no active faults in the general vicinity of the proposed project. Therefore, liquefaction potential is not anticipated to be an issue for the proposed site.

Based on the subsurface conditions encountered, and the assigned seismic Site Class, the mapped maximum considered earthquake spectral response acceleration parameter at short period and 1-second period for  $F_a$  and  $F_v$ , are 1.6 and 2.4 respectively. The recommended design spectral response acceleration at short periods (SDs) and at 1-second period (SD1), are 0.18g and 0.071g, respectively. The risk of seismically induced settlement or liquefaction for this site is relatively low. Additional seismic design parameters are summarized in the table below.

*Table 4: Seismic Design Parameters*

<b>Site Class: D</b>	
<b>Risk Category: III</b>	
$S_s$ - Acceleration Parameter	0.22 g
$S_1$ - Acceleration Parameter	0.051 g
$F_a$ - Site Coefficient	1.6
$F_v$ - Site Coefficient	2.4



$S_{MS}$ - Adjusted MCE* Spectral response Acceleration Parameter	0.27 g
$S_{M1}$ - Adjusted MCE* Spectral response Acceleration Parameter	0.11 g
$S_{DS}$ - Design Spectral Acceleration Parameter	0.18 g
$S_{D1}$ - Design Spectral Acceleration Parameter	0.071 g

\*Maximum Considered Earthquake

## Foundation Design Recommendations

It is our understanding that the proposed building will house process mechanical equipment including three vertical pressure filters, two PFAS treatment trains, chemical feed and storage areas, an open space for future nitrate treatment, and an underground storage tank below the proposed location of the pressure filters, a control room, an electrical room, a mechanical room, and a restroom. Initial discussions with the structural engineer indicate that the structural slab on grade supporting the pressure filters will be approximately 12 to 18 inches thick, and the underground storage tank will be supported on a mat foundation approximately 24 inches thick. The exterior foundation walls will be 18 inches thick.

For the conventional building foundation, it is our opinion that the proposed pre-engineered metal building may be supported on conventional shallow foundation with slab on grade construction. Based on the standard penetration tests conducted at the site during the subsurface exploration and the estimated bearing capacity, the underlying soils are suitable to carry applied bearing pressures of 2.5 tons per square foot (tsf) for the anticipated footing size without experiencing potential differential settlement in the order of 1/2-inch. The recommended bearing pressure should provide a factor of safety of 3.0 against shear failure.

The foundation of the proposed building should be placed at a minimum depth of 4 feet below the lowest adjacent grade.

The proposed mat foundation for the support of the underground storage tank is expected to be placed on a granular leveling base to promote even distribution. We recommend that the thickness of this layer be 8 inches and be composed of free draining, well graded, non-cohesive fill. Use of fine sand, masonry sand, or recycled concrete is not allowed.

The on-site soil may be reused as fill material across the site and as backfill against foundations. Some reconditioning and moisture adjustment of the excavated soils may become required to achieve the desired degree of compaction. It is our recommendation to excavate and remove any loose fill from existing grade and replace with structural fill to the proposed bottom of foundation elevation. The structural fill should be compacted in thin lifts (6 to 8 inches) such that the entire lifts can achieve a minimum compaction of 95% of the maximum dry density as determined by ASTM D1557. Moisture conditioning within +/- 3% of the optimum moisture content of the soils may be required.

*Table 5: Foundation Design Parameters*

<b>Parameter</b>	<b>Value</b>
Allowable Bearing Capacity	2.5 tsf
Friction Angle	32 °
Unit Weight	115 pounds per cubic foot (pcf)

## CONSTRUCTION CONSIDERATIONS

The foundation areas should be prepared first by removing topsoil, and other unsuitable materials to expose the naturally deposited inorganic sand and gravel. The outer limit of the excavation should be at least 5 feet beyond the outer perimeter of the footing, where possible, without disturbing the foundations of adjacent structures.

Construction of the access road, parking area, and WTP driveway should be able to withstand the loading of chemical delivery trucks and heavy machinery. Access road, parking, and driveway pavement should be constructed with a base layer comprised of 12 inches of compacted processed gravel; 2 inches of hot mix asphalt (HMA) base course; 2 inches of HMA binder course; and 1.5 inches of HMA top course. The base, binder, and top courses for the pavement shall conform to the Massachusetts Highway Department Standard Specifications.

We anticipate that following construction, the underground storage tank be filled and tested for liquid tightness by filling and measuring the loss of water in the tank. ACI 350 and the American Water Works Association recommends maintaining the water level in the tank for a period of 3 days before measuring the water surface for indications of leakage. Horizontal and vertical movement of the tank foundation should be monitored daily during the first filling of the tank.

Temporary construction slopes should be designed and excavated in strict compliance with the rules and regulations of the Occupational Safety and Health Administration (OSHA), 29 CFR, Part 1926.

Groundwater may be encountered in the excavation for the underground wastewater tank. It is anticipated that groundwater and surface water entering the building foundation excavations can be managed to prevent foundation subgrade disturbance using normal diversion trenching and sump pumping.

Foundation bearing soils should not be allowed to freeze before, during, or after foundation construction. In addition, the exposed foundation subgrade should be compacted with a heavy vibratory roller until firm and stable.

All fill placed below foundation bearing levels, as well as over footings, against foundation, and in areas that are designated to be paved, should be structural fill. Structural fill is defined as well graded natural sand and gravel with a maximum particle size of four inches and no more than 10% passing the No. 200 sieve. Structural fill should be placed in 6 to 8-inch loose lifts and compacted to 95% if the Modified Proctor Maximum Dry Density (ASTM D1557) for the specific material being used.

It is recommended that structural fills be constructed as controlled, well-compacted engineered fills. Structural engineered fill should be inorganic, low plastic clay, sand, or gravel. It is recommended that only granular fill be used within the building footprint and within 5 feet of the foundation footprint, where possible. The intent of these recommendations is to reduce the potential for consolidation and settlement of new fills.

Laboratory testing should be performed on the fill materials to determine the appropriate moisture-density relationship of the fill being placed. Adjustments to the soil moisture by wetting or drying should be made as needed during fill placement. During grading operations, representative samples of the proposed imported structural fill materials should be periodically checked via laboratory

testing. A full-time representative from the testing agency should be on site to monitor excavation and grading operation as well as the suitability of fill materials. All finished and disturbed ground surfaces should be adequately prepared to reduce erosion.

*Table 6: Structural Fill Placement Guidelines*

<b>Area</b>	<b>Degree of Compaction Based on ASTM D1557</b>
Below Footings and Slab	95%
Access Road, Parking, and Driveway	95%
Utility Trenches within Building and Pavement Area	95%
Grade-raise Fill Placed within 1 foot of the Base of the Pavement	95%
Granular Cushion Beneath Floor Slab and over Footings	95%
Structural Fill Supporting Footing	95%
Other Landscape Areas	92%

Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

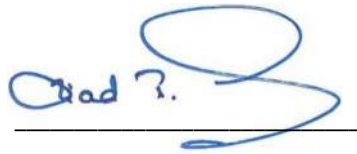
Table 7: Crushed Stone Guidelines

Percent Passing by Weight		
Sieve Size	¾ inch Stone*	½ inch Stone
1 inch	75 – 100	-
¾ Inch	0-5	-
5/8 Inch	-	100
½ Inch	-	85-100
3/8 Inch	-	15-45
No. 4	-	0-15
No. 8	-	0-15

## LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practices and it is intended to be used to assist in the design of the new water treatment plant. The findings and recommendations contained in this report are based on site conditions encountered during the subsurface exploration in February 2023. These opinions were arrived at in accordance with accepted engineering procedures at this time. Conclusions and additions made from these data by others are their responsibilities. Should the location of the proposed building change, or if the soil conditions become notably different during construction from those described herein, Environmental Partners should be notified immediately. Should potentially hazardous materials be encountered at the site during excavation, an environmental investigation should be performed immediately.

Prepared by:



Ziad F. Kary, PE<sup>1</sup>

Regional Manager and Senior Principal

Environmental Partners Group, LLC

## APPENDICES

Appendix A – Figure 1: Boring Locations

Appendix B – Geotechnical Boring Logs

Appendix C – Laboratory Soil Analysis

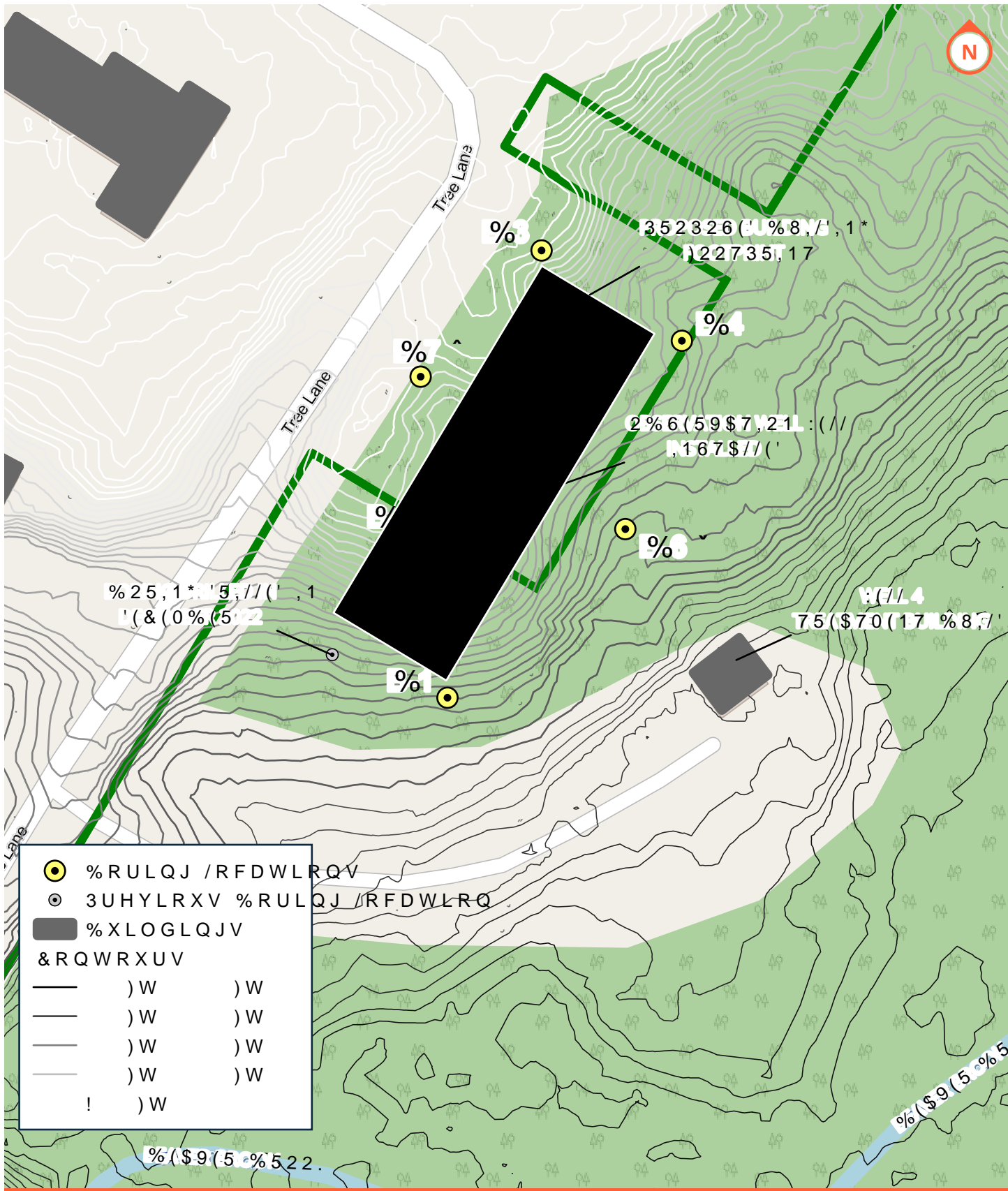
## REFERENCES

- *American Society for Testing and Materials, 2004, Standard test method for penetration test and Split-barrel sampling of soils, Test Method D1586-99, in Annual Book of ASTM Standards.*
- *Geologic Provinces of New England, U.S. Geological Survey, Open File Report 03-225: Figure 1.*
- *USGS Massachusetts Seismic Hazard Map. USGS, <https://www.usgs.gov/media/images/2014-seismic-hazard-map-massachusetts> 2006/2009 International Building code.*



## APPENDIX A

### Figure 1: Boring Locations



●	%RULQJ /RFDWLRQV
○	3UHYLRXV %RULQJ /RFDWLRQ
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**ENVIRONMENTAL PARTNERS**  
— An Apex Company —

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## **APPENDIX B**

### Geotechnical Boring Logs

## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

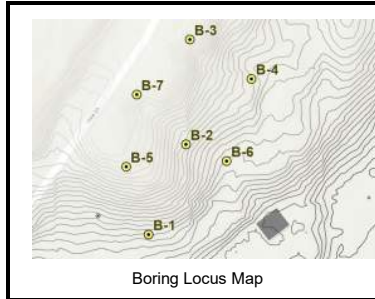
Weather: 30°F, rain

Performed By: AET

Date: 2/21/23

Checked By:

Date:



**Boring No: B-1**

Location: S corner of proposed building

Approx. Ground Elevation: 217.8'

Approx. Groundwater Elevation: 208.7'

Date/Time of Groundwater Elevation: 2/21 10AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-1 0-2	5/24	2	0-3" Medium, dark brown, moist, ORGANIC SOIL	Soil	1
			1			
2-4	N/A	N/A	N/A	No Sample Collected	Sand	
			4			
			5			
4-6	B-1 4-6	7/24	3 14 12 5	0-3" Medium dense, brown, moist, SILTY SAND with gravel	Sand	
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-1 9-11	11/24	5 8 9 11	Very stiff, light brown, moist, SILT with few fine sand, lightly laminated	Silt	
11-14	N/A	N/A	N/A	No Sample Collected		
14-16	B-1 14-16	11/24	6	0-6" Same as above	Sand with Silt	
			8	6-8" Very stiff, light brown, moist, SILT		
16-18	N/A	N/A	N/A	No Sample Collected	Sand with Silt	
			12			
			10			
18-20	B-1 18-20	15/24	5 6 6 6	Stiff, light brown, wet, SILT	Silt	
20-22	B-1 20-22	18/24	9	0-8" Stiff, light brown, wet, SILT with few fine sand		
			6	8-18" Stiff, light brown, wet, SILT		
			7			
			7			

**NOTES:**

1. Depth to water measured at 9.1ft below ground surface with water level meter

**LEGEND**

Trace - Approximately <5%	Few - Approximately 6% to 15%	
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard

# BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

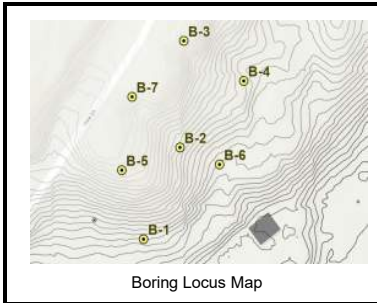
Weather: 30°F, rain

Performed By: AET

Date: 2/21/23

Checked By:

Date:



**Boring No: B-1**

Location: S corner of proposed building

Approx. Ground Elevation: 217.8'

Approx. Groundwater Elevation: 208.7'

Date/Time of Groundwater Elevation: 2/21 10AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
22-24	B-1 22-24	18/24	9 9 12 14	Very stiff, light brown, wet, SILT with trace fine sand	Silt	
24-26	N/A	3/24	10 11 11 7	Same as Above with 1" colored red		
26-28	B-1 26-28	18/24	12 13 14 16	Same as Above		
28-30	B-1 28-30	15/24	8 9 11 10	Same as Above		

BORING TERMINATED AT A PREDETERMINED DEPTH OF 30FEET

<p><b>NOTES:</b></p> <p>2. Boring ended at a predetermined depth of 30 feet below ground surface</p>	<p><b>LEGEND</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Trace - Approximately &lt;5%</td> <td style="width: 33%;">Few - Approximately 6% to 15%</td> <td style="width: 33%;"></td> </tr> <tr> <td>Little - Approximately 16% to 30%</td> <td>Some - Approximately 31% to 49%</td> <td></td> </tr> <tr> <td>0-4 Coarse Soil N Value - Very Loose</td> <td>5-10 Coarse Soil N Value - Loose</td> <td>11-29 Coarse Soil N Value - Medium Dense</td> </tr> <tr> <td>30-49 Coarse Soil N Value - Dense</td> <td>&gt;50 Coarse Soil N Value - Very Dense</td> <td></td> </tr> <tr> <td>0-3 Fine Soil N Value - Very Soft</td> <td>3-4 Fine Soil N Value - Soft</td> <td>5-8 Fine Soil N Value - Medium</td> </tr> <tr> <td>9-15 Fine Soil N Value - Stiff</td> <td>16-30 Fine Soil N Value - Very Stiff</td> <td>&gt;30 Fine Soil N Value - Hard</td> </tr> </table>	Trace - Approximately <5%	Few - Approximately 6% to 15%		Little - Approximately 16% to 30%	Some - Approximately 31% to 49%		0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense		0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard
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0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium																	
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard																	

# BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

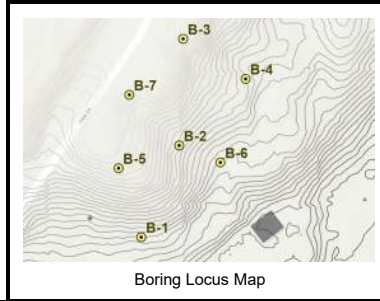
Weather: 30°F, rain

Performed By: AET

Date: 2/21/23

Checked By:

Date:



**Boring No: B-2**

Location: Center of proposed building

Approx. Ground Elevation: 225.1'

Approx. Groundwater Elevation: 200.1'

Date/Time of Groundwater Elevation: 2/24 8AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-2 0-2	18/24	1	0-8" Very soft, dark brown, moist, ORGANIC SOIL	Soil	
			1	8-18" Very loose, yellow brown, moist, POORLY GRADED SAND with few gravel and silt	Sand	
2-4	N/A	N/A	N/A	No Sample Collected		
4-6	B-2 4-6	8/24	9	Medium dense, brown, wet, POORLY GRADED GRAVEL with few sand	Gravel	
			9			
7						
6						
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-2 9-11	11/24	20 18 16 13	Dense, olive, wet, POORLY GRADED GRAVEL with silt and sand		
11-14	N/A	N/A	N/A	No Sample Collected	Sand	
14-16	B-2 14-16	11/24	11 10 11 12	Medium dense, brown, moist, POORLY GRADED SAND with silt	Silty Sand	
16-18	N/A	N/A	N/A	No Sample Collected		
18-20	B-2 18-20	10.5/24	12 17 17 16	Dense, light brown, moist, SILTY SAND		
20-22	B-2 20-22	14/24	8 12 12 8	Very stiff, light brown, moist, SANDY SILT	Sandy Silt	

**NOTES:**

**LEGEND**

Trace - Approximately <5%	Few - Approximately 6% to 15%	
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dens
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard

## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

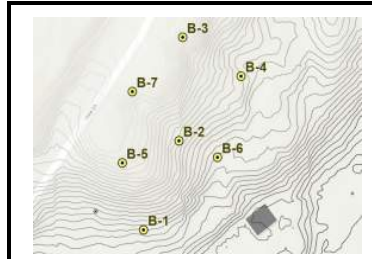
Weather: 30°F, rain

Performed By: AET

Date: 2/21/23

Checked By:

Date:



Boring Locus Map

**Boring No: B-2**

Location: Center of proposed building

Approx. Ground Elevation: 225.1'

Approx. Groundwater Elevation: 200.1'

Date/Time of Groundwater Elevation: 2/24 8AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
22-24	B-2 22-24	12/24	9 12 14 17	Same as Above	Sandy Silt	1
24-26	N/A	12/24	8 8 9 7	Same as Above		
26-28	B-2 26-28	18.5/24	12 6 9 8	Same as Above		
28-30	B-2 28-30	12.5/24	5 6 7 7	Same as Above		

BORING TERMINATED AT A PREDETERMINED DEPTH OF 30FEET

**NOTES:**

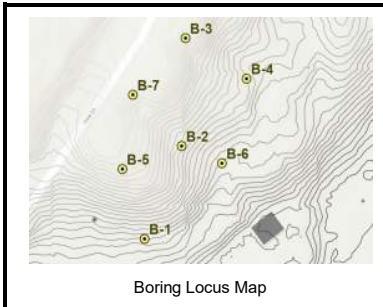
1. Water level measured 25 feet below ground surface with water level meter in well
2. Boring ended at a predetermined depth of 30 feet below ground surface
3. Well set in boring with screen from 25 to 30 feet below ground surface

**LEGEND**

Trace - Approximately <5%	Few - Approximately 6% to 15%	
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dens
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard

## BORING LOG

Project: Well 4 PFAS Treatment System  
 Location: Tree Lane, Sharon MA  
 Client: Town of Sharon  
 Driller: Northern Drilling Service  
 Drilling Methods: Drive & Wash  
 Weather: 30°F, sleeting/snowing  
 Performed By: AET Date: 2/23/23  
 Checked By: Date:



**Boring No: B-3**  
 Location: N corner of proposed building  
 Approx. Ground Elevation: 239.5'  
 Approx. Groundwater Elevation: 222.5'  
 Date/Time of Groundwater Elevation: 2/23 11AM  
 Datum: NAVD 83  
 Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-3 0-2	3/24	4 6 6 5	0-2" Stiff, dark brown, moist, ORGANIC SOIL 2-3" Medium dense, yellow/brown, moist, POORLY GRADED SAND, with medium to coarse sand and few silt Rock fragment in tip	Soil	1
2-4	N/A	N/A	N/A	No Sample Collected		
4-6	B-3 4-6	3/24	5 10 12 3	Medium dense, brown, wet, POORLY GRADED SAND, with trace gravel and few silt		
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-3 9-11	4/24	14 16 11 8	Same as Above	Sand	
11-14	N/A	N/A	N/A	No Sample Collected		
14-16	B-3 14-16	9/24	5 5 6 6	Same as Above		
16-19	N/A	N/A	N/A	No Sample Collected		
19-21	B-3 19-21	8/24	5 4 4 6	Same as Above		

**NOTES:**

- Boulder encountered. Drilling continued 2ft away
- Depth to water measured at 17ft below ground surface with water level meter

LEGEND		
Trace - Approximately <5%	Few - Approximately 6% to 15%	
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard



## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

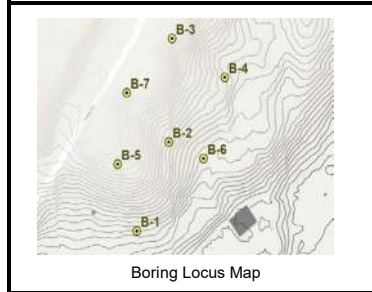
Weather: 30°F, sleeting/snowing

Performed By: AET

Date: 2/23/23

Checked By:

Date:



**Boring No: B-3**

Location: N corner of proposed building

Approx. Ground Elevation: 239.5'

Approx. Groundwater Elevation: 222.5'

Date/Time of Groundwater Elevation: 2/23 11AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note	
21-24	N/A	N/A	N/A	No Sample Collected	Sand		
24-26	B-3 24-26	7/24	8 7 9 9	Same as Above			
26-29	N/A	N/A	N/A	No Sample Collected			
29-31	B-3 29-31	5/24	7 8 10 10	Same as Above			
31-34	N/A	N/A	N/A	No Sample Collected			
34-36	B-3 34-36	6/24	10 11 14 15	Very stiff, brown, wet, SILT, with little sand		Silt	
36-39	N/A	N/A	N/A	No Sample Collected			
39-41	B-3 39-41	12/24	5 5 6 8	Stiff, brown, wet, SILT			
BORING TERMINATED AT A PREDETERMINED DEPTH OF 41FEET							

<p><b>NOTES:</b></p> <p>3. Boring ended at a predetermined depth of 41 feet below ground surface</p>	<p><b>LEGEND</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Trace - Approximately &lt;5%</td> <td style="width: 50%;">Few - Approximately 6% to 15%</td> </tr> <tr> <td>Little - Approximately 16% to 30%</td> <td>Some - Approximately 31% to 49%</td> </tr> <tr> <td>0-4 Coarse Soil N Value - Very Loose</td> <td>5-10 Coarse Soil N Value - Loose</td> <td>11-29 Coarse Soil N Value - Medium Dens</td> </tr> <tr> <td>30-49 Coarse Soil N Value - Dense</td> <td colspan="2">&gt;50 Coarse Soil N Value - Very Dense</td> </tr> <tr> <td>0-3 Fine Soil N Value - Very Soft</td> <td>3-4 Fine Soil N Value - Soft</td> <td>5-8 Fine Soil N Value - Medium</td> </tr> <tr> <td>9-15 Fine Soil N Value - Stiff</td> <td>16-30 Fine Soil N Value - Very Stiff</td> <td>&gt;30 Fine Soil N Value - Hard</td> </tr> </table>	Trace - Approximately <5%	Few - Approximately 6% to 15%	Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dens	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense		0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard
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## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

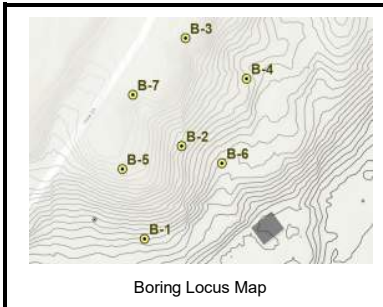
Weather: 30°F, clear

Performed By: AET

Date: 2/22/23

Checked By:

Date:



**Boring No: B-4**

Location: NE corner of proposed building

Approx. Ground Elevation: 222.5'

Approx. Groundwater Elevation: 203.5'

Date/Time of Groundwater Elevation: 2/22 1PM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-4 0-2	12/24	1	0-3" Soft, dark brown, moist, ORGANIC SOIL	Soil	
			1			
			3			
			4			
2-4	N/A	N/A	N/A	No Sample Collected		
4-6	B-4 4-6	11/24	8 8 6 5	Medium dense, brown, wet, WELL GRADED SAND with gravel	Sand	
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-4 9-11	3/24	6 5 4 3	Loose, brown, wet, POORLY GRADED GRAVEL, few coarse sand	Gravel	1
11-14	N/A	N/A	N/A	No Sample Collected		
14-16	B-4 14-16	2/24	6 5 5 5	Same as Above		
16-19	N/A	N/A	N/A	No Sample Collected		
19-21	B-4 19-21	2/24	168 50 13 25	Very dense, brown, wet, POORLY GRADED SAND, with some gravel and trace silt	Sand	2  3

**NOTES:**

1. 2in split spoon had no recovery. Drillers re-pounded a 3in split spoon at same interval to collect sample

2. Depth to water measured at 19.2ft below ground surface with water level meter

3. Boulder encountered and bent split spoon

**LEGEND**

Trace - Approximately <5%	Few - Approximately 6% to 15%
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff
	5-8 Fine Soil N Value - Medium
	>30 Fine Soil N Value - Hard

## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

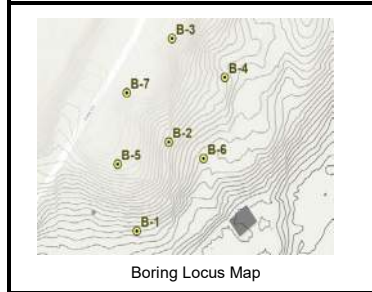
Weather: 30°F, clear

Performed By: AET

Date: 2/22/23

Checked By:

Date:



**Boring No: B-4**

Location: NE corner of proposed building

Approx. Ground Elevation: 222.5'

Approx. Groundwater Elevation: 203.5'

Date/Time of Groundwater Elevation: 2/22 1PM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
21-23	B-4 21-23	4/24	9 9 12 14	Medium dense, brown, wet, POORLY GRADED SAND, with some gravel and trace silt	Sand	4
23-24	N/A	N/A	N/A	No Sample Collected		
24-26	B-4 24-26	8/24	7 8 7 8	Medium dense, brown, wet, SILTY SAND	Silty Sand	
26-29	N/A	N/A	N/A	No Sample Collected		
29-31	B-4 29-31	11/24	6 7 7 8	Same as Above		
31-34	N/A	N/A	N/A	No Sample Collected		
34-36	B-4 34-36	8/24	8 8 13 16	Same as Above		
36-39	N/A	N/A	N/A	No Sample Collected	Silt	6
39-41	B-4 39-41	21/24	4 6 7 10	0-10" Same as Above 10-21" Stiff, brown, wet, SILT		

BORING TERMINATED AT A PREDETERMINED DEPTH OF 41FEET

**NOTES:**

- 4. Boulder encountered
- 5. 2in split spoon had no recovery. Drillers re-pounded a 3in split spoon at same interval to collect sample
- 6. Boring ended at a predetermined depth of 41 feet below ground surface

**LEGEND**

Trace - Approximately <5%	Few - Approximately 6% to 15%	
Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dens
30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard

## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

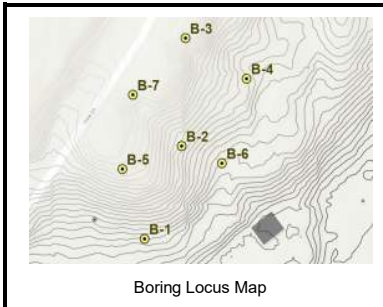
Weather: 30°F, sleeting/snowing

Performed By: AET

Date: 2/24/23

Checked By:

Date:



**Boring No: B-5**

Location: SW corner of proposed building

Approx. Ground Elevation: 235.1'

Approx. Groundwater Elevation: 214.1'

Date/Time of Groundwater Elevation: 2/24 10AM

Datum: NAVD 83

Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-5 0-2	13/24	2	0-2" Soft, dark brown, moist, ORGANIC SOIL	Soil	1
			1			
			3	2-13" Very loose, yellow/brown, moist, POORLY GRADED SAND, with trace gravel, and few silt	Sand	
			7			
2-4	N/A	N/A	N/A	No Sample Collected		
4-6	B-5 4-6	4/24	10	Medium dense, brown, wet, POORLY GRADED GRAVEL, with little sand and trace silt	Gravel	
			10			
			9			
			5			
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-5 9-11	5/24	9	Medium dense, brown, wet, POORLY GRADED GRAVEL, with some sand and little silt	Sandy Silt	
			6			
			5			
			4			
11-14	N/A	N/A	N/A	No Sample Collected		
14-16	B-5 14-16	8/24	6	Stiff, brown, moist, SANDY SILT, non-plastic fines	Sandy Silt	
			7			
			6			
			6			
16-19	N/A	N/A	N/A	No Sample Collected		
19-21	B-5 19-21	13/24	6	Same as Above		
			5			
			7			
			7			

<b>NOTES:</b>  1. 2in split spoon had no recovery. Drillers re-pounded a 3in split spoon at same interval to collect sample  2. Depth to water measured at 21ft below ground surface with water level meter	<b>LEGEND</b>		
	Trace - Approximately <5%	Few - Approximately 6% to 15%	
	Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
	0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense
	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard	

## BORING LOG

Project: Well 4 PFAS Treatment System

Location: Tree Lane, Sharon MA

Client: Town of Sharon

Driller: Northern Drilling Service

Drilling Methods: Drive & Wash

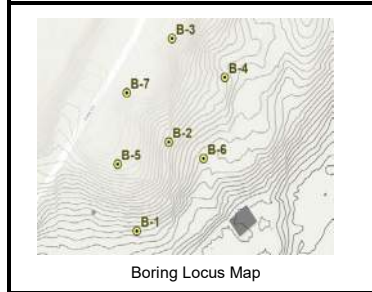
Weather: 30°F, sleeting/snowing

Performed By: AET

Date: 2/24/23

Checked By:

Date:



**Boring No: B-5**

Location: SW corner of proposed building

Approx. Ground Elevation: 235.1'

Approx. Groundwater Elevation: 214.1'

Date/Time of Groundwater Elevation: 2/24 10AM

Datum: NAVD 83

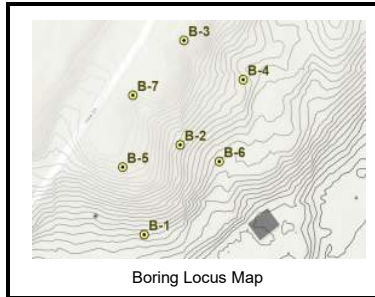
Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
21-24	N/A	N/A	N/A	No Sample Collected	Sandy Silt	
24-26	B-5 24-26	13/24	7 7 9 6	Same as Above, except very stiff		
26-29	N/A	N/A	N/A	No Sample Collected		
29-31	B-5 29-31	14/24	9 10 10 10	Same as Above		
31-34	N/A	N/A	N/A	No Sample Collected		
34-36	B-5 34-36	18/24	3 3 4 5	Same as Above, except medium		
36-39	N/A	N/A	N/A	No Sample Collected		
39-41	B-5 39-41	19/24	8 11 12 12	Same as Above, except very stiff		
BORING TERMINATED AT A PREDETERMINED DEPTH OF 41 FEET						

<b>NOTES:</b>  3. Boring ended at a predetermined depth of 41 feet below ground surface	<b>LEGEND</b>		
	Trace - Approximately <5%	Few - Approximately 6% to 15%	
	Little - Approximately 16% to 30%	Some - Approximately 31% to 49%	
	0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dens
	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense	
0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	
9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard	

## BORING LOG

Project: Well 4 PFAS Treatment System  
 Location: Tree Lane, Sharon MA  
 Client: Town of Sharon  
 Driller: Northern Drilling Service  
 Drilling Methods: Drive & Wash  
 Weather: 30°F, clear  
 Performed By: AET Date: 2/22/23  
 Checked By: Date:



**Boring No: B-6**  
 Location: Bottom middle of proposed building  
 Approx. Ground Elevation: 217.5'  
 Approx. Groundwater Elevation: 208.5'  
 Date/Time of Groundwater Elevation: 2/22 11AM  
 Datum: NAVD 83  
 Project No. R245.2103

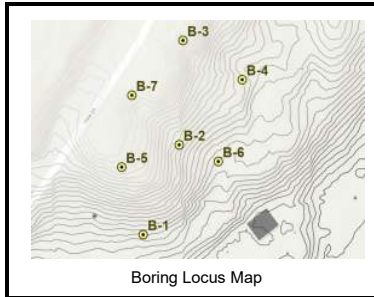
Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-6 0-2	7/24	3	0-4" Medium, dark brown, moist, ORGANIC SOIL	Soil	1
			2			
2-4	N/A	N/A	N/A	4-7" Loose, yellow/brown, moist, POORLY GRADED SAND with few gravel and trace silt	Sand	
			N/A			
4-6	B-6 4-6	11/24	4	Medium, yellow/brown, moist, SILT with little fine sand and trace gravel Rock fragment in tip	Silt	
			3			
6-9	N/A	N/A	N/A	No Sample Collected	Gravel	
			N/A			
9-11	B-6 9-11	2/24	5	Loose, brown, wet, WELL GRADED GRAVEL with sand	Silty Sand	
			3			
11-14	N/A	N/A	N/A	No Sample Collected	Silt	
			N/A			
14-16	B-6 14-16	10/24	12	Medium dense, brown, wet, SILTY SAND	Silt	
			9			
16-19	N/A	N/A	N/A	No Sample Collected	Silt	
			N/A			
19-21	B-6 19-21	13/24	4	Stiff, brown, wet, SILT with sand, non-plastic fines	Silt	
			6			
			7			

BORING ENDED AT A PREDETERMINED DEPTH OF 21 FEET

<p><b>NOTES:</b></p> <p>1. Depth to water measured at 9ft below ground surface with water level meter</p> <p>2. 2in split spoon had no recovery. Drillers re-pounded a 3in split spoon at same interval to collect sample</p> <p>3. Boring ended at a predetermined depth of 21 feet below ground surface</p>	<p><b>LEGEND</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Trace - Approximately &lt;5%</td> <td style="width: 33%;">Few - Approximately 6% to 15%</td> <td style="width: 33%;"></td> </tr> <tr> <td>Little - Approximately 16% to 30%</td> <td>Some - Approximately 31% to 49%</td> <td></td> </tr> <tr> <td>0-4 Coarse Soil N Value - Very Loose</td> <td>5-10 Coarse Soil N Value - Loose</td> <td>11-29 Coarse Soil N Value - Medium Dense</td> </tr> <tr> <td>30-49 Coarse Soil N Value - Dense</td> <td>&gt;50 Coarse Soil N Value - Very Dense</td> <td></td> </tr> <tr> <td>0-3 Fine Soil N Value - Very Soft</td> <td>3-4 Fine Soil N Value - Soft</td> <td>5-8 Fine Soil N Value - Medium</td> </tr> <tr> <td>9-15 Fine Soil N Value - Stiff</td> <td>16-30 Fine Soil N Value - Very Stiff</td> <td>&gt;30 Fine Soil N Value - Hard</td> </tr> </table>	Trace - Approximately <5%	Few - Approximately 6% to 15%		Little - Approximately 16% to 30%	Some - Approximately 31% to 49%		0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense		0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard
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## BORING LOG

Project: Well 4 PFAS Treatment System  
 Location: Tree Lane, Sharon MA  
 Client: Town of Sharon  
 Driller: Northern Drilling Service  
 Drilling Methods: Drive & Wash  
 Weather: 30°F, sleeting/snowing  
 Performed By: AET Date: 2/23/23  
 Checked By: Date:



**Boring No: B-7**  
 Location: Top middle of proposed building  
 Approx. Ground Elevation: 239.0'  
 Approx. Groundwater Elevation: Approx. 230.0'  
 Date/Time of Groundwater Elevation: 2/23 2PM  
 Datum: NAVD 83  
 Project No. R245.2103

Depth (feet)	Sample No.	Rec./ Pen. (inch)	Blow Counts per 6 inch	Soil Description	Stratum Change Depth (feet)	Note
0-2	B-7 0-2	13/24	2	0-3" Medium, dark brown, moist, ORGANIC SOIL	Soil	1
			2			
3	No Sample Collected	Sand				
9			Medium dense, brown, moist, POORLY GRADED SAND, with few gravel and few silt	Sandy Silt		
2-4	N/A	N/A			N/A	
4-6	B-7 4-6	5/24	9 13 11 5	Medium dense, brown, moist, POORLY GRADED SAND, with few gravel and few silt	Sandy Silt	
6-9	N/A	N/A	N/A	No Sample Collected		
9-11	B-7 9-11	5/24	5 5 7 9	Medium dense, brown, moist, POORLY GRADED SAND, with trace gravel, and few silt	Silt	
11-14	N/A	N/A	N/A	No Sample Collected		
14-16	B-7 14-16	12/24	8 7 6 6	Stiff, brown, moist, SANDY SILT	Silt	
16-19	N/A	N/A	N/A	No Sample Collected		Silt
19-21	B-7 19-21	10/24	6 5 6 6	Stiff, brown, moist, SILT, with few sand	Silt	

BORING ENDED AT A PREDETERMINED DEPTH OF 21 FEET

<p><b>NOTES:</b></p> <p>1. Depth to water measured at 9ft below ground surface with water level meter - however water was added to hole during drilling process which raised the water table. Undisturbed water table is likely lower than 9 feet</p> <p>2. Boring ended at a predetermined depth of 21 feet below ground surface</p>	<p><b>LEGEND</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Trace - Approximately &lt;5%</td> <td style="width: 33%;">Few - Approximately 6% to 15%</td> <td style="width: 33%;"></td> </tr> <tr> <td>Little - Approximately 16% to 30%</td> <td>Some - Approximately 31% to 49%</td> <td></td> </tr> <tr> <td>0-4 Coarse Soil N Value - Very Loose</td> <td>5-10 Coarse Soil N Value - Loose</td> <td>11-29 Coarse Soil N Value - Medium Dense</td> </tr> <tr> <td>30-49 Coarse Soil N Value - Dense</td> <td>&gt;50 Coarse Soil N Value - Very Dense</td> <td></td> </tr> <tr> <td>0-3 Fine Soil N Value - Very Soft</td> <td>3-4 Fine Soil N Value - Soft</td> <td>5-8 Fine Soil N Value - Medium</td> </tr> <tr> <td>9-15 Fine Soil N Value - Stiff</td> <td>16-30 Fine Soil N Value - Very Stiff</td> <td>&gt;30 Fine Soil N Value - Hard</td> </tr> </table>	Trace - Approximately <5%	Few - Approximately 6% to 15%		Little - Approximately 16% to 30%	Some - Approximately 31% to 49%		0-4 Coarse Soil N Value - Very Loose	5-10 Coarse Soil N Value - Loose	11-29 Coarse Soil N Value - Medium Dense	30-49 Coarse Soil N Value - Dense	>50 Coarse Soil N Value - Very Dense		0-3 Fine Soil N Value - Very Soft	3-4 Fine Soil N Value - Soft	5-8 Fine Soil N Value - Medium	9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard
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9-15 Fine Soil N Value - Stiff	16-30 Fine Soil N Value - Very Stiff	>30 Fine Soil N Value - Hard																	

## **APPENDIX C**

### Laboratory Soil Analysis





195 Frances Avenue  
 Cranston RI, 02910  
 Phone: (401)-467-6454  
 Fax: (401)-467-2398  
[thielsch.com](http://thielsch.com)  
*Let's Build a Solid Foundation*

**Client Information:**  
 Environmental Partners  
 Quincy, MA  
 Project Manager: Adam Kran, PE  
 Assigned By: Adam Kran, PE  
 Collected By: Annie Tucker

**Project Information:**  
**Sharon WTP Boring Analysis**  
 Sharon, MA  
 Project Number: R245-3103.04.  
 Summary Page: 1 of 1  
 Report Date: 03.22.23

**LABORATORY TESTING DATA SHEET, Report No.: 7423-C-139**

Material Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests							Laboratory Log and Soil Description	
				As Rcvd Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	$\gamma_d$ MAX (pcf) $W_{opt}$ (%)	$\gamma_d$ MAX (pcf) $W_{opt}$ (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"		Permeability cm/sec
				D2216	D4318	D6913			D2974	D4792	D1557									
Grab	B-1	4-6	23-S-1241				27.4	55.6	17.0											Brown silty sand with gravel
Grab	B-2	9-11	23-S-1242				49.7	44.5	5.8											Olive poorly graded gravel with silt and sand
Grab	B-2	14-16	23-S-1243				0.4	90.4	9.2											Brown poorly graded sand with silt
Grab	B-4	4-6	23-S-1244				32.3	64.1	3.6											Brown well-graded sand with gravel
Grab	B-5	14-16	23-S-1245				0.7	42.4	56.9											Brown sandy silt
Grab	B-6	9-11	23-S-1246				77.7	22.1	0.2											Brown well-graded gravel with sand
Grab	B-6	19-21	23-S-1247				0.0	21.2	78.8											Brown silt with sand

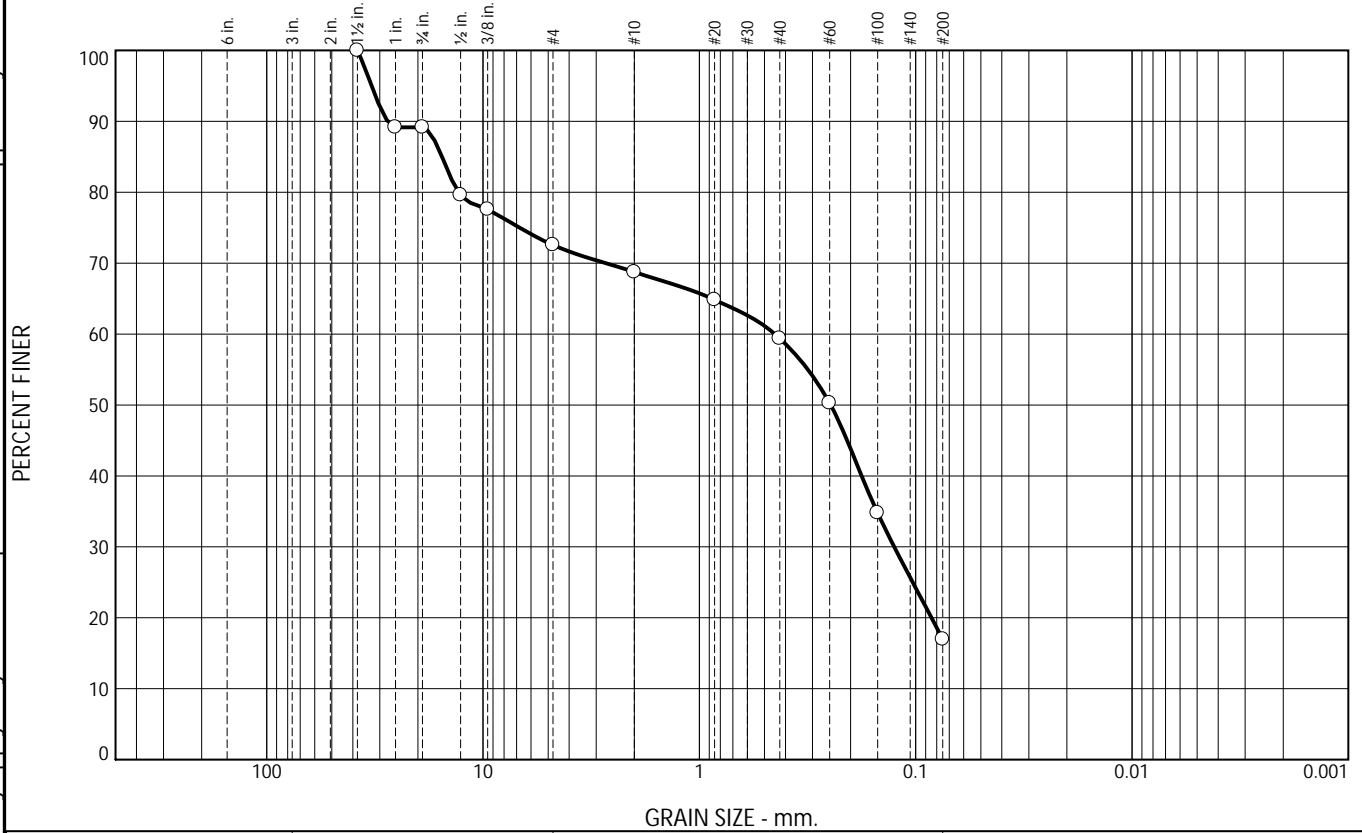
Date Received: 03.16.23

Reviewed By: 

Date Reviewed: 03.22.23

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.8	16.6	3.8	9.4	42.4	17.0	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	89.2		
3/4"	89.2		
1/2"	79.6		
3/8"	77.6		
#4	72.6		
#10	68.8		
#20	64.8		
#40	59.4		
#60	50.3		
#100	34.8		
#200	17.0		

Soil Description

Brown silty sand with gravel

PL= NP      Atterberg Limits      LL= NV      PI= NP  
 D<sub>90</sub>= 27.6286      D<sub>85</sub>= 15.4758      D<sub>60</sub>= 0.4472  
 D<sub>50</sub>= 0.2472      D<sub>30</sub>= 0.1257      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

Coefficients

USCS= SM      Classification      AASHTO= A-2-4(0)

Remarks

\* (no specification provided)

Source of Sample: Grab      Depth: 4-6'  
 Sample Number: B-1

Date: 03.21.23

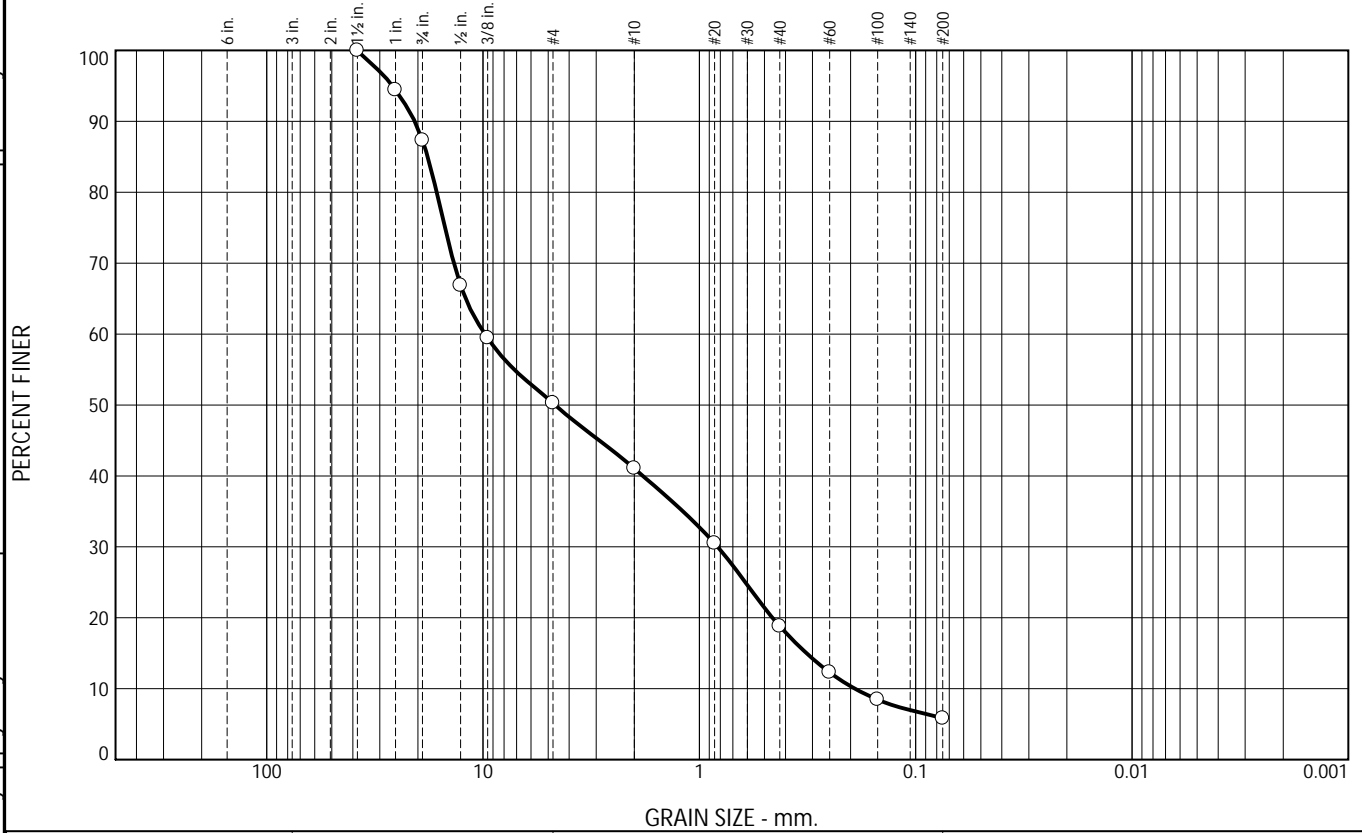
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1241	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.7	37.0	9.2	22.3	13.0	5.8	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	94.4		
3/4"	87.3		
1/2"	66.9		
3/8"	59.5		
#4	50.3		
#10	41.1		
#20	30.5		
#40	18.8		
#60	12.3		
#100	8.5		
#200	5.8		

Soil Description

Olive poorly graded gravel with silt and sand

PL= NP      Atterberg Limits      LL= NV      PI= NP  
 LL= NV      PI= NP

Coefficients

D<sub>90</sub>= 20.6957      D<sub>85</sub>= 18.0317      D<sub>60</sub>= 9.7915  
 D<sub>50</sub>= 4.6452      D<sub>30</sub>= 0.8230      D<sub>15</sub>= 0.3198  
 D<sub>10</sub>= 0.1910      C<sub>u</sub>= 51.26      C<sub>c</sub>= 0.36

Classification

USCS= GP-GM      AASHTO= A-1-a

Remarks

\* (no specification provided)

Source of Sample: Grab      Depth: 9-11'  
 Sample Number: B-2

Date: 03.21.23

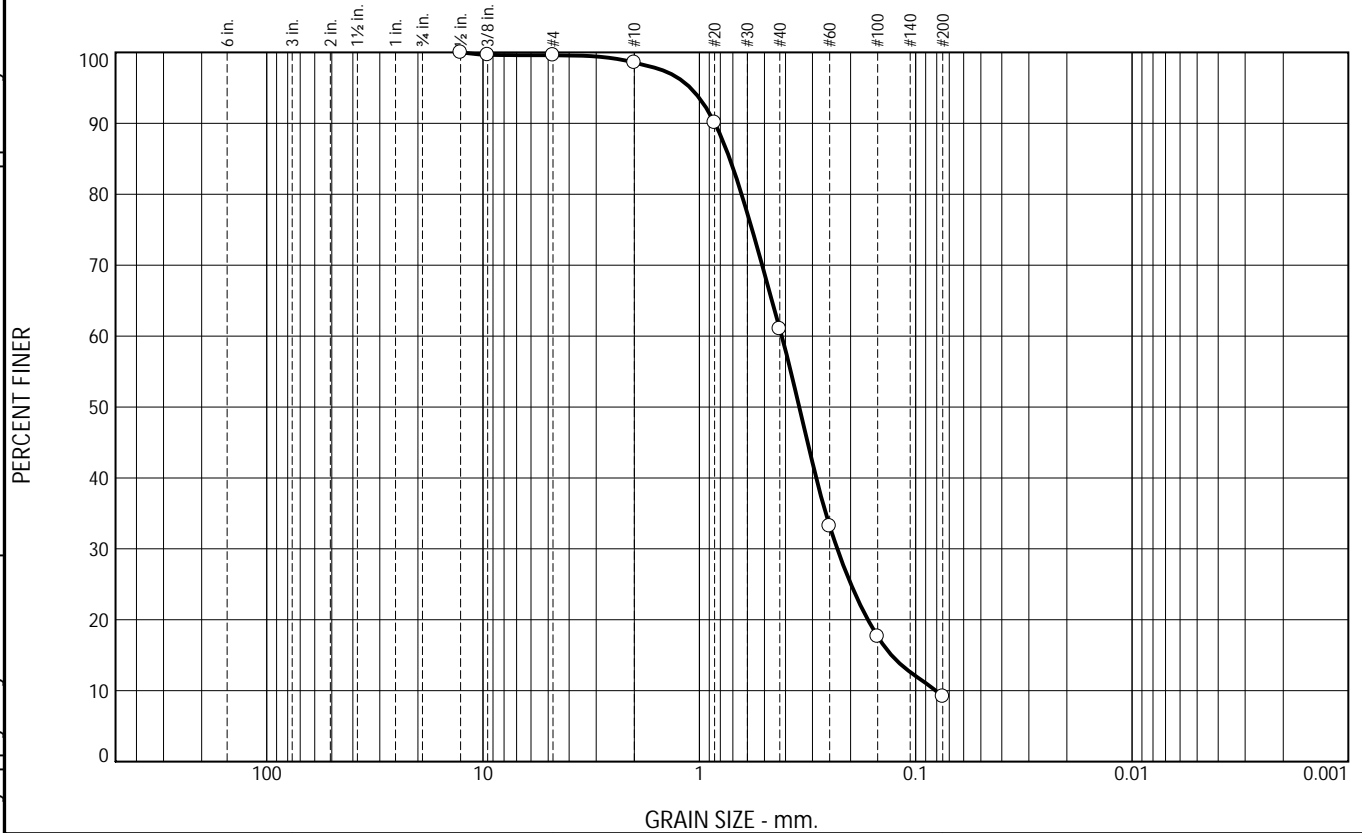
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1242	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

## Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	1.0	37.6	51.8	9.2	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	99.7		
#4	99.6		
#10	98.6		
#20	90.1		
#40	61.0		
#60	33.2		
#100	17.6		
#200	9.2		

Soil Description

Brown poorly graded sand with silt

Atterberg Limits  
 PL= NP      LL= NV      PI= NP

Coefficients  
 D<sub>90</sub>= 0.8471      D<sub>85</sub>= 0.7235      D<sub>60</sub>= 0.4161  
 D<sub>50</sub>= 0.3454      D<sub>30</sub>= 0.2305      D<sub>15</sub>= 0.1294  
 D<sub>10</sub>= 0.0807      C<sub>u</sub>= 5.16      C<sub>c</sub>= 1.58

Classification  
 USCS= SP-SM      AASHTO= A-3

Remarks

\* (no specification provided)

Source of Sample: Grab      Depth: 14-16'  
 Sample Number: B-2

Date: 03.21.23

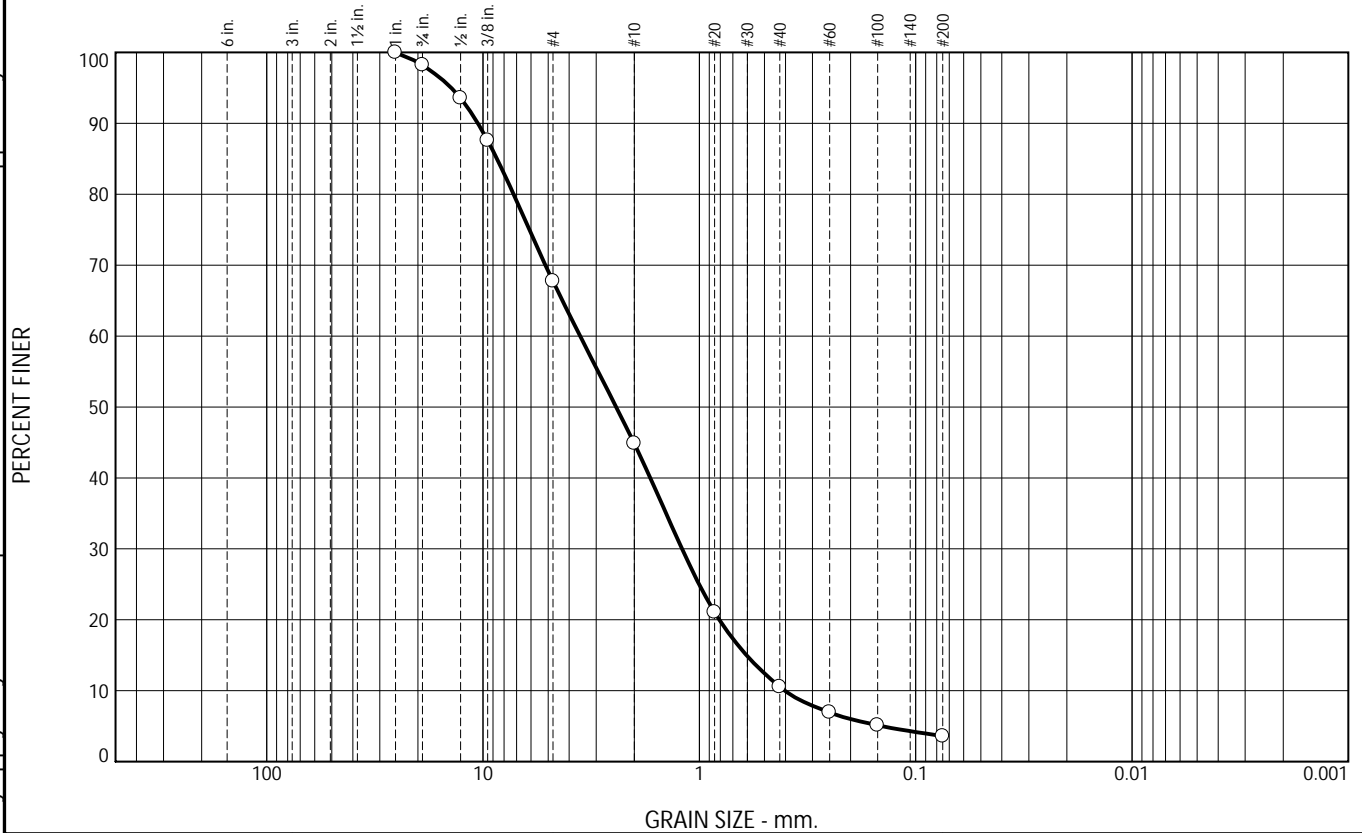
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1243	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

## Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.8	30.5	22.9	34.3	6.9	3.6	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	98.2		
1/2"	93.6		
3/8"	87.6		
#4	67.7		
#10	44.8		
#20	21.1		
#40	10.5		
#60	6.9		
#100	5.1		
#200	3.6		

Soil Description

Brown well-graded sand with gravel

Atterberg Limits  
 PL= NP      LL= NV      PI= NP

Coefficients  
 D<sub>90</sub>= 10.5651    D<sub>85</sub>= 8.6230      D<sub>60</sub>= 3.5565  
 D<sub>50</sub>= 2.4256      D<sub>30</sub>= 1.2031      D<sub>15</sub>= 0.6055  
 D<sub>10</sub>= 0.4033      C<sub>u</sub>= 8.82          C<sub>c</sub>= 1.01

Classification  
 USCS= SW      AASHTO= A-1-a

Remarks

\* (no specification provided)

Source of Sample: Grab      Depth: 4-6'  
 Sample Number: B-4

Date: 03.21.23

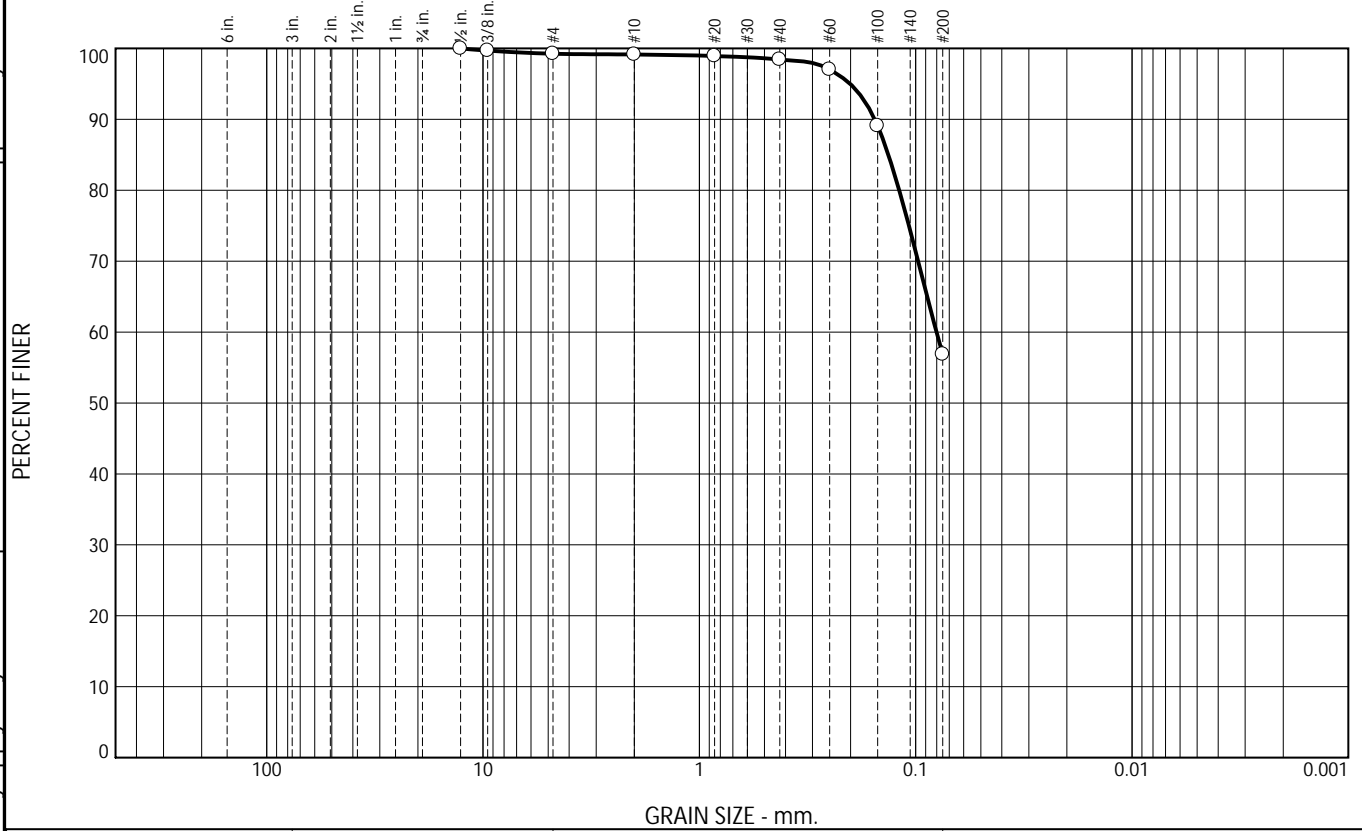
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1244	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

## Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	0.2	0.7	41.5	56.9	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	99.7		
#4	99.3		
#10	99.1		
#20	98.9		
#40	98.4		
#60	97.0		
#100	89.1		
#200	56.9		

\* (no specification provided)

Soil Description

Brown sandy silt

Atterberg Limits

PL= NP      LL= NV      PI= NP

Coefficients

D<sub>90</sub>= 0.1546      D<sub>85</sub>= 0.1337      D<sub>60</sub>= 0.0801  
D<sub>50</sub>=                  D<sub>30</sub>=                  D<sub>15</sub>=  
D<sub>10</sub>=                  C<sub>u</sub>=                  C<sub>c</sub>=

Classification

USCS= ML                  AASHTO= A-4(0)

Remarks

Sample visually classified as non-plastic.

Source of Sample: Grab      Depth: 14-16'  
Sample Number: B-5

Date: 03.21.23

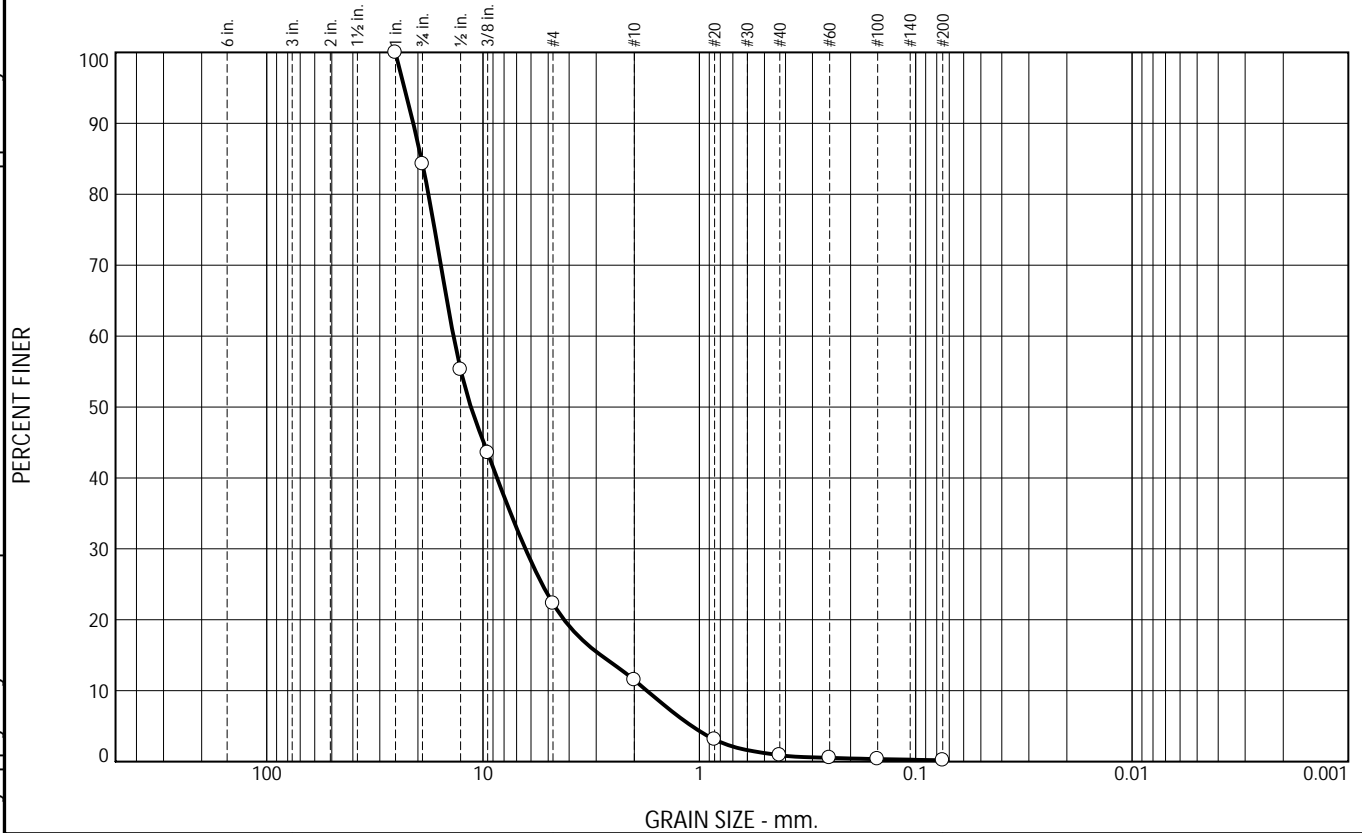
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1245	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.7	62.0	10.8	10.6	0.7	0.2	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	84.3		
1/2"	55.3		
3/8"	43.5		
#4	22.3		
#10	11.5		
#20	3.1		
#40	0.9		
#60	0.5		
#100	0.4		
#200	0.2		

\* (no specification provided)

Soil Description

Brown well-graded gravel with sand

Atterberg Limits  
 PL= NP      LL= NV      PI= NP

Coefficients  
 D<sub>90</sub>= 21.0192      D<sub>85</sub>= 19.2770      D<sub>60</sub>= 13.6967  
 D<sub>50</sub>= 11.3750      D<sub>30</sub>= 6.3693      D<sub>15</sub>= 2.8551  
 D<sub>10</sub>= 1.7493      C<sub>u</sub>= 7.83      C<sub>c</sub>= 1.69

Classification  
 USCS= GW      AASHTO= A-1-a

Remarks

Source of Sample: Grab      Depth: 9-11'  
 Sample Number: B-6

Date: 03.21.23

<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1246	

Tested By: RB / AF / JGW

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	21.1	78.8	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.3		
#100	96.2		
#200	78.8		

Soil Description

Brown silt with sand

PL= NP      Atterberg Limits      LL= NV      PI= NP  
 D<sub>90</sub>= 0.1131      D<sub>85</sub>= 0.0944      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

Classification

USCS= ML      AASHTO= A-4(0)

Remarks

Sample visually classified as non-plastic. Sample recieved with some standing water.

\* (no specification provided)

Source of Sample: Grab      Depth: 19-21'  
 Sample Number: B-6

Date: 03.21.23

<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon WTP Boring Analysis Sharon, MA Project No: R245-2103.04.
Fig. 23-S-1247	

Tested By: RB / AF / JGW

Checked By:



## BORING LOG

Project: Well 4 Geotechnical Exploration

Location: Sharon, MA

Client: Town of Sharon

Driller: Maher Drilling Services

Drilling Methods: Geoprobe

Weather: Overcast, 40s

Performed By: AET Date: 11/21/22

Checked By: Date:



Boring Locus Map

**Boring No: B-1**

Location: Off Tree Lane

Approx. Ground Elevation: 220 ft

Approx. Groundwater Elevation: 204 ft

Date/Time of Groundwater Elevation: 11/21/22 2PM

Datum: NAVD88

Project No. 22010789

Depth (feet)	Sample No.	Pen./ Rec.	Soil Description	Stratum Change	Note
0-5'	B-1 0-5'	21" / 60"	0-5" Dark brown, dry, ORGANIC SOIL with sand and gravel 2-21" Light brown lightening downward, dry, fine SAND with few silt	Soil Fine Sand	1
5-10'	B-1 5-10'	41" / 60"	Light brown, dry, SILTY SAND (SM), non-plastic fines	Silty Sand / Sand with Silt	
10-15'	B-1 10-15'	43" / 60"	Light brown, dry, fine SAND with few silt Orange, dry, medium SAND layer from 32-33"		
15-20'	B-1 15-20'	46" / 60"	Light brown, moist to wet, SILT (ML) with trace fine sand, non-plastic fines		Silt
20-25'	B-1 20-25'	49" / 60"	Light brown, wet, SILT with trace fine sand	3	
25-30'	B-1 25-30'	60" / 60"	Same as above		
30-35'	B-1 30-35'	60" / 60"	Same as above		
35-39'	B-1 35-39'	38" / 48"	Same as above	4, 5	
END OF BORING					

**NOTES:**

- 1, 2. Soil samples sent for laboratory analysis
3. Water table encountered at 16 feet below ground surface
4. Split spoon refusal encountered at 39 feet below ground surface
5. Throughout boring, drilling was smooth and consistent. No rocks encountered

**LEGEND**

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| Trace - Approximately <5%         | Few - Approximately 6% to 15%   |
| Little - Approximately 16% to 30% | Some - Approximately 31% to 49% |



195 Frances Avenue  
 Cranston RI, 02910  
 Phone: (401)-467-6454  
 Fax: (401)-467-2398  
[thielsch.com](http://thielsch.com)  
*Let's Build a Solid Foundation*

Client Information:  
 Environmental Partners  
 Quincy, MA  
 PM: Adam Kran  
 Assigned By: Adam Kran  
 Collected By: Annie Tucker

Project Information:  
**Sharon Well 4 Boring Analysis**  
**Sharon, MA**  
 Project Number: 22010789  
 Summary Page: 1 of 1  
 Report Date: 01.16.23

**LABORATORY TESTING DATA SHEET, Report No.: 7423-A-130**

Material Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests							Laboratory Log and Soil Description	
				As Rcvd Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	Dry unit wt. (pcf)	Test Moisture Content %	$\gamma_d$ MAX (pcf) / $W_{opt}$ (%)	$\gamma_d$ MAX (pcf) / $W_{opt}$ (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"		Permeability cm/sec
				D2216	D4318		D6913			D2974	D4792			D1557						
Grab	B-1	5-10	23-S-114	11.9	NV	NP	0.9	53.4	45.7										Light Brown silty sand	
Grab	B-1	15-20	23-S-115	24.5	NV	NP	0.0	2.9	97.1										Light Brown silt	

Date Received: 01.11.23

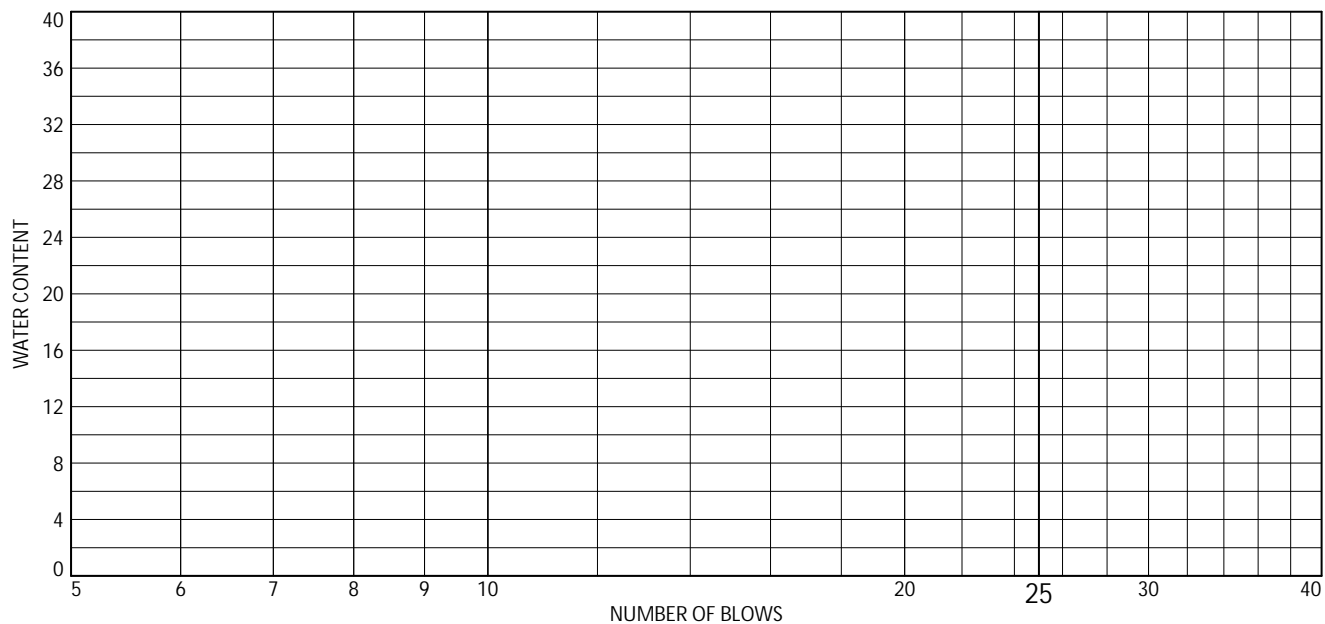
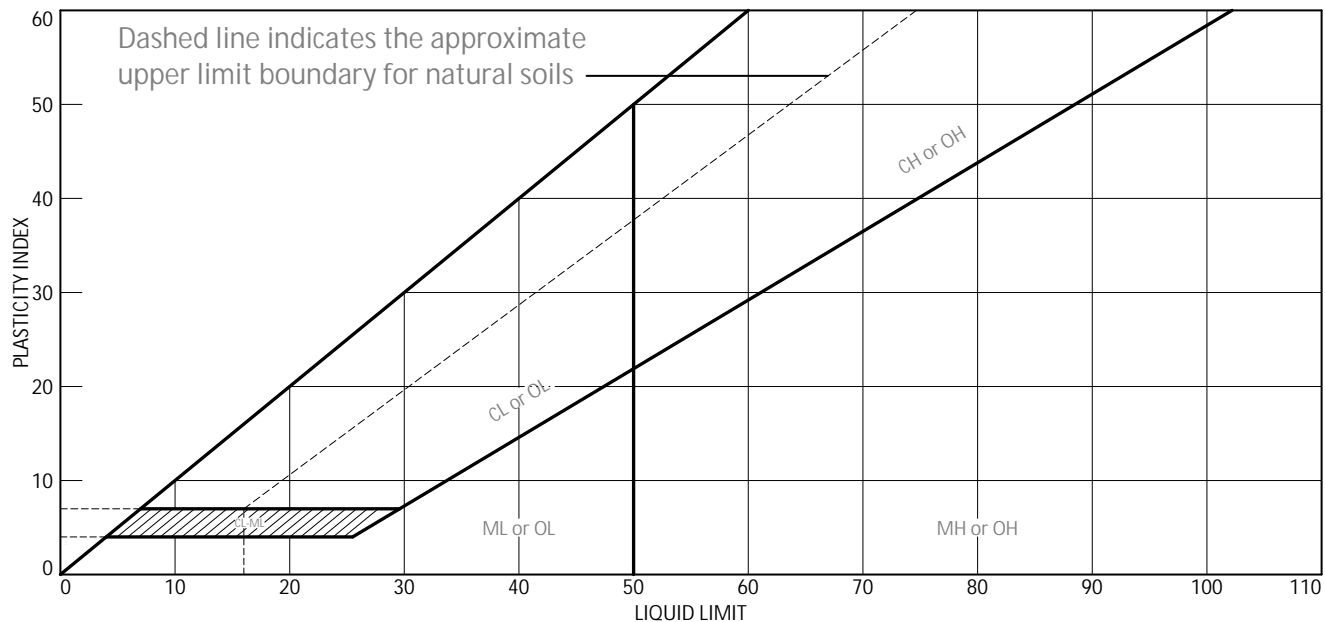
Reviewed By: 

Date Reviewed: 01.16.23

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These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

## LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Light Brown silty sand	NV	NP	NP	95.9	45.7	SM

Project No. 22010789      Client: Environmental Partners  
 Project: Sharon Well 4 Boring Analysis  
 Sharon, MA  
 Source of Sample: Grab      Depth: 5-10'  
 Sample Number: B-1

Thielsch Engineering Inc.  
 Cranston, RI

Remarks:  
 ● Sample classified as non-plastic and non-viscous. Sample could not roll past 1/4" and could not achieve more than 25 blows.

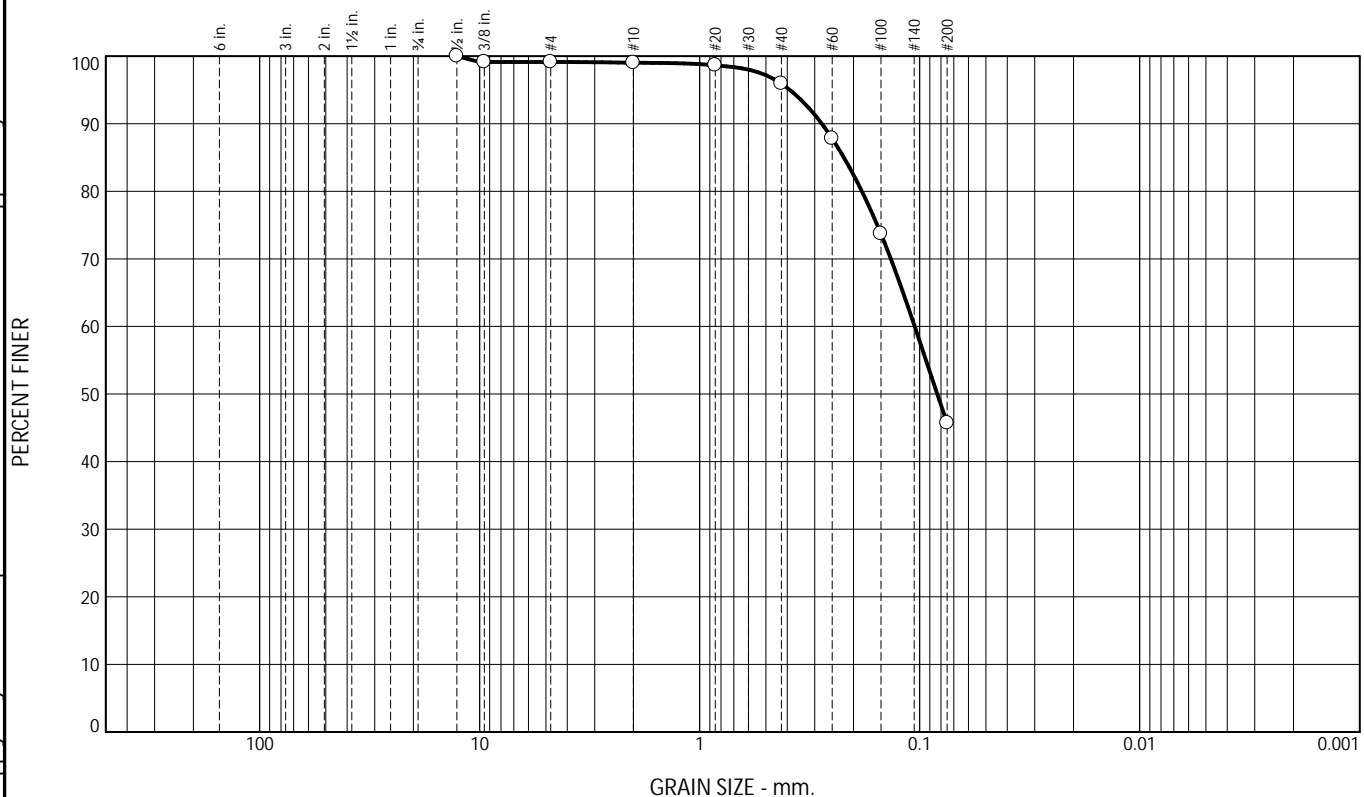
Figure 23-L-114

Tested By: JF      Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	0.1	3.1	50.2	45.7	

Test Results (ASTM D6913)				
Sieve Size or Diam. (mm.)	Finer (%)	Spec. * (%)	Out of Spec. (%)	Pct. of Fines
1/2"	100.0			
3/8"	99.1			
#4	99.1			
#10	99.0			
#20	98.6			
#40	95.9			
#60	87.8			
#100	73.7			
#200	45.7			

Material Description

Light Brown silty sand

PL= NP	<u>Atterberg Limits</u>	PI= NP
	LL= NV	
	<u>Coefficients</u>	
D <sub>90</sub> = 0.2787	D <sub>85</sub> = 0.2210	D <sub>60</sub> = 0.1054
D <sub>50</sub> = 0.0832	D <sub>30</sub> =	D <sub>15</sub> =
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
	<u>Classification</u>	
USCS= SM	AASHTO=	A-4(0)
	<u>Test Remarks</u>	

\* (no specification provided)

Source of Sample: Grab      Depth: 5-10'  
 Sample Number: B-1

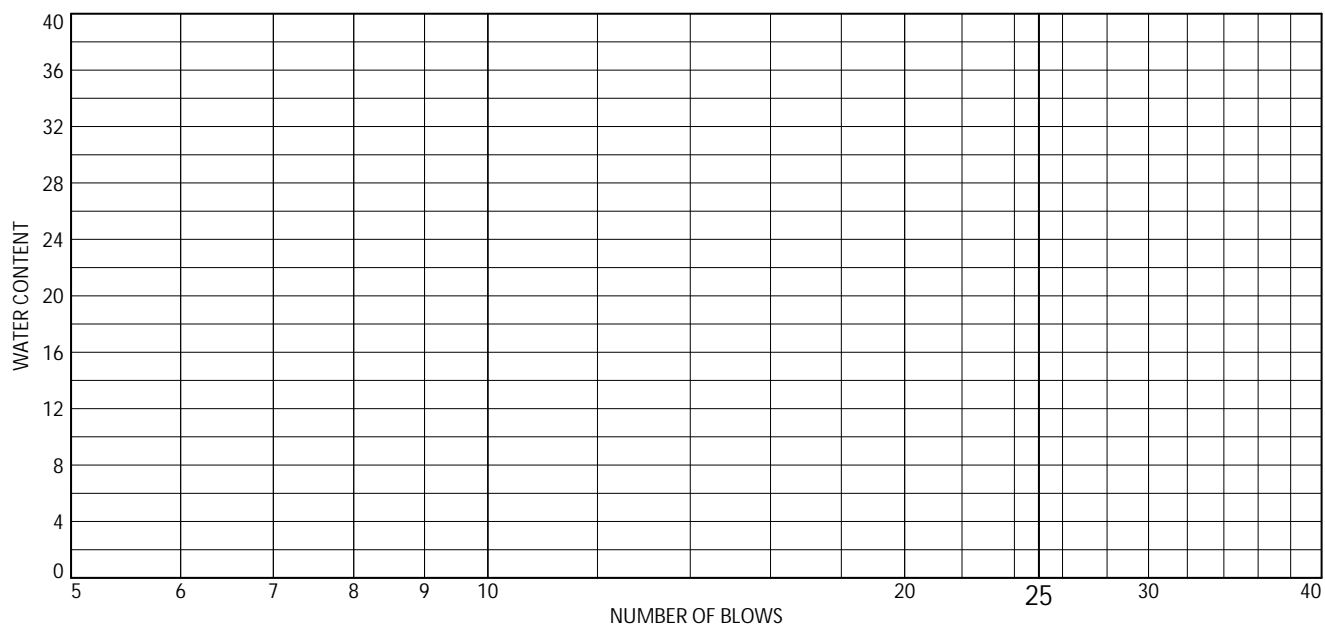
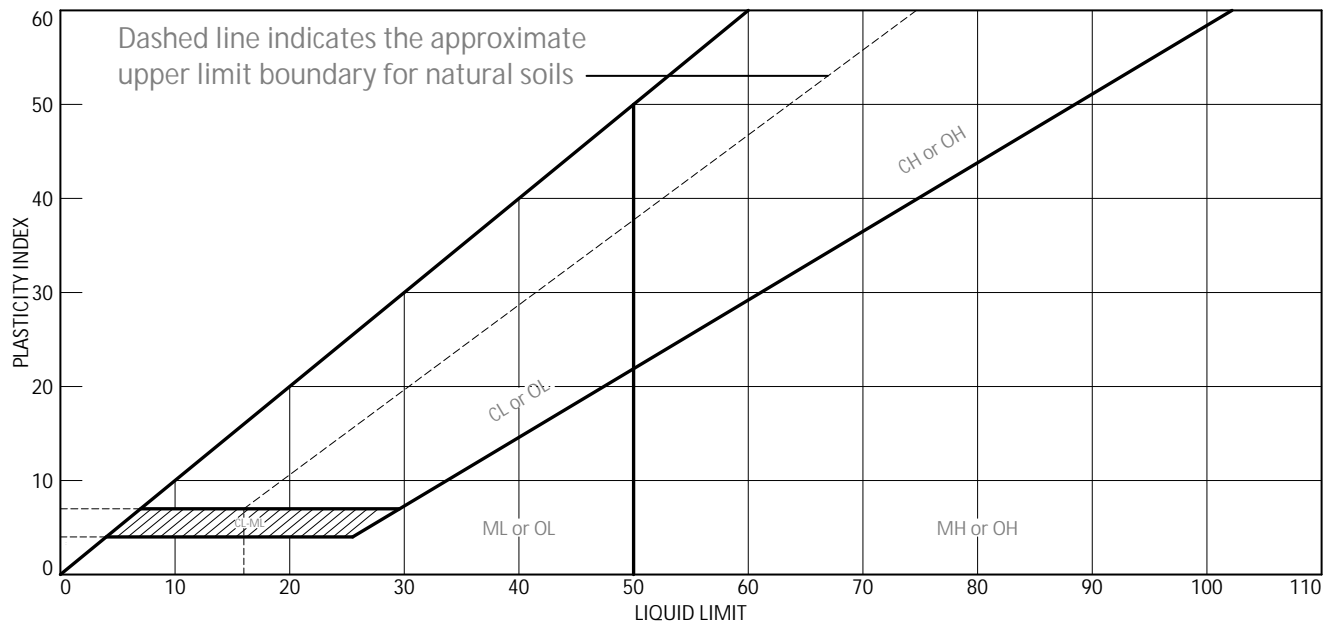
Sample Date: 1.16.23

<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon Well 4 Boring Analysis Sharon, MA Project No: 22010789
Figure 23-S-114	

Tested By: RB / AV      Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

## LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
Light Brown silt	NV	NP	NP	99.7	97.1	ML

Project No. 22010789 Client: Environmental Partners  
 Project: Sharon Well 4 Boring Analysis  
 Sharon, MA  
 Source of Sample: Grab Depth: 15-20'  
 Sample Number: B-1

Thielsch Engineering Inc.  
 Cranston, RI

Remarks:  
 ● Sample classified as non-plastic and non-viscous. Sample could not roll past 1/4" and could not achieve more than 25 blows.

Figure 23-L-115

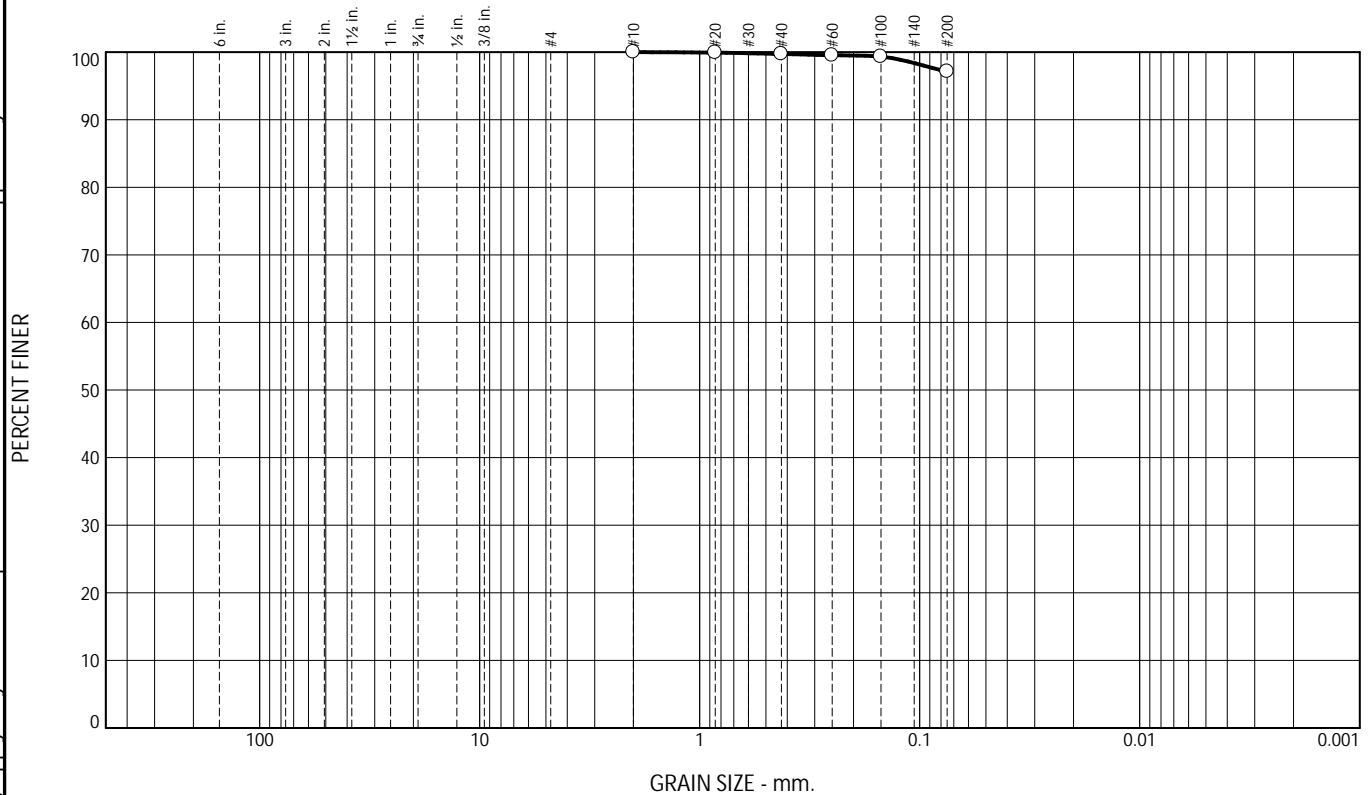
Tested By: JF \_\_\_\_\_

Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

# Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	2.6	97.1	

Test Results (ASTM D6913)				
Sieve Size or Diam. (mm.)	Finer (%)	Spec. * (%)	Out of Spec. (%)	Pct. of Fines
#10	100.0			
#20	99.9			
#40	99.7			
#60	99.5			
#100	99.3			
#200	97.1			

Material Description		
Light Brown silt		
PL= NP	<u>Atterberg Limits</u>	PI= NP
	LL= NV	
	<u>Coefficients</u>	
D <sub>90</sub> =	D <sub>85</sub> =	D <sub>60</sub> =
D <sub>50</sub> =	D <sub>30</sub> =	D <sub>15</sub> =
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
USCS= ML	<u>Classification</u>	
	AASHTO=	A-4(0)
<u>Test Remarks</u>		

\* (no specification provided)

Source of Sample: Grab      Depth: 15-20'  
 Sample Number: B-1

Sample Date: 1.16.23

<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: Environmental Partners Project: Sharon Well 4 Boring Analysis Sharon, MA Project No: 22010789
Figure 23-S-115	

Tested By: RB / AV

Checked By:



## APPENDIX E

Massachusetts DEP Permit Approval







Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

## Department of Environmental Protection

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

Maura T. Healey  
Governor

Kimberley Driscoll  
Lieutenant Governor

Rebecca L. Tepper  
Secretary

Bonnie Heiple  
Commissioner

March 19, 2024

Mr. Eric Hooper  
Sharon Water Department  
217 Rear South Main Street  
Sharon, MA 02067

RE: SHARON – Public Water Supply  
Sharon Water Department  
PWS ID#: 4266000  
BRP WS24, Approval to Construct a  
Facility to Treat > 1MGD  
Record #24-WS24-0001-APP

Dear Mr. Hooper:

The Southeast Regional Office of the Massachusetts Department of Environmental Protection (MassDEP), Drinking Water Program, is in receipt of plans and specifications for the installation of a Greensandplus™ filtration system and a per- and polyfluoroalkyl substances (PFAS) removal system at the proposed Water Treatment Facility at 15 Tree Lane in the Town Sharon, Massachusetts.

Please find attached MassDEP approval of the proposed Water Treatment Facility in the Town of Sharon, MA.

Please note that the signature on this cover letter indicates formal issuance of the attached document. If you have any questions regarding this document, please contact Giliane Tardieu at (508) 946-2789 or [Giliane.tardieu@mass.gov](mailto:Giliane.tardieu@mass.gov).

Sincerely,

Jim McLaughlin, Chief  
Drinking Water Program  
Bureau of Water Resources

DWP Archive/SERO/SHARON-4266000-System Modifications-2024-03-19 WS24 Wells 2-3-4 PFAS

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The Southeast Regional Office of the Department of Environmental Protection, Drinking Water Program (“the Department”), is in receipt of plans and specifications for the Construction of a new Water Treatment Plant in the Town of Sharon, Massachusetts. The plans and specifications, submitted on behalf of the Sharon Water Department (“the PWS”) by Environmental Partners of Quincy, Massachusetts, were received by the Department on February 29, 2024, and bear the seal and signature of Alston Potts, a Massachusetts Registered Professional Engineer, P.E. No.56074 (“the Engineer”).

Specific documents relative to this proposal received and reviewed by the Department for conformance with the Department’s Water Supply Regulations, 310 CMR 22.00 (Regulations) and “Guidelines and Policies for Public Water Systems” (Guidelines) are as follows:

- Water Supply Certification Form.
- Cover Letter, Checklists for KOH, NaOH, NaOCl, and NaF.
- Project Specifications, Volume 1 and 2.
- Project Plans, Volume 1 and 2.

**BACKGROUND:** The work includes the construction of the Wells 2, 3, and 4 Water Treatment Plant, and modifications to the existing Well Stations. Well 2 (Department Source ID 4266000-01G) is a 9-well wellfield, while Well 3 (4266000-02G) and Well 4 (4266000-03G) are individual wells. Currently, water from each well is treated at its respective pumping station. Treatment consists of sodium hypochlorite for disinfection, potassium hydroxide for pH adjustment and sodium fluoride for dental health. On June 25, 2021, the Department approved the activation of temporary, portable, ion exchange treatment of Well 4 to remove per- and polyfluoroalkyl substances (PFAS). Well 2 also has had PFAS levels exceeding the Massachusetts Maximum Contaminant Level (MMCL), and Well 3 PFAS levels are significant. The PWS made the decision to build a single treatment plant to treat the flows from all three wells. Two pilot studies were performed in parallel to evaluate the use of pressure filtration technology for the removal of iron and manganese from Well 2. The first pilot study evaluated the oxidation and subsequent filtration of iron and manganese using two different adsorptive media: GreensandPlus™ (Greensand) and Pureflow© PM-200 pyrolusite media. The second pilot study evaluated the filtration of iron and manganese using biologically activated media. On September 15, 2023, the Department approved the pilot study report for the use of GreensandPlus™ filtration (Record No. 23-WS22-0024-APP).

The proposed Water Treatment Plant will include a pre-fabricated metal building system; chemical storage tanks; chemical feed systems; bag filtration; iron and manganese filtration system; PFAS treatment system; air scour blower; backwash waste tank with supernatant recycling equipment; finished water wet well; recycle, backwash waste, sludge, and finished water pumps; associated structural, architectural, process piping, instrumentation and controls, plumbing, fire protection, HVAC, and electrical work. Modifications to Well Stations 2, 3, and 4 include selective demolition of chemical feed systems; instrumentation and controls; and replacement of process mechanical equipment, pumps, piping, and appurtenances. There will no longer be chemical addition at the individual well stations following project completion.

The discharge lines from Wells 2 and 3 will be manifolded and sodium hypochlorite injected into a common line as an oxidant to feed three parallel greensand pressure filtration vessels for iron and manganese removal. Sodium bisulfite for dechlorination is injected in the common line effluent from the greensand filters. The effluent from the greensand filters and the discharge from Well 4 will be manifolded, flow through three (3) parallel bag filters, and feed the PFAS removal system. Potassium

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hydroxide for pH adjustment shall be injected ahead of the PFAS filtration system in the common line of Well 4 raw water and the effluent line from the greensand filters. The effluent from the PFAS treatment system is treated with sodium hypochlorite before entering the finished water wet well located in the lower level of the Treatment Plant. Three finished water pumps convey the water to the distribution system. The finished water also supplies backwash water to the greensand filter system and the PFAS removal system.

WELLS 2 AND 3 REDEVELOPMENT

The wells will be redeveloped using chemical and mechanical cleaning. The maximum withdrawal rates of the wells shall be determined. Drawdown measurements shall be taken and recorded during the well capacity evaluation and redevelopment. A vertical turbine pump will be installed at Well Station 3. Well 2 raw water pumps shall be multi-stage in-line vertical pumps. A vacuum priming system shall be provided for the Well Station 2 Raw Water Pumps. Variable frequency drives will be installed for the pumps.

Feed System	Number of Pumps	Pump Type	Capacity (gpm)	Motor Size (HP)
Well Station 2	2	Multi- Stage in-line Vertical	326 gpm @ 306 ft TDH	50
Well Station 3	1	Vertical Turbine	264 gpm @ 311 ft TDH	40

IRON AND MANGANESE REMOVAL SYSTEM

The vertical Greensandplus™ filtration system will have the following characteristics:

Maximum Design Flow Rate	590 gpm
Average System Design Flow Rate (typical operation)	500 gpm
Unit design flow rate with all units in service (typical operations)	167 gpm
Unit design flow rate with one unit out of service	250 gpm
Filter loading rate with all units in service (typical operations)	4.33 gpm/ft <sup>2</sup>
Filter loading rate with one unit out of service	6.5 gpm/ft <sup>2</sup>
Maximum allowable filter loading rate	8 gpm/ft <sup>2</sup>
Normal maximum operating pressure:	100 psi
Influent water quality (Historic Worst)	Iron :1.78 mg/L; Manganese: 0.240 mg/L

The filter backwash water source shall be finished water from the distribution system. The vertical pressure filters will measure 7-foot O.D. by 63- inch straight shell height. The filter tanks shall be of welded steel construction using SA-516 Grade 70 steel and shall be tested to withstand a hydrostatic pressure thirty (30) percent more than the designed working pressure of 100 psi. Each tank shall include the following features:

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- One (1) 18-inch diameter manway with davit and a spare gasket.
- One (1) 14-inch x 18-inch manway with spare gasket.
- Flange pad or nozzle type connections as shown on the Contract Drawings.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs.

Each filter shall have a hub-lateral type inlet distributor/backwash collector system furnished and installed. The hub shall extend down from the tank top head and include two (2) lateral arms, each ending with two (2) upturned elbows. Filter inlet distribution system shall be designed to allow 40% expansion of the filter bed.

Each filter tank shall be furnished and installed with an air scour distributor of stainless-steel construction. Each distributor shall consist of a 2-inch stainless steel manifold with 3/8-inch slotted stainless steel threaded and capped laterals on 7.5-inch maximum centers. The air scour distributor shall be firmly supported from the gravel retaining screen using a 1-inch stainless steel support pipe and stainless-steel U-bolts. Each lateral shall have a series slotted openings by first milling a longitudinal slot every 3.5 inches, approximately one (1) inch long and 1/50th of an inch in width, two thirds (2/3) of the way through the side wall of the 1/2-inch lateral. An orifice 1/8 inch long and slightly less than 1/50th of an inch in width shall be punched through the remainder of the side wall. The end of each lateral shall receive one 1/16" diameter hole as low as possible in the cap.

The gravel retaining screen assembly prevents the possibility of gravel bed upset and must be included. Each filter tank shall have a gravel retaining screen assembly consisting of all necessary 2-inch Type 304 stainless steel angles.

Each filter tank shall be furnished and installed with a nonferrous underdrain system designed to uniformly distribute backwash water and for collection of filtered water. The distributor shall be of polypropylene construction.

A gravel support bed shall be incorporated in the bottom of each filter tank, consisting of five (5) layers of graded gravel, with the largest size gravel loaded into the filter first and the succeeding smaller sizes placed on top.

Each filter shall be provided with GreensandPlus™ filter media manufactured by Inversand Company to form an 18-inch bed depth. In addition to the GreensandPlus™ filter media, the Filter Manufacturer shall provide specially graded anthracite to form an 18-inch bed depth. The GreensandPlus™ media and anthracite bed depth shall total 36-inches. All filter media shall be accepted under NSF Standard 61.

A differential pressure transmitter shall be installed for each filter. A pressure gauge shall be installed for each filter inlet and outlet.

Each filter shall be equipped with an electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe. The filtration system shall be controlled via the Main Control Panel.

#### PFAS Removal System

The PFAS removal system shall be a vertical pressure-type PFAS removal system for operation in series. The removal system shall be specifically designed to provide filtration and treatment for PFAS removal

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and shall operate in a lead-lag configuration. The vessel media shall consist of granular activated carbon in the lead vessel and ion exchange resin in the lag vessel. Potassium hydroxide for pH adjustment and sodium bisulfite for dechlorination shall be fed ahead of the filtration system.

There will be three (3) identical systems operating in parallel. Each system shall include two (2) identical pressure vessels, (1) piping and valve manifold, and interconnecting piping. Each system shall meet the following requirements:

- Vessel Diameter: 10-feet.
- Maximum System Flow Rate: 520 gpm.
- Minimum System Flow Rate: 390 gpm.
- Lead Vessel Media: GAC
  - o GAC Minimum EBCT: 10 minutes.
- Lag Vessel Media: ion exchange.
  - o Ion Exchange Minimum EBCT: 3 minutes.

The pressure vessel systems shall be designed to treat the raw water with the following typical characteristics:

Parameter	Influent
pH	8.0-8.2
Temperature	50-55°F
PFAS6 (ppt)	43.2-81.4

Effluent Water Quality Requirements:

Parameter	Effluent
PFAS6	ND
GAC Minimum Bed Volumes Treated*	40,000
IX Minimum Bed Volumes Treated*	120,000
pH	8.0-8.2

\*Minimum bed volumes treated per vessel, per batch of media

The PFAS removal system will have the following design characteristics:

Maximum clean bed headloss at maximum system flow rate through the pressure vessel system	20psi
Maximum system operating pressure	75 psi
Maximum height of pressure vessel and influent piping	22'-6"
Maximum footprint of pressure vessel system	31'-4" long by 12'-9" wide

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The pressure vessels shall be fabricated of carbon steel, conforming to ASTM A516 grade 70, approximately 10' diameter with elliptical top and bottom heads. The straight side height of each vessel shall be sized to contain:

- Approximately 700 cubic feet of GAC (as specified in Section 11203) and to accommodate approximately 30% bed expansion at 50°F with one foot of freeboard within the straight side of the vessel using GAC.
- and approximately 240 cubic feet of IX resin.

Each vessel shall be designed and furnished with an underdrain system that provides uniform distribution of the treated water, facilitates GAC removal without the need to open a manway, and allows the replacement of the underdrain without the need to remove external piping. The underdrain system shall be designed to contain the media within the vessel and be constructed of stainless steel. The underdrain system provided shall be compatible with both GAC media and ion exchange resin.

Each vessel shall include the following features:

- Two (2) 14" x 18" elliptical diameter manways with a spare gasket.
- One (1) 20" diameter manway with a spare gasket (with a davit).
- Flange pad or nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs.
- Four (4) sample ports.

The sample ports shall be located above the underdrain system to provide water level indication during initial water fill before media loading and to provide tracking of PFAS6 breakthrough through the vessel bed during normal operations. Each of the sample ports shall be connected to a ½" diameter vertical stainless-steel pipe with the stainless-steel ball valve at the end, installed approximately five (5) feet above ground level. The sample ports locations shall correspond with the following GAC media depths (applies to both GAC and IX treatment vessels):

- 100% bed depth (top of bed).
- 75% bed depth.
- 50% bed depth.
- 25% bed depth.

Media fill and discharge lines shall be fitted with hose connections, such that media transfer to and from the vessels can be facilitated using media transfer hoses. These connectors shall be 4" Quick Disconnect Adapters constructed of aluminum. Two (2) flush connections shall be provided on each media fill line, one upstream and one downstream of the fill valve. One (1) flush connection shall be provided on each media discharge line, downstream of the discharge valve.

The influent and effluent pipe for each vessel shall be provided with an NSF-61 approved reinforced rubber expansion joint that allows 4-way movement and 30° angular misalignment.

#### GRANULAR ACTIVATED CARBON (GAC) MEDIA

The GAC shall be made from selected grades of bituminous or sub-bituminous coal capable of withstanding repeated backwash procedures without significant change in physical sizes and shall be suitable for reactivation and re-use. Only coal-based GAC with MassDEP New Technology Approval for PFAS removal will be acceptable.

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The PFAS Filter Manufacturer shall conduct a small-scale pilot study at Well Station 4 using shortened GAC media beds to confirm it can meet or exceed the bed life (number of treated water bed volumes) required herein.

A minimum 700 cubic feet of GAC media shall be provided per pressure vessel. The final volume per vessel shall depend on the results of the small-scale pilot study. The GAC media will be chosen from the following list:

- Calgon Carbon, Filtrasorb 400 AR+ PH, approved on 5/6/2022.
- Evoqua Water Technologies, 1240 AWLD, approved 3/16/2021.
- Carbon Activation Corporation, Norit GAC 400, approved 5/17/2022.

ION EXCHANGE (IX) RESIN

The IX shall be styrene-based polymer resin capable of removing per- and polyfluoroalkyl (PFAS) compounds in water treatment processes. Only buffered type IX with MassDEP New Technology Approval for PFAS removal will be acceptable.

The PFAS Filter Manufacturer shall conduct a small-scale pilot study at Well Station 4 using shortened IX media beds to confirm it can meet or exceed the bed life (number of treated water bed volumes) required herein.

A minimum 240 cubic feet of IX media shall be provided per pressure vessel. The final volume per vessel shall depend on the results of the small-scale pilot study. The ion exchange media will be chosen from the following list:

- Purolite, Purofine PFA694EBF, approved 11/4/2021.
- Calgon, CALRES 2301(buffered option), approved 10/15/2019.
- Dow Chemical Company, DOWEX PSR-2 Plus, approved 3/26/2019.

CHEMICAL FEED SYSTEMS

Four chemical feed systems are included in the treatment process: potassium hydroxide, sodium hypochlorite (pre-filtration and post filtration), sodium bisulfite, and sodium fluoride. Each chemical feed system includes redundant chemical feed pumps, day tank, bulk storage tank and transfer pumps for filling day tanks. Potential chemical spillage is contained within the chemical feed area. Each chemical feed system has its own containment area.

The electric solenoid diaphragm chemical metering pumps shall be positive displacement type metering pumps. The pumps shall be fully compatible with the chemicals being pumped. Metering pump shall be capable of dividing or multiplying pulse inputs from 1 to 999 or responding directly or inversely to a 4-20mA input signal. Design criteria for the pumps are listed in the following table:

Feed System	Number of Pumps	Max. Feed Rate (GPH)	Min. Feed Rate (GPH)	Max. Injection Pressure (PSI)	Liquid End Construction
KOH	2	5.37	1.67	65	316 SS
Pre-filtration NaOCl	2	1.32	0.30	75	PVC



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Feed System	Number of Pumps	Max. Feed Rate (GPH)	Min. Feed Rate (GPH)	Max. Injection Pressure (PSI)	Liquid End Construction
Post-filtration NaOCl	2	1.23	0.40	25	PVC
NaHSO3	2	0.38	0.008	65	PVC
NaF	1	3.72	1.16	64	PVC

Metering pumps shall be supplied with a four-function valve capable of providing positive anti-siphon, back pressure, priming aid – line pressure release, and pressure relief. Sodium Hypochlorite metering pumps shall be supplied with a four-function valve with automatic priming to allow for constant removal of gas and vapors in the line.

Each metering pump shall be supplied with external cables for start/stop control and 4- 20 mA control. If required, an analog to digital converter shall be provided.

Sodium Fluoride (NaF) is added for fluoridation. The chemical solution is prepared on a continuous basis by potable water flowing through a bed of fluoride and dissolving the fluoride to saturation concentration within a fluoride saturator. NAF shall be stored in a 55-gallon saturator tank and shall include an overflow assembly. The saturator and overflow assembly shall be provided with a solenoid valve, float switch, and mechanical float shutoff valve to facilitate automatic operation of the fluoride saturator. The float switch shall be located within the saturator and shall be connected to the solenoid valve, which controls potable water flow into the saturator. Flow into the saturator is initiated when the tank level drops and the float switch signals for the solenoid valve to open. Flow into the saturator shall continue until the float switch returns to the manufacturer-specified level, at which point the float switch shall signal for the solenoid valve to close. A disc water meter indicates the process water flow rate locally.

Pressure Gauges: Each chemical feed system shall be supplied with a pressure gauge for reading discharge pressure.

Metering pumps shall be provided with a freestanding mounting system consisting of a FRP framing system and mounting board. The freestanding mounting system shall have a minimum of four support legs.

The chemical transfer pumps shall be magnetic drive centrifugal transfer pumps. The pumps shall be fully compatible with the chemicals being pumped. One (1) magnetic drive centrifugal transfer pump shall be supplied for the following chemical feed systems: potassium hydroxide, pre-filtration sodium hypochlorite, post filtration sodium hypochlorite, sodium bisulfite. The plastic body chemical pumps 3 HP or less shall have horizontal, heavy-duty, TEFC electric motor, suitable for 460-volt, 3-phase, 60-Hz AC power supply. Motors shall be chemical mill duty rated with corrosion resistance.

Feed System	Number of Pumps	Design Capacity (gpm)	Pump Design Head (ft)	Min. Motor Size (hp)	Max. Motor Speed (rpm)	Shut-Off Head (ft)
KOH	1	50	25	1	3450	33
Pre-filtration NaOCl	1	27	13.8	1/2	3450	21
Post-filtration NaOCl	1	23	11	1/2	3450	21
NaHSO3	1	23	11	1/2	3450	21

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A spring-loaded switch will be provided for chemical transfer pump operation. When switch is turned clockwise, the pump shall energize and shall return left to the OFF position once the switch is released. The transfer pump control switch shall be installed on the metering pump table backer board, within sight of the transfer pump and the day tank.

**CHEMICAL STORAGE TANK SCHEDULE**

Equipment	Capacity (gal)	Material
Potassium Hydroxide Bulk Storage Tank	3,000	HDXLPE
Sodium Hypochlorite Bulk Storage Tank	905	HDXLPE
Sodium Bisulfite Bulk Storage Tank	1,150	HDXLPE
Potassium Hydroxide Day Tank	230	HDXLPE
Sodium Hypochlorite Day Tank ( Pre-filtration)	70	HDXLPE
Sodium Hypochlorite Day Tank ( Post-filtration)	30	HDXLPE
Sodium Bisulfite Day Tank	30	HDXLPE
Fluoride Saturator	55	PE

**PROCESS PUMPS**

Feed System	Number of Pumps	Pump Type	Capacity (gpm)	Motor Size (HP)
Sludge Pumps	2	Multi- Stage in-line Vertical	50 gpm @ 24 ft TDH	1.5
Recycle Pumps	2	Multi- Stage in-line Vertical	30 gpm @ 254 ft TDH	5
Finished Water Pumps	3	Multi- Stage in-line Vertical	660 gpm @ 232 psi	50

## PROCESS CONTROL AND INSTRUMENTATION

The Town of Sharon has standardized their PLC system on Allen-Bradley CompactLogix™ 5380 Programmable Logic Controllers. The PLC shall be capable of stand-alone operation in the event of SCADA network or SCADA computer failure. Operator interface terminals (OIT) shall be Allen-Bradley Panel View Plus 7 Performance.

Electromagnetic flow meters and flow switches shall be installed. All electromagnetic flow meters shall be Badger, the Town of Sharon has standardized on this electromagnetic flow meter. No exceptions shall be allowed. One flow switch shall be installed on the feed line to each emergency shower, which shall be used to indicate emergency shower usage.

Pressure indicating transmitters and differential pressure indicating transmitters shall be installed.

Ultrasonic Level Transducers and Transmitters, Flood/Float Switches, Level Transducers shall be installed.

Each sample stream shall have a single analyzer assembly, pH, temperature, chlorine residuals will be monitored.

### Chemical Feed Metering Pumps

The KOH, NaOCl, NaHSO<sub>3</sub>, and NaF metering pumps shall be supplied with a pre-designed chemical feed interlock receptacle which shall include an HOA switch, emergency stop pushbutton, twist lock plug receptacle, integral lock-out timer, and local indicator light during Hand Operation. Any WTP equipment de-energized by an interlock shall be reset at the WTP MCP. Remote resetting of interlock conditions shall not be permitted.

**PRE-FILTRATION NaOCl FEED PUMP:** Pre-filtration NaOCl feed shall be paced based on the treatment plant water flow rate as measured by the Wells 2 & 3 raw and recycle flow meter. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the pre-filtration pump shall be selected by an H-O-A selector switch located on the pre-filtration NaOCl Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the Wells 2 & 3 raw and recycle flow meter shall shut down the pre-filtration chemical feed pump.

**POST-FILTRATION NaOCl FEED PUMP:** Post-filtration NaOCl feed shall be paced based on the combined PFAS filters effluent flow rate. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the post-filtration pump shall be selected by an H-O-A selector switch for disinfection located on the post-filtration NaOCl Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition at the filtered water flow meter shall shut down the post-filtration chemical feed pump. When operating the

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pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panels. Selection of “HAND” can only be performed at the Metering Pump Control Panel via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

**KOH FEED PUMP:** KOH feed shall be paced based on the Wells 2, 3, and 4 combined flow rate as measured by the PFAS Treatment Influent flow meter. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the metering pump shall be selected by an H-O-A selector switch for pH control located on the KOH Metering Pumps Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the PFAS Treatment Influent flow meter shall shut down the chemical feed metering pumps. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of “HAND” can only be performed at the KOH Metering Pump Control Panel via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

**SODIUM BISULFITE METERING PUMPS:** Sodium bisulfite feed shall be paced based on the Fe/Mn filter effluent flow rate. The chemical feed pumps are equipped with integral mode start/stop controls. Automatic or Manual control of the metering pump shall be selected by an H-O-A selector switch for pH control located on the sodium bisulfite Metering Pump Control Panels. The pumps can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panels H-O-A switch. The pump motor speed can be set manually by integral pump controls or remotely by the SCADA system. A no-flow condition as measured by the Fe/Mn filter effluent flow meter shall shut down the chemical feed metering pumps. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select “HAND” position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. “Pump in Hand” shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of “HAND” can only be performed at the KOH Metering Pump Control Panel via the selector switch, and “HAND” operation of the metering pumps cannot be completed in the SCADA system. In the “OFF” position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

**SODIUM FLUORIDE (NaF) CHEMICAL METERING PUMP:** NAF feed shall be paced based on the treatment plant water flow rate as measured by the combined PFAS filters effluent water flow meter. The chemical feed pump is equipped with integral mode start/stop controls. Automatic or Manual control of

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the metering pump shall be selected by an H-O-A selector switch located on the NAF Metering Pump Control Panel. The pump can be operated via the SCADA system (direct 4-20 mA signal) or manually using the integral pump controls and the Metering Pump Control Panel H-O-A switch. A no-flow condition as measured by the combined PFAS filtered water flow meter shall shut down the chemical feed metering pump. When the metering pump is in "AUTO" mode, it is controlled and operated via the SCADA system. When operating the pump in the manual mode (maintenance/service, calibration, etc.), the operator shall select "HAND" position on the Metering Pump Control Panel, which shall begin a timer in the Metering Pump Control Panel. The timer duration is operator selectable up to a maximum of 10 minutes, after which time the metering pump shall be de-energized. "Pump in Hand" shall be an alarm condition in SCADA and at the Metering Pump Control Panel. Selection of "HAND" can only be performed at the NAF Metering Pump Control Panel via the selector switch, and "HAND" operation of the metering pump cannot be completed in the SCADA system. In the "OFF" position the metering pump shall not run. A metering pump fault shall be reported in the SCADA system.

### Analyzers

**WELLS 2 & 3 RAW & RECYCLE WATER:** A combined pH and temperature analyzer shall measure pH and temperature of the Wells 2 & 3 raw & recycle water. High and low pH alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable.

**OXIDIZED WATER:** A combined chlorine residual, pH, and temperature analyzer shall measure chlorine residual, pH, and temperature of the oxidized water. High, high-high, low, and low-low chlorine residual alarm conditions shall be reported in the SCADA system. High and low pH alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. In the event of a high-high or low-low oxidized chlorine residual, the SCADA system shall de-energize the Well 2 Pumps and Well 3 Pump.

**FE/MN FILTERED WATER:** A combined chlorine residual, pH, and temperature analyzer shall measure chlorine residual, pH, and temperature of the Fe/Mn filtered water. High and low pH and chlorine alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable.

**PFAS FILTER INFLUENT WATER:** A combined chlorine residual, pH, and temperature analyzer shall measure chlorine residual, pH, and temperature of the PFAS influent water. Alarm conditions for pH and chlorine shall be reported in the SCADA system. Low-low or high-high pH alarm conditions (operator selectable setpoint) shall turn off Well 2 Pumps, Well 3 Pump and Well 4 Pump, and an alarm shall be reported in the SCADA system. A high-high chlorine alarm condition (operator selectable setpoint) shall turn-off Well 2 Pumps and Well 3 Pump, and alarm shall be reported in the SCADA system. The alarm set points shall be operator selectable.

**FINISHED WATER:** A combined chlorine residual, pH, and temperature analyzer shall measure chlorine residual, pH, and temperature of the finished water. Alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. Low-low or high-high finished water pH shall turn-off Well 2 Pumps, Well 3 Pump, Well 4 Pump and Finished Water Pumps, and an alarm shall be reported in the SCADA system. Low-low or high-high finished water chlorine reading shall turn off Well

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2 Pumps, Well 3 Pump, Well 4 Pump and Finished Water Pumps, and an alarm shall be reported in the SCADA system.

FINISHED WATER (100-ft sample Tap): A combined chlorine residual, pH, and temperature analyzer shall be used to measure chlorine residual, pH, and temperature of the 100-ft sample tap water. Alarm conditions shall be reported in the SCADA system. The alarm set points shall be operator selectable. Low-low or high-high 100-ft sample tap water pH shall turn off Well 2 Pumps, Well 3 Pump, Well 4 Pump and Finished Water Pumps, and an alarm shall be reported in the SCADA system. Low-low or high-high 100-ft sample tap water chlorine reading shall turn off Well 2 Pumps, Well 3 Pump, Well 4 Pump, and Finished Water Pumps, and an alarm shall be reported in the SCADA system.

Any well station equipment de-energized by an interlock shall be reset at the respective well station control panel. Remote resetting of interlock conditions shall not be permitted.

The SCADA software to be furnished and installed for the WTP shall be integrated with and work in harmony with the Town's existing SCADA systems associated with existing site facilities and off-site or remote facilities.

FINISHED WATER WET WELL; Sodium hypochlorite and sodium fluoride feed systems shall provide chemical treatment for finished water chlorine residual and dental health, respectively, to meet finished water quality goals. Finished water shall flow through one of two redundant pressure sustaining valves before entering the finished water wet well, which is approximately 23 feet wide by 47 feet long. Two of three 60-horsepower vertical in-line pumps shall pump finished water from the FWW through a 12-inch ductile iron main on Tree Lane. A level indicating transmitter shall measure water level in the FWW. High- and low-level float switches shall provide interlock controls of the well pumps and finished water pumps. The finished water pumps shall operate based on the water level in the Upland Road Storage Tank. A 12-inch ductile iron overflow pipe shall convey finished water to a bioretention basin southwest of the WTP. The overflow shall include a duckbill check valve for backflow prevention. The finished water wet well shall act as a break tank to reduce pressures through WTP. The finished water wet well shall not provide 4-log inactivation of viruses.

BACKWASH WASTE TANK: Filter backwash waste (backwash waste and filter to waste) from backwashed Fe/Mn filters and PFAS filters is directed to the Backwash Waste Tank (BWWT) located in the WTP lower floor. The WTP water quality analyzer flows shall also discharge by gravity into the BWWT. Each Compartment shall have a dedicated inlet pipe with a manual isolation butterfly valve to allow the Town to select the compartment that backwash waste shall enter. The tank floor shall slope towards a sump adjacent to the Water Treatment Plant access driveway for sludge collection. A 12-inch ductile iron overflow pipe shall convey backwash waste to a bioretention basin northeast of the Water Treatment Plant. The overflow shall include a duckbill check valve for backflow prevention. The operator shall select the "ONLINE" BWWT compartment for automatic operation in the SCADA system via the MCP OIT or the SCADA Server. Each backwash compartment shall be equipped with an ultrasonic transmitter (LIT-811A, LIT-811B, LIT-811C) to monitor the liquid level in the tank, which shall report a high and low alarm (operator selectable) in the SCADA system. Each backwash waste tank compartment shall be outfitted with a floating decanter. The decanters shall be manifolded and convey

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settled backwash water to the recycle pump suction header in the pipe gallery. One of two recycle pumps shall deliver recycle water to the Well 2 and 3 raw water pipe where an electromagnetic flow meter measures the recycle water flow rate. The recycle flow shall not exceed 5% of the Wells 2 and 3 raw water flow. The sludge will be removed through a truck connection. The overflow from the backwash waste tank will flow to the stormwater infiltration basin.

Security alarm system and fire alarm system will be installed.

A natural gas fired engine driven generator with sound attenuated weatherproof enclosures will be installed at the site. The alternating current generator will be 350 kW, three (3) Phase, 60 Hertz, 277/480 Volts, 4 wire. The generator engine shall have a unit mounted radiator water cooled.

Ductile iron pipes shall be installed as part of the project. All ductile iron pipes shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151). The ductile iron pipe shall be Class 52 and furnished in nominal 18-foot lengths, with Push-on or Mechanical Joints. The ductile iron pipe shall be double cement-mortar lined inside coating in accordance with AWWA C104 ANSI A21.4, latest edition. All ductile iron pipe shall have a bituminous outside coating in accordance with AWWA C151, latest edition. Prior to pressure and leakage tests, the piping shall be thoroughly flushed clean of all dirt, dust, oil, grease and other foreign materials in accordance with AWWA C651. A service shall be brought to each developed parcel of property along the water main route. Corporation cocks shall be installed for connecting all service to the new water mains. All existing services shall be maintained until the new service connections have been fully installed, chlorinated and tested. Unless otherwise specified, all pipe for services up to 2-inch diameter shall be copper tubing Type K, conforming to ASTM B88.

## APPROVAL CONDITIONS

Pursuant to the Department's authority under 310 CMR 22.04(7) to require that each supplier of water operate and maintain its system in a manner that ensures the delivery of safe drinking water to consumers, this approval is made subject to the following conditions:

1. All submittals required by this approval shall be directed to the Department's Southeast Regional Office Drinking Water Program unless otherwise specified. All submittals required by this approval shall reference the date of this approval letter and Record #24-WS24-0001-APP.
2. The PWS shall notify the Department, in writing, thirty (30) days prior to the completion of the facility modifications so that a final inspection can be conducted. The PWS shall not place the subject facility into service until such time as the Department conducts its final inspection of the completed treatment works and approves the use of the described facility in writing.
3. Construction shall be completed in strict accordance with the submitted plans. Any changes made to the submitted plans or specifications affecting the capacity, hydraulic conditions, operating units, functioning of water treatment processes or quality of water to be delivered, shall receive prior written approval of the Department's Southeast Regional Office Drinking Water Program.
4. The media used in the PFAS removal vessels shall be GAC in the lead vessel and an anionic resin in the lag vessel. The PWS shall adhere to the Manufacturer's requirements and the requirements contained in the Department's New Technology Approval.

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5. All sample taps within the treatment facility shall be a smooth-nosed style. No threads shall be on any sample tap.
6. The PWS shall update its Emergency Response Plan to incorporate the new facilities.
7. The PWS shall update its asset management plan, inventory, maintenance plan, and budget to include the new facilities.
8. The PWS shall, minimally, complete the EPA's "10 Questions for a Cybersecurity Dialogue with a Utility." The results shall not be submitted to the Department. The engineer shall certify that the work was done and the completed work shall be shown during the final inspection.
9. No later than sixty (60) days following the date of the Department's written approval to activate the modified facility, the PWS shall engage a third party to conduct a cybersecurity assessment. Free cybersecurity assessments are available from EPA. The PWS will receive an assessment report following completion of the assessment. Do not email or share the report with anyone. Contact the Department upon receipt of the assessment report and the Department will arrange to conduct an onsite review of the report.
10. All chemical tanks, carry pipes, and chemical injection locations shall be labeled in accordance with the Department's Guidelines And Policies for Public Water Systems ("*Guidelines*"). The bulk fill station shall be labeled with the chemical name, chemical formula, and 4-digit UN number.
11. Bulk and day chemical storage tank vents shall vent individually to the exterior of the facility. Bulk tanks shall not feed directly to a chemical feed pump, and no connection from a bulk tank shall bypass the day tank.
12. The PWS shall post an emergency contingency planning sheet in a readily visible part of the treatment facility as required and specified at *Guidelines* sections 7.2.9 and 12.1.1.
13. The PWS shall maintain the pH of the finished water (point of distribution system entry) at a level consistent with their corrosion control strategy. The Department will require full rounds of semiannual monitoring under the Lead and Copper Rule after granting final approval of the modified treatment facilities to go online. Please submit a new LCR sampling plan for approval at least thirty (30) days prior to anticipated activation of the water treatment plant.
14. The PWS shall, at a minimum, monitor and record the pH levels and chlorine residual levels of water entering the distribution system from the treatment facilities daily. The results shall be entered on the required water treatment reporting forms. Daily readings are being required in order to validate the accuracy of the continuous pH and chlorine residual monitoring equipment.
15. The PWS must establish its applicable Optimum Water Quality Parameters (OWQP) to comply with the Lead and Copper Rule (LCR) (310 CMR 22.06B). To accomplish this, the PWS will need to collect water quality samples from the finished water sample line, all other entry points (i.e., sample the source water; post-treatment if treatment is used), and from sites in the distribution system which represent water quality throughout the distribution system (e.g., coliform sampling sites). Water quality data shall be reported to the Department on Form LCR-WQA. Please contact



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Nicholas Shuler of the Southeast Regional Office at 617-418-0444 to verify the OWQP sampling protocol.

16. Instrumentation, monitoring equipment, and alarm systems must be properly maintained and calibrated at all times. Separate calibration logs for each instrument/monitor must be maintained.
17. Water Treatment Chemicals:
  - a) The PWS shall ensure that chemicals which may come in contact with the water or affect the quality of the water, are certified to be in conformance with ANSI/NSF Standard 60 or meet the food grade standards of the United States Pharmacopeia. Each chemical barrel delivered from the manufacturer must bear the NSF seal.
  - b) A properly certified operator shall be present when any deliveries of chemicals are made. Handling and storage of any chemical shall conform to the *Guidelines*. Chemical delivery procedures shall be posted at the facility.
  - c) The facility shall be equipped with appropriate quantities of personal protection equipment as directed by Safety Data Sheets (SDS) for the chemicals used on site. Such equipment shall include, but not be limited to, safety goggles, face shields, chemical aprons, chemical resistant gloves, hearing protection, fire extinguishers, litmus paper, first aid kit, etc. All staff working at the facility shall be trained in the use and proper application of the safety equipment. A copy of the SDS for each chemical used or stored shall be available at all times at the treatment facility.
  - d) The PWS shall have available appropriate laboratory equipment to monitor chlorine and pH. The equipment shall be on hand at the time of the final inspection.
  - e) The PWS shall report to the Department the amount of all chemicals introduced to the subject water supply in accordance with 310 CMR 22.15(4) of the Drinking Water Regulations of Massachusetts on a form approved by the Department.
18. The PWS shall implement best management practices regarding sodium hypochlorite to minimize the formation of chlorate.
19. In accordance with the submitted specifications, the Department's Guidelines And Policies for Public Water Systems, and AWWA Standard C-655, thorough consideration should be given to the impact of discharge of highly chlorinated water to the environment. If there is any possibility that chlorinated discharge will cause damage to the environment, a neutralizing chemical, as listed in AWWA standard C-655, shall be applied to the water to be wasted to thoroughly neutralize the chlorine residual remaining in the water. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.
20. A cross connection survey of the new treatment plant and renovated pumping stations shall be performed by a Massachusetts certified cross connection control surveyor prior to final inspection. Completed and signed standard cross connection control survey forms shall be provided to the Department at the time of final inspection. The PWS shall maintain copies of all cross-connection control documents.
21. The PWS shall maintain communication with its customers regarding any potential water service disruption during the project.

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22. The Operation and Maintenance (O&M) manual for each water treatment plant, including a spare parts list and parts order form, shall be updated to include the new chemical feed systems. This O&M manual shall contain information necessary for the operator of the water supply system to properly operate and maintain said system in accordance with the Department's Regulations, *Guidelines* and Policy 93-02 "Operation and Maintenance Manuals."
23. The following shall be prepared and available on site prior to the Department's final inspection of the completed facility: O&M manual; emergency contact sheet; chemical receiving procedure; alarm testing procedure; and quarterly alarm testing logs.
24. The PWS shall not place the treatment facility in service until such time as satisfactory post-treatment results for the following contaminants are provided to the Department from a Massachusetts-certified testing laboratory: bacteria, VOC's, secondary contaminants including iron and manganese, and PFAS. All sample results shall be submitted on standard Department reporting forms with the "SS" (Special Sample) boxes checked.
25. The PWS shall, prior to the construction of the facility, secure any and all approvals necessary for the ultimate disposal of the accumulated water treatment plant residuals in accordance with applicable rules and regulations. In addition, in accordance with the Department's *Guidelines* Chapter 5, Section 10, the PWS shall prepare and provide the Department with a written (electronic pdf document) Waste Disposal Plan including a detailed Residuals Management Plan prior to placing the facility on-line.
26. The PWS shall register its drywells with the Department's Underground Injection Control (UIC) Program using the application found online at: <https://www.mass.gov/underground-injection-control-uic> . Contact Joe Cerutti at 781-465-4123 for guidance.
27. The PWS shall provide the Department with a facility-staffing plan. The plan should detail staff coverage of the new facilities in accordance with the requirements of 310 CMR 22.11B of the Massachusetts Drinking Water Regulations. For this purpose, please be advised the Department has rated the Wells 2, 3, 4 treatment facility at a Grade II-T level.
28. Prior to the Department's final inspection, a Massachusetts Registered Professional Engineer shall submit a stamped certification of the completed works. The certification shall be accompanied by the following:
  - a. A statement certifying that the facilities have been constructed in accordance with the plans and specifications, and are in compliance with the Department's regulations, guidance, policies, and this approval.
  - b. A statement that the facilities are fully operational, tested and ready to be put on-line.
  - c. A statement certifying that the piping and facilities have been disinfected in accordance with the applicable ANSI/AWWA standards.
  - d. A statement certifying that pressure testing of the water mains has occurred, as applicable. A copy of the test results shall be submitted to this office. If a pressure test has not been performed then this office will require one according to the manufacturer's specifications. (See *Guidelines*, Section 9.7.6).
  - e. A form summarizing the critical chemical alarm testing results and other requirements as provided by the Department.

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29. During the final inspection, the applicant shall demonstrate the operation of the treatment processes, interlocking, alarms and the instrumentation and control system.
30. This permit approval does not grant water withdrawal to exceed those limits authorized by the PWS's Water Management Act Registration and Permit.
31. The Department recommends the PWS assess the vulnerability of the treatment plant and equipment and include the results of the assessment in any security planning.
32. The PWS shall submit a certification to the Department's Air Quality Program within 60 days of installing the emergency power generator. Instructions for the certification can be found at: <https://www.mass.gov/how-to/submit-a-compliance-certification-stationary-engine-or-turbine>.
33. All equipment installations, including horizontal and vertical pumps, shall be guarded in accordance with OSHA standard 1910.219 (rotating equipment) and OSHA standard 1910.212 (all moving equipment.) The PWS is responsible for ensuring compliance with all applicable safety regulations in addition to these specific citations. The review of this permit does not constitute a review of safety requirements under the purview of OSHA or the Massachusetts Department of Labor.

Both the Administrative and Technical Reviews of the following application has been completed: BRP WS24, Treatment Facility Construction > 1 MGD, #24-WS24-0001-APP. This approval pertains only to the water supply aspects of the proposal and therefore does not negate the responsibility of the owners or operators to comply with other applicable laws, and/or regulations.

# APPENDIX F

## Order of Conditions



# Sharon Wetlands Protection Bylaw



**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands  
**WPA Form 5 – Order of Conditions**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
 SE280-0653  
 MassDEP File #  
 eDEP Transaction #  
 Sharon  
 City/Town

## A. General Information

**Please note:**  
 this form has been modified with added space to accommodate the Registry of Deeds Requirements

**Important:**  
 When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. From: Sharon  
 Conservation Commission

2. This issuance is for (check one):  
 a.  Order of Conditions      b.  Amended Order of Conditions

3. To: Applicant:  
 a. Eric      b. Hooper  
 a. First Name      b. Last Name  
 c. Town of Sharon Department of Public Works  
 c. Organization  
 d. 217 R South Main Street  
 d. Mailing Address  
 e. Sharon      f. MA      g. 02067  
 e. City/Town      f. State      g. Zip Code

4. Property Owner (if different from applicant):  
 a. Town of Sharon      b. Town of Sharon  
 a. First Name      b. Last Name  
 c. 90 South Main Street  
 c. Organization  
 d. Sharon      f. MA      g. 02067  
 d. Mailing Address      f. State      g. Zip Code  
 e. Sharon      f. MA      g. 02067  
 e. City/Town      f. State      g. Zip Code

5. Project Location:  
 15 Tree Ln, 0 Moose Hill Pkwy, 12-17 Farnham Rd, Depot St, Moose Hill Pkwy (Refer to Locus Map)  
 a. Sharon      b. Sharon  
 a. Street Address      b. City/Town  
 c. 101-010-000; 80-27; 100-33;  
 c. Assessors Map/Plat Number      d. 101-010-000; 80-27; 100-33;  
 d. Parcel/Lot Number  
 Latitude and Longitude, if known: 42 d 12 m 6 s -71 d 18 m 4 s  
 d. Latitude      e. Longitude



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**A. General Information (cont.)**

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):  
 Norfolk  
 a. County Norfolk b. Certificate Number (if registered land) 162 & 356 (Tree Ln) 490, 50, & 95 (12-17 Farnham Rd)  
 4839 & 4842 (Tree Ln) 32164, 32293, & 32844 (12-17 Farnham Rd)  
 c. Book 10/19/2023 d. Page 1/15/2024  
 7. Dates: a. Date Notice of Intent Filed 10/19/2023 b. Date Public Hearing Closed 1/15/2024 c. Date of Issuance 1/26/2024  
 8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):  
 See Attached.  
 a. Plan Title \_\_\_\_\_  
 b. Prepared By \_\_\_\_\_ c. Signed and Stamped by \_\_\_\_\_  
 d. Final Revision Date \_\_\_\_\_ e. Scale \_\_\_\_\_  
 f. Additional Plan or Document Title \_\_\_\_\_ g. Date \_\_\_\_\_

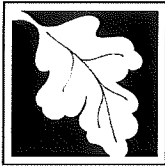
**B. Findings**

See Attached.

1. Findings pursuant to the Massachusetts Wetlands Protection Act:  
 Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:  
 a.  Public Water Supply b.  Land Containing Shellfish c.  Prevention of Pollution  
 d.  Private Water Supply e.  Fisheries f.  Protection of Wildlife Habitat  
 g.  Groundwater Supply h.  Storm Damage Prevention i.  Flood Control  
 2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

**Approved subject to:**

- a.  the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.



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**B. Findings (cont.)**

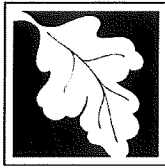
Denied because:

- b.  the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**
- c.  the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**
- 3.  Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) 0  
 a. linear feet

**Inland Resource Area Impacts:** Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. <input type="checkbox"/> Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. <input checked="" type="checkbox"/> Bordering Vegetated Wetland	6,765 (p) 29,513 (t) a. square feet	6,765 (p) 29,513 (t) b. square feet	c. square feet	d. square feet
6. <input type="checkbox"/> Land Under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
7. <input checked="" type="checkbox"/> Bordering Land Subject to Flooding	e. c/y dredged 10,367 (t) a. square feet	f. c/y dredged 10,367 (t) b. square feet	c. square feet	d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	g. cubic feet	h. cubic feet
8. <input type="checkbox"/> Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. <input checked="" type="checkbox"/> Riverfront Area	23,203 (p) 44,659 (t) a. total sq. feet	23,203 (p) 44,659 (t) b. total sq. feet		
Sq ft within 100 ft	768 (p) 26,513 (t) c. square feet	768 (p) 26,513 (t) d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	22,435 (p) 18,146 (t) g. square feet	768 (p) 26,513 (t) h. square feet	i. square feet	j. square feet





**Massachusetts Department of Environmental Protection**  
**Bureau of Resource Protection - Wetlands**  
**WPA Form 5 – Order of Conditions**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
 SE280-0653  
 MassDEP File # \_\_\_\_\_  
 eDEP Transaction # \_\_\_\_\_  
 Sharon  
 City/Town \_\_\_\_\_

**B. Findings (cont.)**

**Coastal Resource Area Impacts:** Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. <input type="checkbox"/> Land Under the Ocean	_____ a. square feet	_____ b. square feet		
	_____ c. c/y dredged	_____ d. c/y dredged		
12. <input type="checkbox"/> Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. <input type="checkbox"/> Coastal Beaches	_____ a. square feet	_____ b. square feet	_____ c. nourishment cu yd	_____ d. nourishment cu yd
14. <input type="checkbox"/> Coastal Dunes	_____ a. square feet	_____ b. square feet	_____ c. nourishment cu yd	_____ d. nourishment cu yd
15. <input type="checkbox"/> Coastal Banks	_____ a. linear feet	_____ b. linear feet		
16. <input type="checkbox"/> Rocky Intertidal Shores	_____ a. square feet	_____ b. square feet		
17. <input type="checkbox"/> Salt Marshes	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
18. <input type="checkbox"/> Land Under Salt Ponds	_____ a. square feet	_____ b. square feet		
	_____ c. c/y dredged	_____ d. c/y dredged		
19. <input type="checkbox"/> Land Containing Shellfish	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
20. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	_____ a. c/y dredged	_____ b. c/y dredged		
21. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	_____ a. square feet	_____ b. square feet		
22. <input type="checkbox"/> Riverfront Area	_____ a. total sq. feet	_____ b. total sq. feet		
Sq ft within 100 ft	_____ c. square feet	_____ d. square feet	_____ e. square feet	_____ f. square feet
Sq ft between 100-200 ft	_____ g. square feet	_____ h. square feet	_____ i. square feet	_____ j. square feet



**Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands**

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Provided by MassDEP:  
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**B. Findings (cont.)**

\* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23.  Restoration/Enhancement \*:

a. square feet of BVW

b. square feet of salt marsh

24.  Stream Crossing(s):

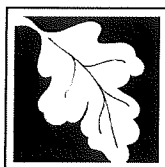
a. number of new stream crossings

b. number of replacement stream crossings

**C. General Conditions Under Massachusetts Wetlands Protection Act**

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
  - a. The work is a maintenance dredging project as provided for in the Act; or
  - b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
  - c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on 1/26/2027 unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

## WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

SE280-0653

MassDEP File #

eDEP Transaction #

Sharon

City/Town

### C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.
10. A sign shall be displayed at the site not less than two square feet or more than three square feet in size bearing the words,
 

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]  
"File Number                    SE280-0653 "
11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

## WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

SE280-0653

MassDEP File #

eDEP Transaction #

Sharon

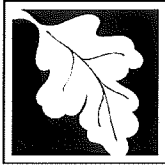
City/Town

### C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.
19. The work associated with this Order (the "Project")
  - (1)  is subject to the Massachusetts Stormwater Standards
  - (2)  is NOT subject to the Massachusetts Stormwater Standards

**If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:**

- a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.
- b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
  - i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
  - ii.* as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
  - iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

## WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

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### C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

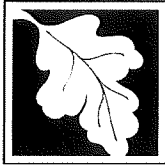
i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 19(f) through 19(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 19(f) through 19(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.



Massachusetts Department of Environmental Protection  
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## WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

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### C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

- g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
  2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
  3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.
- h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.
- i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.
- j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.
- k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.
- l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

Please see attached

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

**WPA Form 5 – Order of Conditions**

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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**D. Findings Under Municipal Wetlands Bylaw or Ordinance**

- 1. Is a municipal wetlands bylaw or ordinance applicable?  Yes  No
- 2. The Sharon Conservation Commission hereby finds (check one that applies):

- a.  that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

1. Municipal Ordinance or Bylaw \_\_\_\_\_ 2. Citation \_\_\_\_\_

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

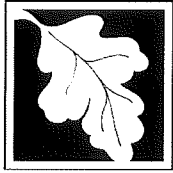
- b.  that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

CH 262 Town of Sharon Wetlands Bylaw  
1. Municipal Ordinance or Bylaw \_\_\_\_\_ 2. Citation \_\_\_\_\_

- 3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

See Attached.



Massachusetts Department of Environmental Protection  
 Bureau of Resource Protection - Wetlands  
**WPA Form 5 – Order of Conditions**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
 SE280-0653  
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### E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

1/26/2024  
 1. Date of Issuance

Please indicate the number of members who will sign this form.

4

This Order must be signed by a majority of the Conservation Commission.

2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

K. M. Cell  
 Signature  
Margaret D. Arguimbau  
 Signature  
Stephen M. Crum  
 Signature  
[Signature]  
 Signature  
 Signature  
 Signature  
 Signature

KEEVIN GELLER  
 Printed Name  
Margaret D. Arguimbau  
 Printed Name  
STEPHEN M. CRUM  
 Printed Name  
Susan Dasico  
 Printed Name  
 Printed Name  
 Printed Name  
 Printed Name  
 Printed Name

by hand delivery on

by certified mail, return receipt requested, on

Date

1/26/2024  
 Date



**FINAL APPROVED PLANS & OTHER DOCUMENTS LIST FOR DEP FILE NUMBER SE 280-0653**

Plan Title: Wells 2, 3, and 4 Water Treatment Plan Town of Sharon, MA Job No. 245-2103 October 2023 For Permitting  
Prepared By: Environmental Partners Group, LLC  
Signed & Stamped By: Adam Kran, PE and as noted  
Final Revision Date: October 18, 2023 (except as noted for Planting Plans on sheets L-1 and L-2)

G1 Drawing Index and General Notes  
V-1 Existing Conditions Locus/Key Plan  
V-2 Existing Conditions I  
V-3 Existing Conditions II  
V-4 Existing Conditions III  
V-5 Existing Conditions IV  
C-1 Civil General Notes and Legend  
C-2 Civil Water Treatment Plant Demolition, Sediment, and Erosion Control Plan  
C-3 Civil Water Treatment Plant Layout Plan  
C-4 Civil Water Treatment Plant Grading and Drainage Plan  
C-5 Civil Water Treatment Plant Utilities Plan  
C-6 Civil Water Treatment Plant Paving Plan  
CD-1 Civil Construction Details I  
CD-2 Civil Construction Details II  
CD-3 Civil Construction Details III  
CD-4 Civil Construction Details IV  
CD-5 Civil Construction Details V  
CD-6 Civil Construction Details VI  
CD-7 Civil Construction Details VII  
CD-8 Civil Construction Details VIII  
L-0 Planting Notes, Details, and Schedule  
L-1 Planting Plan **Revision Date: January 16, 2024**  
L-2 Planting Palette **Revision Date: January 16, 2024 (L-2 Planting Plan)**  
W-1 Water Main Plan I  
W-2 Water Main Plan II  
W-3 Water Main Plan III  
W-4 Wells 2 and 3 Horizontal Directional Drill Plan  
WD-1 Water Main Construction Details 1  
WD-2 Water Main Construction Details II  
WD-3 Water Main Construction Details III

Report Title: Wells 2, 3, and 4 Water Treatment Plant  
Stormwater Report Town of Sharon, Massachusetts [Includes Operation & Maintenance Plan]  
Prepared By: Environmental Partners Group, LLC  
Date: October 18, 2023

## 000 Upland Rd. (Tree Lane) Water Treatment Plant

## HEARING DATES – ACTION TAKEN

Opened November 2, 2023 – vote to continue  
 Continued to November 16, 2023 – vote to continue  
 Continued to December 7, 2023 – vote to continue  
 Continued to December 21, 2023 – vote to continue  
 Continued to January 4, 2024 – vote to accept Well 4 location (4 in favor - 0 opposed -1 abstain)  
 vote to continue, awaiting planting plan update  
 Continued to January 18, 2024 – Planting plan received. Hearing closed.

## DOCUMENTS RECEIVED DURING, AND ENTERED INTO, THE HEARING PROCESS:

September 26, 2023 Letter from Atty. Madeja and 4Sharon to Select Board  
 September 28, 2023 Letter from Philibert to DEP regarding PFAS Treatment facility  
 October 2, 2023 Table (Revised) Cost estimates by Xiaofeng Frank Xia - Pine Grove Ave  
 October 16, 2023 Wells 2, 3, 4 WTP Single EIR – EEA #16725  
 October 18, 2023 NOI PFAS Treatment Facility  
 Wells 3 and 4 Site Plans  
 Wells 3 and 4 Water Main Figures  
 October 30, 2023 Name removed MEPA 16725 Sharon Wells Comment Letter  
 November 2, 2023 Environmental Partners (EP) presentation – Wells 2, 3, and 4 Water  
 Treatment Plant  
 November 2, 2023 Receipt of DEP Number SE 280-0653  
 December 2, 2023 Letter from Atty. Madeja and 4Sharon - opposition to Well 4 site  
 December 6, 2023 Environmental Partners (EP) Response to DEP  
 December 6, 2023 Letter from Betsy Schneider - Pine Grove Ave resident  
 December 7, 2023 Letter from Abutters  
 Letter from Paul Lauenstein to Commission  
 January 4, 2024 Weston & Sampson - Third-party Groundwater Treatment Plant  
 Evaluation  
 Letter from Atty. Madeja for 4Sharon opposing Building at Well 4 site  
 January 16, 2024 Letter from Abutter Julia Tavares regarding proposed project conditions  
 January 18, 2024 Planting plan received

## WETLANDS PROTECTION ACT REGULATIONS

The following WPA regulations were referred to and used in arriving at the findings of and decision made by the Commission:

10.53 (1), (3), (3)(d)1, 2, 3, (7);

10.58 (1), (3), (4), (4)(d)(1), (5), (5)(c), (5)(g).

## FINDINGS

The Commission found that while there were treatment plant alternatives presented at the Well 2 and Well 3 sites, they were not practicable nor substantially equivalent, economically or environmentally, due to what the Commission believed were greater adverse impacts to interests protected under the Wetlands Protection Act from construction at those sites.

Two treatment plant options at Well 2 were dropped from consideration due to constraints related to the floodplain elevation, required earthwork, and the steepness of the access road once the facility was moved high enough out of the floodplain.

The Well 3 alternative that was considered would require three separate lengths of water main to be horizontally bored for 1,690 feet under the Beaver Brook resource area, including below the stream channel, bordering wetland, and floodplain. Important to consider is the fact that this Well 3 alternative would place the town's entire water supply within one 12-inch 1,690-foot-long main below the resource area as it is pumped back from Well 3 to the distribution system near Well 4. One of the other two 8-inch mains below the resource area, carrying raw water from Well 4 to Well 3 for treatment, would also be critical to the water supply. The third 8-inch main would carry raw water from Well 2 for treatment at Well 3. The Commission agrees with the third-party review anticipating the potential for serious impacts within the Beaver Brook resource area due to construction, future maintenance, or in the event of a failure.

The Well 4 option includes one 8-inch raw-water main horizontally bored from near Well 3 through the Beaver Brook resource area. This main is the same length and in the same location as the three mains associated with the Well 3 alternative. Loss of this raw water main for maintenance or to address a failure would not disrupt the town's ability to supply water nor would it require an expedient response. With additional time to engineer a solution, the potential for impacts to the resource area could be minimized.

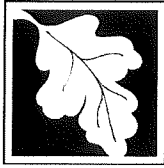
The area of construction impact to the riverway at Well 4 (23,203 sq. ft.) is less than the allowable 10% of the total riverfront area on the site (7.25 acres (315,870 sq. ft.) (10.58 4(d)1). Changes have been incorporated into the design in response to abutter concerns raised during the hearing process to help decrease that impact.

A suitable parcel exists to serve as mitigation under 310 CMR 10.58(5)(g) for the riverfront impacts of this project.

Therefore, after careful consideration of evidence presented during the hearing process by the applicants, consultants, and concerned abutters, the Commission issues the following Order of Conditions:

ORDER- in addition to “boiler plate” conditions, the following special conditions shall apply.

1. The Final Order of Conditions for DEP# SE280-0653 must be recorded with the Norfolk County Registry of Deeds, 649 High Street, Dedham, MA 02026.
2. After recording the original order with the Norfolk County Registry of Deeds, the applicant/owner must provide proof of recording with recording information to the Conservation Department before any site work begins.
3. No work is to commence until a DEP number sign is displayed at the site.
4. Work performed shall be per approved NOI site plans. Any changes or deviations within the Conservation Commission’s regulatory jurisdiction will require additional review and approval.
5. Erosion control measures shall be installed and inspected by the Conservation Administrator prior to the start of work.
6. The Conservation office shall be notified at least two business days prior to the start of the horizontal directional drilling.
7. Plantings done per the Planting Plan dated 1/16/2024 shall be 80% successful at the end of two full growing seasons. The growing season shall be defined as May 1<sup>st</sup> through September 30<sup>th</sup>. The first full growing season for plants put in after May 1<sup>st</sup> shall be the following year.
8. As mitigation for the riverfront impacts of this project, a Conservation Restriction (CR) shall be placed on a portion of Beaver Brook riverfront area on a parcel of land owned by the Water Department to the north of the subject parcel. The CR shall be consistent with the requirements of 310 CMR 10.58(5)(g). Recording of the CR at the Registry of Deeds shall occur prior to the issuance of a Certificate of Compliance for the project.



**Massachusetts Department of Environmental Protection**  
Bureau of Resource Protection - Wetlands

**WPA Form 5 – Order of Conditions**

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
SE280-0653  
MassDEP File #

eDEP Transaction #

Sharon

City/Town

**F. Appeals**

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department’s Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.



**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands  
**WPA Form 5 – Order of Conditions**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
 SE280-0653  
 MassDEP File #

eDEP Transaction #  
 Sharon  
 City/Town

### G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Sharon  
 Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Sharon  
 Conservation Commission

Please be advised that the Order of Conditions for the Project at:

15 Tree Ln, 0 Moose Hill Pkwy, 12-17 Farnham Rd, Depot St, Moose Hill Pkwy (Refer to Locus Map)

Project Location

SE280-0653

MassDEP File Number

Has been recorded at the Registry of Deeds of:

Norfolk

County

Book

Page

for: Town of Sharon  
 Property Owner

and has been noted in the chain of title of the affected property in:

Book

Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

DEP File Number:

**Request for Departmental Action Fee  
Transmittal Form**

Provided by DEP

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

**A. Request Information**

1. Location of Project

a. Street Address	b. City/Town, Zip
c. Check number	d. Fee amount

2. Person or party making request (if appropriate, name the citizen group's representative):

Name

Mailing Address

City/Town	State	Zip Code
Phone Number	Fax Number (if applicable)	

3. Applicant (as shown on Determination of Applicability (Form 2), Order of Resource Area Delineation (Form 4B), Order of Conditions (Form 5), Restoration Order of Conditions (Form 5A), or Notice of Non-Significance (Form 6)):

Name

Mailing Address

City/Town	State	Zip Code
Phone Number	Fax Number (if applicable)	

4. DEP File Number:

\_\_\_\_\_

**Important:**  
When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



**B. Instructions**

1. When the Departmental action request is for (check one):

- Superseding Order of Conditions – Fee: \$120.00 (single family house projects) or \$245 (all other projects)
- Superseding Determination of Applicability – Fee: \$120
- Superseding Order of Resource Area Delineation – Fee: \$120



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

DEP File Number:

## Request for Departmental Action Fee Transmittal Form

Provided by DEP

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

### B. Instructions (cont.)

Send this form and check or money order, payable to the *Commonwealth of Massachusetts*, to:

Department of Environmental Protection  
Box 4062  
Boston, MA 02211

2. On a separate sheet attached to this form, state clearly and concisely the objections to the Determination or Order which is being appealed. To the extent that the Determination or Order is based on a municipal bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.
3. Send a **copy** of this form and a **copy** of the check or money order with the Request for a Superseding Determination or Order by certified mail or hand delivery to the appropriate DEP Regional Office (see <https://www.mass.gov/service-details/massdep-regional-offices-by-community>).
4. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.





## APPENDIX G

Zoning Board of Appeals Special Permit Decision



DECISION ON APPLICATION FOR RENEWAL OF SPECIAL PERMIT

APPLICANT: Town of Sharon Department of Public Works by its consultant, Environmental Partners Group, LLC - Case No. 1927

PROPERTY LOCATION: 15 Tree Lane, Sharon, MA

By application (“Application”) filed with the Sharon Town Clerk on January 16, 2024, Town of Sharon Department of Public Works by its consultant, Environmental Partners Group, LLC. (“Applicant”), petitioned the Town of Sharon Zoning Board of Appeals for Minor Site Plan Review for the construction of a new water treatment plant and water mains for Wells 2, 3, and 4 at 15 Tree Lane, Sharon, MA (the “Property”), in order to come into compliance with current and proposed drinking water regulations for PFAS and for the removal of source water iron and manganese. These are as follows:

1. Applicant seeks approval under Section 10.6.4 , Minor Site Plan Review, as set forth in the Town of Sharon, MA Zoning Code, Division 1, Part 2, Chapter 275 of the Sharon Massachusetts By-Laws. Site plan review is required for the projects listed below:
  - a. Construction, exterior alteration, exterior expansion, or change of use within a municipal, institutional, commercial, or industrial project.
  - b. Residential projects involving three or more dwelling units; or
  - c. Construction or expansion of a parking lot for a municipal, institutional, commercial, industrial, or residential structure with 20 or more parking spaces.
2. Applicant also requests the granting of such other Special Permits, Variances, Findings, or any other relief which the Zoning Board determines requisite for the proposed use.

A hearing, duly noticed under the applicable statutes and Bylaw provisions was opened via Zoom Meeting on February 28, 2024, and continued on March 13, 2024, and closed as requested by the applicant. The voting members were Garber, Mehta & Wallenstein.

At the opening hearing, the Zoning Board of Appeals and the Applicant reviewed the following correspondence, a memo from the Kevin Davis, Agent of the Board of Health, dated February 22, 2024, and a memo from Conservation Administrator, Josh Philibert, dated January 30, 2024.

DECISION:

Having considered the Application, the evidence presented at the public hearing and all of the public records, the Zoning Board of Appeals voted 3-0-0 (Garber, Mehta, Wallenstein) to grant the Applicant a Minor Site Plan Review pursuant to Section 10.6.4 of the Zoning By-Law.

In rendering this Decision, the Zoning Board of Appeals notes that the Minor Site Plan review issued hereunder shall expire within twenty-four (24) months (exclusive of the time required to pursue or await the determination of an appeal referred to in M.G.L., Chapter 40A, Section 17) from the grant hereof if a substantial use thereof has not sooner commenced, except for good cause, or in the case of a permit for construction, if construction has not begun by such date, except for good cause.

Appeals, if any, shall be made pursuant to M.G.L. Chapter 40A, Section 17 and shall be filed within twenty days after the date of the filing of this Decision in the Office of the Sharon Town Clerk.

This Decision shall not take effect until a copy of the Decision bearing the certification of the Sharon Town Clerk that twenty (20) days have elapsed after the Decision has been filed in the Office of the Sharon Town Clerk and no appeal has been filed or that if such appeal has been filed, that it has been dismissed or denied, is recorded with the Registry of Deeds for the county and district in which the land is located and indexed, in the grantor index under the name of the owner of record or is recorded and noted on the owner's certificate of title.

IN WITNESS WHEREOF, the undersigned has executed this instrument under seal as of the date set forth below.

By: \_\_\_\_\_  
Joe Garber, Chair  
Town of Sharon Zoning Board of Appeals

Dated: \_\_\_\_\_, 2024

I, Joe Garber, Chairman of the Town of Sharon Zoning Board of Appeals, hereby certify on behalf of the Town of Sharon Zoning Board of Appeals that the foregoing is a true copy of the Decision of the Sharon Zoning Board of Appeals and that certified copies of the Decision referred to herein have been filed with the Planning Board and the Town Clerk.

By: \_\_\_\_\_  
Joe Garber, Chair  
Town of Sharon Zoning Board of Appeals

\*\*\*\*\*

Filed in the Office of the Town Clerk on the \_\_\_\_\_ day of \_\_\_\_\_, 2024.

\_\_\_\_\_  
Mark F. Hogan, Town Clerk

I, Mark F. Hogan, Town Clerk of the Town of Sharon, hereby certify that the foregoing is a true copy of the Decision of the Town of Sharon Zoning Board of Appeals dated \_\_\_\_\_ and filed with the Office of the Town Clerk on \_\_\_\_\_ and those twenty (20) days have elapsed after the date of such filing without the filing of any appeal on such Decision.

Dated: \_\_\_\_\_

\_\_\_\_\_  
Mark F. Hogan, Town Clerk

## EXHIBIT A

This Decision is subject to the following standard conditions:

### **Standard Conditions:**

- 1) The proposed structural expansion use shall be as shown on the Plans approved, as submitted by the Applicant dated November 20, 2023.
- 2) Any construction area shall be returned to the condition it was in prior to the commencement of construction.
- 3) The Premises shall be equipped with water conserving showerheads, water conserving faucets and water conserving flush toilets.
- 4) All fertilizers, pesticides and herbicides used at the Premises shall be organic and of the low nitrogen content variety.
- 5) The property will require further evaluation by the Sharon Board of Health to ensure that the septic system shall meet all current requirements. The septic system shall be maintained in accordance with the requirements of the Sharon Board of Health.
- 6) There shall be no garbage disposers or disposals at the Premises.
- 7) No sodium chloride (road salt) shall be used on any driveways or walkways at the Premises.
- 8) Only laundry detergents with no phosphorous shall be used at the Premises, and only dishwashing detergents with low phosphorous shall be used at the Premises.
- 9) Leaders for roof gutters must be directed into drywells.

This Decision is subject to the following special conditions:

### **Special Conditions:**

- 1) Neighbors to be included in discussion and review of planting plans within 12 months prior to installation.
- 2) Install public safety construction signage on Pine Grove Ave, Norwood Street, Tree Lane and Upland Road.
- 3) Traffic Mitigation – control and limit construction traffic on Tree Lane
- 4) Install 6-foot chain linked construction fencing with windscreen blockage.
- 5) Potential jersey barrier or gated road for pedestrian and children safety for entry at Pine Grove Ave and Tree Lane towards Upland Road.

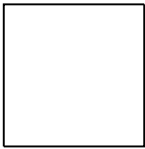


## APPENDIX H

### MassDEP Certification for Generator







**Massachusetts Department of Environmental Protection**  
**Environmental Results Program**  
**Installation Compliance Certification**  
**For New Emergency Engines and Emergency Turbines**

Facility Name \_\_\_\_\_

MassDEP Facility ID# (if known) \_\_\_\_\_

**A. Facility Information**

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Facility Location:

Facility Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Federal Employer ID # (FEIN) \_\_\_\_\_

2. Mailing Address and Contact Information:

Street/PO Box: \_\_\_\_\_ Email Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

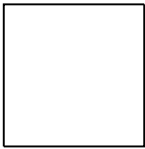
Telephone Number \_\_\_\_\_ Fax Number \_\_\_\_\_

Contact Person Name \_\_\_\_\_ Contact Person Title \_\_\_\_\_

**B. Compliance Information**

Complete and submit an Initial Compliance Certification form for *each* new emergency engine and emergency turbine that is subject to the Environmental Results Program (ERP) for Emergency Engines and Emergency Turbines. Answer all questions. **IMPORTANT NOTE:** Answering "No" to certain questions requires completion of the Return to Compliance form. In these cases, the notation "RTC" appears next to "No."

	Engine or Turbine	Genset
Manufacturer of Unit	_____	_____
Model #	_____	_____
Serial #	_____	_____
Rated Power Output (Engine or Turbine)	_____	N/A
Electrical Output (Kilowatts)	N/A	_____
Date Installed (MM/DD/YYYY)	_____	_____
EPA Certificate # for Unit (Oil-Fired Engines Only)	_____	_____
Date Operation Commenced (MM/DD/YYYY)	_____	_____



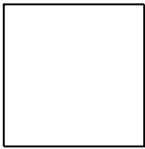
**Massachusetts Department of Environmental Protection**  
**Environmental Results Program**  
**Installation Compliance Certification**  
**For New Emergency Engines and Emergency Turbines**

Facility Name \_\_\_\_\_

MassDEP Facility ID# (if known) \_\_\_\_\_

**B. Compliance Information** (continued)

1. Is the new unit an emergency engine?  Yes – Go to Question 3  No
2. Is the new unit an emergency turbine?  Yes  No
3. Is the primary fuel to be burned natural gas?  Yes  No
- 4a. Is the primary fuel to be burned fuel oil?  Yes  No
- 4b. Are you only accepting delivery of fuel that meets the sulfur content limits pursuant to 310 CMR 7.05 (i.e., less than 15 ppm sulfur)?  Yes  No  
*Workbook Section 2.2.*
- 5a. For emergency engines burning fuel oil, have you attached to this certification a statement from the supplier that the engine has been issued, by the Administrator of the U.S. Environmental Protection Agency (EPA), a certificate of conformity stating that it meets the applicable emission standards?  Yes  No – RTC  
*Workbook Section 2.1.*
- 5b. For emergency engines burning natural gas, have you attached a letter or other documentation from your supplier that the engine meets the applicable non-road emission limitations that will satisfy the certificate of conformity requirement at the time of installation and is capable of compliance with the emission limitations for the first three years of operation?  Yes  No – RTC  
*Workbook Section 2.1.*
6. Is the unit equipped with a non-turn back hour counter?  Yes  No – RTC  
*Workbook Section 2.3.*
7. Will the emergency engine only operate during emergencies, and for up to 100 hours/year for maintenance checks and readiness testing (or as otherwise approved by EPA) including up to 50 hours/year for non-emergency use, as allowed by 40 CFR 63 part ZZZZ?  Yes  No – RTC
- 8a. Is the exhaust stack configured to discharge combustion gases vertically, and not equipped with any part or device that restricts the vertical exhaust flow of the emitted combustion gases?  Yes  No – RTC  
*Workbook Section 2.4.*



**Massachusetts Department of Environmental Protection**  
**Environmental Results Program**  
**Installation Compliance Certification**  
**For New Emergency Engines and Emergency Turbines**

\_\_\_\_\_  
 Facility Name

\_\_\_\_\_  
 MassDEP Facility ID# (if known)

**B. Compliance Information** (continued)

- 8b. Have you located the unit to minimize emission impacts on sensitive receptors, including but not limited to, people, windows and doors that open, and building fresh air intakes, by employing good air pollution control engineering practices? Such practices include avoiding locations that may be subject to downwash of the exhaust and providing sufficient stack height to minimize flue gas impacts upon sensitive receptors.
- Yes  No – RTC

*Workbook Section 2.4*

**For questions 8c and 8d, answer only the questions that apply to your unit's power output rating. If your unit is rated at less than 300 kilowatts, skip to Question 12.**

- 8c. If the unit has a power output rating of 300 kilowatts or greater, is the height of the stack a minimum of ten feet above the facility rooftop or unit enclosure, whichever is lower?
- Yes – If Unit is Below 1 Megawatt Go to Question 11; otherwise Go to Question 8d  No – RTC

*Workbook Section 2.4*

- 8d. If the unit has a power output rating of one megawatt or greater, is the height of the stack at least ten feet above and greater than 1.5 times above the height of the building, and higher than the height of any structure that is within 5L of the stack (5L being five times the lesser of the height or maximum projected width of the structure)?
- Yes – Go to Question 11  No – Go to Question 9

*Workbook Section 2.4*

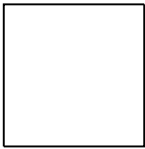
9. If you answered No to Question 8d, have you performed an analysis using an EPA dispersion model to determine that emissions will not cause a violation of the National Ambient Air Quality Standards?
- Yes  No – RTC

*Workbook Section 2.4.*  
*See Appendix 1 for data needs*

10. Did the analysis demonstrate that the stack emissions will not cause a violation of the National Ambient Air Quality Standards? (Attach a copy of the analysis to this certification form)
- Yes  No – RTC

11. Is the unit designed, and have you located the unit, so that when operated sound impacts upon sensitive receptors will be minimized and will be in compliance with 310 CMR 7.10 Noise?
- Yes  No – RTC

*Workbook Section 2.5.*



**Massachusetts Department of Environmental Protection**  
**Environmental Results Program**  
**Installation Compliance Certification**  
**For New Emergency Engines and Emergency Turbines**

\_\_\_\_\_  
 Facility Name

\_\_\_\_\_  
 MassDEP Facility ID# (if known)

12. Have you put in place procedures to maintain records as listed in Section 2.6 of the workbook?  Yes  No – RTC

**C. Certification Statement**

Note: Complete all required forms before signing this statement

I attest under the pains and penalties of perjury:

- I. That I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification statement;
- II. That, based on my inquiry of those individuals responsible for obtaining the information, the information contained in this submittal is, to the best of my knowledge, true, accurate, and complete;
- III. That systems to maintain compliance are in place at the facility and will be maintained even if processes or operating procedures are changed; and
- IV. That I am fully authorized to make this attestation on behalf of this facility.

I am aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

\_\_\_\_\_  
 Signature

\_\_\_\_\_  
 Print First Name

\_\_\_\_\_  
 Print Last Name

\_\_\_\_\_  
 Title

\_\_\_\_\_  
 Date of Certification (MM/DD/YYYY)

Source of Signatory Authority:

If a Corporation:

- President  Secretary
- Treasurer  Vice President\*
- Representative of the above\*\*

\* If authorized by corporate  
 \*\*If authorized by corporate vote and responsible for overall operation of the facility

If a Partnership:  General Partner

If a Sole Proprietorship:  Proprietor

If a Municipality or Public Agency:

- Principal Executive Officer
- Ranking Elected Official (empowered to enter into contracts on behalf of the municipality or public agency)

## **APPENDIX I**

DWSRF Construction Stage Loan Application Paperwork



APPENDIX A2

Certification Statements wording required in the BID PROPOSAL of contracts bid under the provisions of c.149 s 44A – 44J (Building Contract with filed Sub-bids)

Pursuant to M.G.L. Ch. 62C, s 49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes Required under law.

The undersigned bidder hereby certifies he/she will comply with the specific affirmative action steps contained in the Equal Employment Opportunity/Affirmative Action (EEO/AA) provisions of this Contract, including compliance with the Disadvantaged Business Enterprise provisions as required under these contract provisions. The contractor receiving the award of the contract shall incorporate the EEO/AA provisions of this contract into all subcontracts and purchase orders so that such provisions will be binding upon each subcontractor or vendor.

The undersigned certifies under penalties of perjury that there have been no substantial changes in his financial position or business organization other than those changes noted within the application since the applicant's most recent pre-qualification statement and that the bid is in all respects bonafide, fair and made without collusion or fraud with any other person.

c149 s44D (1)(b) "Person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity which sells materials, equipment or supplies used in or for, or engages in the performance of, the same or similar construction, reconstruction, installation, demolition, maintenance or repair work or any part thereof.

c149 s44E (2) The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to section forty-four A.

c149 s44E (3) The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provision of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulation promulgated thereunder; and is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(Date)

(Name of General Bidder)

(Federal Employer Identification No.)

By: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Title & Name of person signing bid)

\_\_\_\_\_  
(Business Address)

\_\_\_\_\_  
(City State, Zip)



## APPENDIX B DIESEL RETROFIT PROGRAM

The Department of Environmental Protection (“DEP”) has developed the Diesel Retrofit Program in response to increasing public health concerns with the emissions from diesel engines and vehicles.

### **Diesel Construction Equipment Standard**

All diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter “Diesel Construction Equipment”) must have the following pollution control device installed unless exempt as provided below:

1. Emission control technology verified by U.S. Environmental Protection Agency (“EPA”) or the California Air Resources Board (“CARB”) for use with non-road engines;
2. Emission control technology verified by EPA or CARB for use with on-road engines provided that such equipment is operated with diesel fuel that has no more than 15 parts per million sulfur content (i.e. Ultra Low Sulfur Diesel fuel); or
3. Emission control technology certified by the manufacturer that such technology meets or exceeds the emission reductions provided by on-road or off-road emission control technology verified by EPA or CARB, i.e. that a Diesel Oxidation Catalyst is achieving the following minimum emission reductions: particulate matter 20%; carbon monoxide 40%; volatile organic compounds 50%; or a Diesel Particulate Filter is achieving a minimum of 85% emission reductions for particulate matter.

Emission control devices, such as oxidation catalysts or particulate filters, shall be installed on the exhaust system side of the Diesel Construction Equipment. The Contractor shall be responsible to insure that the emissions control technology is operated, maintained, and serviced as recommended by the manufacturer.

For the latest up-to-date list of EPA verified-technologies, see:

<https://www.epa.gov/verified-diesel-tech>

For the latest up-to-date list of CARB verified technologies, see:

<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>

### **Exemptions**

The following Diesel Construction Equipment shall be exempt from the standard above. The Contractor shall include such Diesel Construction Equipment in the required recordkeeping:

1. Diesel Construction Equipment not owned by the Contractor and used in the performance of the work under this Contract for 30 calendar days (cumulative days but not necessarily consecutive) or less;
2. Unless otherwise exempt, additional Diesel Construction Equipment originally not anticipated to be used under the Contract or used as permanent replacement after the work under the Contract has commenced, for 15 calendar days from the date such Diesel Construction Equipment is brought on site;

**APPENDIX B (cont.)  
DIESEL RETROFIT PROGRAM**

3. Diesel Construction Equipment with an engine that meets the EPA particulate matter (PM) Tier emission standards in effect at the start of the Contract for non-road diesel engines for the applicable engine power group (e.g., as of January 1, 2009, a piece of Diesel Construction Equipment with a Tier 3 engine is exempt from meeting the standard until the piece of Diesel Construction Equipment is available with a Tier 4 engine) provided that if such emissions standards are superseded during the Contract then such Diesel Construction Equipment must be retrofitted in accordance with the standards above prior to the end of the Contract;
4. A large crane (e.g. a sky crane or link belt crane which is responsible for critical lift operations) if such device would adversely affect the operation of the crane provided the Contractor submits to the municipality's project engineer written technical justification documenting the adverse impact on operation; and
5. Diesel Construction Equipment that the project engineer has determined is necessary to control a compelling emergency including but not limited to, the need for rescue vehicles or other equipment to prevent harm to human beings or additional equipment required to address a catastrophic emergency such as structure collapse or imminent collapse. After the compelling emergency is controlled, such non-compliant equipment must be removed from the Contract site and may not be used in further performance of the work under this Contract. Meeting Contract deadlines is not a compelling emergency.

**Contractor Certification**

Each bidder shall submit as part of its bid, the Statement of Intent to Comply. Within 10 days of being notified that it has been awarded a contract, the bidder and each of its Contractors and Subcontractors shall submit a Diesel Retrofit Program Contractor Certification. Each such Certification shall contain the following information for each piece of Diesel Construction Equipment:

1. Contractor or Subcontractor name;
2. Equipment type, make, model;
3. Vehicle Identification Number or VIN;
4. Engine model and year of manufacture;
5. Engine HP rating;
6. Emission Control Device (ECD) type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
7. ECD make, model, and manufacturer;
8. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
9. ECD installation date;
10. Type of fuel to be used; and
11. Whether the equipment is owned or rented.

**Recordkeeping**

Each Contractor and Subcontractor shall maintain detailed records of all Diesel Construction Equipment used under the Contract, including the dates and duration times the Diesel Construction Equipment is

**APPENDIX B (cont.)**  
**DIESEL RETROFIT PROGRAM**

used at the Contract site. Records shall be available for inspection by DEP. Each Contractor and Subcontractor shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site.

For Diesel Construction Equipment that has an emissions control device with a manufacturer's certification, the Contractor shall maintain records of all supporting emissions test data and test procedures. If upon review the emissions reductions are not supported by the test data and test procedures, then the emissions control device may need to be replaced with a compliant retrofit device.

**Project Regulatory Agreement**

The following language shall be included section 4 (Covenants of the Borrower) of the municipality's Project Regulatory Agreement if it receives funds from the State Revolving Fund:

The Borrower shall require each Contractor and Subcontractor to submit the Diesel Retrofit Program Contractor Certification to DEP and the Borrower prior to commencing work on the Project. The Borrower shall not allow any Contractor or Subcontractor to commence work at the Project site prior to submitting such Certification.

**APPENDIX B (cont.)  
DIESEL RETROFIT PROGRAM**

**STATEMENT OF INTENT TO COMPLY**

*This form must be signed and submitted by the bidder as part of the bid.*

**Local Governmental Unit** \_\_\_\_\_ **SRF Project No.** \_\_\_\_\_

**Contract No.** \_\_\_\_\_ **Contact Title** \_\_\_\_\_

**Bidder** \_\_\_\_\_

**The undersigned, on behalf of the above-named Bidder, agrees that, if awarded the Contract:**

- 1. the Bidder shall comply with the Massachusetts Department of Environmental Protection's ("MassDEP") Diesel Retrofit Program by ensuring that all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard;**
- 2. the Bidder shall require all Subcontractors to comply with MassDEP's Diesel Retrofit Program by ensuring all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard; and**
- 3. The Bidder shall submit and shall require each Subcontractor to submit a Diesel Retrofit Program Contractor Certification (form attached) with a Diesel Retrofit List to MassDEP Municipal Services and the Bidder within 10 days of the bidder being notified that it has been awarded the Contract. The Bidder shall require each Subcontractor to update such Certification and List within 2 days of using additional Diesel Construction Equipment on the project under the Contract.**

\_\_\_\_\_  
**(Signature of Bidder's Authorized Representative)** **(Date)**

**APPENDIX B (cont.)**  
**DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION**

*Each Contractor and its Subcontractor(s) must sign and email this form to the DEP DMS project engineer, within 10 days after the contractor is awarded.*

**Local Governmental Unit** \_\_\_\_\_ **SRF Project No.** \_\_\_\_\_

**Contract No.** \_\_\_\_\_ **Contact Title** \_\_\_\_\_

**Contractor** \_\_\_\_\_

I, \_\_\_\_\_, an authorized signatory for \_\_\_\_\_, whose principal place of business is at \_\_\_\_\_ do hereby certify that any and all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter "Diesel Construction Equipment") have pollution control devices, such as oxidation catalysts or particulate filters, installed on the exhaust system side of the diesel combustion engine equipment in accordance with the Diesel Retrofit Program Standard.

I am submitting on behalf of \_\_\_\_\_ a list of all said Diesel Construction Equipment, labeled "Diesel Retrofit List," that will be used in connection with this Contract by \_\_\_\_\_. I hereby certify that the information on the attached Diesel Retrofit List is correct and accurate as of the date of signature. The List includes the following information for each piece of Diesel Construction Equipment:

1. Equipment type, make, model;
2. Vehicle Identification Number or VIN;
3. Engine model and year of manufacture;
4. Engine HP rating;
5. Emission Control Device ("ECD") type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
6. ECD make, model, and manufacturer;
7. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
8. ECD installation date;
9. Type of fuel to be used; and
10. Whether the equipment is owned or rented.

**APPENDIX B (cont.)**

**DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION**

\_\_\_\_\_ shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site. \_\_\_\_\_ shall maintain detailed records of all Diesel Construction Equipment used at the Contract site, including the dates and duration times the Diesel Construction Equipment is used at the Contract site. \_\_\_\_\_ shall make such records available for inspection by DEP. \_\_\_\_\_ shall ensure that the emissions control technology for each piece of Diesel Construction Equipment is operated, maintained, and serviced as recommended by the manufacturer. \_\_\_\_\_ shall retrofit prior to the end of the Contract any Diesel Construction Equipment no longer exempt from meeting the Diesel Construction Equipment Standard under exemption 3 (because it had an engine that met the EPA particulate matter (PM) Tier emission standards currently in effect at the start of the Contract for non-road diesel engines for the applicable engine power group and such emissions standards were superseded during the Contract).

I acknowledge that this certificate is being furnished as a requirement under this Contract and is subject to applicable State and federal laws, both criminal and civil. Signed under pains and penalty of perjury on this date \_\_\_\_\_.

Signature \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

**APPENDIX E  
CONSTRUCTION BID SPECIFICATIONS  
SPECIAL PROVISIONS FOR DISADVANTAGED BUSINESS ENTERPRISES  
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF MUNICIPAL SERVICES**

DISADVANTAGED BUSINESS ENTERPRISE PROGRAM BACKGROUND

In May 2008 a United States Environmental Protection Agency (EPA) rule became effective that changed the Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) Program to a Disadvantaged Business Enterprise (DBE) Program.

For firms to qualify under the old MBE/WBE program they needed to be socially disadvantaged and had to be certified by the Supplier Diversity Office (SDO). Under the new DBE rule, the firms must be both **socially** and **economically** disadvantaged, **citizens of the United States**, and certified as a DBE. Women and certain minorities are presumed to be socially disadvantaged. The economic disadvantage is measured by the owner's initial and continuing personal net worth of less than \$1,320,000.

Because the Clean Water Act requires the use of MBEs and WBEs, these firms will still be utilized in the State Revolving Fund (SRF) Loan Program, but they must also be certified as DBEs.

SDO will continue to be the certifying agency for the SRF program. SDO certifies firms under the federal Department of Transportation program, which is acceptable for use in the SRF program. An additional form has been added to the DBE package to verify that DBEs are owned or controlled by United States citizens.

**BID SPECIFICATIONS**

**I.** In this contract, the percentage of business activity to be performed by disadvantaged business enterprise(s) (DBE) shall not be less than the following percentages of the total contract price or the percentage submitted by the contractor in the Schedule of Participation, whichever is greater:

Disadvantaged MBE (D/MBE) 4.2%

Disadvantaged WBE (D/WBE) 4.5%

## II. DEFINITIONS

For the purpose of these provisions, the following terms are defined as follows:

- A. Awarding Authority – Entity that awards a prime contract under a State Revolving Fund loan.
- B. Bidder - Any individual, partnership, joint venture, corporation, or firm submitting a price, directly or through an authorized representative, for the purpose of performing construction or construction related activities under a Contract.
- C. Certified DBE – A DBE certified by the United States Small Business Administration, under its 8(a) Business Development Program (13 CFR part 124, subpart A) or its Small Disadvantaged Business Program (13 CFR part 124, subpart B); The United States Department of Transportation (DOT), under its regulations for Participation by DBSs in DOT programs (49 CFR parts 23 and 26); or SDO in accordance with 40 CFR part 33; provided that the certification meets the U.S. citizenship requirement under 40 CFR §33.202 or §33.203.
- D. Compliance Unit - A subdivision of MassDEP’s Affirmative Action Office designated to ensure compliance under these provisions.
- E. Contractor - Any business that contracts or subcontracts for construction, demolition, renovation, survey, or maintenance work in the various classifications customarily used in work and that is acting in this capacity under the subject contract.
- F. Construction Related Services - Those services performed at the work site ancillary to, and/or in support of, the construction work, such as hauling, trucking, equipment operation, surveying or other technical services, etc. For the purposes hereof, supply and delivery of materials (e.g. pre-cast concrete elements) to the site by a supplier who has manufactured those goods, or substantially altered them before re-sales shall be considered as “construction related services
- G. Construction Work - The activities at the work site, or labor and use of materials in the performance of constructing, reconstructing, erecting, demolishing, altering, installing, disassembling, excavating, etc, all or part of the work required by the Contract Documents.
- H. Disadvantaged Business Enterprise (DBE) - An entity owned or controlled by a socially and economically disadvantaged individual as described by Public Law 102-389 (42 U.S.C. 4370d) or an entity owned and controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note); a Small Business Enterprise (SBE); a Small Business in a Rural Area (SBRA); or a Labor Surplus Area Firm (LAF), a Historically Underutilized Business (HUB) Zone Small Business Concern, or a concern under a successor program.



- I. Equipment Rental Firm - A firm that owns equipment and assumes actual and contractual responsibility for renting said equipment to perform a useful function of the work of the contract consistent with normal industry practice
- J. Good Faith Efforts – The race and/or gender neutral measures described in 40 CFR 33, subpart C.
- K. HUBZone - A historically underutilized business zone, which is an area located within one or more qualified census tracts, qualified metropolitan counties, or lands within the external boundaries of an Indian reservation.
- L. HUBZone small business concern - A small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.
- M. Joint Venture - An agreement between SDO certified DBE and a non-DBE or non-DBE controlled enterprise.
  - 1. A pairing of companies will be considered a DBE joint venture if the SDO certified DBE which is part of the relationship has more than 51% of the profits that are derived from that project.
  - 2. A joint venture between a certified DBE subcontractor and a non DBE subcontractor, in which the DBE for that proportion of the joint venture’s contract equal to the DBE participation in the joint venture.
  - 3. Whenever a general bid is filed by a joint venture with a certified DBE participant in the joint venture that does not exercise more than 51% control over management and profits, that joint venture shall be entitled to credit as a DBE for that portion of the joint venture’s contract equal to the DBE participation in the joint venture. Minority As deemed by SDO.
- N. Labor surplus area firm (LSAF) - A concern that together with its first-tier subcontractors will perform substantially in labor surplus areas (as identified by the Department of Labor in accordance with 20 CFR part 654). Performance is substantially in labor surplus areas if the costs incurred under the contract on account of manufacturing, production or performance of appropriate services in labor surplus areas exceed 50 percent of the contract price.
- O. Letter of Intent – Certified document signed by the principal(s) of the DBE with respect to the work to be performed under contract.
- P. Local Government Unit (LGU) – A city, town, or municipal district which applies for a loan under the Clean Water Trust Program.
- Q. Material Supplier – A vendor certified by SDO as a DBE in sales to supply industry from an established place of business or source of supply, and that vendor.

1. Manufactures goods from raw materials, or substantially utilizes them in the work, or substantially alters them before resale, entitling the general contractor to DBE credit for 100% of the purchase order.
  2. Provides and maintains a storage facility for materials utilized in the work, entitling the general contractor to DBE credit for 10% of the purchase order
- R. Minority and Women Business Enterprise (M/WBE) – Any business concern certified by the SDO as a bona-fide M/WBE. A bona-fide M/WBE is a business whose minority group/women ownership interests are real, which have at least 51% ownership and control over management and operation.
- S. Percent of Total Price – Is the percentage to be paid to the DBE, work they perform, as compared to the total bid price
- T. Recipient - An agency, person or political subdivision which has been awarded or received financial assistance by the Trust or MassDEP.
- U. Small business, small business concern or small business enterprise (SBE) - A concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR part 121.
- V. Small business in a rural area (SBRA) - A small business operating in an area identified as a rural county with a code 6-9 in the Rural-Urban continuum Classification Code developed by the United States Department of Agriculture in 1980.
- W. SDO – The Supplier Diversity Office.
- X. Subcontractor – A company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.
- Y. Total Contract Price – The total amount of compensation to be paid for all materials, work or services rendered in the performance of the contract
- Z. Trust – The Massachusetts Clean Water Trust established by M.G.L. c.29.

### **III. REQUIREMENTS FOR CONTRACT AWARD**

DBE packages must be submitted by the two lowest bidders on the project. Following bid opening, the LGU shall notify the two lowest bidders to submit DBE packages to the LGU or the LGUs consultant, as directed. By the close of business on the third business day after notification, the two lowest bidders, including a bidder who is a MBE, WBE or DBE, shall submit the following information:

- A. A Schedule of Participation (Form EEO-DEP-190). The Schedule of Participation shall list those certified DBEs the bidder intends to use in fulfilling the contract obligations, the nature of the work to be performed by each certified DBE subcontractor and the total price they are to be paid.
  - 1. A listing of bona-fide services such as a professional, technical, consultant or managerial services, assistance in the procurement of essential personnel, facilities, equipment, materials, or supplies required for performance of the contract, and reasonable fees or commissions charged.
  - 2. A listing of haulers, truckers, or delivery services, not the contractors, including reasonable fees for delivery of said materials or supplies to be included on the project.
- B. A Letter of Intent (Form EEO-DEP-191) for each DBE the bidder intends to use on the project. The Letter of Intent shall include, among other things, a reasonable description of the work the certified DBE is proposing to perform and the prices the certified DBE proposes to charge for the work. A Letter of Intent shall be jointly signed by the certified DBE and the General Contractor who proposes to use them in the performance of the Contract.
- C. Each DBE must also sign and return the DBE Certification of United States Citizenship form to verify that the firm is owned or controlled by a United States citizen.
- D. The SDO “DBE Certification” as prepared by each certified DBE.
- E. A completed Request for Waiver form and backup documentation should the goals not be achieved (See IV below).

### **IV. REQUIREMENTS FOR MODIFICATION OR WAIVERS.**

The bidder shall make every possible effort to meet the minimum requirements of certified DBE participation. If the percentage of DBE participation submitted by the bidder on its Schedule of Participation (EEO-DEP-190) does not meet the minimum requirements, the bid may be rejected by the Awarding Authority and found not to be eligible for award of the contract.

In the event that the bidder is unable to meet the minimum requirements of DBE participation, the bidder shall submit with his/her submittal required in Section III. Requirement of Contract Award a Request for Waiver form (EEO-DEP-490). The Awarding Authority shall review the waiver request to determine if the request should proceed. If approved by the Awarding Authority, the Awarding Authority shall submit the waiver request and supporting documentation, with a recommendation to MassDEP within five days of receipt of the Request for Waiver. MassDEP in conjunction with the project manager, Compliance Unit, will determine whether the waiver will be granted.

The waiver request shall include detailed information as specified below to establish that the bidder has made a good faith effort to comply with the minimum requirements of DBE participation specified in Part I. In addition, the bidder must show that such efforts were undertaken well in advance of the time set for opening of bids to allow adequate response. A waiver request shall include the following:

- A. A detailed record of the effort made to contact and negotiate with the certified DBE, including, but not limited to:
  - 1. names, addresses and telephone numbers of all such companies contacted;
  - 2. copies of written notices(s) which were sent to certified DBE potential subcontractors, prior to bid opening;
  - 3. a detailed statement as to why each subcontractor contacted (i) was not willing to do the job or (ii) was not qualified to perform the work as solicited; and
  - 4. in the case(s) where a negotiated price could not be reached the bidder should detail what efforts were made to reach an agreement on a competitive price;
  - 5. copies of advertisements, dated not less than ten (10) days prior to bid opening, as appearing in general publications, trade-oriented publications, and applicable minority/ women-focused media detailing the opportunities for participation.
- B. MassDEP may require the bidder to produce such additional information as it deems appropriate.
- C. No later than fifteen (15) days after MassDEP receives all required information and documentation, it shall make a decision in writing, whether the waiver is granted and shall provide that determination to the bidder and Awarding Authority. If the waiver request is denied, the facts upon which a denial is based will be set forth in writing. If the waiver request is denied, the bid shall be rejected by the Awarding Authority, or the contract will be determined ineligible for SRF funding.

If a Request for Waiver is denied by MassDEP and the bid is rejected by the Awarding Authority, the Awarding Authority may then move to the second bidder on the project. At the Awarding Authority's discretion, it may collect a DBE package from the third bidder on the project.

## **V. DISADVANTAGED BUSINESS ENTERPRISES PARTICIPATION**

### **A. Reporting Requirements**

1. The Contractor's utilization of certified DBEs will be documented based upon submittal of the LGU's monthly Payment Requisitions as reported on Form-2000. The Form-2000 form will show all certified DBEs performing work on the project regardless of any billing activity for that month. For auditing and accounting purposes, the Contractor periodically may be required to submit copies of canceled checks verifying that payments have been made to the certified DBE as listed on the schedule. The Contractor may also be required to submit current schedules on utilization of all DBEs to indicate when their services will commence and be billed for.
2. During the life of the Contract, the Contractor's fulfillment of the percentage requirements in Part I shall be determined with reference to the Contract price as follows:
  - A. If the price in the Contract executed exceeds the base bid price (e.g., because an alternate was selected or because unit prices were used in awarding the Contract), the Contractor shall submit for approval by MassDEP a revised Schedule of Participation by certified DBEs satisfying the percentage requirements and such other information concerning additional DBE participation as may be requested by MassDEP.
  - B. If the Contract price increases after execution due to change orders or other adjustments, MassDEP may require the Contractor to subcontract additional work or to purchase additional goods and services from certified DBEs up to the percentages stated in Part I.

## **VI. COMPLIANCE**

- A. If the Schedule or any of the Letters of Intent are materially incomplete or not submitted in a timely manner, the LGU may rescind its vote of award; treat the bid informal as to substance and reject the bid. If the bid is incomplete in any other respect than the Schedule the LGU with the approval of MassDEP may waive the informalities upon satisfactory completion of the required information by the Contractor and the certified DBE as applicable.
- B. If the LGU finds that the percentage of certified DBE participation submitted by the contractor on its Schedule does not meet the percentage requirement in Part I, it shall rescind its vote of award and find such contractor not to be eligible for award of the contract.

- C. The Contractor shall not perform with its own organization, or subcontract to any other primary or subcontractor any work designated for the named certified DBEs on the schedule submitted by the Contractor under Part III without the approval of MassDEP.
- D. A Contractor's compliance with the percentage requirement in Part I shall continue to be determined by reference to the required percentage of the total contract price as stated in Section I even though the total of actual contract payments may be greater or less than the bid price.
- E. If the Contractor for reasons beyond its control cannot comply with Part III in accordance with the Schedule submitted under Part III, Section B, the contractor must submit to MassDEP as soon as they are aware of the deficiency, the reason for its inability to comply. Proposed revisions to the Schedule stating how the contractor intends to meet its obligations under these conditions must be submitted within ten (10) working days of notification.
- F. If the Contractor becomes aware by any means that that DBE is no longer certified, the Contractor shall immediately notify MassDEP. The Contractor shall use good faith efforts to retain a substitute certified DBE.
- G. If a certified DBE listed by the bidder in its Schedule of M/WBE contractors fails to obtain a performance or payment bond requested by the bidder, said failure shall not entitle the bidder to avoid the requirements of Part III (A). After a bidder has been awarded the contract, he shall not change the certified DBE listed in its Schedule at the time of the award or make any other such substitutions without the written approval of MassDEP.

## **VII. SANCTIONS**

- A. If the Contractor does not comply with the terms of these Special Provisions, the Awarding Authority may (1) suspend any payment for the work that should have been performed by a certified DBE pursuant to the schedule, or (2) require specific performance of the Contractor's obligation by requiring the Contractor to subcontract with a DBE for any contract or specialty item at the contract price established for that item in the proposal submitted by the Contractor.
- B. To the extent that the Contractor has not complied with the terms of these Special Provisions, the Awarding Authority may retain in connection with Estimates and Payments an amount determined by multiplying the bid price of this contract by the percentage in Section I, less the amount paid to DBE's for work performed under the contract and any payments already suspended under VII A.
- C. The Awarding Authority may suspend, terminate or cancel this contract, in whole or in part, or may call upon the Contractor's surety to perform all terms and conditions in the contract, unless the contractor is able to demonstrate his compliance with the terms

of these Special Provisions, and further deny to the Contractor, the right to participate in any future contracts awarded by the Awarding Authority for a period of up to three years.

- D. In any proceeding involving the imposition of sanctions by the Awarding Authority, no sanctions shall be imposed if the Awarding Authority finds that the contractor has taken every possible measure to comply with these Special Provisions or that some other justifiable reason exists for waiving these Special Provisions in whole or in part.
- E. The contract shall provide such information as is necessary in the judgment of the Awarding Authority to ascertain its compliance with the terms of these Special Provisions.
- F. A contractor shall have the right to request suspension of any sanctions imposed under this section upon demonstrating that he is in compliance with these Special Provisions.

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION  
 MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
 DIVISION OF MUNICIPAL SERVICES

**SCHEDULE OF PARTICIPATION FOR SRF CONSTRUCTION**

**Project Title:** \_\_\_\_\_ **Project Location:** \_\_\_\_\_

**Disadvantaged Minority Business Enterprise Participation in the SRF Loan Work**

Name & Address of D/MBE	Nature of Participation	Dollar Value of Participation
1.		
2.		
3.		
<b>Total D/MBE Commitment:</b>		<b>\$</b> _____
<b>Percentage D/MBE Participation = (Total D/MBE Commitment) / (Bid Price) =</b>		<b>%</b> _____

**Disadvantaged Women Business Enterprise Participation in the SRF Loan Work**

Name & Address of D/WBE	Nature of Participation	Dollar Value of Participation
1.		
2.		
3.		
<b>Total D/WBE Commitment:</b>		<b>\$</b> _____
<b>Percentage D/WBE Participation = (Total D/WBE Commitment) / ( Bid Price) =</b>		<b>%</b> _____

The Bidder agrees to furnish implementation reports as required by MassDEP to indicate the D/MBEs and D/WBE(s) which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

Name of Bidder: \_\_\_\_\_

Date: \_\_\_\_\_ By: \_\_\_\_\_  
Signature

NOTE: Participation of a DBE may be counted in only their certified category; the same dollar participation cannot be used in computing the percentage of D/MBE participation and again of D/WBE participation.





**DBE CERTIFICATION OF UNITED STATES CITIZENSHIP**

For the SRF program, under the EPA Disadvantage Business Enterprise (DBE) Rule, a DBE must be owned or controlled by a socially and economically disadvantaged person that is also a **citizen of the United States** (See 40 CFR 33.202). “Ownership” is defined at 13 CFR 124.105 and “control” is defined at 13 CFR 124.106.

DBEs are certified for the SRF program through the Supplier Diversity Office using the federal Department of Transportation (DOT) DBE rules. EPA allows the use of DBEs certified under the DOT rules as long as they are also United States citizens. To ensure compliance with the EPA rule, MassDEP must verify United States citizenship through the completion of the following form for each DBE used on the project.

SRF Project Number \_\_\_\_\_

Contract Number \_\_\_\_\_

Contract Title \_\_\_\_\_

DBE Subcontractor \_\_\_\_\_

The undersigned, on behalf of the above named DBE subcontractor, hereby certifies that the DBE firm is either owned or controlled by a person or persons that are citizens of the United States.

\_\_\_\_\_  
Printed Name and Title of DBE Signatory

\_\_\_\_\_  
DBE Signature

\_\_\_\_\_  
Date

**DISADVANTAGED BUSINESS ENTERPRISE**  
**PROGRAM DBE SUBCONTRACTOR PARTICIPATION**  
**FORM**

The United States Environmental Protection Agency (EPA) requires that this form be provided to all subcontractors on the project. At the option of the subcontractor, this form may be filled out and submitted directly to the EPA DBE Coordinator.

NAME OF SUBCONTRACTOR	PROJECT NAME
ADDRESS	CONTRACT NO.
TELEPHONE NO.	E-MAIL ADDRESS
PRIME CONTRACTOR NAME:	

Please use the space below to report any concerns regarding the above EPA-funded project (e.g., reason for termination by prime contractor, late payment, etc.).

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CONTRACT ITEM NO.	ITEM OF WORK OR DESCRIPTION OF SERVICES RECEIVED FROM THE PRIME CONTRACTOR	AMOUNT SUBCONTRACTOR WAS PAID BY PRIME CONTRACTOR
<div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="width: 45%; border-top: 1px solid black; padding-top: 5px;">Subcontractor Signature</div> <div style="width: 45%; border-top: 1px solid black; padding-top: 5px;">Title/Date</div> </div>		

**REQUEST FOR WAIVER FOR SRF CONSTRUCTION**

Upon exhausting all known sources and making every possible effort to meet the minimum requirements for DBE participation, the Bidder may seek relief either partially or entirely from these requirements by submitting a completed waiver package by the close of business on the third business day after notification by the LGU. Failure to comply with this process shall be cause to reject the bid thereby rendering the Bidder not eligible for award of the contract.

**General Information**

Project Title: \_\_\_\_\_ Project Location: \_\_\_\_\_  
Bid Opening (time/date) \_\_\_\_\_  
Bidder: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Telephone No. \_\_\_\_\_

**Minimum Requirements**

The bidder must demonstrate that good faith efforts were undertaken to comply with the percentage goals as specified. The firm seeking relief must show that such efforts were taken appropriately in advance of the time set for opening bid proposals to allow adequate time for response(s) by submitting the following:

- A. A detailed record of the effort made to contact and negotiate with disadvantaged minority and/or woman owned businesses, including:
  - 1. names, addresses, telephone numbers and contact dates of all such companies contacted;
  - 2. copies of written notice(s) which were sent to DBE potential subcontractors prior to bid opening;
  - 3. a detailed statement as to why each subcontractor contacted (i) was not willing to do the job or (ii) was not qualified to perform the work as solicited; and
  - 4. in the case(s) where a negotiated price could not be reached the bidder should detail what efforts were made to reach an agreement on a competitive price.
  - 5. copies of advertisements, dated not less than ten (10) days prior to bid opening, as appearing in general publications, trade-oriented publications, and applicable minority/women-focused media detailing the opportunities for participation;

- B. MassDEP may require the bidder to produce such additional information as it deems appropriate.
- C. No later than fifteen (15) days after submission of all required information and documentation, MassDEP shall make a determination, in writing, whether the waiver request is granted and shall provide that determination to the bidder and Awarding Authority. If the waiver request is denied, the facts upon which a denial is based will be set forth in writing.

CERTIFICATION

The undersigned herewith certifies that the above information and appropriate attachments are true and accurate to the best of my knowledge and that I have been authorized to act on behalf of the bidder in this matter.

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(authorized original signature)

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DATE



## APPENDIX F

### DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF WATER RESOURCES DIVISION OF MUNICIPAL SERVICES POLICIES

The Division of Municipal Services (DMS) has established the following policies for all Division financially-assisted projects.

#### **POLICY MEMORANDUM NO. PM-1**

#### **EASEMENTS AND RIGHTS OF WAY**

Prior to the approval of financial assistance for construction, the owner shall obtain and shall thereafter retain, a fee simple or such estate or interest in the site of construction and rights of access as will assure undisturbed use and possession for the purpose of construction and operation for the estimated life of the project. The Division may refuse to approve financial assistance until it has received from the owner sufficient assurances that such interests have been obtained. Unless the Division otherwise notifies the owner, the certificate (under pains and penalties of perjury) of the owner's legal representative shall constitute such sufficient assurance.

Additional cost which result from interruptions of construction or extensions of contract time caused by the owner's failure to obtain the necessary interests in land shall be ineligible for financial assistance, and all such additional costs shall be borne by the owner.

#### **POLICY MEMORANDUM NO. PM-2**

#### **PERMITS**

The owner shall be responsible for identifying and obtaining all federal, state, local and railroad permits required by the nature and location of construction, including but not limited to building construction permits and permits for street and highway cuts and openings, and all such permits shall be listed in a separate permits section of the contract documents. To the extent possible, such permits shall be obtained by the owner prior to the solicitation of bids for construction, and copies of all permits so obtained shall be included in the said permits section. The status of the application for each permit, including the permit conditions, and costs, not obtained prior to the solicitation of bids shall also be indicated in the contract documents permits section. The Division may refuse to approve financial assistance for construction unless and until it has received from the owner sufficient assurances that all necessary permits have been or will be obtained prior to the commencement of construction.

Policy Memorandum No. PM-2 – Permits (Con't)

The contractor shall be responsible for obtaining all permits required of his equipment, work force, or particular operations (such as blasting) in the performance of the contract and not otherwise specified in the two preceding paragraphs as to be obtained by the owner. These permit fees shall be paid by the contractor.

The owner shall be responsible for the payment of all other permit fees required by the construction.

The following permits shall not be eligible for financial participation by the Department of Environmental Protection (DEP).

- Permits and insurance for construction in railroads' rights of way;
- Building permits;
- Permits for opening public streets and other public or municipal rights of way;
- Permits for the use of explosives;
- Permits for the disposal of waste materials;
- Permits and fees for connecting to municipal utilities.

Permits required by extraordinary circumstances and not specifically excluded from eligibility above may be eligible for DEP participation. For such permits to be so eligible, the owner or his representative must notify the DEP project engineer in advance of obtaining such permit and receive from the engineer specific agreement that such permit will be eligible for DEP participation. Eligibility for such participation will not be made retroactively.

Additional costs which result from interruptions of construction or extensions of contract time resulting from the owner's or the contractor's failure to obtain the necessary permits may be ineligible for participation.

**POLICY MEMORANDUM NO. PM-3**

**FIELD CONTROLS**

The Owner shall be responsible for indicating on the contract drawings all easement limits and all property and other control lines for locating the principal component parts of the work together with those elevations and bench marks used in the design of the work, all hereinafter referred to as "field controls". Where easement and property limits have not previously been established in the field, the owner shall be responsible for establishment of such limits. From the information provided by the Owner, unless otherwise specified, the Contractor shall develop and make all layouts required for construction, such as slope stakes, batter boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.

Whenever he has reason to believe that an error exists or whenever he is otherwise unable to locate the field controls, the contractor shall promptly notify the owner and the owner's engineer of such error with appropriate documentation.



**POLICY MEMORANDUM NO. PM-4****RECORD DRAWINGS**

The Owner shall be responsible for the preparation of all record drawings required by this contract. This responsibility may be delegated to the Owner's representative. The responsibility for preparation of record drawings shall not be delegated or transferred to the contractor. They may use the contractor's and sub-contractor's certified AS BUILT drawings along with their own marked up set in the preparation of the Record Drawings.

Division approved contract drawings shall be revised upon completion of the contract to reflect any changes made and/or final quantities, as appropriate.

**POLICY MEMORANDUM NO. PM-5****PLAN SCALE**

Unless otherwise approved in advance by the Division, the horizontal scale for construction plans for non-structural facilities shall be 1" = 40'. A larger horizontal scale shall be used where appropriate to show sufficient detail to construct the project. The vertical scale for construction plans for non-structural facilities shall be 1" = 4'. Based on the best information available at the time of their preparation, the location of underground utilities and support structures for overhead utilities shall be shown on the plans.

Unless otherwise exempted in advance by the Division, construction plans shall be updated whenever the date of the advertisement for bids for the construction of such facilities is more than one year after the date of approval by the Division or EPA; and in the case of approval by both such agencies, the later approval date shall be used in determining the need for update.

The consulting engineer shall receive adequate compensation for updating plans and specifications, and such additional cost shall be eligible for assistance to the extent not otherwise prohibited by USEPA and Division regulations and program guidance.

All revision, or review without need for revision, shall be noted and dated on the plans prior to advertisement of the project for bid.

**POLICY MEMORANDUM NO. PM-6****BORINGS LOGS**

All soil borings shall be taken as close as practicable to the construction line, and the location of all such borings shall be clearly indicated on the contract drawings. The plan view shall show the location and boring number of each boring. The profile view shall show the location, elevation, and depth of each soil boring, the location of each change in soil stratum, the groundwater level, and the average of blow counts at each five foot interval. As a minimum, boring logs to be submitted with the plans and specifications shall show the name of the company taking the borings, the soil classification, the number of blows per foot of penetration, the groundwater elevation, and the date on which the borings were taken.

As part of the submission of plans and specification for approval, the owner's representative shall include written justification for the lesser frequency and depth of borings where their interval is more than approximately 300' or their depth is less than 50% below depth of pipe invert.

**POLICY MEMORANDUM NO. PM-7**

**BREAKDOWN OF BID ITEMS**

The following items shall, where applicable, be listed separately in the bid documents.

- 1. Mobilization
- 2. Pavement
  - a. Municipal
    - i. temporary
    - ii. permanent
  - b. State
    - i. temporary
    - ii. permanent
- 3. Concrete cradle or encasement  
(to be identified where applicable)
- 4. Rock-Excavation
- 5. Wood or steel sheeting left in place
- 6. Excavation of unsuitable materials below grade.
- 7. Select and/or borrow material
- 8. Dewatering
- 9. Special Dewatering (coffer dam)

Mobilization costs are the costs of initiating the contract, exclusive of the cost of materials. Payment for mobilization shall be a lump sum at the price bid for this item in the proposal and shall be payable when the contractor is operational on the site. For purposes of this policy, “operational” shall mean the substantial commencement of work on site.

The lump sum price bid for mobilization shall not exceed five per centum (5%) of the total amount of the bid.

**POLICY MEMORANDUM NO. PM-8**

**PAVEMENT**

All roads and trenches therein shall be refilled and repaved in accordance with specifications provided by the owner in the contract documents. Please note that this policy may be excludable on federally assisted projects where bid alternative items may be required (i.e. trench width vs. full width pavement). You are advised to seek project specific clarification.

Loan eligibility shall be limited to the following:

- A. Where the depth of the pipe invert is 0 to 8’, the maximum pavement widths which shall be eligible for financial assistance are as follows:

<u>Nominal Pipe Diameter</u>	<u>Maximum Eligible Widths</u>	
	<u>Initial Pavement</u>	<u>Permanent Trench</u>
0-24”	6’-6”	8’-6”

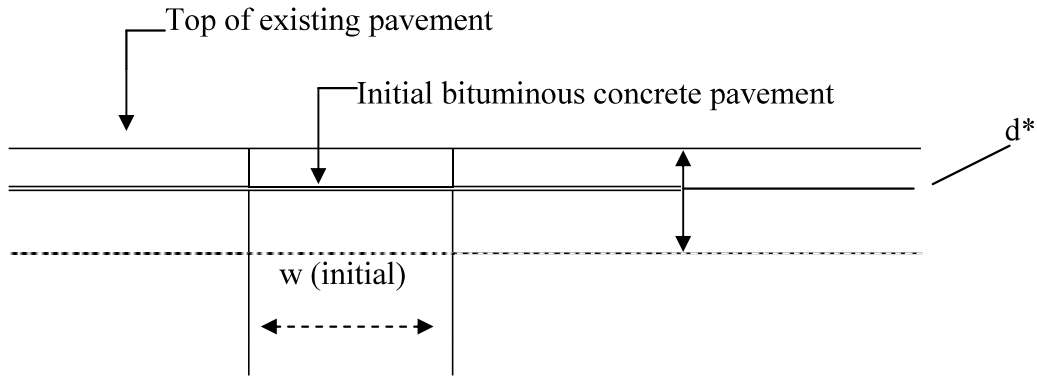
Where the nominal pipe diameter is greater than 24” the maximum eligible width for initial re-paving shall be the nominal diameter of the pipe plus four (4) feet, and for permanent trench re-paving the maximum eligible width shall be the nominal pipe diameter plus six (6) feet.

- B. For each additional four (4) feet (or fraction thereof) of pipe invert depth, add three feet to the eligible width limits stated in paragraph A.

Policy Memorandum No. PM-8 – Pavement (Con't)

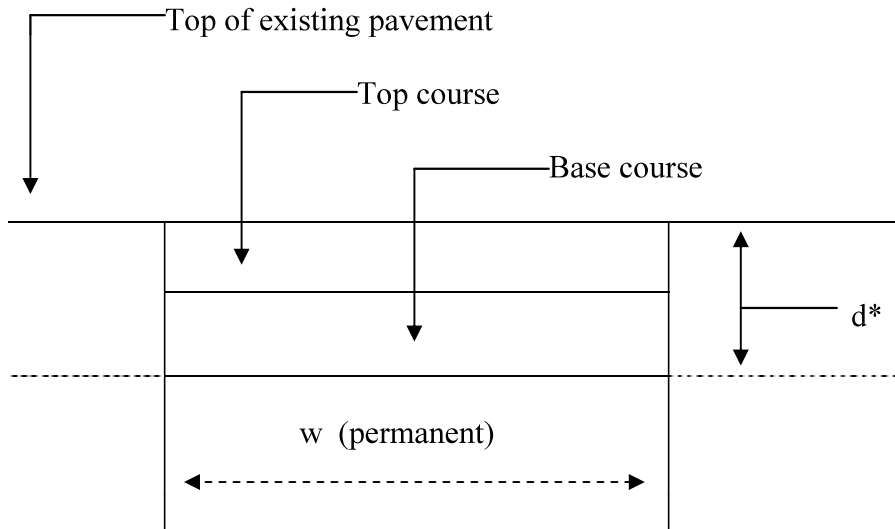
At the design phase of a project the owner has the option to elect either Initial Pavement with Option I (Permanent Trench replacement) or Initial with Option II (curb to curb over initial)

Initial Pavement



d\* = depth of existing pavement to a maximum of 3 inches (see general notes #3)  
w = maximum eligible Initial pavement width as described in paragraphs “A” & “B” on page DEP-DMS-CG’s-P4.

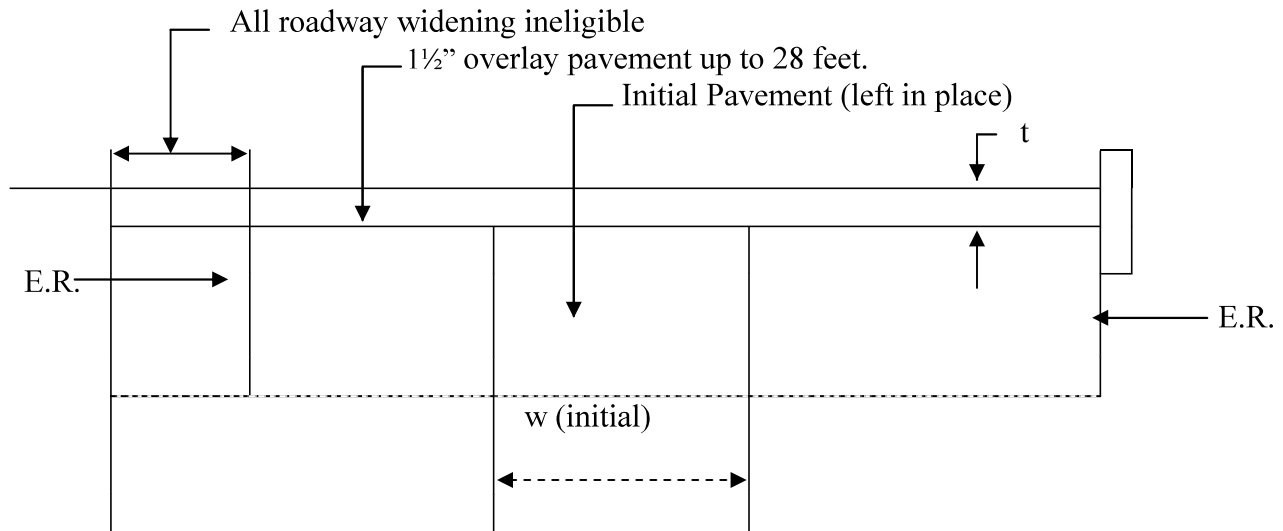
OPTION I Permanent Trench Pavement



d\* = depth of existing pavement trench to a maximum of 3 inches (see general notes #3)  
w = maximum eligible permanent pavement width as described in paragraphs “A” & “B”.  
equals initial width plus 2 feet and includes:

- Cutting edges for the permanent trench
- Removal of initial patch plus two feet of existing pavement
- Fine grading/compacting gravel
- Placement of Permanent Trench pavement in two courses.

OPTION II Curb to Curb Pavement (overlay pavement for roadways up to 28 feet)



E.R.= edge of existing paved roadway

t = one and one half inch (1 1/2") overlay of bituminous concrete pavement

GENERAL NOTES:

1. Repavement of settled areas and crown restoration within the trench limits shall be the responsibility of the contractor.
2. Leveling outside the trench limits shall be the responsibility of the owner.
3. Sewer trench re-fill and pavement re-paving on public ways under the jurisdiction of the Massachusetts Department of Public Works, the Metropolitan District Commission, or other such agency shall be in accordance with permit(s) issued therefore by that Department or Commission, as the case may be.
4. The Division will consider requests for increase in the participating pay limits defined in paragraphs A and B, when such increases are, in the Division's opinion, reasonable. Such requests should be documented in writing and submitted to the Division in a timely manner.
5. Projects which deviate from the above options are required to seek Division review and approval.

**POLICY MEMORANDUM NO. PM-9**

**PIPE TESTING**

Monthly payment estimates shall be prepared in accordance with contract documents. All pipe shall be tested in accordance with the contract documents and sound engineering practice. If, after 60 days following submission of a monthly payment estimate for pipe items, the pipe for which payment is requested has not been successfully tested, the owner may withhold up to 10% of the amount requested for such pipe items until the pipe has been so tested. However, in the case of a major (pipe diameter 24 inches or greater) interceptor pipe installation, sums retained by the owner pursuant to this policy memorandum shall not exceed two per centum (2%) of the costs of such pipe items.

**POLICY MEMORANDUM NO. PM-10**

**CHANGE ORDERS**

Executed change orders submitted to the Division for review and processing for financial assistance must be prepared on the attached Change Order Forms (PM-10, Attachment 1, pages A-1 & A-2) with a duplicate copy, calculation sheet(s) (PM-10, Attachment 2), and all other supporting documentation necessary for evaluation. Failure to comply with these instructions will result in delays in processing the change order and/or limited financial assistance.

M.G.L. c.44, s.31C requires that the auditor, accountant, or other municipal officer having similar duties must certify that adequate funding in an amount sufficient to cover the total cost of the change order has been made. Change orders will not be processed or approved until this certification is made on the face of the Change Order Form (PM-10 Attachment 1).

Payment of Change Orders:

Payment of all change orders shall be in accordance with the relevant provisions of Massachusetts General laws, Chapter 30, Section 39G for non-building construction and Section 39K for building construction.

Payment of change orders shall be made in accordance with one of the following three methods:

- A. Existing unit prices as set forth in the contract; or
  - B. Agreed upon lump sum or unit prices; or
  - C. Time and materials
- A. Payment for work for which there is a unit price in the contract:

Where the contract contains a unit price for work and the Engineer orders a change for work of the same kind as other work contained in the contract and is performed under similar physical conditions, the contractor may accept full and final payment at the contract unit price(s) for the acceptable quantities.

Policy Memorandum No. PM-10 – Change Orders (Con't)

B. Payment for work or materials for which no price is contained in the contract:

If the Engineer directs, the contractor shall submit promptly in writing to the Engineer and offer to do the required work on a lump sum or unit price basis, as specified by the Engineer. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

- (1) The estimated cost of labor, plus
- (2) Direct Labor Cost, plus
- (3) Material and Freight Costs, plus
- (4) Equipment Costs, plus
- (5) An amount not to exceed 20% of the sum of items (1) through (4) for overhead and profit, plus (if applicable),
- (6) In the case of work done by a subcontractor an amount not to exceed 7 ½ %, for the general contractor of the sum of items (1) through (4) for his overhead and profit, less, if applicable,
- (7) Credits for work deleted from the contract.

C. Payment for work on a time and materials basis:

Unless an agreed lump sum and/or unit price is obtained from above and is so stated in the change price, the contractor shall accept as full payment for which no other agreement is contained in contract, and amount equal to:

- (1) The estimated cost of Labor, plus
- (2) Direct Labor Cost, plus
- (3) Material and Freight Costs, plus
- (4) Equipment Costs, plus
- (5) An amount not to exceed 20% of the sum of items (1) through (4) for overhead and profit, plus (if applicable),
- (6) In the case of work done by a subcontractor an amount not to exceed 7 ½ %, for the general contractor of the sum of items (1) through (4) for his overhead and profit, less, if applicable,
- (7) Credits for work deleted from the contract.

Explanation of items (1) through (7) as outlined in “B” and “C”:

- (1) Labor – Only those workers employed on the project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided in items (5) and/or (6). Hourly labor rates in excess of those as listed in the contract wage rates (Federal or State, whichever applies) require documentation. As a minimum, an explanation and the appropriate copy of the certified payroll are required.



Policy Memorandum No. PM-10 – Change Orders (Con't)

- (4) Equipment – Only the equipment required as a result of the change order is allowable. Equipment rental rates shall be governed by the current Nielson/Dataquest Rental Rate bluebook for Construction Equipment (the “Bluebook”). In determining the rental rate the following shall apply:
- (a) For equipment already on the project – the monthly prorated rental rate by the hourly use shall be applicable;
  - (b) For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in items (5) and/or (6) (1 month (normal use) = 176 hours)
- (5) & (6) Overhead and Profit – All other costs not previously mentioned are considered to be included in this item, be it for the general contractor or subcontractor(s).
- (7) Credits – Work deleted, material and equipment removed from the contractor, stored and/or returned shall be credited to the cost of the change order, less costs.

The Contractor shall furnish itemized statements of the cost of the work ordered and shall give the Engineer access to all accounts, bills and vouchers relating thereto; and unless the Contractor shall furnish such itemized statements, and access to all accounts, bills and vouchers, he shall not be entitled to payment for any items of extra work for which such information is sought by the Engineer. Deviations from any of the above will be reviewed for financial assistance on a case-by-case basis.

The change order will be prepared in such manner as to clearly separate Eligible and Ineligible Costs.



# CHANGE ORDER FORM

SRF Number \_\_\_\_\_  
 Public Entity \_\_\_\_\_  
 Contract Number \_\_\_\_\_  
 Change Order Number \_\_\_\_\_

Contract Amount (As Bid) \$ \_\_\_\_\_  
Net Change in Contract Price (this change order) \$ \_\_\_\_\_  
 Total Adjusted Contract Price (including this and all other change orders) \$ \_\_\_\_\_

This change order extends the time to complete the work by \_\_\_\_\_ calendar days.

The extended completion date is \_\_\_\_\_

This change order checked by \_\_\_\_\_  
 (Chief) Resident Engineer Date

This change order is requested by: \_\_\_\_\_

This change order is recommended by: \_\_\_\_\_

\_\_\_\_\_  
 Consultant Engineer P.E. Number Date

The undersigned agree to the terms of the change order.

\_\_\_\_\_  
 Contractor Date

\_\_\_\_\_  
 Owner Date

Certification of Appropriation under M.G.L. c.44, §31C: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: \_\_\_\_\_  
 Certification Officer (Auditor, accountant, treasurer) Date

Do not write below: this space reserved for STATE AGENCY APPROVAL

DEP/DMS

**CHANGE ORDER FORM (Continued)**

PM-10 Attachment 1

Page 2 of 2

Public Entity \_\_\_\_\_

SRF No: \_\_\_\_\_ Contract No. \_\_\_\_\_ Change Order No. \_\_\_\_\_

Contract Title: \_\_\_\_\_

Owner's Name: \_\_\_\_\_

Owner's Address: \_\_\_\_\_

Contractor's Name: \_\_\_\_\_

Contractor's Address: \_\_\_\_\_

Description of Change

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reason for Change

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

CALCULATION SHEET

(1) Labor

Foreman	10 hrs @ \$10.00/hr.	\$	100.00	
Engineer	10 hrs @ 8.50/hr		85.00	
Operator	10 hrs @ 9.50/hr		95.00	
Laborers	24 hrs @ 7.00/hr		<u>168.00</u>	\$448.00

(2) Direct Labor Cost (use the agreed upon Direct Labor Cost)

*	(30)% of \$448			
*	(Used for example purposes only)			134.00

(3) Materials & Freight

150 l.f. of 12" pipe @ \$2.00/l.f.	\$	300.00	
15 v.f. precast SMH		1,700.00	
Freight (slip # _____ Enclosed)		<u>25.00</u>	
			2,025.00

(4) Equipment

1 Backhoe 10 hrs @ \$80.00/hr	\$	800.00	
1 Truck-crane 10 hrs @ \$100.00/hr		<u>1,000.00</u>	
			1,800.00
Total (Items 1 through 4)			4,407.00

(5) 20% markup for Overhead, Profit

20% of \$4,407		881.00
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(6) 7 ½% markup for general contractor (if subcontractor is involved)

7 ½% of \$4,407		331.00
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(7) Credits (deductibles)

<u>- 323.00</u>
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Total Cost      \$ 5,296.00

Reminder:      Provide support documentation as necessary i.e. vouchers, correspondence,  
Calculation, photographs, reports .....

**POLICY MEMORANDUM NO. PM-11**

**UTILITY RELOCATION**

The construction of treatment facilities, sewers, pumping stations, force mains and appurtenant work can cause the relocation of utilities. Costly relocation can sometimes be minimized by early communication and cooperation of the representatives of the municipality (owner) and the utilities.

Every possible effort should be made by the owner and each utility to establish the location of existing utilities in the vicinity of the proposed construction. The owner or its consulting engineer should make every reasonable effort to design the proposed construction so that relocation of existing utilities is minimized whenever possible. If the proposed construction is in an area of many existing utilities or in an otherwise critical area, the utilities are encouraged to mark the location of their existing utilities at the site during the design phase of the project.

During the design phase of the project, the municipality should provide timely notice to all utilities known or thought to have facilities in or proximate to the site of such future construction.

**POLICY MEMORANDUM NO. PM-12**

**REFUNDABLE DEPOSITS FOR PLANS AND SPECIFICATIONS**

For each set of project plans and specifications provided, the owner may require a deposit in form of cash or other appropriate security, in an amount sufficient to cover the costs of production of such plans and specifications.

Upon return of the plans and specifications to the owner within a reasonable time and in good condition, such deposit shall be refunded.

Actual mailing costs, if any, shall be borne by the party requesting such plans and specifications.

**POLICY MEMORANDUM NO. PM-13**

**BID OPENING PROCEDURES**

As a minimum, bid documents shall be reviewed/inspected for conformance to the following bid opening procedure in the order presented below. Failure to comply with any of these steps shall render the bid non-responsive and upon determination of such non-responsiveness, such bid shall be rejected immediately, set aside, and shall receive no further consideration.

**Bid Opening Procedure**

Step #1. Timeliness – The bid must be filed at the place and within the time specified therefore in the invitation to bid, and no bid shall be accepted after such time. The time at which a bid is filed should be time/date stamped or otherwise prominently noted on the bid;

Policy Memorandum No. PM-13 – Bid Opening Procedures (Con't)

Step #2. Bid Security – Properly executed bid security, in the amount and terms specified in the invitation to bid (equal to 5% of Base Bid or Highest Possible Amount considering all alternatives) shall be placed in a seal envelope and attached to the outside of the envelope containing the bid at the time of its submission;

A. Bid Bond

The Bid bond must be dated On or Before the Bid Date;  
Issued by a Bonding Company Licensed in Massachusetts;  
Accompanied by a Current Power of Attorney;  
Signed by Surety;

B. Check

The Check must be a Certified, Cashiers or Bank Treasurer's;  
Dated On or Before the Bid Date;

Step #3. Bid Signature – The bid and all accompanying documents so required shall be signed by the bidder or its authorized representative before submission;

Step #4. Addenda – All addenda shall be sent certified mail, return receipt requested, by the owner to all individuals and organizations which have received plans and specifications and shall be mailed not later than five days prior to the date established for submission of bids. All bidders shall include with their bids written acknowledgement of receipt of all addenda, which acknowledgement may be on a form provided therefore by the owner.

Alternates – Any Alternates shall be acknowledged.

Step #5. Written Dollar Amounts – The total dollar amount of each bid shall be read, and the three lowest bids shall be selected for further consideration. The remaining bids shall then be set aside. The three apparent low bids shall be read to determine whether the unit price for each line item of each bid has been written therein in words. If it has not, such bid shall be rejected and shall receive no further consideration. ***Bid amounts shall be consistent (words vs. numbers) and if words and numbers differ, the words govern.*** This procedure shall then be repeated with the next apparent low bid until three are acceptable which have all the unit prices written in words, at which time the lowest bid shall be announced as the apparent low bidder, and the bid opening procedure shall be closed.

The Division recommends that this policy memorandum be included in all contract specifications and that the owner's evaluator(s) use the attached form (PM-13 Attachment 1) for bid opening procedures.

The Contractor's Bid Opening Checklist also attached hereto, is for use by each contractor to assure that his bid conforms with this policy memorandum. It is recommended that the checklist (PM-13 Attachment 2) be included in information for bidders, or at the end of the bid proposal, or in some other prominent part of the bid specifications

**FORM FOR BID OPENING PROCEDURES**  
(to be completed by the owner's evaluator(s))

CONTRACT NO.: \_\_\_\_\_

DATE: \_\_\_\_\_

CONTRACT NAME: \_\_\_\_\_

BID OPENING TIME: \_\_\_\_\_

All non-responsive bids shall be rejected forthwith by the awarding authority upon determination of such bids' non-responsiveness at the time bids are opened and read. Failure to comply with any one of the requirements shall render the bid non-responsive, and upon determination of such non-responsiveness such bid shall be rejected and receive no further consideration.

A = Acceptable

N-R = Non-Responsive (explain reasons on supplemental sheet & attach)

BIDDER	1. TIMELINESS	2. BID SECURITY	3. SIGNATURE	4. ADDENDA ALTERNATIVES	5. WRITTEN DOLLAR AMOUNTS	COMPLIANCE (CIRCLE ONE)	
1						YES	NO
2						YES	NO
3						YES	NO
4						YES	NO
5						YES	NO
6						YES	NO
7						YES	NO
8						YES	NO
9						YES	NO
10						YES	NO
11						YES	NO
12						YES	NO

Evaluator(s) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**BID OPENING PROCEDURES  
CONTRACTORS CHECKLIST**

CONTRACT NO.: \_\_\_\_\_ BIDDER: \_\_\_\_\_ DATE: \_\_\_\_\_

All non-responsive bids shall be rejected forthwith by the awarding authority upon determination of such bids' non-responsiveness at the time bids are opened and read. Failure to comply with one or more of the following requirements shall render the bid non-responsive, and upon determination of such non-responsiveness such bid shall be rejected and receive no further consideration.

ITEM	REQUIREMENTS	COMPLIANCE (CIRCLE 1)		REASONS FOR REJECTION
		Yes	No; Rejected	
1. Timeliness	Bid filed w/in time specified	Yes	No; Rejected	
2. Bid Security	Appropriate and properly Executed security w/bid.	Yes	No; Rejected	
3. Signature	Bid signed by authorized Representative	Yes	No; Rejected	
4. Addenda	All addenda acknowledge Any alternative	Yes	No; Rejected	
5. Dollar Amount	Dollar amount in words Specified for each line item in bid	Yes	No; Rejected	

There shall be in the contract documents a separate pay item for rock excavation. For such purposes, “rock” shall mean igneous, sedimentary, metamorphic, and conglomerate rock, which for excavation must be drilled, blasted, broken, or ripped by power tools. Boulders and concrete structures one cubic yard or greater, however removed, are included within this definition of rock for payment purposes. At the option of the owner or his representative a separate pay item for boulders, concrete structures, or concrete road base may be used.

<u>Depth From Ground Surface</u> <u>To Invert Pipe</u>	<u>Pay Width</u> <u>(Nominal Pipe Diameter)</u>	
* 0 – 12’	<u>0-24”</u>	<u>Over 24”</u>
* Over 12’ – 20’	5’0”	D+3’0”
	7’0”	D+5’

Engineer’s plans and specifications shall establish pay limits below pipe and structures.

- See PM-14 Attachment 1 (typical cross section)

Payment width for depths over twenty feet (20’) shall be determined on a case-by-case basis consistent with the foregoing chart.

The pay limit for rock removal outside proposed manholes shall commence one foot (1’) outside the widest dimension of the structure of shall be the maximum connecting trench width, whichever is greater.

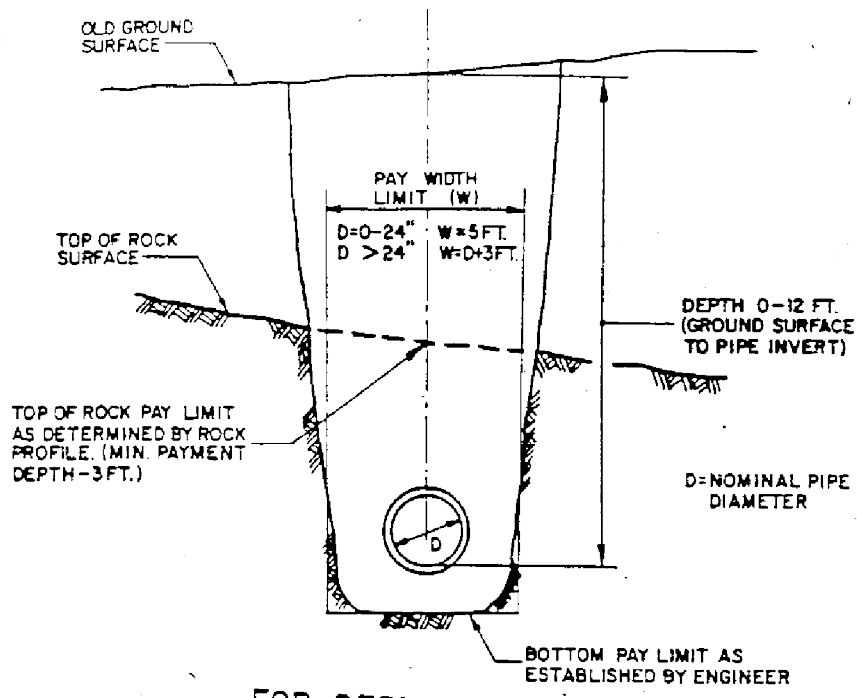
Payment depth for rock which is encountered in a trench shall be no less than three feet (3’) when removal can be accomplished only by drilling and blasting or by use of jack (air or hydraulic) hammers.

Payment for rock removed, using the same or equal equipment as utilized for normal trench excavation, shall be limited to the actual depth removed within the limits established by the contract documents.

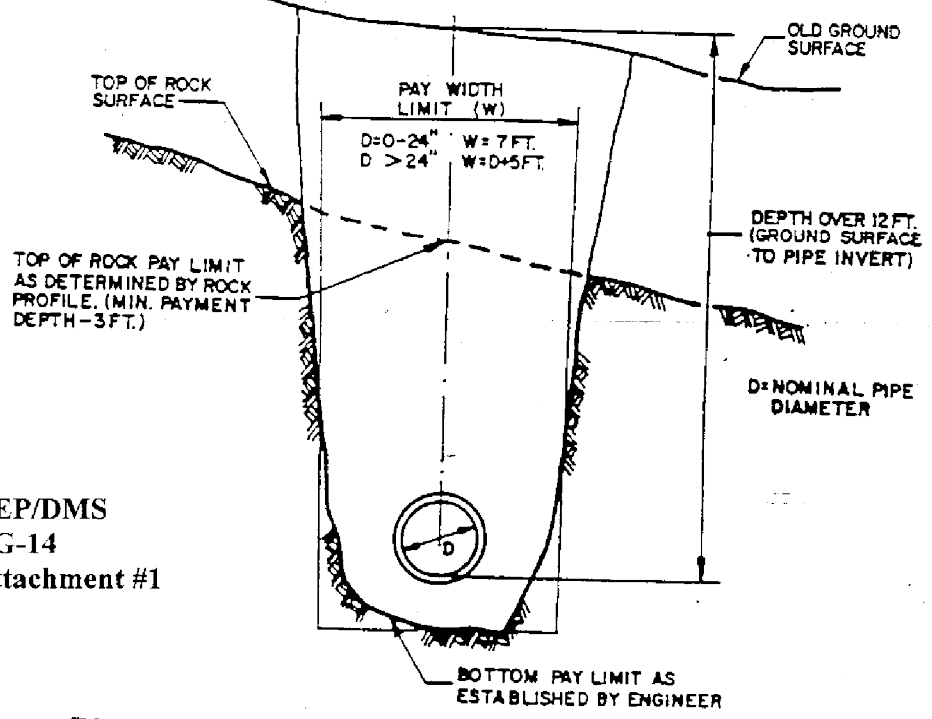
Boulders encountered within the pay limits of excavation, whose volume is one cubic yard or greater, part of which extends outside said limits shall be paid in accordance with the actual volume excavated.



# CG-14 ROCK EXCAVATION



FOR DEPTH 0 TO 12 FEET



FOR DEPTH OVER 12 FEET AND UP TO 20 FEET

DEP/DMS  
CG-14  
Attachment #1

**POLICY MEMORANDUM NO. PM-15**

**TRAFFIC POLICE**

The reasonable costs for police details required for traffic control on a construction project which receives financial assistance shall be considered as an eligible administrative cost. A police detail item shall not be included as a bid item in the contract documents.

“Police” as used in this memorandum includes local, county, capital, state, regular and auxiliary police.

Owner’s Responsibility

It shall be the owner’s responsibility to submit in writing the hourly rate of pay to be established for detailed traffic police and each change in rate during the course of the project. It is the owner’s responsibility to arrange, document and pay for such police details. The owner or its representative shall meet with the police chief or other officer in charge of police detail duty to review contract needs. The owner shall maintain a daily record of the following:

- a. Officer’s name
- b. Hours worked
- c. Location of assignment
- d. Hourly rate

**POLICY MEMORANDUM NO. PM-16      DOCUMENTATION REQUIRED TO  
SUBSTANTIATE CONTRACT QUANTITIES**

<u>Unit</u>	<u>Documentation required</u>
Acres (A)	Location, station, offset and calculations. Location = Street right-of-way, etc; Station = Point on Baseline; Offset = Distance left or right of Baseline
Cubic Yard (C.Y.)	Location, stations, widths, depths, calculations and Cross sections as necessary
Each (Ea.)	Location, station, and offset.
Gallon (Gal.)	Location, stations, calculations (if appropriate) and delivery slips.
Hour (Hr.)	Hours and location.
Linear Feet (L.F.)	Location, stations, and offsets.
Month (Mo.)	Location, period of time and calculations if applicable.

1000 Foot Board Measure (MFBM)	Location, stations, offset, elevations, grade, and calculations.  Attach invoices where applicable.
Pound (Lb.)	Locations, stations, and calculations (if applicable). Attach Delivery weight slips.
Square Feet (S.F.)	Locations, stations and calculations
Square Yard (S.Y.)	Locations, stations and calculations
Ton	Locations, stations and calculations (if applicable). Attach Delivery weight slips.
Vertical Feet (V.F.)	Locations, stations, elevations, and offsets.

Note:

1. All of the above, that apply must be submitted with a final payment request or change order as applicable.
2. Where in place measurement is not possible or practical, delivery slips may be used to substantiate quantities.
3. Change orders – See PM-10 in which some of the above may be applicable in justifying materials, equipment and labor.
4. When necessary, itemized quantities must be separated into eligible and non-eligible units with separate calculations to justify eligible costs.
5. Overruns and underruns of any specific item shall be explained with an appropriate sentence or paragraph.
6. On all quantities, units of payment shall be maintained at the project site and shall be updated daily so that upon field inspection by the C.O.E., EPA or DMS, the quantities paid to date can be substantiated.
7. In the case of unforeseen conditions, photos should be submitted with the applicable item in addition to the recommended documentation.
8. Documentation of units of payment shall be clearly legible and cross referenced to the applicable sheets of the record drawings.
9. For record drawings policy, please see PM-4.

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DMS Policies 1 through 16 Approved By:

Steven J. McCurdy  
Division of Municipal Services

**DWS POLICY 88-02**  
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
**POLICY FOR REVIEW OF SEWER LINE/WATER SUPPLY PROTECTION**

The Department of Environmental Protection seeks to protect existing and potential water supplies from the potentially negative effects of leaking sewer lines through the adoption of a Department policy on this subject.

The following restrictions will apply to new sewer construction statewide:

Gravel Packed Wells

- ~ Within the 400 foot radius protective distance around gravel packed wells, all sewer lines and appurtenances are prohibited, unless they are necessary to eliminate existing and/or potential sources of pollution to the well.

Tubular Wells

- ~ Within the 250 foot radius protective distance around tubular wells, all sewer lines and appurtenances are prohibited, unless they are necessary to eliminate existing and/or potential sources of pollution to the well.

Gravel Packed and Tubular Wells

- ~ Within a minimum radius of 2,640 feet or unless otherwise documented by an appropriate study specifically defining the area of influence and approved by the Division of Water Supply, all sewer lines and appurtenances will be designed and constructed for maximum water tightness.
- Force Mains or Pressure Sewers: shall be tested at 150% above maximum operating pressure or 150 p.s.i. whichever is greater. Testing shall conform to the requirements of the American Water works Association (AWWA) standard c 600.
- Gravity Sewers: shall be tested by approved methods which will achieve test results for infiltration or exfiltration of less than 100 gallons/inch diameter/mile/24 hours.
- Manholes: shall be installed with watertight covers with locking or bolted and gasketed assemblies. Testing for infiltration/exfiltration shall conform to the same standards as the maximum allowed for pipes in the manhole as required for gravity sewers, indicated above.
- Satisfactory test results for Force Mains, Manholes and Gravity Sewers shall be performed prior to the expiration of the contractor's one year guarantee period.
- All pumping stations within this zone shall have standby power high water alarms telemetered to an appropriated location that is manned at all times. An emergency contingency plan must be developed by the owner and approved by the BWR.
- A minimum of Class B bedding as defined by WPCF-MOP9 must be used for all piping.
- Service connections (laterals and house connections) shall be rigidly inspected by the appropriate municipal official. Certified inspection reports shall be submitted to the BWR.

### Bedrock Wells

The above requirements are the same for bedrock wells, with the Department reserving the right to require more stringent controls on a case-by-case basis.

### Surface Water Supplies

- ~ Within 100 feet of all surface water supplies and tributaries all sewer lines and appurtenances are prohibited except as required to cross tributaries or to eliminate existing or potential pollution to the water supply. In the latter case, watertight construction methods shall be use.
- ~ Tributary stream crossings shall employ watertight construction methods of sewer lines and manholes. Watertight construction must extend 100 feet to either side of the stream.
- ~ Within 1,000 feet of surface water supplies and tributaries, all pumping stations shall have standby power and high water alarms telemetered to an appropriate location that is manned at all times. An emergency contingency plan must be developed by the owner of the wastewater treatment facility and submitted to the BWR for approval.
- ~ Beyond 1,000 feet and within the watershed of surface water supplies the Department may in specific circumstances after review, require additional controls.

### Potential Public Water Supplies

The above requirements also apply to potential public water supplies.

### Baseline Date Requirements

Two (2) copies of an appropriately scaled map(s) shall be submitted to the Department which details the proposed sewers and/or appurtenances and also includes the following:

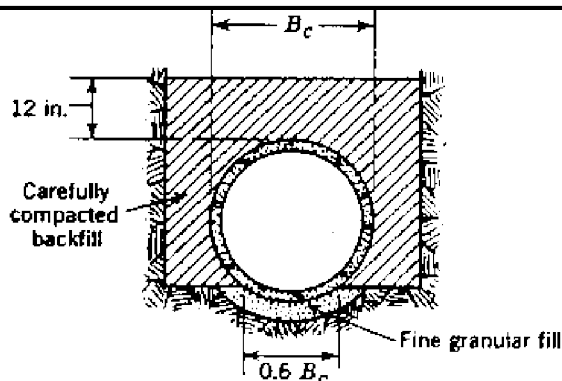
- (1) the location of all nearby existing or potential surface water supplies, tributaries thereto, and watershed boundaries;
- (2) the location of existing and potential public and municipal potable groundwater supply wells.

The Department reserves the right to impose more restrictive measures than those contained in this policy as deemed appropriate.

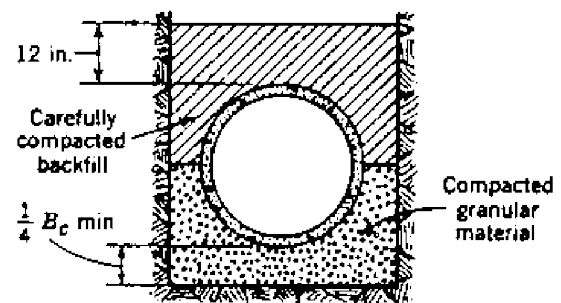
### Definitions

- Appurtenances – all attachments to sewer lines necessary for the transport and operation and maintenance of sewer lines, including manholes, pumping station, siphons, etc.
- Area of influence – that area of an aquifer which contributes water to a well under the most severe recharge and pumping condition that can be realistically anticipated (i.e. pumping at the safe yield of the well for 180 days without any natural recharge occurring). It is bounded by the groundwater divides which result from pumping the well and by the contact of the edge of the aquifer with less permeable materials such as till and bedrock. At some locations, streams and lakes may form recharge boundaries.
- Potential public water supply – areas designated by communities for water supply purposes where land has been set aside and Department approved pump tests conducted and surface water supplies as defined below.
- Surface Water Supply – Waters classified as Class A by the DWPC.
- Public Water Supply Systems – as defined in 310 CMR 22.02 (DEP Drinking Water Regulations).
- Class B Bedding – as defined in WPCF Manual of Practice No. 9.

APPROVED: (Signature on File)



Shaped bottom with tamped backfill,  
load factor 1.9



Compacted granular bedding,  
load factor 1.9

**Class B---First-Class Bedding** – Class B bedding may be achieved by either of two construction methods:

- a. **Shaped Bottom with Tamped Backfill.** The bottom of the trench excavation shall be shaped to conform to a cylindrical surface with a radius at least 2 in. (5 cm) greater than the radius to the outside of the pipe and with a width sufficient to allow six-tenths of the width of the pipe barrel to be bedded in fine granular fill placed in the shaped excavation. Carefully compacted backfill shall be placed at the sides of the pipe to a thickness of at least 12 in. (30 cm) above the top of the pipe. Shaped trench bottoms are difficult to achieve under current construction conditions.
- b. **Compacted Granular Bedding with Tamped Backfill.** The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of one-fourth the outside pipe diameter and shall extend halfway up the pipe barrel at the sides. The remainder of the side fills and a minimum depth of 12 in. (30 cm) over the top of the pipe shall be filled with carefully compacted material.

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# INVESTING IN AMERICA

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## Investing In America Signage Guidelines

The Bipartisan Infrastructure Law

The CHIPS and Science Act

The Inflation Reduction Act

The American Rescue Plan



## Guidelines for Logo Applications

The purpose of this document is to provide general guidelines for signs displayed at project sites for projects funded under the Bipartisan Infrastructure Law (also known as the Infrastructure Investment and Jobs Act), the CHIPS and Science Act, the Inflation Reduction Act, the American Rescue Plan, and other Federally-funded projects as appropriate. The first part of this document pertains to signs for Federally-funded projects that are not installed in the highway right-of-way. For highway signage guidance that is MUTCD compliant please see pages 13 and 14. For all other signs please start here. This document provides information about the Investing In America logo mark as well as how logos, marks and seals of states, cities, and counties can be incorporated into signage. Logos of contractors are not permitted on the signage. When logos are included in signage, the placement should conform to these brand guidelines.



## Variations and Usage

There is one approved mark associated with the Investing In America logo. To preserve the integrity of the Investing In America logo mark, make sure to apply them correctly. Altering, distorting, or recreating the 'marks' in any way weakens the power of the image and what it represents. Layout and design of signs and communication materials will vary, so care must be taken when applying the logo mark.

## Primary Logo Mark

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# INVESTING IN AMERICA

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## Colors

The colors, graphics, and fonts used should conform to graphic standards.

COLOR	CMYK	RGB	HEX	PMS
 <b>Blue</b>	83, 48, 0, 48	22 / 68 / 132	#164484	PMS 7687 C
 <b>Red</b>	0, 100, 81, 0	255 / 0 / 49	#FF0031	PMS 185 C
 <b>White</b>	2, 2, 0, 3	242 / 244 / 248	#F2F4F8	Bright White

Logos



White background: logo in red and blue

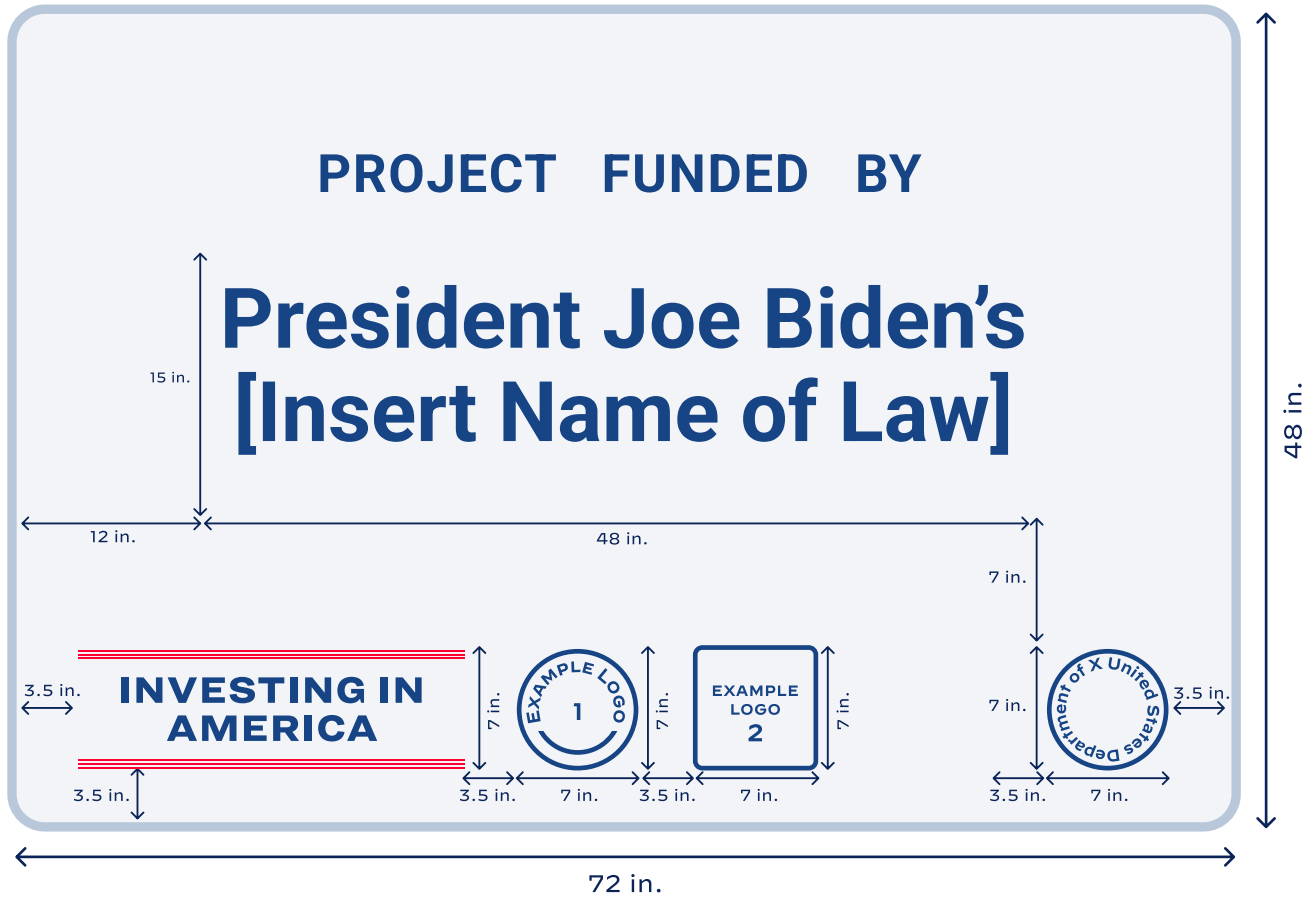


Gray background: logo in red and blue



Blue background: logo in all white

# Investing In America General Guidelines for Logo Applications

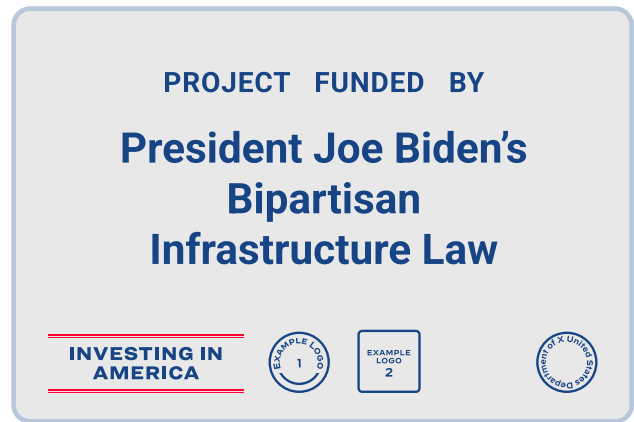


## Sign Colors

### 1. The Bipartisan Infrastructure Law



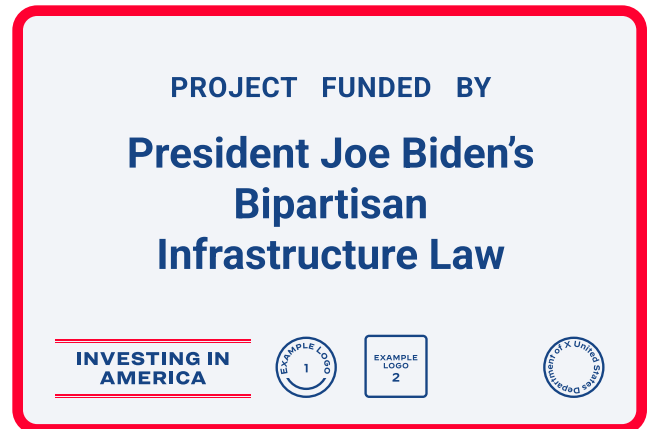
White



Gray



Blue



Red Border

## Sign Colors

### 2. The CHIPS and Science Act



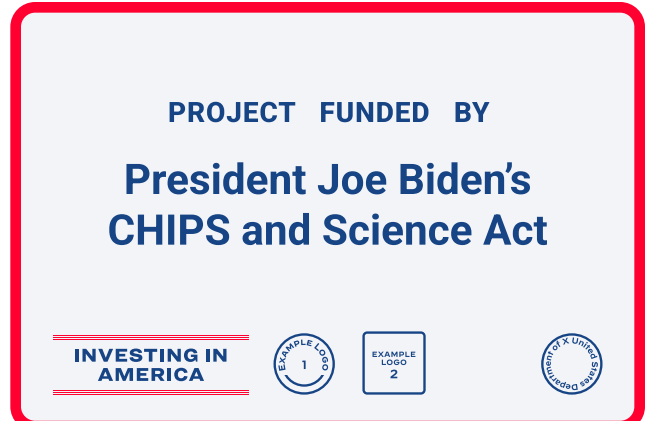
White



Gray



Blue



Red Border

## Sign Colors

### 3. The Inflation Reduction Act



White



Gray



Blue



Red Border

## Sign Colors

### 4. The American Rescue Plan



White



Gray



Blue



Red Border

## State, City, and County Logo Variations



Square or Circular State Logo: 7x7 in.



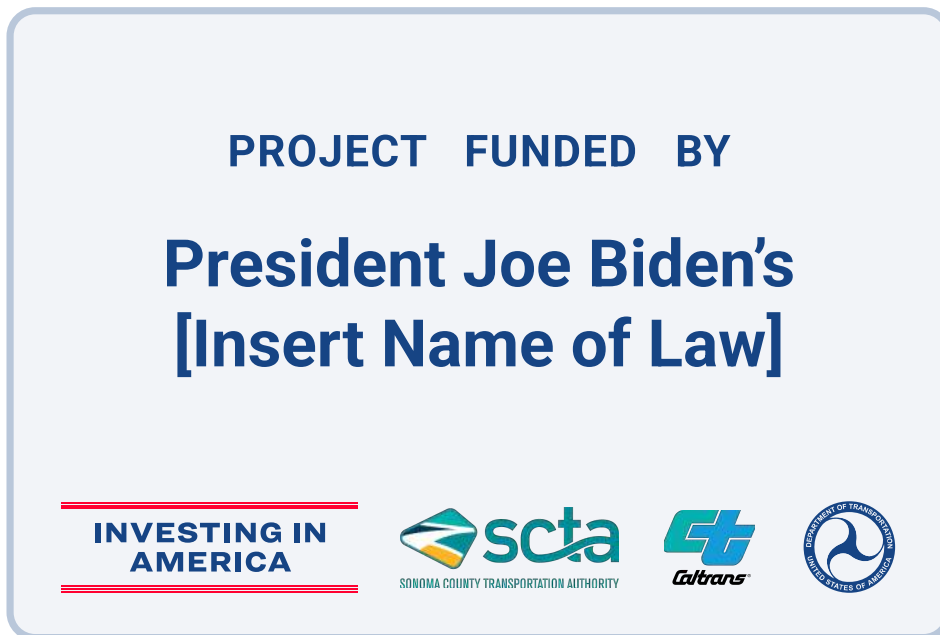
Rectangular or Oval State Logo: **not** to exceed 17.5 x 7 in.



### 3 Logo Samples



Circular City Logo 7 x 7 in. State rectangular logo should **not** exceed 17.5 x7 in.



Rectangular State Logo: **not** to exceed 17.5 x 7 in.

## 2 Logo Samples

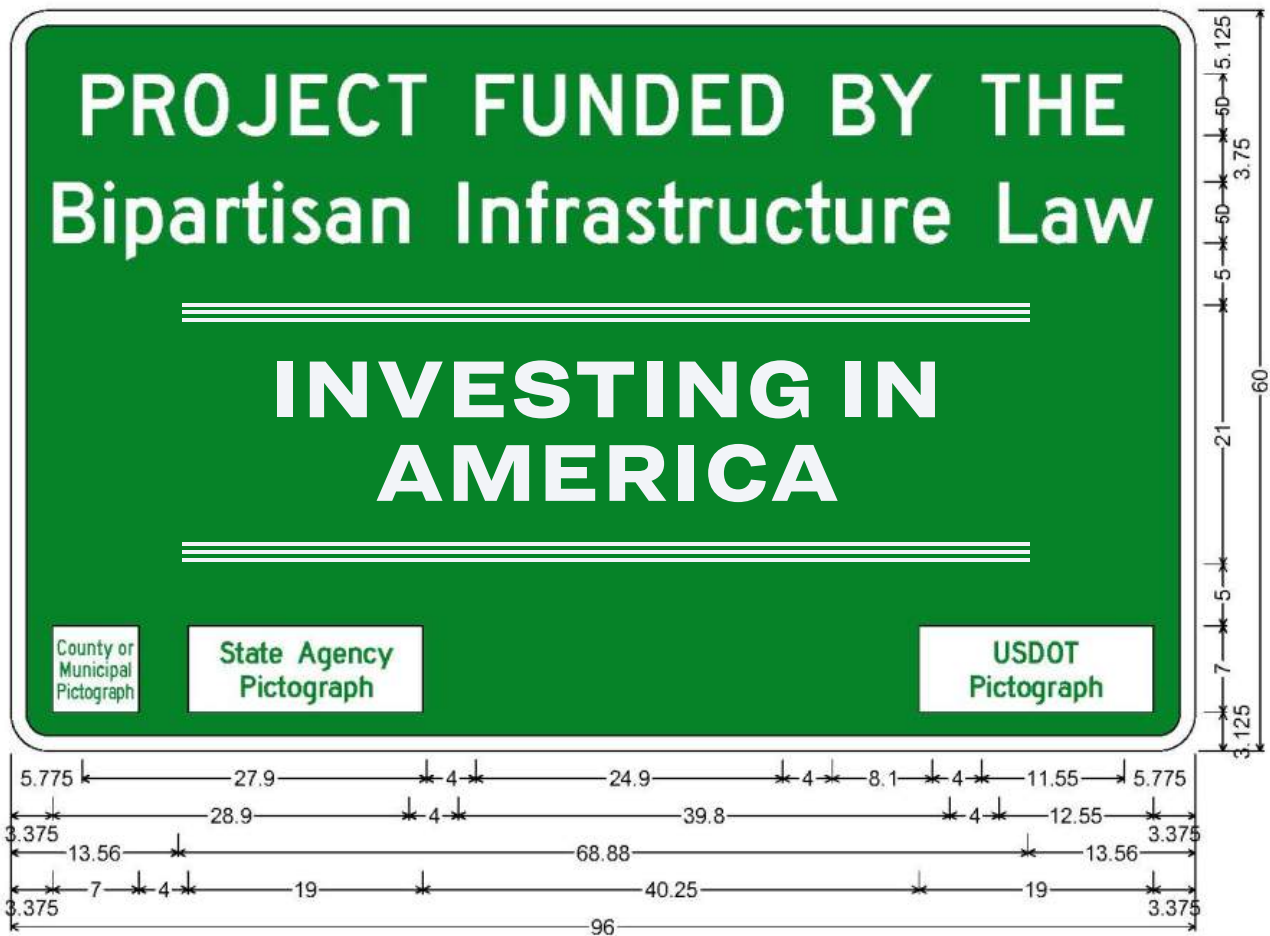


Circular State Logo: 7 x 7 in.

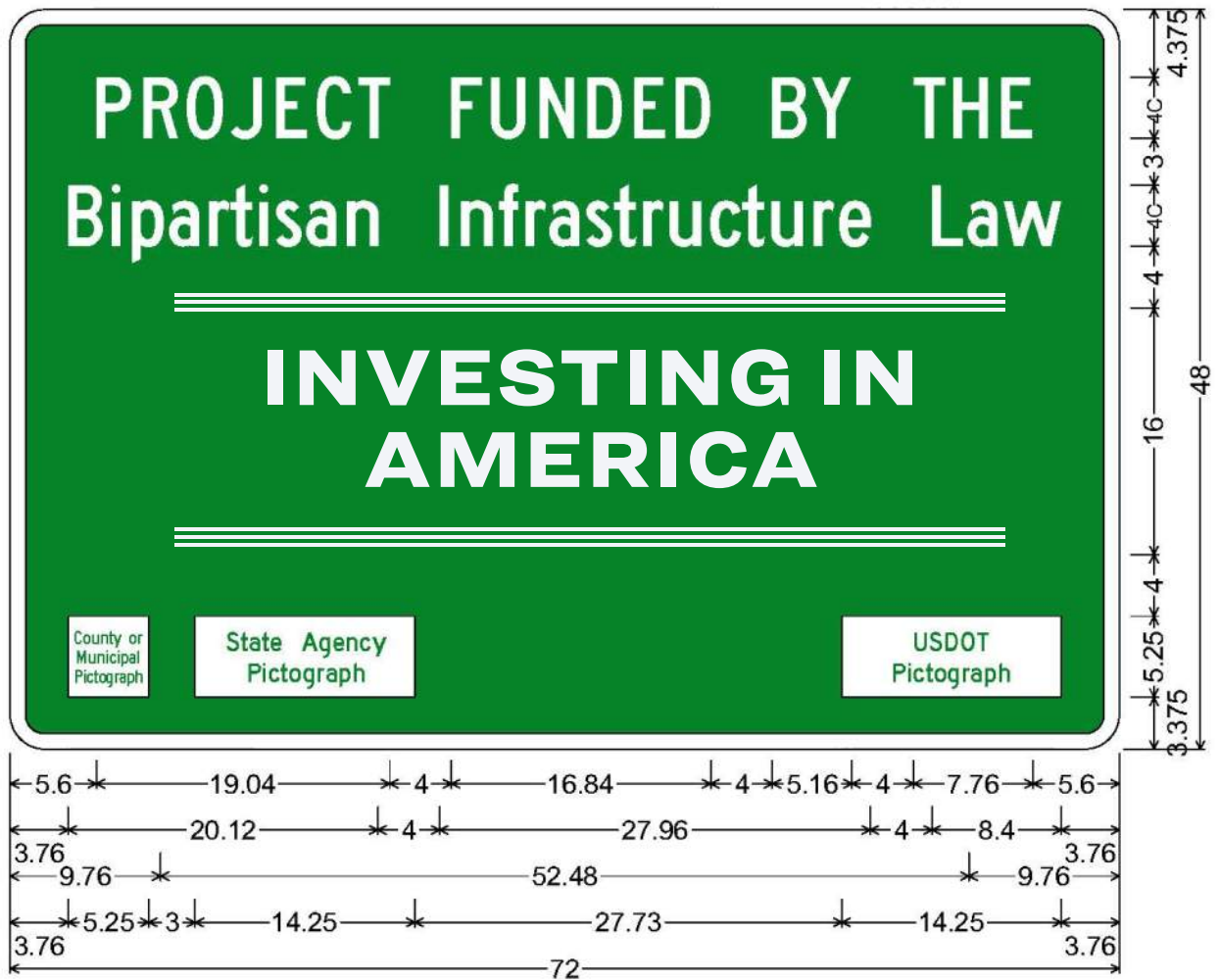


Rectangular State Logo: **not** to exceed 17.5 x 7 in.

## Rules for Highway Right of Way Signage 8 Feet



## Rules for Highway Right of Way Signage 6 Feet



## APPENDIX H

### BUILD AMERICA, BUY AMERICA ACT (BABA)

### AMERICAN IRON AND STEEL (AIS)

#### ATTACHMENTS

1. **Information Checklist for Waiver Request**
2. **HQ Review Checklist for Waiver Request**
3. **Example Loan Agreement Language**
4. **Sample Construction Contract Language**
5. **Sample Certification 1**  
**Sample Certification 2**

# Appendix I

## Build America, Buy America (BABA) Requirements




UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF WATER

November 3, 2022

### MEMORANDUM

**SUBJECT:** Build America, Buy America Act Implementation Procedures for EPA Office of Water Federal Financial Assistance Programs

**FROM:** RadhikaFox  
Assistant Administrator 

**TO:** EPA Regional Water Division Directors, Regions I - X  
EPA Office of Water Office Directors

### OVERVIEW

The Biden-Harris Administration recognized the Nation's critical need for infrastructure investment, championing the Bipartisan Infrastructure Law (BIL), which Congress passed on November 15, 2021 (also known as the Infrastructure Investment and Jobs Act (IIJA)). The BIL will provide an unprecedented level of federal investment in water and wastewater infrastructure in communities across America.

In Title IX of the IIJA, Congress passed the Build America, Buy America (BABA) Act, which establishes strong and permanent domestic sourcing requirements across all Federal financial assistance programs for infrastructure. The U.S. Environmental Protection Agency (EPA) Office of Water is honored to help lead the implementation of these provisions and is proud of its near decade of successful implementation of the American Iron and Steel (AIS) provisions for its flagship water infrastructure programs.

This is a transformational opportunity to build a resilient supply chain and manufacturing base for critical products here in the United States that will spur investment in good-paying American manufacturing jobs and businesses. EPA's efforts to implement BABA will help cultivate the domestic manufacturing base for a wide range of products commonly used across the water sector but not currently made domestically. This will take time, and flexibility will be important to ensure that EPA can leverage critical water investments on time and on budget to protect public health and improve water quality.

## IMPLEMENTATION

Recognizing the opportunity and need for BABA implementation guidance, the Made in America Office (MIAO) of the Office of Management and Budget (OMB) published [Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure](#) (OMB Guidance M-22-11) on April 18, 2022. The guidance provides government-wide implementation direction for all Federal financial assistance programs for infrastructure. Despite the extensive guidance developed by MIAO, EPA's Office of Water infrastructure investment programs have received many questions that were not addressed in OMB Guidance M-22-11 or that require further clarification for EPA water infrastructure programs. The following questions and answers serve to supplement OMB Guidance M-22-11 with implementation procedures specific to EPA's relevant water infrastructure programs.

Section 70914(a) of the IIIA states when a Buy America preference under BABA applies: "Not later than... [May 14, 2022], the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure... may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, Federal financial infrastructure investments obligated on or after May 14, 2022, must comply with the BABA requirements. Absent a waiver, all iron, steel, manufactured products, and construction materials permanently incorporated into an infrastructure project subject to the BABA requirements must be produced in the United States. For many of EPA's Office of Water infrastructure investment programs, the vast majority of products permanently incorporated into construction, maintenance, or repair projects must comply with the BABA requirements, with the exception of select construction materials (cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives), which are specifically excepted by the BABA statute.

EPA's Office of Water implements many infrastructure investment programs subject to BABA requirements, including the following:

- Alaska Native Villages and Rural Communities Water Grant Program (ANV) (and any associated Interagency Agreements with the Indian Health Service)
- Clean Water and Drinking Water State Revolving Fund Programs (CW and DWSRF)
- Clean Water and Drinking Water Grants to U.S. Territories and the District of Columbia
- Clean Water Indian and Drinking Water Tribal Infrastructure Grant Set-aside (and any associated Interagency Agreements with the Indian Health Service)
- Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA) Programs
- Congressionally Directed Spending/Community Project Funding (also known as Community Grants)
- Geographic Programs<sup>1</sup>
- Gulf Hypoxia Program
- National Estuaries Program (CWA Section 320)

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<sup>1</sup> Geographic Programs include: Great Lakes Restoration Initiative, Chesapeake Bay, San Francisco Bay, Puget Sound, Long Island Sound, Gulf of Mexico, South Florida, Lake Champlain, Lake Pontchartrain, Southern New England Estuaries, Columbia River Basin, Pacific Northwest

- 319 Nonpoint Source Management Program Implementation
- Reducing Lead in Drinking Water Grant Program (SDWA §1459B)
- Assistance for Small and Disadvantaged Communities Grants: Small, Underserved, and Disadvantaged Community Grant Program (SUDC), Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) and Drinking Water Infrastructure Resilience & Sustainability (SDWA §1459A)
- Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)
- USMCA Implementing Legislation (Section 821 and Title IX, USMCA Supplemental Appropriations, 2020)
- U.S.-Mexico Border Water Infrastructure Program
- Voluntary School and Child Care Program Lead Testing and Remediation Grant Program (SDWA 1464(d))
- Water Infrastructure Finance and Innovation Act (WIFIA)

The questions and answers in this document apply to the implementation of BABA requirements for the Office of Water infrastructure programs listed above unless superseded by regulation, statute, or other applicable guidance. For many of the programs listed above which did not have domestic preference requirements prior to BABA, additional implementation details are pending or may be developed after the issuance of these procedures. In addition, EPA notes that more direction will be helpful to inform the determination and definition of domestic content in manufactured goods. Supplemental guidance on these and other issues, from either OMB or EPA, may be forthcoming. These implementation procedures may also apply to additional, unlisted EPA programs which may be required to apply BABA subsequent to publication of this memorandum (e.g., future funding programs which have been authorized, but not yet appropriated).

For more information on the BABA requirements, visit the EPA Office of Water’s dedicated website – <https://www.epa.gov/cwsrf/build-america-buy-america-baba> – or contact your funding authority (such as your grants officer, portfolio manager, or state contact). For information on approved waivers, visit <https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers>. You may also email questions to [BABA-OW@epa.gov](mailto:BABA-OW@epa.gov).

This Implementation Procedures document is organized to provide responses to questions in the following topic areas:

• Section 1: General.....	4
• Section 2: Product Coverage.....	5
• Section 3: Co-funding.....	9
• Section 4: Waivers.....	10
• Section 5: Documenting Compliance.....	12
• Section 6: Programs with American Iron and Steel Requirements.....	16
• Section 7: Program-Specific Issues.....	17
• Appendix 1: Example Build America, Buy America (BABA) Act Construction Contract Language.....	22
• Appendix 2: Example Build America, Buy America (BABA) Act Assistance Agreement Language.....	23



## QUESTIONS AND ANSWERS

### SECTION 1: GENERAL

- Q1.1: Will EPA provide documentation for BABA for bid solicitations and suggested contract language? Will EPA provide suggested language for Assistance Agreements?
  - A1.1: See Appendix 1, which includes suggested language for construction contracts which addresses the BABA requirements. In addition to the language suggested in Appendix 1, EPA also recommends that assistance recipients prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the certifications are sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

All Federal Financial infrastructure assistance agreements subject to BABA must have a clause requiring compliance with the requirements. See Appendix 2 for example assistance agreement language.

- Q1.2: Would federally-financed infrastructure projects outside of the United States need to comply with the BABA requirements?
  - A1.2: No. According to the OMB Guidance (M-22-11), a “project” is defined as “...any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.” Therefore, the BABA requirements are not implicated for infrastructure projects occurring outside of the United States, such as projects funded through the United States-Mexico-Canada Agreement with infrastructure activities occurring in Mexico or Canada (that is, outside the United States).
  -
- Q1.3: If most of the project is BABA compliant, and a small portion is not, can an assistance recipient self-fund (i.e., paying with non-federal dollars) the non-compliant products?
  - A1.3: Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. All iron, steel, manufactured products, and construction materials used in a project must meet the BABA requirements unless waived. Absent a waiver, there is no “small portion” or product that does not need to satisfy the BABA requirements unless the requirements are waived (or specifically excluded as is the case for cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products). An assistance recipient may request a waiver or inquire as to whether a broad waiver, such as a *de minimis* waiver, might apply.

- Q1.4: How do international trade agreements affect the implementation of the BABA requirements?
  - A1.4: The BABA requirements apply in a manner consistent with United States obligations under international trade agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to these trade agreements. In general, assistance recipients are not signatories to such agreements, so these trade agreements have no impact on BABA implementation. In the few instances where such an agreement applies to a municipality, that municipality is responsible for determining its applicability and requirements and communicating with the funding authority (such as EPA and/or a state) on the actions taken to comply with BABA.

SECTION 2: PRODUCT COVERAGE

- Q2.1: For products made of iron and steel, what is the difference between predominantly and primarily iron and steel?
  - A2.1: EPA considers the terms “predominantly” and “primarily” to be interchangeable, such that a product is considered predominantly (or primarily) iron and steel if it contains greater than 50 percent iron and steel by material cost.
- Q2.2: What is the definition of construction materials (with examples)?
  - A2.2: From OMB Guidance M-22-11: “construction materials” include an article, material, or supply (other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products) that is or consists primarily of:
    - non-ferrous metals,
    - plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), (including optic glass),
    - lumber, and
    - drywall.

For example, a plate of glass would be a construction material under BABA, but a framed window that incorporates the glass into a frame would be a manufactured product. Another common construction material for water infrastructure projects would be polyvinyl chloride (PVC) pipe and fittings. However, if PVC components are incorporated into a more complex product such as instrumentation and control equipment or a water treatment unit, those items would be manufactured products.

- Q2.3: What are manufactured products (with examples)?
  - A2.3: From OMB Guidance M-22-11: “...all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total

cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation...”

The manufactured products category would cover the majority of potential water infrastructure products, including complex products made up of a variety of material types and components. For water infrastructure projects, common manufactured products would include, but not be limited to, pumps, motors, blowers, aerators, generators, instrumentation and control systems, gauges, meters, measurement equipment, treatment equipment, dewatering equipment, actuators, and many other mechanical and electrical items.

- Q2.4: Which category will valves fall under for BABA? Will it differ from the American Iron and Steel (AIS) requirements?
  - A2.4: For programs that are subject to BABA and AIS (SRF, WIFIA, and Community Project Funding), projects using valves should classify them as iron and steel products under BABA as long as their material cost is made up of more than 50 percent iron and/or steel. Valves with 50 percent or less iron and/or steel by material cost would be considered manufactured products under the BABA requirements.

In accordance with OMB Guidance M-22-11, an article, material, or supply should be classified into only one of the three categories: iron and steel, manufactured products, or construction materials. Under the AIS requirements, all valves made primarily of iron and steel (that is, those with iron and/or steel material cost greater than 50 percent) must comply with the AIS requirements. For BABA, EPA interprets Section IV of OMB Guidance M-22-11 to mean that iron and steel products are those items that are primarily iron and steel, the same as for the AIS requirements.

- Q2.5: Does EPA have a list of products to be classified as “Iron and Steel” under BABA?
  - A2.5: Although this list is not comprehensive, the following products were classified as AIS products if made primarily (more than 50 percent) of iron and/or steel by materials cost (for programs subject to both AIS and BABA, this list would be equivalent for “iron and steel” items or products under either requirement):

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Lined and Unlined Pipe	Lined and Unlined Fittings	Tanks
Flanges	Pipe Clamps and Restraints	Structural Steel
Valves	Hydrants	Pre-Cast, Iron/Steel Reinforced Concrete (of all types, regardless of iron/steel content percentage)
Manhole Covers and other Municipal Castings	Access Hatches	Ballast Screens
Iron or Steel Benches	Bollards	Cast Bases
Cast Iron Hinged Hatches	Cast Iron Riser Rings	Catch Basin Inlets
Cleanout/Monument Boxes	Construction Covers and Frames	Curb and Corner Guards

Products likely made "primarily" of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Curb Boxes	Curb Openings	Curb Stops
Detectable Warning Plates	Downspout Shoes	Drainage Grates
Drainage Grate Frames and Curb Inlets	Inlets	Junction Boxes
Lampposts	Manhole Rings and Frames	Manhole Risers
Meter Boxes	Service Boxes	Steel Hinged Hatches
Steel Riser Rings	Trash Receptacles	Tree Grates
Tree Guards	Trench Grates	Valve Boxes
Valve Box Covers and Risers	Access Ramps	Aeration Pipes and Fittings (separate from aeration/blowers)
Angles	Backflow Preventers/Double Check Valves	Baffle Curtains
Iron or Steel Bar	Bathroom Stalls	Beam Clamps
Cable Hanging Systems	Clarifier Tanks	Coiled Steel
Column Piping	Concrete Reinforcing Bar, Wire, and Fibers	Condensate Sediment Traps
Corrugated Pipe	Couplings	Decking
Digester Covers	Dome Structures	Door Hardware
Doors	Ductwork	Expansion Joints
Expansion Tanks (diaphragm, surge, and hydropneumatics)	Fasteners	Fencing and Fence Tubing
Fire Escapes	Flanged Pipe	Flap Gates
Framing	Gate Valves	Generic Hanging Brackets
Grating	Ground Testing Boxes	Ground Test Wells
Guardrails	HVAC Registers, Diffusers, and Grilles	Joists
Knife Gates	Ladders	Lifting Hooks, J-bar, Connectors within, and Anchors for Concrete
Lockers	Man Baskets and Material Platforms	Manhole Steps
Mud Valves	Municipal Casting Junctions	Non-mechanical (aka stationary) Louvers and Dampers
Overhead Rolling Doors/ Uplifting Doors (manual open, no motor)	Pipe Connectors	Pipe Hangers
Pipe Piling (any type of steel piling)	Pipe Spool (pipe, flanges, connectors, etc.)	Pipe Supports
Pitless Adaptors	Pre-fab Steel Buildings/Sheds (simple structure, unfinished)	Pre-stressed Concrete Cylinder Pipe (PCCP)
Railings	Reduced Pressure Zone (RPZ) Valves	Roofing
Service Saddles	Sheet Piling	Sinks (not part of eyewash systems)
Solenoid Valves	Stairs	Static Mixers
Stationary Screens	Surface Drains	Tapping Sleeves
Telescoping Valves	Tipping Buckets	Trusses
Tubing	Valve Stem Extensions	Valve Stems (excluding handwheels and actuators)
Wall Panels	Wall Sleeves/Floor Sleeves	Welding Rods
Well Casing	Well Screens	Wire
Wire Cloth	Wire Rod	Wire Rope and Cables

Q2.6: Does EPA have a list of products that could be made “primarily” of iron and steel but would be classified as “manufactured products” under BABA?

A2.6: Although this list is not comprehensive, the following products would be considered “manufactured products” under the BABA requirements, even if the item might be composed primarily of iron and steel by materials cost (Note: These items are not subject to the AIS requirements.):

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Actuator Superstructures/ Support Structures	Aeration Nozzles and Injectors	Aerators
Analytical Instrumentation	Analyzers (e.g., ozone, oxygen)	Automated Water Fill Stations
Blowers/Aeration Equipment	Boilers, Boiler Systems	Chemical Feed Systems (e.g., polymer, coagulant, treatment chemicals)
Chemical Injection Quills	Chemical Injectors	Clarifier Mechanisms/Arms
Compressors	Controls and Switches	Conveyors
Cranes	Desiccant Air Dryer Tanks	Dewatering Equipment
Dewatering Roll-offs	Disinfection Systems	Drives (e.g., variable frequency drives)
Electric/Pneumatic/Manual Accessories Used to Operate Valves (such as electric valve actuators)	Electrical Cabinetry and Housings (such as electrical boxes/enclosures)	Electrical Conduit
Electrical Junction Boxes	Electronic Door Locks	Elevator Systems (hydraulic, etc.)
Emergency Life Systems (including eyewash stations, emergency safety showers, fire extinguishers, fire suppression systems including sprinklers /piping/valves, first aid, etc.)	Exhaust Fans	Fall Protection Anchor Points
Fiberglass Tank w/Appurtenances	Filters (and appurtenances, including underdrains, backwash systems)	Flocculators
Fluidized Bed Incinerators	Galvanized Anodes/Cathodic Protection	Gear Reducers
Generators	Geothermal Systems	Grinders
Heat Exchangers	HVAC (excluding ductwork)	HVAC Dampers (if appurtenances to aerators/blowers)
HVAC Louvers (mechanical)	Intake and Exhaust Grates (if appurtenances to aerators/blowers)	Instrumentation
Laboratory Equipment	Ladder Fall Prevention Systems	Ladder Safety Posts
Lighting Fixtures	Lightning and Grounding Rods	Mechanical or Actuated Louvers/Dampers
Membrane Bioreactor Systems	Membrane Filtration Systems	Metal Office Furniture (fixed)
Meters (including flow, wholesale, water, and service connection)	Motorized Doors (unit)	Motorized Mixers
Motorized Screens (such as traveling screens)	Motors	Pelton Wheels
Pipeline Flash Reactors (similar to injectors)	Plate Settlers	Precast Concrete without Iron/Steel Reinforcement

Products likely made "primarily" of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Furnished Pre-fab Buildings (such as furnished with pumps, mechanics inside)	Presses (including belt presses)	Pressure Gauges
Pump Cans/Barrels and Strainers	Pumps	Mechanical Rakes
Safety Climb Cable	Sampling Stations (unless also act as hydrant)	Scrubbers
Sensors	Sequencing Batch Reactors (SBR)	Steel Shelving (fixed)
Slide and Sluice Gates	Spray Header Units	Steel Cabinets (fixed interior/furniture)
Supervisory Control and Data Acquisition (SCADA) Systems	Tracer Wire	Valve Manual Gears, Actuators, Handles
Voltage Transformer	Water Electrostatic Precipitators (WESP)	Water Heaters
Weir Gates		

- Q2.7: Is asphalt paving a covered product under BABA?
  - A2.7: No. EPA interprets Section 70917(c) of the IIIA to exclude asphalt from BABA requirements. Asphalt paving is a type of concrete composed of an aggregate material mixed with a binder (bitumen). EPA considers asphalt concrete to be excluded by section 70917(c) due to its similarities with cement and cementitious materials.

### SECTION 3: CO-FUNDING

- Q3.1: If projects are co-funded with funding mechanisms that don't require BABA, must the entire project comply with BABA?
  - A3.1: Yes. Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all the contracts and assistance agreements awarded are closely related in purpose, time, and place. This precludes the intentional splitting of projects into separate and smaller contracts or assistance agreements to avoid BABA's applicability on some portions of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreements would carry separate requirements.

- Q3.2: How will project requirements be determined for co-funded projects subject to potentially different general applicability/programmatic waiver conditions (such as different adjustment period waivers)?
  - A3.2: OMB Guidance M-22-11 addresses cases with project co-funding from separate programs. EPA would apply the guidance’s “cognizant” program determination to projects that are co-funded with different general applicability/programmatic waivers. For instance, if a project were co-funded between WIFIA and SRF and the majority of the Federal funding for the project is from WIFIA, then WIFIA would be the “cognizant” program for application and determination of waivers. In that case, any conditions from an applicable WIFIA waiver would apply.

#### SECTION 4: WAIVERS

- Q4.1: Who may apply for a waiver and how do you apply?
  - A4.1: Assistance recipients and their authorized representatives may apply for a project-specific waiver. EPA does not accept waiver requests from suppliers, distributors, or manufacturers unless the assistance recipient endorses and submits the request on its own behalf to the funding authority. In the case where multiple programs are providing federal funds to the project, the assistance recipient should submit the waiver request to the cognizant program, the one providing the greatest amount of federal funds for the project. For information on applying for cost waivers, see questions 4.4 and 4.5. For information on the SRF program roles and responsibilities, see question 7.6.

Project-specific waiver requests should generally include: (1) a brief summary of the project, (2) a description and explanation of the need for the waiver for the product(s) in question, (3) a brief summary of the due diligence conducted in search of domestic alternatives (which could include correspondence between assistance recipient and supplier/distributors), (4) the quantity and materials of the product(s) in question, (5) all engineering specifications and project design considerations relevant to the product(s) in question, (6) the approximate unit cost of items (both foreign and domestic) in addition to an estimated cost of the materials and overall project, (7) the date any products will be needed on site in order to avoid significant project schedule disruptions, and (8) any other pertinent information relevant to EPA’s consideration of the waiver (e.g., if relevant for SRF projects: whether the project is designated as an equivalency project, the date the plans and specifications were submitted to the state, the date of construction initiation, expected date of project completion, any special considerations such as local zoning and building ordinances, seismic requirements, or noise or odor control requirements).

In the case of indirect federal assistance, such as the SRF programs, the state authority reviews and conveys the waiver request to EPA. States should submit waiver requests to the appropriate program waiver request inbox. For SRF projects, please use [CWSRFWaiver@epa.gov](mailto:CWSRFWaiver@epa.gov) or [DWSRFWaiver@epa.gov](mailto:DWSRFWaiver@epa.gov).

- Q4.2: Can an assistance recipient request a waiver based on a specification written for a specific brand or model of product (that is, a specification that names a branded item or model)?
  - A4.2: In most cases, performance-based specifications are expected and required for the majority of infrastructure projects funded by EPA’s financial assistance programs. In rare cases where “branded” or product-specific sourcing may be included in project specifications, it is suggested that the specifications include the item in question (that is, not simply a catalog page, but also materials of construction, sizing, quantities, and applicable engineering performance design characteristics for the project, etc.) in addition to the standard phrase “or equal.” For the purposes of product alternative market research, EPA will evaluate the BABA requirements based on performance-based engineering specifications for the product(s) in question. If the project’s specifications do not include performance-based specifications, or at least an “or equal” designation, EPA will base its research on an “or equal” designation using best professional judgment to the extent practicable.
  
- Q4.3: If a manufactured product is not readily available domestically, will EPA provide short-term “limited availability” product waivers?
  - A4.3: EPA will address the unavailability of domestic products through the waiver process, including potential national short-term waivers for specific products, if appropriate. To the extent practicable and with the intent to maximize domestic market and supply chain development, EPA intends to address issues of broad product unavailability with targeted, time-limited, and conditional waivers, as prescribed in OMB Guidance M-22-11. EPA will follow its robust and thorough product research processes (those put into place for the AIS requirements for the SRF and WIFIA programs and expanded for the new BABA requirements) to identify and determine those products for which proposed national/general applicability waivers may be appropriate.
  
- Q4.4: What information is needed when applying for a cost waiver under BABA?
  - A4.4: As part of the cost waiver request, the assistance recipient must demonstrate that implementation of the BABA requirements will increase the overall project cost more than 25 percent. Depending on the circumstances of the overall project cost increases, documentation to justify the cost waiver can vary but may include itemized cost estimates or bid tabulations comparing project costs with and without BABA implementation. Assistance recipients should begin assessing the potential cost impacts of the BABA requirements during the design phase of a project.
  
- Q4.5: Can administrative costs associated with tracking and verification of certifications be considered when determining if the cost of a project increases by 25 percent or more?
  - A4.5: Yes. Section 70914(b)(3) of the IIJA states that a waiver may be provided if the overall cost of the project increases by more than 25 percent due to the “inclusion of iron, steel, manufactured products, or construction materials produced in the United States.” EPA interprets this to mean that the “inclusion” of the BABA-covered products could encompass



reasonable administrative costs associated with complying with the BABA requirements, such as staff, contractor, and technological resources to collect and track BABA compliance documentation.

- Q4.6: How can assistance recipients and construction contractors address product delivery delays?
  - A4.6: Assistance recipients should reasonably plan for material procurement to account for known potential supply chain issues or extended lead times and shall notify the funding authority well in advance of the issues so that prompt attention can be given to explore options. Where extended lead times for compliant products are impacting project schedules and may significantly impact construction progress, timely communication with the funding agency is important. For products that are unavailable within a reasonable timeframe to meet the objectives and schedule of a project, EPA may consider a non-availability waiver with adequate justification. An assistance recipient would need to apply for the waiver and contact its funding authority (such as EPA and/or a state) to initiate the waiver process.

#### SECTION 5: DOCUMENTING COMPLIANCE

- Q5.1: Who will be responsible for BABA enforcement?
  - A5.1: Responsibility for BABA implementation applies at all levels, from manufacturers to suppliers and distributors, construction contractors, assistance recipients, and funding authorities.

The manufacturers have responsibility to provide adequate and accurate documentation of the products manufactured. If suppliers and distributors are involved, they are responsible for passing along compliance documentation for products supplied to projects that are subject to the BABA requirements.

The assistance recipient and their representatives are primarily responsible for ensuring the documentation collected for products used on the project is sufficient to document compliance with the BABA requirements.

The funding authority is responsible for providing oversight and guidance as needed to ensure the proper implementation of the requirements. The Uniform Grants Guidance (UGG) (Title 2 of the Code of Federal Regulations (CFR) Part 200) applies to many Federal financial assistance agreements that will include BABA requirements. The general provisions of 2 CFR Part 200 determine the responsible party for the grant funding authority.

For information on SRF program roles and responsibilities, see question 7.6.

At all levels, where fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888-546-8740 or [OIG\\_Hotline@epa.gov](mailto:OIG_Hotline@epa.gov). More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

- Q5.2: When will the BABA requirements be assessed for compliance? Do assistance recipients need to have waivers for potential non-domestic products before assistance agreements are in place, at the time products are procured or products are incorporated into the project (i.e., used)?
  - A5.2: Compliance is assessed where the domestic product is used (or installed) at the project site. Proper compliance documentation, whether it is a BABA certification letter or a waiver, should accompany a product prior to its “use”, in accordance with Section 70914(a) of IIJA. This may occur prior to assistance agreements being in place but is not necessary. Additionally, communication of BABA requirements through appropriate Terms and Conditions in financial assistance agreements and in project solicitation and contract documents is key in ensuring all parties involved are informed of the requirements for the project before construction is underway.
  
- Q5.3: How can product compliance with the BABA requirements be demonstrated?
  - A5.3: Assistance recipients and their representatives should ensure that the products delivered to the construction site are accompanied by proper documentation that demonstrate compliance with the law and be made available to the funding authority upon request. The documentation may be received and maintained in hard copy, electronically, or could be embedded in construction management software. The use of a signed certification letter for the project is the most direct and effective form of compliance documentation for ensuring products used on site are BABA-compliant prior to their installation; however, other forms of documentation are also acceptable as long as collectively, the following can be demonstrated:
    - (1) Documentation linked to the project. For example, this can be in the form of the project name, project location, contract number, or project number.
    - (2) Documentation linked to the product used on the project. For example, description of product(s) (simple explanation sufficient to identify the product(s)), or an attached (or electronic link to) purchase order, invoice, or bill of lading.
    - (3) Documentation includes statement attesting that the products supplied to the assistance recipient are compliant with BABA requirement. Reference to the Infrastructure Investment and Jobs Act (“IIJA”) or the Bipartisan Infrastructure Law (BIL) are also acceptable. For iron and steel items under BABA, references to the American Iron and Steel (AIS) requirements are also acceptable and reciprocal with BABA for such items.
    - (4) Documentation that manufacturing occurred in the United States, which could include, for example, the location(s) of manufacturing for each manufacturing step that is being certified. It is acceptable for manufactured products to note a single point of manufacturing, documenting that the final point of manufacturing is in the United States. Note that each BABA category may require different determinations for compliance.
    - (5) Signature of company representative (on company letterhead and signature can be electronic). The signatory of the certifying statement affirms their knowledge of the manufacturing processes for the referenced product(s) and attests that the product meets the BABA requirements.

In addition to compliance documentation, assistance recipients or their representatives should also conduct a visual inspection of the product when it arrives to the project site, especially for iron and steel products which are often stamped with the country of origin. (Note: A country of origin stamp alone is not sufficient verification of compliance with BABA and assistance receipts should not rely on it to ensure compliance.)

EPA may develop alternative procedures for demonstrating compliance. Additional project- or program-specific instructions may be developed on a case-by-case basis in order to meet individual circumstances.

- Q5.4: Will EPA provide a form or template for tracking and documenting compliance?
  - A5.4: EPA does not require a specified format for tracking or documenting compliance. Assistance recipients are free to develop any system (from simple to complex software) for tracking items used on the project and the accompanying compliance documentation, e.g., certification letters, applicable waivers, if it helps with implementation and compliance. Elements that may help with keeping track of compliance may include: product description, quantity required/used, product category (i.e., iron and steel, manufactured product, or construction material), status of obtaining certification letter, product cost, and whether the item might qualify as *de minimis*, or qualify under another applicable waiver.
- Q5.5: If a manufacturer claims to comply with the Buy American Act, does it also comply with BABA?
  - A5.5: No. With the exception of the AIS requirements – which EPA interprets to be equivalent to the “iron and steel” requirements under BABA – EPA does not have an interpretation about the comparability of other domestic preference requirements relative to BABA. Any products that are to be certified as compliant with BABA should include a specific reference to the BABA requirements and appropriate attestation from a responsible manufacturing company official. See Question 5.3 for EPA’s recommendations for BABA certification letters.
- Q5.6: How will assistance recipients manage certification letters for hundreds, possibly thousands of products?
  - A5.6: EPA recognizes that the new BABA requirements will cover most products used in typical water and wastewater infrastructure projects, and that the number of items which may require certification at large and/or complex projects may reach several hundred. EPA is concerned about the potential administrative burden that this would place on assistance recipients. EPA recommends that projects with a high number of potentially covered products meet with their funding authority about potential compliance strategies to minimize burden and streamline compliance activity. Assistance recipients should prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the documentation is sufficient to demonstrate compliance with Build America,

Buy America Act requirements.” In most cases, the assistance recipient’s representatives may assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

- Q5.7: Who is responsible for documenting the 55 percent content requirement for manufactured products under BABA? What if the final manufacturer cannot trace or verify domestic origin for all components?
  - A5.7: The manufacturer who signs a certification letter is responsible for documenting compliance with any of the three categories of products (iron and steel, manufactured products, or construction materials). For manufactured products, BABA requires that greater than 55 percent of the total cost of all components of the manufactured product be from domestic sources. EPA recommends that the certification letter for manufactured products document whether the item passes the content test in the final product along with a statement attesting to compliance with the BABA requirements for manufactured products.
- Q5.8: How do final product fabricators document compliance when the final step of manufacturing may be simply assembling components?
  - A5.8: It is acceptable, in many cases, especially for highly complex manufactured products that utilize many sub-components, for the final point of assembly to certify without using a “step certification” process. Multiple certifications (i.e., step certifications) or a singular certification can be used for a product, as long as the certifying official is willing to attest to the product’s compliance with BABA requirements at all stages of manufacturing.
- Q5.9: Will Material Test Reports be acceptable in lieu of a BABA certification for iron and steel?
  - A5.9: Material Test Reports (MTRs, commonly referred to as “Mill Certifications” or “Mill Certs”) provide the chemical composition of steel and iron from a mill or foundry. If an MTR accompanies the delivery of steel or iron to a project site with an invoice or bill of lading, EPA will consider it sufficient to demonstrate compliance (equivalent to a certification letter) as long as the MTR includes a manufacturer representative’s signature in addition to the location (city and state) of the mill/foundry. It is common for MTRs to be the first letter in a “step certification” if the product is further fabricated or painted, etc., by another manufacturer.
- Q5.10: Can a manufacturer use a fillable certification letter for products?
  - A5.10: EPA recommends that certifications be signed by representatives of the manufacturing entity. EPA does not oppose manufacturers using forms to internally develop letters within their company, thereby providing signed, non-manipulable certification letters to suppliers, distributors, and/or assistance recipients. A fillable form that can be changed by someone outside of the manufacturer after signature does not demonstrate compliance and may create compliance concerns for the manufacturer or assistance recipient.

- Q5.11: Are product certifications from suppliers and distributors allowed?
  - A5.11: EPA recommends that representatives of product manufacturers certify compliance and discourages suppliers and distributors from creating certification letters. EPA does not rule out the possibility that a third-party certification process, such as a certification by a distributor, may be viable. However, EPA is currently not aware of a system or proposed system that meets the EPA's recommendations for documentation of product certification.
- Q5.12: How long should assistance recipients keep compliance documentation?
  - A5.12: Assistance recipients should apply recordkeeping requirements for the project according to the procedures dictated by the funding authority. For most EPA grant programs, this is prescribed in the UGG at 2 CFR 200.334-200.338; e.g., the SRF programs require a minimum of three years. Other funding programs may require longer documentation retention periods.

#### SECTION 6: PROGRAMS WITH AMERICAN IRON AND STEEL REQUIREMENTS

- Q6.1: Does BABA supersede the American Iron and Steel (AIS) Requirements?
  - A6.1: The BABA requirements for items considered "iron and steel" are equivalent to those for covered iron and steel products under the AIS requirements in the Clean Water Act and the Safe Drinking Water Act. These requirements apply to the CWSRF, DWSRF, WIFIA, and Water Infrastructure Community Grants. BABA includes a "Savings Provision" (Section 70917(b)) that states that BABA does not affect existing domestic content procurement preferences for infrastructure projects funded by Federal financial assistance programs that meet the requirements of section 70914. EPA views the AIS requirements as meeting the "iron and steel" product requirements of BABA Section 70914, as they both include the key requirement that items made of iron and steel be wholly manufactured in the United States from the point of melting and/or pouring the iron or steel components through final manufacturing step. Because of the "Savings Provision" of Section 70917, the AIS requirements satisfy the "iron and steel" requirements of BABA. For the programs that have AIS requirements, EPA intends to implement BABA requirements the same way for iron and steel items as it has done for AIS products.
- Q6.2: For iron and steel products, does a manufacturer need to demonstrate compliance from initial melting through the finished product?
  - A6.2: For iron and steel products, the BABA requirements are the same as the existing AIS requirements, in that all of the iron and steel in a covered product (that is, the product is comprised of more than 50 percent iron and steel by material cost) must be melted and poured in the United States and all subsequent manufacturing processes (such as grinding, rolling, bending, reheating, and casting) must occur in the United States.

Q6.3: Will EPA apply the same manufacturing standards for BABA iron and steel products as for the American Iron and Steel (AIS) requirements?

- A6.3: Yes. For AIS, EPA did not require raw materials used in the production of steel or iron to be domestically sourced. For BABA, EPA interprets the requirements to be the same. Hence, like AIS, raw materials in the production of iron and steel subject to BABA requirements would not need to be domestically sourced. The key step for both AIS and BABA domestic iron and/or steel production is the melting/pouring (that is, the location of the furnace), which must be in the United States.
- Q6.4: Will the certification process be similar to the process established for the American Iron and Steel requirements?
  - A6.4: EPA expects the certification process for the BABA requirements to be very similar to that established for the AIS requirements. For iron and steel products, the process should remain the same for AIS and BABA. EPA recommends for manufactured products and for construction materials that certification letters include direct reference to the product/material content requirements under BABA, in addition to an affirmative statement verifying that the product meets the BABA requirements.
- Q6.5: Will duplicate certification letters be required for AIS and BABA for iron/steel products?
  - A6.5: No. Compliance with BABA requirements will be sufficient to demonstrate compliance with AIS requirements for iron and steel products. If a project is subject to BABA, the only demonstration of compliance necessary is with the BABA requirements, of which the iron and steel requirements are equivalent to those of the AIS statutory requirements: the iron or steel in a product made primarily or predominantly of iron and steel (comprising more than 50 percent iron and steel by material cost) must be melted and/or poured in the United States and all subsequent manufacturing processes must occur in the United States.

#### SECTION 7: PROGRAM-SPECIFIC ISSUES

- Q7.1.: How do the BABA requirements apply to Community Grants?
  - A7.1: The Community Project Funding/Congressionally Directed Spending grants for the construction of drinking water, wastewater, and stormwater infrastructure and for water quality protection are subject to the requirements specified in the explanatory statement accompanying the Consolidated Appropriations Act (Explanatory Statement for Division G of P.L. 117-13, the Consolidated Appropriations Act of 2022). The explanatory statement asserts: “Applicable Federal requirements that would apply to a Clean Water State Revolving Fund or Drinking Water State Revolving Fund project grant recipient shall apply to a grantee receiving a CPF grant under this section.” Therefore, the federally funded Community Project Funding/Congressionally Directed Spending grants are subject to the same requirements that apply to CWSRF or DWSRF projects, including BABA and AIS requirements. See also A1.2.

- Q7.2: Should SRF projects covered by the BABA SRF Projects Design Planning Adjustment Period Waiver follow the same procedures for demonstrating compliance as outlined for American Iron and Steel requirements?
  - A7.2: Yes. The SRF Design Planning Adjustment Period waiver does not waive the iron and steel requirements under BABA. The SRF programs have existing domestic preference requirements for SRF projects under CWA Section 608 and SDWA Section 1452(a)(4) (AIS requirements) to use iron and steel products that are produced in the United States. Sections 70917(a) and (b) of BIL explain the application of BABA to existing domestic preference requirements. Specifically, the savings provision in Section 70917(b) states that existing domestic preference requirements that meet BABA requirements are not affected by BABA. The statutory AIS requirements were existing at the time BABA became law and satisfy the BABA iron and steel requirements. Therefore, the statutory AIS requirements that have previously applied to SRF-funded projects will continue to do so, and compliance with AIS requirements will satisfy the BABA iron and steel requirements. Demonstration of compliance for iron and steel products will follow the AIS implementation policies for projects subject to the waiver.
- Q7.3: For SRF programs, is BABA considered a federal cross-cutting authority? (i.e., do “equivalency” rules apply?)
  - A7.3: Yes, BABA is considered a federal cross-cutting requirement that applies to SRF assistance equivalent to the federal capitalization grant (i.e., “equivalency” projects). EPA’s SRF regulations at 40 CFR 35.3145 and 35.3575 require states and recipients of SRF funds equivalent to the amount of the federal capitalization grant to comply with federal cross-cutting requirements. Section 70914 of the IIJA, which states when a Buy America preference applies, explains that “none of the funds made available for a Federal financial assistance program for infrastructure... may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.” Therefore, BABA only applies to projects funded in an amount equivalent to the federal capitalization grant and not to those projects receiving funds in excess of the capitalization grant (i.e., “non-equivalency” projects). (Note: The AIS requirements continue to apply for all SRF projects, including non-equivalency projects, and all WIFIA and Community Grant projects, because equivalency does not apply.)
- Q7.4: Do the BABA requirements apply to Drinking Water State Revolving Fund set-asides?
  - A7.4: Due to requirements related to the deposit of funds in the DWSRF program, almost all of the funds used to conduct set-aside activities are Federal dollars. Therefore, Federal cross-cutting requirements must be applied to all set-aside activities. However, in the case of most set-aside activities, the cross-cutting requirements will not be implicated because of the nature of the activities conducted under the set-asides. Because the BABA requirements only apply to infrastructure, and infrastructure typically is not an eligible set-aside expenditure (with one potential exception being loans for incentive-based source water protection

measures under the Local Assistance and Other State Programs Set-Aside), the BABA requirements will not apply to most set-aside activities.

- Q7.5: What if an SRF project is refinanced using Federal financial assistance on or after May 14, 2022?
  - A7.5: If an SRF project began construction, financed from another funding source, prior to May 14, 2022, but is refinanced through an assistance agreement executed on or after that date, BABA requirements will apply to all construction that occurs on or after May 14, 2022, through completion of construction, unless a waiver applies. There is no retroactive application of the BABA requirements where a refinancing occurs for an SRF project that has completed construction prior to May 14, 2022. (Note: If SRF funding is used for the refinancing, the AIS requirements may still apply depending on the timing of construction.)
- Q7.6: What are the roles and responsibilities for SRF programs for BABA implementation?
  - A7.6: Implementation of the BABA requirements for the State Revolving Fund programs will continue the roles and responsibilities from the successful AIS implementation process.

As with AIS, it is both the assistance recipient's and the state's responsibility to ensure compliance with the BABA requirements. The state is the recipient of a federal capitalization grant and must comply with all grant conditions, including a condition requiring adherence to BABA requirements.

Consequently, states are strongly advised to conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance. In EPA's experience, most states conduct periodic site visits and arrange timely meetings with funded projects. Observed best practices typically include a meeting early in the process (sometimes before bid and usually prior to commencing construction) and at least one project site visit during the construction process. Assistance recipients must maintain documentation of compliance with the BABA requirements, as explained in question 5.3. The documents must be kept by the assistance recipient and should be reviewed by the state during project reviews.

The state's role in the waiver process is to review any waiver requests submitted to the state to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with the assistance recipient to help obtain complete information. Question 4.1 explains the information needed by EPA to expediently review a waiver request.

In order to implement the BABA requirements, EPA has developed an approach for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow states, on behalf of the assistance recipients, to apply for waivers of the BABA requirements directly to EPA Headquarters. Only waiver requests received and/or endorsed from states will be considered. Pursuant to BABA, EPA has the responsibility to make findings as to the issuance of waivers to the BABA requirements.



### Step-by-step SRF Waiver Process

The waiver process begins with the assistance recipient. To fulfill the BABA requirements, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American-made iron and steel, manufactured goods, and construction materials. It is essential that the assistance recipient include the BABA terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 2 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three statutory conditions is demonstrated to EPA and approved.

To apply for a project-specific waiver, the assistance recipient should email the request in the form of a Word document (.doc) or editable PDF (.pdf) to the funding program. It is strongly recommended that each state identify a person or persons for BABA communications. The state designee(s) will review the application for the waiver and determine whether the necessary information has been included (Note: More information may be provided in the future regarding what information is required to be included in waiver requests). Once the waiver application is complete, the designee will forward the application to [CWSRFWaiver@epa.gov](mailto:CWSRFWaiver@epa.gov) or [DWSRFWaiver@epa.gov](mailto:DWSRFWaiver@epa.gov).

### Evaluation by EPA

After receiving an application for waiver of the BABA requirements and ensuring sufficient information was provided, EPA will publish the request on its website for 15 days and receive public comment. EPA will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the state designee whether a waiver request has been approved or not approved as soon as such a decision has been made. Granting such a waiver is a four-step process:

1. Research – After receiving an application for a waiver, EPA will perform market research to determine whether the iron, steel, manufactured goods, or construction materials are available domestically.
2. Posting – After research, if no domestic product has been identified, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: <https://www.epa.gov/cwsrf/build-america-buy-america-baba-waivers-open-public-comment>
3. Evaluation – After receiving an application for waiver of the BABA requirements, EPA will determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program and post the signed waiver on the Agency’s website. The assistance recipient should keep a copy of the signed waiver in its project files.

(Note: Additional steps may be required in the future regarding the waiver process depending on additional guidance from OMB)

## APPENDIX 1

### Example Build America, Buy America (BABA) Act Construction Contract Language

ALL CONSTRUCTION CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE BABA REQUIREMENTS. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN A PROJECT'S CONSTRUCTION CONTRACT. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the \_\_\_\_\_ (“Owner”) and the \_\_\_\_\_ (the “Funding Authority”) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America,” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

## APPENDIX 2

### Example Build America, Buy America (BABA) Act Assistance Agreement Language

ALL FEDERAL FINANCIAL INFRASTRUCTURE ASSISTANCE AGREEMENTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE BABA REQUIREMENTS. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN AN ASSISTANCE AGREEMENT (E.G., SRF LOAN AGREEMENT). EPA MAKES NO CLAIMS REGARDING THE LEGAL SUFFICIENCY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the assistance received (including those imposed by the Infrastructure Investment and Jobs Act (“IIJA”), Public Law No. 117-58) which the Participant understands includes, but is not limited to, the following requirements: that all of the iron and steel, manufactured products, and construction materials used in the Project are to be produced in the United States (“Build America, Buy America Requirements”) unless (i) the Participant has requested and obtained a waiver from the cognizant Agency<sup>[1]</sup> pertaining to the Project or the Project is otherwise covered by a general applicability waiver; or (ii) all of the contributing Agencies have otherwise advised the Participant in writing that the Build America, Buy America Requirements are not applicable to the Project.

Comply with all record keeping and reporting requirements under all applicable legal authorities, including any reports required by the funding authority (such as EPA and/or a state), such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the applicable legal requirements and this Agreement may result in a default hereunder that results in a repayment of the assistance agreement in advance of the maturity of the Bonds, termination and/or repayment of grants, cooperative agreements, direct assistance or other types of financial assistance, and/or other remedial actions.

<sup>[1]</sup> From OMB Guidance M-22-11: To avoid a need for duplicative waiver requests from entities that receive funding for one infrastructure project through multiple Federal agencies, the Federal agency contributing the greatest amount of Federal funds for the project should be considered the “Cognizant Agency for Made in America” and should take responsibility for coordinating with the other Federal awarding agencies. Such coordination will provide uniform waiver criteria and adjudication processes, minimize duplicative efforts among Federal agencies, and reduce burdens on recipients. The Cognizant Agency for Made in America shall be responsible for consulting with the other Federal awarding agencies, publicizing the proposed joint waiver, and submitting the proposed joint waiver for review to MIAO.



# APPENDIX I AMERICAN IRON AND STEEL (AIS) REQUIREMENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

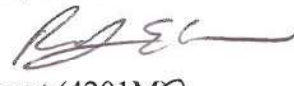
WASHINGTON, D.C. 20460


MAR 20 2014

OFFICE OF WATER

## MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: *for* Andrew D. Sawyers, Director   
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director   
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors  
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an “American Iron and Steel (AIS)” requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

## Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

### **Project Coverage**

#### **1) What classes of projects are covered by the AIS requirement?**

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

#### **2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?**

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

#### **3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?**

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

#### **4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?**

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

**5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?**

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

**6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?**

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

**7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?**

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

**8) What if a project has split funding from a non-SRF source?**

Many States intend to fund projects with “split” funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger



project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

**9) What about refinancing?**

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

**10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?**

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12)

**Covered Iron and Steel Products**

**11) What is an iron or steel product?**

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

**12) What does the term ‘primarily iron or steel’ mean?**

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

**13) Can you provide an example of how to perform a cost determination?**

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

**14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?**

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

**15) What is the definition of steel?**

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

**16) What does ‘produced in the United States’ mean?**

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

**17) Are the raw materials used in the production of iron or steel required to come from US sources?**

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

**18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?**

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

**19) What is the definition of ‘municipal castings’?**

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;

Meter Boxes;  
Service Boxes;  
Steel Hinged Hatches, Square and Rectangular;  
Steel Riser Rings;  
Trash receptacles;  
Tree Grates;  
Tree Guards;  
Trench Grates; and  
Valve Boxes, Covers and Risers.

## **20) What is ‘structural steel’?**

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

## **21) What is a ‘construction material’ for purposes of the AIS requirement?**

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

## **22) What is not considered a ‘construction material’ for purposes of the AIS requirement?**

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

**23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?**

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

**24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?**

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

**Compliance**

**25) How should an assistance recipient document compliance with the AIS requirement?**

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

## **26) How should a State ensure assistance recipients are complying with the AIS requirement?**

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

## **27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?**

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or [OIG\\_Hotline@epa.gov](mailto:OIG_Hotline@epa.gov). More information can be found at this website: <https://oig.hhs.gov/fraud/report-fraud/>

## **28) How do international trade agreements affect the implementation of the AIS requirements?**

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

### **Waiver Process**

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

### **Definitions**

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

## Step-By-Step Waiver Process

### Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: [cwsrfwaiver@epa.gov](mailto:cwsrfwaiver@epa.gov). For DWSRF waiver requests, please send the application to: [dwsrfwaiver@epa.gov](mailto:dwsrfwaiver@epa.gov).



## Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA’s website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: [http://water.epa.gov/grants\\_funding/aisrequirement.cfm](http://water.epa.gov/grants_funding/aisrequirement.cfm)
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

## Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at [dorfman.jordan@epa.gov](mailto:dorfman.jordan@epa.gov) or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at [anderer.kirsten@epa.gov](mailto:anderer.kirsten@epa.gov) or (202) 564-3134.

Attachments

**Attachment 1: Information Checklist for Waiver Request**

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
<p><b>General</b></p> <ul style="list-style-type: none"> <li>• Waiver request includes the following information:               <ul style="list-style-type: none"> <li>— Description of the foreign and domestic construction materials</li> <li>— Unit of measure</li> <li>— Quantity</li> <li>— Price</li> <li>— Time of delivery or availability</li> <li>— Location of the construction project</li> <li>— Name and address of the proposed supplier</li> <li>— A detailed justification for the use of foreign construction materials</li> </ul> </li> <li>• Waiver request was submitted according to the instructions in the memorandum</li> <li>• Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor</li> </ul>	✓	
<p><b>Cost Waiver Requests</b></p> <ul style="list-style-type: none"> <li>• Waiver request includes the following information:               <ul style="list-style-type: none"> <li>— Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products</li> <li>— Relevant excerpts from the bid documents used by the contractors to complete the comparison</li> <li>— Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers</li> </ul> </li> </ul>		
<p><b>Availability Waiver Requests</b></p> <ul style="list-style-type: none"> <li>• Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested:               <ul style="list-style-type: none"> <li>— Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials</li> <li>— Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers.</li> <li>— Project schedule</li> <li>— Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials</li> </ul> </li> <li>• Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought</li> <li>• Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?</li> </ul>		

**Attachment 2: HQ Review Checklist for Waiver Request**

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
<p><b>Cost Waiver Requests</b></p> <ul style="list-style-type: none"> <li>• Does the waiver request include the following information?                             <ul style="list-style-type: none"> <li>— Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products</li> <li>— Relevant excerpts from the bid documents used by the contractors to complete the comparison</li> <li>— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market</li> </ul> </li> <li>• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?</li> </ul>				
<p><b>Availability Waiver Requests</b></p> <ul style="list-style-type: none"> <li>• Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested?                             <ul style="list-style-type: none"> <li>— Supplier information or other documentation indicating availability/delivery date for materials</li> <li>— Project schedule</li> <li>— Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials</li> </ul> </li> <li>• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?</li> <li>• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)</li> <li>• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested?</li> </ul> <p><b>Examples include:</b></p> <ul style="list-style-type: none"> <li>— Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State</li> <li>— Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States</li> <li>— Correspondence with construction trade associations indicating the non-availability of the materials</li> </ul> <ul style="list-style-type: none"> <li>• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?</li> </ul>				

### **Attachment 3: Example Loan Agreement Language**

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States (“American Iron and Steel Requirement”) unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

#### Attachment 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of \_\_\_\_\_ (“Purchaser”) and the \_\_\_\_\_ (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

## Attachment 5: Sample Certification 1

The following information is provided as a sample letter of certification for BABA and AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: BABA and AIS Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

BIL extends this procurement requirement to all construction projects going forward with the inclusion of the Build America, Buy America Act (BABA). Starting on May 14, 2022, all steel, iron, manufactured products, non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), glass (including optic glass), lumber, and drywall used in infrastructure projects for federal financial assistance programs must be produced in the United States.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

## Attachment 5: Sample Certification 2

The following information is provided as a sample letter of certification for BABA and AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: BABA and AIS Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

BIL extends this procurement requirement to all construction projects going forward with the inclusion of the Build America, Buy America Act (BABA). Starting on May 14, 2022, all steel, iron, manufactured products, non-ferrous metals, plastic and polymer-based products (including polyvinyl chloride, composite building materials, and polymers used in fiber optic cables), glass (including optic glass), lumber, and drywall used in infrastructure projects for federal financial assistance programs must be produced in the United States.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative





## APPENDIX J

### Massachusetts COVID-19 Guidelines



# **Supplemental Guidelines for Construction Sites**

## **ADDENDUM 1 Limiting Exposures and Worker Infection Protocol**

### **COVID-19 Employee Health, protection, guidance and prevention**

#### **Limiting Exposures**

Workers should follow the General On-the-Job Guidance to Prevent Exposure & Limit the Transmission of the Virus of the COVID-19 Employee Health, protection, guidance and prevention guide.

In addition, Contractors should advise workers of best practice to limit exposures off the construction site.

When leaving a construction site for breaks, lunch, or other reasons are required to wash hands with soap for at least 20 seconds or use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol before leaving the site and must maintain social distancing if traveling to other locations off the construction site. Frequent use of handwashing or alcohol-based hand sanitizers should be encouraged and handwashing facilities and/or alcohol-based hand sanitizers should be made readily available at work sites.

#### **Worker Infection Protocol**

As provided in the guidance document, there is a zero tolerance for sick workers reporting to work. Employees should be instructed that even those with mild symptoms of respiratory infection (cough, shortness of breath, sore throat) or fever should stay off work. Contractors shall take immediate steps to limit infections at the job site in the event that a worker discovered to have tested positive for COVID-19 or has COVID-19 related symptoms.

Although it is understood that contractors are enforcing Work Site Risk Prevention Practices including social distancing rules and use of PPE, consistent with guidelines it is also recognized that there may be occasions where someone who has tested positive for COVID-19 or who has COVID-19 symptoms has been present in a work area..

Prompt identification and isolation of potentially infectious individuals is a critical step in protecting workers, vendors, visitors, and others at a worksite.

#### **IDENTIFICATION OF EXPOSURE**

The Contractor shall direct workers with COVID-19 related symptoms to leave the jobsite immediately and contact their healthcare provider. The Massachusetts Department of Health (DPH) or a local board of health will make appropriate notifications to those who had direct prolonged contact with the COVID-19 positive workers.

The Contractor shall work with the local board of health to identify any potential jobsite exposures, including :

- Other workers , vendors, inspectors, or visitors to the work site with close contact to the individual
- Work areas such as supply cabinets and designated work stations or rooms
- Work tools and equipment
- Common areas such as break rooms and tables, vending machines, and sanitary facilities

## **NOTIFICATION AND QUARANTINE REQUIREMENTS**

As provided by law, the identity of the worker must be kept confidential.

Upon learning of an infection, the contractor must immediately notify the designated COVID-19 safety officer, the site safety officer, and the owner.

## **SANITIZATION REQUIREMENTS**

Contractor shall take immediate steps to sanitize common areas and direct work places. This includes all on-site bathrooms facilities, any break facilities, and any other common areas on the job site that may have been in close contact with the infected worker.

Sanitation will be conducted with personnel, equipment, and material approved for COVID-19 sanitization.

Identified areas should remain isolated from workers until sanitation process has been completed and area is deemed safe for use.

## **RETURNING TO WORK**

All impacted workers should follow CDC and DPH recommended steps concerning return to work. Workers who are considered close contacts to a COVID19 case by public health authorities should not return for 14 days and are subject quarantine by public health.

Workers who leave during the work day due to COVID-19 symptoms and develop COVID-19 as confirmed by laboratory testing or diagnosis by a healthcare provider shall not return to the site until either released from isolation by healthcare provider or public health.

## **IN ALL CASES**

Keep all employee names confidential as required by law.

Other employees may be sent home while a workspace is being cleaned but will return to work after cleaning unless advised otherwise by a health care provider.

Other employees should be asked to contact their health provider if they have any questions. Remind other employees to continue to practice proper sanitation and monitor for flu like symptoms.

## Enforcement of the COVID-19 Safety Guidelines and Procedures for Construction Sites

COVID-19 Order No. 13, as revised and extended on March 31, 2020, requires the Massachusetts Department of Transportation and the Division of Capital Asset Management and Maintenance to “issue guidance and enforcement procedures for the safe operation of public works construction sites.” The safety guidance is attached as “COVID-19 Guidelines and Procedures for All Construction Sites and Workers at All Public Works Sites” (hereinafter, the COVID-19 Construction Safety Guidance) and is posted online and may be revised from time to time. This document contains the required enforcement procedures, which shall be followed by all state agencies and authorities who undertake, manage or fund construction projects and may be used by each city or town for ensuring the safety of both publicly- and privately-owned construction projects.

- All Projects: Construction sites that cannot consistently comply with the COVID-19 Construction Safety Guidance , including ensuring that social distancing and safety requirements are being followed, must:
  - Safely secure the site and pause construction activities until a corrective action plan is prepared, submitted and approved by both the Owner and the city or town; or
  - Close down the site for the duration of the State of Emergency if repeatedly found by either the Owner’s COVID-19 Officer or a state or local inspector (including a third-party private inspector accountable to a city or town) to be in violation of the social distancing and safety requirements.
- A city or town may additionally require the Owner to develop and submit a site-specific risk analysis and enhanced COVID-19 safety plan. The city or town shall review and approve such plan and may require such projects to pause construction until such a risk analysis and plan is submitted and approved. Once such an enhanced COVID-19 safety plan is approved, a violation of the plan shall be treated the same as a violation of the COVID-19 Construction Safety Guidance.
- A site-specific COVID-19 Officer (who may also be the Health and Safety Officer) shall be designated for every site.
- The approved project Health and Safety Plan (HASP) shall be modified to require that the Contractor’s site-specific project COVID-19 Officer submit a written daily report to the Owner’s Representative. The COVID-19 Officer shall certify that the contractor and all subcontractors are in full compliance with the COVID-19 Construction Safety Guidance.
- Public Projects: For all projects undertaken, managed or funded by a state agency or authority there shall be joint enforcement responsibility between the project’s public Owner and the city or town where the project is located.
  - The Owner of the project has the lead responsibility for compliance and enforcement including frequent on-site inspections by an employee or contractor of the state agency or authority who is familiar with the COVID-19 Construction Safety Guidance and is authorized to enforce that guidance and shut down work at the site if violations are found.
  - The Owner of the project is required to notify the municipality where the work is taking place whenever a site is shut down or of any violations of the COVID-19 Construction

Safety Guidance and the resulting corrective action plan, as well as to provide copies of the COVID-19 Officer's written daily reports upon request.

- While the public Owner has the lead responsibility for enforcement, cities and towns retain the authority to take enforcement action against public projects found not in compliance with the COVID-19 Construction Safety Guidance, including the authority to order the project to shut down until a corrective action plan is developed, approved and implemented.
- Private Projects: For all private projects the primary enforcement responsibility rests with the city or town, with the Massachusetts Department of Transportation and other state agencies providing technical assistance and resource support.
  - Cities and towns are authorized to enforce the COVID-19 Construction Safety Guidance using their public health staff, building inspectors or any other appropriate official or contractor.
  - Cities and towns may enforce the safety and distance protocols including requiring the Owner and/or Contractor to safely secure the site and pause construction activities until a corrective action plan is prepared, submitted and approved by the city or town.
  - The city or town may require the Owner of a private project to pay for an independent, third party inspector or inspection firm (or to pay into a pool to pay for such inspections). The third party inspector shall be accountable solely to the city or town and shall be responsible for enforcement on behalf of the city or town. A city or town may require private projects to pause construction until such a third-party inspector has been secured.

Any questions about these enforcement procedures or the accompanying Guidance can be directed to:

For MassDOT, Michael McGrath, Assistant Administrator for Construction Engineering, [michael.a.mcgrath@state.ma.us](mailto:michael.a.mcgrath@state.ma.us)

For DCAMM, Jay Mitchell, Deputy Commissioner, [Jayson.mitchell@mass.gov](mailto:Jayson.mitchell@mass.gov)

# COVID-19 Employee Health, protection, guidance and prevention

**The following applies to both State employees and contracted staff working on behalf of the State.**

These Guidelines and Procedures MUST be implemented at all times on all construction sites. All construction sites MUST conduct a Safety Stand Down day to disseminate these Guidelines to all employees and workers.

## **Employee Health Protection – ZERO Tolerance**

**ZERO TOLERANCE FOR SICK WORKERS REPORTING TO WORK. IF YOU ARE SICK, STAY HOME! IF YOU FEEL SICK, GO HOME! IF YOU SEE SOMEONE SICK, SEND THEM HOME!**

If you are exhibiting any of the symptoms below, you are to report this to your supervisor (via phone, text or email) right away, and head home from the job site or stay home if already there.

If you notice a co-worker showing signs or complaining about such symptoms, he or she should be directed to their supervisor (via phone, text or email) and asked to leave the project site immediately.

## **COVID-19 Typical Symptoms:**

- Fever
- Cough
- Shortness of Breath
- Sore Throat

## **Self-certify prior to shift**

Prior to starting a shift, each employee will self-certify to their supervisor that they:

- Have no signs of a fever or a measured temperature above 100.3 degrees or greater, a cough or trouble breathing within the past 24 hours.
- Have not had "close contact" with an individual diagnosed with COVID-19. "Close contact" means living in the same household as a person who has tested positive for COVID-19, caring for a person who has tested positive for COVID-19, being within 6 feet of a person who has tested positive for COVID-19 for about 15 minutes, or coming in direct contact with secretions (e.g., sharing utensils, being coughed on) from a person who has tested positive for COVID-19, while that person was symptomatic.
- Have not been asked to self-isolate or quarantine by their doctor or a local public health official.

Workers that are working in a confined space or inside a closed building envelope will have to be temperature screened by a Medical Professional or Trained Individual provided that such screening is out of public view to respect privacy and results are kept private.

Employees exhibiting symptoms or unable to self-certify should be directed to leave the work site and seek medical attention and applicable testing by their health care provider. They are not to return to the work site until cleared by a medical professional.

## **General On-the-Job Guidance to Prevent Exposure & Limit the Transmission of the Virus**

- No handshaking
- Wash hands often with soap for at least 20 seconds or use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol
- Contractor and State Agency Field Offices are locked down to all but authorized personnel
- Each jobsite should develop cleaning and decontamination procedures that are posted and shared. These Procedures must cover all areas including trailers, gates, equipment, vehicles, etc. and shall be posted at all entry points to the sites, and throughout the project site.
- A "No Congregation" policy is in effect, individuals must implement social distancing by maintaining a minimum distance of 6-feet from other individuals



- Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing
- Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion
- All individual work crew meetings/tailgate talks should be held outside and follow social distancing
- Please keep all crews a minimum of 6’ apart at all times to eliminate the potential of cross contamination
- At each job briefing/tool box talk, employees are asked if they are experiencing any symptoms, and are sent home if they are
- Each jobsite should have laminated COVID-19 safety guidelines and handwashing instructions
- All restroom facilities/porta-potties should be cleaned and handwashing stations must be provided with soap, hand sanitizer and paper towels
- All surfaces should be regularly cleaned, including surfaces, door handles, laptops, etc.
- All common areas and meeting areas are to be regularly cleaned and disinfected at least once a day but preferably twice a day
- Be sure to use your own water bottle, and do not share
- To avoid external contamination, we recommend everyone bring food from home
- Please maintain Social Distancing separation during breaks and lunch.
- Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough into your elbow
- Avoid touching eyes, nose, and mouth with your hands
- To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings
- If you or a family member is feeling ill, stay home!

#### **Work Site Risk Prevention Practices**

- At the start of each shift, confirm with all employees that they are healthy.
- We will have a 100% glove policy from today going forward. All construction workers will be required to wear cut-resistant gloves or the equivalent.
- Use of eye protection (safety goggles/face shields) is recommended
- In work conditions where required social distancing is impossible to achieve affected employees shall be supplied PPE including as appropriate a standard face mask, gloves, and eye protection.
- All employees shall drive to work site/parking area in a single occupant vehicle. Contractors / State staff shall not ride together in the same vehicle
- When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant prior to entry
- In instances where it is possible, workers should maintain separation of 6’ from each other per CDC guidelines.
- Multi person activities will be limited where feasible (two person lifting activities)
- Large gathering places on the site such as shacks and break areas will be eliminated and instead small break areas will be used with seating limited to ensure social distancing.
- Contact the cleaning person for your office trailer or office space and ensure they have proper COVID- 19 sanitation processes. Increase their cleaning visits to daily
- Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles

#### **Wash Stations**

All site-specific projects with outside construction sites without ready access to an indoor bathroom MUST install Wash Stations.

- Install hand wash stations with hot water, if possible, and soap at fire hydrants or other water sources to be used for frequent handwashing for all onsite employees
- All onsite workers must help to maintain and keep stations clean

- If a worker notices soap or towels are running low or out, immediately notify supervisors
- Garbage barrels will be placed next to the hand wash station for disposal of tissues/towels

Do all you can to maintain your good health by: getting adequate sleep; eating a balanced, healthy diet, avoid alcohol; and consume plenty of fluids.

Please Note: This document is not intended to replace any formalized procedures currently in place with the General Contractor.

Where these guidance does not meet or exceed the standards put forth by the General Contractor, everyone shall abide by the most stringent procedure available.

A site-specific COVID-19 Officer (who may also be the Health and Safety Officer) shall be designated for every site.

The approved project Health and Safety Plan (HASP) shall be modified to require that the Contractor's sitespecific project COVID-19 Officer submit a written daily report to the Owner's Representative. The COVID-19 Officer shall certify that the contractor and all subcontractors are in full compliance with these guidelines.

Any issue of non-compliance with these guidelines shall be a basis for the suspension of work. The contractor will be required to submit a corrective action plan detailing each issue of non-conformance and a plan to rectify the issue(s). The contractor will not be allowed to resume work until the plan is approved by the Owner. Any additional issues of non-conformance may be subject to action against the contractor's prequalification and certification status.



## APPENDIX K

Well Stations Hazardous Waste Building Materials Survey Report



**HAZARDOUS BUILDINGS MATERIALS SURVEY REPORT  
WELL PUMP HOUSES # 2, 3 & 4  
VARIOUS ADDRESSES, SHARON, MA**



*PREPARED FOR:*

**ENVIRONMENTAL PARTNERS  
1900 CROWN COLONY DRIVE  
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*PREPARED BY:*

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**MARCH 24, 2023**

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## CERTIFICATION OF RESULTS

This report has been prepared for the exclusive use of AXIOM's Client, Environmental Partners. Photocopying of this document by parties other than those designated by the Client or use of this document for purposes other than it is intended, is strictly prohibited.

Respectfully submitted this 24<sup>th</sup> day of March 2023.

Prepared by:



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Geoff Gerace  
Project Manager/Asbestos Inspector

Reviewed by:



---

Randal Ames  
Principal



## **1.0 PURPOSE AND SCOPE OF WORK**

Axiom Partners, Inc. (AXIOM) was retained by Environmental Partners to perform a hazardous buildings materials inspection of the referenced buildings in advance of planned property redevelopment activities.

The purpose of this investigation was to identify Asbestos-Containing Materials (ACMs), Lead-Containing Paint (LCP), Polychlorinated Biphenyls (PCBs), Mercury (Hg), Chlorofluorocarbons (CFCs) and other miscellaneous hazardous materials and wastes for abatement prior to or in conjunction with planned property redevelopment activities.

## **2.0 SITE DESCRIPTION**

The pump houses are either brick or CMU block construction with asphaltic roofing. The buildings are occupied and currently being used as pump houses. The roof of Building 4 consists of rubber membrane covering concrete and is flat. The roofs of Buildings 2 and 3 and the corrosives buildings are asphaltic shingles. The exterior walls of the buildings are brick, concrete, and CMU.

The interior consists primarily of concrete floors with plaster or suspended ceiling tile ceilings. Interior walls are a combination of painted CMU, brick, and concrete. The vast majority of the floors are unfinished concrete.

## **3.0 INSPECTION PERSONNEL, METHODS AND LABORATORY**

### **3.1 Inspection Personnel and Process**

#### *3.1.1 Inspection Personnel*

The investigative survey was conducted on March 8, 2023, by experienced and Massachusetts Department of Labor Standards (DLS) licensed Asbestos Inspector, Geoff Gerace (Massachusetts Asbestos Inspector License Number AI034620). Mr. Gerace was assisted by inspector Jeff Albert also from AXIOM.

#### *3.1.2 Inspection Process*

The inspection for ACMs and hazardous buildings materials (HBMs) was conducted in a systematic manner using AXIOM's standard safety procedures and inspection protocols including:

1. A visual inspection of the buildings' interiors and exteriors to locate, quantify and assess the condition of materials suspected to contain asbestos, lead, PCBs, CFCs, Mercury and other hazardous chemicals, materials and wastes.
2. Collection and analysis of materials as described herein to determine their composition.
3. Review of previous asbestos survey and post-abatement reports, sampling reports and laboratory analysis for ACMs. None were ascertained.

### **3.2 Asbestos-Containing Materials (ACM) Investigation**

3.2.1 *Methodology*

The inspection for suspect ACMs included:

1. Collection of representative bulk samples of each homogeneous application of suspect material in sufficient numbers to comply with EPA/AHERA criteria (see Chart A below).
2. To prevent release of any airborne asbestos, samples of suspect friable materials were collected by wetting the suspect materials and then removing a small full-thickness sample and placing it in a sealed plastic bag labeled with a unique sample identification number.
3. Chain-of-custody documentation was used to ensure sample integrity.
4. Analysis of the bulk samples by an accredited laboratory using the EPA-approved Polarized Light Microscopy (PLM) method.
5. A review of the inspection findings and lab results to ensure proper and consistent identification and characterization of all confirmed and presumed ACMs.

**Chart A**  
**Minimum Asbestos Bulk Sampling Criteria**

Type of Suspect Material <sup>1</sup>	Minimum Sampling Criteria
Surfacing	EPA/AHERA mandated statistically random criteria (Min. of 3 samples; Max. of 7 samples)
Miscellaneous	A sufficient number of samples to determine if material is an ACM (typically 2 samples of each homogeneous application)
Thermal System Insulations	Three random samples of each homogeneous material

3.2.2 *Definition of Key Inspection Terms*

Given the specific purposes and objectives of this inspection, the following definitions were used for the terms: Suspect Materials, Non-Suspect Materials, Homogeneous Applications or Areas, Inaccessible Buildings Areas, and Confirmed ACMs:

1. Suspect Materials: Installed buildings materials that either were pre-formed (i.e., manufactured off-site) or were prepared and installed on-site. All buildings materials are considered to be suspect ACMs except as noted in #2 below.
2. Non-Suspect Materials: For the purposes of this inspection, the following materials were considered non-suspect and were not assessed or sampled if observed:
  - Plastic
  - Glass
  - Wood or Wood Composite Materials
  - Clay or Ceramic Tiles
  - Rubber or Synthetic Foam
  - Paint (unless textured)

---

<sup>1</sup> Per homogeneous material or area

- Brick, Granite, Marble, or Other Stonework
- Concrete or Mortar (except Gyp-Crete)
- Pink or Yellow Fiberglass Insulation on Pipes or Other Mechanical Components
- Carpeting, Curtains, Wallpaper, and Other Paper/Natural Fiber, Fabric, or Synthetics

3. Homogeneous Applications or Areas: Are suspect materials which serve the same function or purpose (e.g., floor or ceiling tiles) have similar color and texture and were likely installed at or near the same time. Note that the homogeneity of certain materials such as wall and ceiling plaster at times cannot be readily determined.
4. Inaccessible Buildings Areas: As this was a due-diligence survey, AXIOM was not able to get into all buildings areas, or to investigate all systems, structural components, or surfaces. Additionally, there were other areas that AXIOM could not survey because it was unsafe or impractical to disassemble or remove systems or coverings or because a human being cannot physically enter or observe the area or components. These areas include, but are not limited to, Transite pipes coming on to the site from municipal utilities mains from the surrounding streets, underground trenches, boilers, vessels, storage tanks and mechanical systems.
5. Confirmed ACMs: Suspect materials where at least one of the bulk samples contains an asbestos concentration equal to<sup>2</sup> or greater than 1%. According to the EPA/AHERA criteria, if all bulk samples of a homogeneous area of material are found to contain less than 1% asbestos, the material may be classified as a non-asbestos material.
6. Friable and Non-Friable ACMs: An ACM that can be crumbled, crushed or otherwise reduced to powder by hand pressure is a friable material; non-friable ACMs cannot. This is important with respect to managing ACMs. Additionally, some non-friable ACMs are regulated differently.
7. Asbestos-Containing Waste Material (ACWM): The Commonwealth of Massachusetts Department of Environmental Protection (MADEP) defines an ACWM as "any ACM removed during a demolition or renovation project and anything contaminated with asbestos in the course of a demolition or renovation project including, but not limited to, asbestos waste from control devices, bags or containers that previously contained asbestos, contaminated clothing, materials used to enclose the work area during the demolition or renovation operation, and demolition or renovation debris. Asbestos-Containing Waste Material (ACWM) shall also include ACM on and/or in facility components that are inoperable or have been taken out of service and any ACM that is damaged or deteriorated to the point where it is no longer attached as originally applied or is no longer serving the intended purpose for which it was originally installed."

### **3.3 Asbestos Laboratory Services**

#### *3.3.1 PLM Bulk Sample Analysis*

Bulk samples collected during the inspection were submitted to and analyzed by Optimum Analytical, Inc. (OPTIMUM) located in Salem, New Hampshire. OPTIMUM is a Massachusetts-licensed asbestos bulk sample laboratory (License #AA000175). Bulk samples were analyzed for

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<sup>2</sup> Massachusetts regulations define an ACM as a material with 1% or greater asbestos. EPA defines an ACM as a material with greater than 1% asbestos.

asbestos content using EPA Method 600/R-93/116. A chain-of-custody form was used to ensure sample integrity.

The entire inventory of collected samples may not have required analysis. Initially, one sample per material was analyzed. If the first sample was found to contain asbestos, the remaining samples were not analyzed (*Positive Stop* protocol). If the first sample was determined not to contain asbestos, however, the remaining samples were analyzed until >1% asbestos was detected or until the entire sample set was analyzed.

### **3.4 Lead Containing Paint (LCP) Investigation**

Representative testing of paints for the presence of lead was performed in the buildings as part of AXIOM's scope of work.

#### *3.4.1 Introduction*

Historically, lead was added to paint because its color stability properties made it a desirable pigment and because it enhances durability. Lead-Containing Paint (LCP) becomes harmful when ingested or inhaled as dust or fumes. Once lead was proven to be a health hazard, it was officially banned in 1978 from paints used in residences.

In an occupational setting, if lead-based painted surfaces are to be impacted by renovation or demolition activities, contractor personnel exposure (per OSHA compliance) and waste disposal (per EPA compliance) issues must be addressed and factored into the cost of the project.

#### *3.4.2 Testing Methodology*

AXIOM utilized a Portable X-Ray Fluorescence Analyzer (XRF) to perform the lead paint survey. The XRF is a hand-held instrument that contains a radioisotopic source and operates on the principle of X-ray fluorescence. The depression of a spring-loaded trigger mechanism on the XRF unit opens a shutter in the face-plate that allows radiation from an isotopic source to stimulate the lead atoms in the paint. This stimulation causes the atoms to emit (fluoresce) X-rays which the unit detects and converts into electrical pulses which are then processed, and the result is read through a digital display on the instrument.

AXIOM used a NITON Model XLp300 which analyzes surfaces quickly, accurately and non-destructively. Surface levels of lead are measured in milligrams per square centimeter (mg/cm<sup>2</sup>). This unit can measure the concentration of LCP on surfaces as little as 0.01 mg of lead/cm<sup>2</sup>.

#### *3.4.3 XRF Testing Procedures*

Upon arrival at the site, a "validation test" was performed to ensure that the XRF instrument was operating properly. The validation test was performed on a calibration test sheet supplied by the manufacturer to determine if the instrument is consistently measuring lead content. During this survey, the XRF was functioning properly as defined by the manufacturer.

In conducting the LCP survey representative tests were performed on homogeneous (similar color and use) painted surfaces. Results were related to other surfaces possessing similar homogeneous characteristics. By following this sampling protocol, every painted surface did not have to be tested.

Representative testing was performed for the presence of lead-based paint (LBP) and lead-containing paint (LCP) on accessible interior and exterior painted surfaces.

### **3.5 Polychlorinated Biphenyls (PCBs) Investigation**

AXIOM conducted an inspection of the buildings and grounds to identify suspect PCB-containing fluorescent light fixture ballasts, electrical transformers and bulk products. The survey was conducted in a systematic manner that included:

1. Performing a detailed walk-through to inspect and categorize the various types of accessible fluorescent light fixtures and electrical transformers.
2. Preparing an inventory of electrical light ballasts and transformers known or suspected to contain PCBs. Nameplate data was recorded if it was present and legible.
3. AXIOM inspected the buildings to identify suspect PCB-containing caulking. The survey included identifying and testing representative caulking compounds materials for PCBs. The bulk samples were collected using hand tools and placed into seal containers (glass sample jars) which were promptly labeled and placed into a cooler with ice. Samples were picked up at the site by a courier and hand delivered to NETLABS Laboratory located in West Warwick, RI for analysis. The samples were prepared using the Soxhlet extraction method and analyzed for PCBs by the Environmental Protection Agency (EPA) Methods 3540C and 8082. The complete laboratory reports can be found in Appendix A.

### **3.6 Mercury Light Tube and Thermostat Investigation**

AXIOM inspected the buildings to identify suspect Mercury-containing equipment as follows:

1. Preparing an inventory of fluorescent light bulbs that contain Mercury vapor in conjunction with the light ballast inspection described in Section 3.5.
2. Performing a walkthrough to identify and inventory thermostats, switches, actuators and other equipment that contain liquid Mercury.

### **3.7 Chlorofluorocarbons (CFCs) Investigation**

AXIOM inspected the buildings to identify suspect chlorofluorocarbons (CFCs) associated with refrigeration and air conditioning equipment and prepared an inventory of equipment including an estimate of CFC quantities. Nameplate data was recorded if it was present and legible. Assumptions were made if the unit was inaccessible or if the nameplate was not present or illegible.

### **3.8 Miscellaneous Hazardous Buildings Materials**

AXIOM inspected the buildings for miscellaneous hazardous buildings materials and chemical wastes including oil-containing devices (e.g. boilers, generators, elevators, motors, grease traps, etc.) and miscellaneous items such as lead acid batteries, paints, cleaners and other chemicals.

## **4.0 FINDINGS AND RECOMMENDATIONS**

#### 4.1 Asbestos-Containing Materials

##### 4.1.1 Asbestos-Containing Materials (ACMs)

Materials **confirmed** to contain  $\geq 1\%$  asbestos for the survey are as follows:

**TABLE 1  
CONFIRMED ACMs**

Sample Description	Sample Location	Sample Reference	Estimated Quantity <sup>3</sup>	Results <sup>4</sup>
030823-57-01A & B	Exterior Door Caulking	Exterior of Well Pump House #4	28 LF	1 @ 2% CHR 1 @ SNA
030823-57-03A&B	Exterior Window Caulking	Exterior of Well Pump House #4	2 Each	1 @ 3% CHR 1 @ SNA

##### 4.1.2 Presumed Asbestos-Containing Materials (PACMs)

The following presumed ACMs (PACMs) may be present in or on the buildings or at the site that could not be investigated or tested due to inaccessibility:

**TABLE 2  
PRESUMED ACMs**

Material	Location	Estimated Quantity	Friability
Buried Pipes	Beneath Buildings or at Site	TBD	TBD
Loose Fill Insulation (in CMU walls)	Various Areas of Buildings' Interiors	TBD	TBD
Concealed Caulkings & Sealants Behind Vinyl or Aluminum Window Frames	Various Areas Buildings' Exteriors	TBD	Friable
Concealed Pipe/Fitting Insulation Behind and Above Hard Ceilings and Walls	Various Areas of Buildings' Interiors	TBD	Friable
Built up Roofing	Well Pump House # 4	580 SF	Non-Friable

##### 4.1.3 Non-Asbestos-Containing Materials

Materials that are non-ACMs based on AXIOM's most recent survey are listed in Table 3 below:

**TABLE 3  
CONFIRMED NON-ACMS**

<sup>3</sup> SF = Square Feet; LF = Linear Feet; EA = Each; TBD = To be Determined;

<sup>4</sup> NAD = No Asbestos Detected; CHR = Chrysotile Asbestos; SNA = Sample not analyzed (Positive Stop)

Sample Reference	Material	Location(s)
030823-57-02A&B	Red Brick Mortar	Well Station #4, Pump House
030823-57-04A&B	2' x 4' White Fissured Ceiling Tile	Well Station #4, Pump House
030823-57-05A&B	Plaster Ceiling	Well Station #4, Pump House
030823-57-06A&B	CMU Block Mortar	Well Station #4, Chemical Storage Bldg
030823-57-07A&B	Black Asphalt Shingle	Well Station #4, Chemical Storage Bldg
030823-57-08A&B	Tar Paper Layer	Well Station #4, Chemical Storage Bldg
030823-57-10A&B	Red Brick Mortar	Well Station #2, Pump House
030823-57-11A&B	2' x 4' White Fissured Ceiling Tile	Well Station #2, Pump House
030823-57-12A&B	Textured Paint on Foundation	Well Station #2, Pump House
030823-57-13A&B	Fiber board Panels	Well Station #2, Pump House
030823-57-14A&B	CMU Block Mortar	Well Station #2, Chemical Storage Bldg
030823-57-15A&B	Gray Asphalt Shingle	Well Station #2, Chemical Storage Bldg
030823-57-16A&B	Tar Paper Layer	Well Station #2, Chemical Storage Bldg
030823-57-17A&B	Gray Asphalt Shingle	Well Station #2, Pump House
030823-57-18A&B	Tar Paper Layer	Well Station #2, Pump House
030823-57-19A&B	Roof Flashing Cement	Well Station #2, Pump House Vent
030823-57-20A&B	CMU Block Mortar	Well Station #3, Chemical Storage Bldg
030823-57-21A&B	Gray Asphalt Shingle	Well Station #3, Chemical Storage Bldg
030823-57-22A&B	Tar Paper Layer	Well Station #3, Chemical Storage Bldg
030823-57-23A&B	White Roof Coating	Well Station #3, Pump House
030823-57-24A&B	Red Brick Mortar	Well Station #3, Pump House
030823-57-25A&B	Exterior Door Caulking	Well Station #3, Pump House
030823-57-26A&B	Plaster Ceiling	Well Station #3, Pump House

#### 4.1.4 Discussion and Recommendations

The mere presence of asbestos in a building does not mean that the health of buildings occupants is necessarily at risk. As long as the ACMs remain in good condition and are not disturbed, exposure is unlikely. However, when buildings maintenance, repair, renovation, demolition or other activities disturb ACMs, or if ACMs are damaged, asbestos fibers are released creating a potential hazard to buildings occupants.

There were two (2) ACMs associated with Well Pump #4 building. There are also PACMs at the buildings that must be explored and/or tested to rule out the possibility that they contain asbestos. If the subject buildings are demolished and/or renovated, and if future testing proves that the PACMs contain asbestos, these ACMs must be removed by a Massachusetts-licensed Asbestos Removal Contractor prior to or in conjunction with the demolition work. As required by governing regulations, completion of each asbestos removal task must include a visual inspection by a

Massachusetts-licensed Asbestos Project Monitor and final clearance air testing if asbestos removal is performed inside a negative pressure enclosure (containment).

Regulations require that all ACMs be included in a site-specific asbestos operations and maintenance (O&M) program designed, at a minimum, to comply with 29 CFR 1910.1001 and 1926.1101, incorporating the basic components in the EPA's *Guide to Managing Asbestos in Buildings*. However, since all ACMs will imminently be removed during buildings demolition, the O&M program will not be required.

PACMs that may be present are identified in Table 2.

Removal of ACMs, PACMs and other HBMs should be clearly defined in a project specification which is used to obtain competitive bids for the work.

A detailed cost estimate for removal of ACMs, PACMs is present in Appendix E and includes an allowance for the removal of HBMs.

#### **4.2 Lead-Containing Paints (LCP)**

The HUD<sup>5</sup> lead paint standard classifies Lead Based Paint (LBP) as paint having  $\geq 1.0$  mg/cm<sup>2</sup> as measured by the XRF or  $\geq 0.5\%$  of lead by weight as analyzed by Atomic Absorption. With respect to renovation and demolition work, OSHA defines a lead-containing paint (LCP) as paint containing detectable amounts of lead.

Based on testing performed by AXIOM, several of the paints were found to contain detectable lead. The paints are generally in fair to good condition. A complete listing of the testing results can be found in Appendix B

Contractors should be made aware of the presence of lead paint testing results to satisfy the hazard communication requirements set forth by OSHA regulations. Specifically, contractors and subcontractors should be required to comply with OSHA regulation 29 CFR 1926.62 and Massachusetts regulation 453 CMR 22.11 for lead exposure in construction and 29 CFR 1926.59, *Hazard Communication for the Construction Industry*. This could be accomplished by providing the affected contractors with a copy of this report. The General Contractor is responsible for informing and managing their employees and subcontractors.

The current interpretation of the EPA's Resource Conservation and Recovery Act (RCRA) requires that waste generated during projects where LCPs are present and will be disposed of is tested for the toxicity characteristic of lead in the waste stream. TCLP<sup>6</sup> testing is performed to determine whether waste (construction/demolition debris) must be classified as hazardous because of its lead content or if it can be disposed in a conventional construction and demolition (C&D) landfill. The regulatory limit for lead toxicity is 5.0 milligrams per liter (mg/L) using the EPA Method SW846-7420 for Atomic Absorption Spectroscopy (AAS). Since the need for TCLP testing is typically determine by the disposal facility/landfill, AXIOM recommends that pre-disposal testing is the contractor's responsibility.

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<sup>5</sup> U.S. Department of Housing and Urban Development

<sup>6</sup> Toxicity Characteristic Leachate Procedure (TCLP)



### **4.3 Polychlorinated Biphenyls (PCBs) and Mercury in Electrical Equipment**

#### *4.3.1 Fluorescent Light Fixtures*

AXIOM identified two (2) types of fluorescent light fixtures in the subject buildings. If there were ballasts labeled “No PCBs” they would be presumed to contain di (2-ethylhexyl) phthalate (DEHP). A summary of fluorescent light fixtures is provided in Appendix C.

Handling and disposal of fluorescent light ballasts that contain PCBs should be performed in accordance with the Massachusetts Universal Waste Management Standard (310 CMR 30.1034) and EPA’s Resource Conservation and Recovery Act (RCRA) and other governing regulations and requirements. There are two methods currently available for disposal of PCB-containing ballasts including incineration and disposal. Incineration is typically more expensive. Regardless of the method, documentation must be provided that verifies the proper removal, transportation, and disposal (destruction/incineration) at an approved facility. In general, PCB ballasts must be placed in 55-gallon drums which once filled, the drums must be closed and properly labeled for temporary storage, transport, and disposal in accordance with all applicable regulations. Drums containing PCB ballasts must be transported to an EPA-approved disposal facility (landfill or incinerator). Documentation must be provided that verifies the proper removal, transportation, and disposal (or destruction/incineration) at the approved facility. Drums containing non-PCB fluids, ballasts or capacitors shall be disposed of at a legally permitted disposal facility. There is presently no regulatory mandate for special handling and disposal of DEHP-containing ballasts, however, since there are a number of regulations that may be indirectly applicable<sup>7</sup> and since the disposal cost is not significant, AXIOM recommends disposing of DEHP-containing ballasts similarly.

#### *4.3.2 Transformers*

AXIOM did observe six (6) pole mounted transformers on the site. These wet-type pole mounted transformers are assumed to contain PCB’s.

#### *4.3.3 Mercury-Containing Items*

There are approximately thirty-four (34) fluorescent light bulbs associated with actual light fixtures in the subject buildings. A summary of mercury-containing items is provided in Appendix C.

Handling and disposal of fluorescent light bulbs that contain Mercury should be performed in accordance with the Massachusetts Universal Waste Management Standard (310 CMR 30.1034) and EPA’s Resource Conservation and Recovery Act (RCRA) and other governing regulations and requirements. Guidance documents are also available from the EPA (e.g. the 1994 Green Lights Program for Lighting Waste Disposal). If fluorescent lamps become broken or damaged during removal, the broken lamps should be managed as hazardous waste. Note that fluorescent light tubes may be reused.

Mercury-containing devices must be properly recycled in accordance with 310 CMR 30.1034.

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<sup>7</sup> Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund"), Solid Waste Disposal Act, the Clean Water Act, Safe Drinking Water Act and the Toxic Substances Control Act.

#### 4.4 Chlorofluorocarbons (CFCs)

AXIOM did not observe CFCs in the subject buildings.

#### 4.5 Polychlorinated Biphenyls (PCBs) Testing

##### 4.5.1 Summary of PCB Bulk Product Testing Results

The following table provide the laboratory results of analysis of caulking for PCBs. The laboratory reports are in Appendix A.

**TABLE 3**  
**SUMMARY OF PCBs IN CAULKING COMPOUND RESULTS**

Sample Number	Description	Location	Analysis Results <sup>8</sup>
PCB-01	Exterior Window Caulking	Well Pump House # 4	ND
PCB-02	Exterior Door Caulking	Well Pump House # 3	ND
PCB-03	Exterior Window Caulking	Well Pump House # 3	ND

Laboratory results are reported in micrograms per kilograms ( $\mu\text{g}/\text{kg}$ ) which AXIOM converted to milligrams per kilograms ( $\text{mg}/\text{kg}$ ) which is equivalent to parts per million (ppm) for comparison to EPA definitions.

##### 4.5.2 Discussion

According to 40 CFR 761, the EPA specifies that products and materials containing greater than 50 ppm are PCB bulk products. Based on the results of this investigation, **none** of the buildings materials (e.g., caulking, glazing or sealants) are considered to be PCB bulk products.

#### 4.6 Miscellaneous Hazardous Wastes

##### 4.6.1 Miscellaneous Hazardous Materials/Wastes

AXIOM identified other hazardous materials/wastes including drums of chemicals, tanks of chemicals in the corrosive buildings and fire extinguishers. These items are also listed in Appendix C.

#### 5.0 LIMITATIONS AND EXCLUSIONS

##### 5.1 Limitations and Conditions of This Investigation

##### 5.1.1 NESHAPs Asbestos Survey

<sup>8</sup> ND = PCBs not detected at the Reporting Limit (RL) for the specific samples. Refer to lab report for PCB Reporting Limits; Results are reported in milligrams per kilogram ( $\text{mg}/\text{kg}$ ) which is equivalent to parts per million (ppm); all ND results include Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262 and 1268 unless specifically noted otherwise.

This NESHAPs survey involved an investigation for ACMs in preparation for buildings demolition. Although this investigation attempted to identify and sample inaccessible buildings materials, some materials were inaccessible, and the potential remains that concealed ACMs may be encountered in the buildings or at the site.

#### *5.1.2 Inaccessible Materials and Locations*

Inaccessible buildings areas, systems, structural components, or surfaces which may not have been observed because it was unsafe or impractical to demolish, disassemble, or remove systems or coverings, or because a human being cannot physically enter or observe the area or component. Unless specifically noted, inaccessible materials or areas may include:

- buried or otherwise concealed pipe trenches and utility vaults/corridors;
- buried foundations;
- asphaltic roofing materials (field & flashings) under rubber membranes;
- enclosed wall and ceiling cavities;
- electrical equipment/wire;
- concealed mechanical materials; and
- remnant window and door caulking that have been replaced or in-filled.

AXIOM made every reasonable effort to address these potential ACMs. However, the potential remains that concealed ACMs could be encountered during renovation or demolition work.

#### *5.1.3 Other Environmental Exclusions*

1. This investigation did not include an assessment of air quality or analysis of soil, surface water or groundwater. Furthermore, this study did not include any subsurface exploration, testing or assessment for wetlands.
2. This investigation did not include assessments for the presence of pesticides, herbicides, urea-formaldehyde or Radon, nor any air quality monitoring, or any chemical analysis of soil, surface water, or groundwater at the Site.
3. No attempt was made to check the compliance of present or past owners of the Site with Federal, State, or local laws.
4. The testing for lead paint was performed by an experienced Industrial Hygienist. It is intended only to satisfy the requirements of OSHA regulations including 29 CFR 1926.62, *Lead Exposure in Construction: Interim Final Rule* and 29 CFR 1926.59, *Hazard Communication for the Construction Industry*. This investigation was not performed by an EPA HUD<sup>9</sup> or state accredited/licensed Lead Inspector which is often required for residential structures where children under the age of six live.

#### *5.1.4 Project Specifications*

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<sup>9</sup> US Department of Housing and Urban Development

Users are cautioned that this document is an inspection report, not a project specification. Although it is often feasible to use a report such as this to obtain bids for asbestos and related abatement work, it does not provide a proper and/or complete document for defining the scope of work and specifying contractual obligations.

## APPENDIX A

### Asbestos Bulk and PCB Bulk Sample Results



Geoff Gerace  
Axiom Partners  
50 Salem Street Building B  
Lynnfield MA 01940

Project Reference: 01383.001  
Laboratory Batch #: 2346262  
Date Samples Received: 03/08/2023  
Date Samples Analyzed: 03/17/2023  
Date of Final Report: 03/17/2023

**SAMPLE IDENTIFICATION:**

Fifty (50) samples from Well Pump House #2, 3, 4; Various Sharon, MA project were submitted by Geoff Gerace on 03/08/2023

This bulk sample(s) was delivered to Optimum Analytical Consulting, LLC (Optimum) located in Salem, New Hampshire for asbestos content determination.

**ANALYTICAL METHOD:**

Analytical procedures were performed in accordance with the U.S. Environmental Protection Agency (EPA) Recommended Method for the Determination of Asbestos in Bulk Samples by Polarized Light Microscopy and Dispersion Staining (PLM/DS)(EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials). This report relates only to those samples analyzed, and may not be indicative of other similar appearing materials existing at this, or other sites. Quantification of asbestos content was determined by Calibrated Visual Estimation. Optimum is not responsible for sample collection activities or analytical method limitations. The laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

In any given material, fibers with a small diameter (<0.25µm) may not be detected by the PLM method. Floor tile and other resinous bound materials may yield a false negative if the asbestos fibers are too small to be resolved using PLM. Additionally, there is currently no approved EPA analytical method to reliably confirm vermiculite as non-asbestos containing. Additional analytical methods may be required. Optimum Analytical recommends using Transmission Electron Microscopy (TEM) or other approved methods for a more definitive analysis.

Optimum will retain all samples for a minimum of three months. Further analysis or return of samples must be requested within this three month period to guarantee their availability. This report may not be reproduced except in full, without the written approval of Optimum Analytical and Consulting, LLC.

The client/laboratory shall not use the NVLAP and AIHA Logo or this test report in a way that constitutes or implies product certification, approval, or endorsement by the National Institute of Standards and Technology or the American Industrial Hygiene Association.

Detection Limit <1%, Reporting Limits: CVES = 1%, 400 Point Count = .25%, 1000 Point Count = 0.1%; Present or Absent are observations made during a qualitative analysis.

This report is considered preliminary until signed by both the Laboratory Analyst and Laboratory Director or Supervisor. If you have any questions regarding this report, please do not hesitate to contact us.

Jamie L. Noel  
Laboratory Director



# OPTIMUM

Analytical and Consulting, LLC

85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

## BULK SAMPLE ANALYSIS REPORT POLARIZED LIGHT MICROSCOPY

PLM (EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials) NVLAP Lab Code: 101433-0

**CLIENT:** Axiom Partners  
**ADDRESS:** 50 Salem Street Building B  
**CITY / STATE / ZIP:** Lynnfield MA 01940  
**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
**PROJECT #:** 01383.001  
**DATE COLLECTED:** 03/08/2023  
**COLLECTED BY:** Geoff Gerace  
**DATE RECEIVED:** 03/08/2023  
**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

### REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
2346262-001 030823-57-01A	Well Station #4, Pump House Exterior Door Caulking, Gray/Tan	LAYER 1 100%	Chrysotile	2%	Cellulose Fiber Binder/Filler	1% 97%
2346262-002 030823-57-01B	Well Station #4, Pump House Exterior Door Caulking, Gray/Tan Note: Positive Stop	LAYER 1 100%				
2346262-003 030823-57-02A	Well Station #4, Pump House NE Red Brick Mortar, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Binder/Filler	1% 99%
2346262-004 030823-57-02B	Well Station #4, Pump House SW Red Brick Mortar, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Binder/Filler	1% 99%
2346262-005 030823-57-03A	Well Station #4, Pump House Rear Ext. Window Caulking, Gray	LAYER 1 100%	Chrysotile	3%	Cellulose Fiber Binder/Filler	1% 96%
2346262-006 030823-57-03B	Well Station #4, Pump House Side Ext. Window Caulking, Gray Note: Positive Stop	LAYER 1 100%				
2346262-007 030823-57-04A	Well Station #4, Pump House NW 2'x4' Fissured Ceiling Tile, Gray/White	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Binder/Filler	65% 15% 20%
2346262-008 030823-57-04B	Well Station #4, Pump House SE 2'x4' Fissured Ceiling Tile, Gray/White	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Binder/Filler	65% 15% 20%
2346262-009 030823-57-05A	Well Station #4, Pump House NW Plaster Ceiling, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Binder/Filler	2% 98%



85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

## BULK SAMPLE ANALYSIS REPORT POLARIZED LIGHT MICROSCOPY

PLM (EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials) NVLAP Lab Code: 101433-0

**CLIENT:** Axiom Partners  
**ADDRESS:** 50 Salem Street Building B  
**CITY / STATE / ZIP:** Lynnfield MA 01940  
**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
**PROJECT #:** 01383.001  
**DATE COLLECTED:** 03/08/2023  
**COLLECTED BY:** Geoff Gerace  
**DATE RECEIVED:** 03/08/2023  
**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

### REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
2346262-010 030823-57-05B	Well Station #4, Pump House SE Plaster Ceiling, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 2% 98%
2346262-011 030823-57-06A	Well Station #4, Chemical Storage Bldg E CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-012 030823-57-06B	Well Station #4, Chemical Storage Bldg N CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-013 030823-57-07A	Well Station #4, Chemical Storage Bldg S Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber Fibrous Glass Binder/Filler 1% 35% 64%
2346262-014 030823-57-07B	Well Station #4, Chemical Storage Bldg E Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber Fibrous Glass Binder/Filler 1% 35% 64%
2346262-015 030823-57-08A	Well Station #4, Chemical Storage Bldg S Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 92% 8%
2346262-016 030823-57-08B	Well Station #4, Chemical Storage Bldg E Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 92% 8%
2346262-017 030823-57-10A	Well Station #2, Pump House S Red Brick Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%





## BULK SAMPLE ANALYSIS REPORT POLARIZED LIGHT MICROSCOPY

PLM (EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials) NVLAP Lab Code: 101433-0

85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

**CLIENT:** Axiom Partners  
**ADDRESS:** 50 Salem Street Building B  
**CITY / STATE / ZIP:** Lynnfield MA 01940  
**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
**PROJECT #:** 01383.001  
**DATE COLLECTED:** 03/08/2023  
**COLLECTED BY:** Geoff Gerace  
**DATE RECEIVED:** 03/08/2023  
**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

### REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
2346262-018	Well Station #2, Pump House NE Interior			
030823-57-10B	Red Brick Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-019	Well Station #2, Pump House E			
030823-57-11A	2'x4' Ceiling Tile, White/Gray	LAYER 1 100%	None Detected	Cellulose Fiber Fibrous Glass Binder/Filler 65% 15% 20%
2346262-020	Well Station #2, Pump House N			
030823-57-11B	2'x4' Ceiling Tile, White/Gray	LAYER 1 100%	None Detected	Cellulose Fiber Fibrous Glass Binder/Filler 65% 15% 20%
2346262-021	Well Station #2, Pump House W			
030823-57-12A	textured Paint on Foundation, White	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-022	Well Station #2, Pump House E			
030823-57-12B	textured Paint on Foundation, White	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-023	Well Station #2, Pump House E			
030823-57-13A	Fiber Board Panles, Brown	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 97% 3%
2346262-024	Well Station #2, Pump House N			
030823-57-13B	Fiber Board Panles, Brown	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 97% 3%
2346262-025	Well Station #2, Chemical Storage Bldg E			
030823-57-14A	CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%
2346262-026	Well Station #2, Chemical Storage Bldg W			
030823-57-14B	CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber Binder/Filler 1% 99%



# OPTIMUM

Analytical and Consulting, LLC

85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

## BULK SAMPLE ANALYSIS REPORT POLARIZED LIGHT MICROSCOPY

PLM (EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials) NVLAP Lab Code: 101433-0

**CLIENT:** Axiom Partners  
**ADDRESS:** 50 Salem Street Building B  
**CITY / STATE / ZIP:** Lynnfield MA 01940  
**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
**PROJECT #:** 01383.001  
**DATE COLLECTED:** 03/08/2023  
**COLLECTED BY:** Geoff Gerace  
**DATE RECEIVED:** 03/08/2023  
**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

### REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
2346262-027	Well Station #2, Chemical Storage Bldg SE			
030823-57-15A	Asphalt Shingle Roof, Gray/Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-028	Well Station #2, Chemical Storage Bldg NE			
030823-57-15B	Asphalt Shingle Roof, Gray/Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-029	Well Station #2, Chemical Storage Bldg SE			
030823-57-16A	Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber 93% Binder/Filler 7%
2346262-030	Well Station #2, Chemical Storage Bldg NE			
030823-57-16B	Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber 93% Binder/Filler 7%
2346262-031	Well Station #2, Pump House S			
030823-57-17A	Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-032	Well Station #2, Pump House E			
030823-57-17B	Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-033	Well Station #2, Pump House S			
030823-57-18A	Tar Paper Layer, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 30% Binder/Filler 69%
2346262-034	Well Station #2, Pump House E			
030823-57-18B	Tar Paper Layer, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 30% Binder/Filler 69%



85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

**CLIENT:** Axiom Partners  
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**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
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**DATE COLLECTED:** 03/08/2023  
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**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

## REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
2346262-035 030823-57-19A	Well Station #2, Pump House Chimney Roof Flashing Cement, Black	LAYER 1 100%	None Detected	Cellulose Fiber 2% Fibrous Glass 5% Binder/Filler 93%
2346262-036 030823-57-19B	Well Station #2, Pump House Vent Roof Flashing Cement, Black	LAYER 1 100%	None Detected	Cellulose Fiber 2% Fibrous Glass 5% Binder/Filler 93%
2346262-037 030823-57-20A	Well Station #3, Chemical Storage Bldg SE CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-038 030823-57-20B	Well Station #3, Chemical Storage Bldg W CMU Block Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-039 030823-57-21A	Well Station #3, Chemical Storage Bldg SE Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-040 030823-57-21B	Well Station #3, Chemical Storage Bldg NW Asphalt Shingle Roof, Black	LAYER 1 100%	None Detected	Cellulose Fiber 1% Fibrous Glass 35% Binder/Filler 64%
2346262-041 030823-57-22A	Well Station #3, Chemical Storage Bldg SE Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber 92% Binder/Filler 8%
2346262-042 030823-57-22B	Well Station #3, Pump House NW Tar Paper, Black	LAYER 1 100%	None Detected	Cellulose Fiber 92% Binder/Filler 8%



# OPTIMUM

Analytical and Consulting, LLC

85 Stiles Road, Suite 201, Salem, NH 03079 Phone: (603)-458-5247

## BULK SAMPLE ANALYSIS REPORT POLARIZED LIGHT MICROSCOPY

PLM (EPA-40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA-600/ R-93-116 Method for Determination of Asbestos in Bulk Building Materials) NVLAP Lab Code: 101433-0

**CLIENT:** Axiom Partners  
**ADDRESS:** 50 Salem Street Building B  
**CITY / STATE / ZIP:** Lynnfield MA 01940  
**CONTACT:** Geoff Gerace  
**DESCRIPTION:** PLM Analysis  
**LOCATION:** Well Pump House #2, 3, 4; Various Sharon, MA

**ORDER #:** 2346262  
**PROJECT #:** 01383.001  
**DATE COLLECTED:** 03/08/2023  
**COLLECTED BY:** Geoff Gerace  
**DATE RECEIVED:** 03/08/2023  
**ANALYSIS DATE:** 03/17/2023  
**REPORT DATE:** 03/17/2023  
**ANALYST:** Jamie Noel

### REPORT OF ANALYSIS

Laboratory ID Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
2346262-043 030823-57-23A	Well Station #3, Pump House E Roof Coating, White	LAYER 1 100%	None Detected	Cellulose Fiber 3% Fibrous Glass 5% Binder/Filler 92%
2346262-044 030823-57-23B	Well Station #3, Pump House W Roof Coating, White	LAYER 1 100%	None Detected	Cellulose Fiber 3% Fibrous Glass 5% Binder/Filler 92%
2346262-045 030823-57-24A	Well Station #3, Pump House SE Red Brick Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-046 030823-57-24B	Well Station #3, Pump House SW Red Brick Mortar, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-047 030823-57-25A	Well Station #3, Pump House E Exterior Door Caulking, Green/White	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-048 030823-57-25B	Well Station #3, Pump House E Exterior Door Caulking, Green/White	LAYER 1 100%	None Detected	Cellulose Fiber 1% Binder/Filler 99%
2346262-049 030823-57-26A	Well Station #3, Pump House NE Plaster Ceiling, Gray/White	LAYER 1 100%	None Detected	Cellulose Fiber 3% Binder/Filler 97%
2346262-050 030823-57-26B	Well Station #3, Pump House E Plaster Ceiling, Gray/White	LAYER 1 100%	None Detected	Cellulose Fiber 3% Binder/Filler 97%

**Analyst Signatory:**   
 Jamie Noel





AXIOM PARTNERS  
 50B SALEM STREET, ST 103  
 LYNNFIELD, MA 01940  
 PHONE: 781.213.9198

OPTIMUM LABORATORY ORDER #:

Sample(s) received in good condition? [Y] [N]  
 Discernable field blank submitted? [Y] [N]

**Asbestos Analysis - Chain of Custody Form**

2346262

**Sampled by:** Geoff Gerace **Date Collected:** 03/08/2023

**Project Name:** Asbestos-Containing Materials Survey-Well Pump House # 2, 3, 4

**Project Site:** Various Sharon, Ma

**Project ID/Number:** 01383.001

**Special Lab Instructions:** Positive Stop, E-Mail Results to [ggerace@axiomenv.com](mailto:ggerace@axiomenv.com)

**TURNAROUND TIME - If turn around time is not chosen standard turnaround time applies (6 + Days)**

3 Hours    6 Hours    2 Hours    24 Hours    48 Hours    72 Hours    4 Days     5 Days    6-10 Days

**TYPE OF ASBESTOS ANALYSIS**

<p>PCM - Air</p> <p><input type="checkbox"/> NIOSH 7400 (A) Issue 2: August 1994</p> <p><input type="checkbox"/> OSHA w/TWA</p> <p>PLM - Bulk</p> <p><input checked="" type="checkbox"/> <b>EPA 600/R-93/116</b></p> <p><input type="checkbox"/> California Air Resource Board (CARB) 435</p> <p><input type="checkbox"/> <b>NY Stratified Point Count</b></p> <p><input type="checkbox"/> NIOSH 9002</p> <p><input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1</p> <p><input type="checkbox"/> EPA Point Count (400 Points)</p> <p><input type="checkbox"/> EPA Point Count (1,000 Points)</p> <p><input type="checkbox"/> <b>Standard Addition Point Count</b></p>	<p>SOILS</p> <p><input type="checkbox"/> <b>EPA Protocol Qualitative</b></p> <p><input type="checkbox"/> <b>EPA Protocol Quantitative</b></p> <p><input type="checkbox"/> EMSL MSD 9000 Method fibers/gram</p> <p><input type="checkbox"/> Superfund EPA 540-R097-028 (dust generation)</p> <p>TEM AIR</p> <p><input type="checkbox"/> <b>AHERA 40 CFR, Part 763 Subpart E</b></p> <p><input type="checkbox"/> NIOSH 7402 Issue 2</p> <p><input type="checkbox"/> EPA Level II</p> <p>TEM WIPE</p> <p><input type="checkbox"/> <b>ASTM D-6480-99</b></p> <p><input type="checkbox"/> Qualitative</p>	<p>TEM MICROVAC</p> <p><input type="checkbox"/> ASTM D 5755-95 (Quantitative)</p> <p>TEM BULK</p> <p><input type="checkbox"/> <b>Drop Mount (Qualitative)</b></p> <p><input type="checkbox"/> Chatfield SOP-1988-02</p> <p><input type="checkbox"/> TEM NOB (Gravimetric) NY 198.4</p> <p>TEM WATER</p> <p><input type="checkbox"/> EPA 100.1</p> <p><input type="checkbox"/> EPA 100.2</p> <p><input type="checkbox"/> <b>NYS 198.2</b></p> <p><input type="checkbox"/> <b>Other: Page 2 of 2</b></p>
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SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE LOCATION
030823-57-01A	Exterior Door Caulking	Well Station #4, Pump House
030823-57-01B	Exterior Door Caulking	Well Station #4, Pump House
030823-57-02A	Red Brick Mortar	Well Station #4, Pump House NE
030823-57-02B	Red Brick Mortar	Well Station #4, Pump House SW
030823-57-03A	Ext Window Caulking	Well Station #4, Pump House Rear
030823-57-03B	Ext Window Caulking	Well Station #4, Pump House Side
030823-57-04A	2' x 4' White Fissured Ceiling Tile	Well Station #4, Pump House NW
030823-57-04B	2' x 4' White Fissured Ceiling Tile	Well Station #4, Pump House SE
030823-57-05A	Plaster Ceiling	Well Station #4, Pump House NW
030823-57-05B	Plaster Ceiling	Well Station #4, Pump House SE
030823-57-06A	CMU Block Mortar	Well Station #4, Chemical Storage Bldg E
030823-57-06B	CMU Block Mortar	Well Station #4, Chemical Storage Bldg N
030823-57-07A	Black Asphalt Shingle	Well Station #4, Chemical Storage Bldg S
030823-57-07B	Black Asphalt Shingle	Well Station #4, Chemical Storage Bldg E

*Alan* 3/8/23 3:00



AXIOM PARTNERS  
 50B SALEM STREET, ST 103  
 LYNNFIELD, MA 01940  
 PHONE: 781.213.9198

OPTIMUM LABORATORY ORDER #:

Sample(s) received in good condition? [Y] [N]  
 Discernable field blank submitted? [Y] [N]

**Asbestos Analysis - Chain of Custody Form**

2346262

SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE LOCATION
030823-57-08A	Tar Paper Layer	Well Station #4, Chemical Storage Bldg S
030823-57-08B	Tar Paper Layer	Well Station #4, Chemical Storage Bldg E
030823-57-10A	Red Brick Mortar	Well Station #2, Pump House S
030823-57-10B	Red Brick Mortar	Well Station #2, Pump House NE Interior
030823-57-11A	2' x 4' White Fissured Ceiling Tile	Well Station #2, Pump House E
030823-57-11B	2' x 4' White Fissured Ceiling Tile	Well Station #2, Pump House N
030823-57-12A	Textured Paint On Foundation	Well Station #2, Pump House W
030823-57-12B	Textured Paint On Foundation	Well Station #2, Pump House E
030823-57-13A	Fiber board Panels	Well Station #2, Pump House E
030823-57-13B	Fiber board Panels	Well Station #2, Pump House N
030823-57-14A	CMU Block Mortar	Well Station #2, Chemical Storage Bldg E
030823-57-14B	CMU Block Mortar	Well Station #2, Chemical Storage Bldg W
030823-57-15A	Gray Asphalt Shingle	Well Station #2, Chemical Storage Bldg SE
030823-57-15B	Gray Asphalt Shingle	Well Station #2, Chemical Storage Bldg NE
030823-57-16A	Tar Paper Layer	Well Station #2, Chemical Storage Bldg SE
030823-57-16B	Tar Paper Layer	Well Station #2, Chemical Storage Bldg NE
030823-57-17A	Gray Asphalt Shingle	Well Station #2, Pump House S
030823-57-17B	Gray Asphalt Shingle	Well Station #2, Pump House E
030823-57-18A	Tar Paper Layer	Well Station #2, Pump House S
030823-57-18B	Tar Paper Layer	Well Station #2, Pump House E
030823-57-19A	Roof Flashing Cement	Well Station #2, Pump House Chimney
030823-57-19B	Roof Flashing Cement	Well Station #2, Pump House Vent
030823-57-20A	CMU Block Mortar	Well Station #3, Chemical Storage Bldg SE
030823-57-20B	CMU Block Mortar	Well Station #3, Chemical Storage Bldg W
030823-57-21A	Gray Asphalt Shingle	Well Station #3, Chemical Storage Bldg SE
030823-57-21B	Gray Asphalt Shingle	Well Station #3, Chemical Storage Bldg NW
030823-57-22A	Tar Paper Layer	Well Station #3, Chemical Storage Bldg SE
030823-57-22B	Tar Paper Layer	Well Station #3, Pump House NW
030823-57-23A	White Roof Coating	Well Station #3, Pump House E
030823-57-23B	White Roof Coating	Well Station #3, Pump House W
030823-57-24A	Red Brick Mortar	Well Station #3, Pump House SE
030823-57-24B	Red Brick Mortar	Well Station #3, Pump House SW

*Rela 3/8/22*



AXIOM PARTNERS  
 50B SALEM STREET, ST 103  
 LYNNFIELD, MA 01940  
 PHONE: 781.213.9198

OPTIMUM LABORATORY ORDER #:

Sample(s) received in good condition? [Y] [N]  
 Discernable field blank submitted? [Y] [N]

**Asbestos Analysis - Chain of Custody Form**

2346262

SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE LOCATION
030823-57-25A	Exterior Door Caulking	Well Station #3, Pump House E
030823-57-25B	Exterior Door Caulking	Well Station #3, Pump House E
030823-57-26A	Plaster Ceiling	Well Station #3, Pump House NE
030823-57-26B	Plaster Ceiling	Well Station #3, Pump House E

Relinquished: Geoff Gerace Date: 3-8-23 Time: 3:00  
 Received: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

*Al. Celen* 3/8/23 3:00



New England Testing Laboratory, Inc.  
(401) 353-3420

## REPORT OF ANALYTICAL RESULTS

**NETLAB Work Order Number: 3C10007**  
**Client Project: 01383.001 - Town of Sharon Well Pump Houses**

Report Date: 17-March-2023

Prepared for:

Geoff Gerace  
Axiom Partners, Inc  
One Pleasure Island Road, Suite 2C  
Wakefield, MA 01880

---

Richard Warila, Laboratory Director  
New England Testing Laboratory, Inc.  
59 Greenhill Street  
West Warwick, RI 02893  
rich.warila@newenglandtesting.com



### ***Samples Submitted :***

The samples listed below were submitted to New England Testing Laboratory on 03/10/23. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 3C10007. Custody records are included in this report.

<b>Lab ID</b>	<b>Sample</b>	<b>Matrix</b>	<b>Date Sampled</b>	<b>Date Received</b>
3C10007-01	PCB-01	Solid (Misc)	03/08/2023	03/10/2023
3C10007-02	PCB-02	Solid (Misc)	03/08/2023	03/10/2023
3C10007-03	PCB-03	Solid (Misc)	03/08/2023	03/10/2023

## ***Request for Analysis***

At the client's request, the analyses presented in the following table were performed on the samples submitted.

### **PCB-01 (Lab Number: 3C10007-01)**

**Analysis**

PCBs (Soxhlet)

**Method**

EPA 8082A

### **PCB-02 (Lab Number: 3C10007-02)**

**Analysis**

PCBs (Soxhlet)

**Method**

EPA 8082A

### **PCB-03 (Lab Number: 3C10007-03)**

**Analysis**

PCBs (Soxhlet)

**Method**

EPA 8082A

## ***Method References***

*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA*

## Case Narrative

### Sample Receipt:

The samples associated with this work order were received in appropriately cooled and preserved containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Exceptions: None

### Analysis:

All samples were prepared and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control requirements and allowances. Results for all soil samples, unless otherwise indicated, are reported on a dry weight basis.

Exceptions: None

## Results: Polychlorinated Biphenyls (PCBs)

**Sample: PCB-01**

**Lab Number: 3C10007-01 (Non-soil solid, as received basis)**

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1221	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1232	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1242	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1248	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1254	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1260	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1262	ND		189	ug/kg	03/13/23	03/15/23
Aroclor-1268	ND		189	ug/kg	03/13/23	03/15/23
PCBs (Total)	ND		189	ug/kg	03/13/23	03/15/23
Surrogate(s)	Recovery%		Limits			
<i>2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>	<i>102%</i>		<i>30-105</i>		03/13/23	03/15/23
<i>Decachlorobiphenyl (DCBP)</i>	<i>77.2%</i>		<i>30-105</i>		03/13/23	03/15/23

## Results: Polychlorinated Biphenyls (PCBs)

**Sample: PCB-02**

**Lab Number: 3C10007-02 (Non-soil solid, as received basis)**

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1221	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1232	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1242	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1248	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1254	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1260	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1262	ND		200	ug/kg	03/13/23	03/15/23
Aroclor-1268	ND		200	ug/kg	03/13/23	03/15/23
PCBs (Total)	ND		200	ug/kg	03/13/23	03/15/23
Surrogate(s)	Recovery%		Limits			
<i>2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>	99.8%		30-100		03/13/23	03/15/23
<i>Decachlorobiphenyl (DCBP)</i>	94.8%		30-105		03/13/23	03/15/23

**Results: Polychlorinated Biphenyls (PCBs)****Sample: PCB-03****Lab Number: 3C10007-03 (Non-soil solid, as received basis)**

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1221	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1232	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1242	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1248	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1254	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1260	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1262	ND		198	ug/kg	03/13/23	03/15/23
Aroclor-1268	ND		198	ug/kg	03/13/23	03/15/23
PCBs (Total)	ND		198	ug/kg	03/13/23	03/15/23
Surrogate(s)	Recovery%		Limits			
<i>2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>	99.1%		30-100		03/13/23	03/15/23
<i>Decachlorobiphenyl (DCBP)</i>	75.8%		30-105		03/13/23	03/15/23

## Quality Control

### Polychlorinated Biphenyls (PCBs)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch: B3C0521 - EPA 3540C</b>										
<b>Blank (B3C0521-BLK1)</b>										
					Prepared: 03/13/23 Analyzed: 03/15/23					
Aroclor-1016	ND		200	ug/kg						
Aroclor-1221	ND		200	ug/kg						
Aroclor-1232	ND		200	ug/kg						
Aroclor-1242	ND		200	ug/kg						
Aroclor-1248	ND		200	ug/kg						
Aroclor-1254	ND		200	ug/kg						
Aroclor-1260	ND		200	ug/kg						
Aroclor-1262	ND		200	ug/kg						
Aroclor-1268	ND		200	ug/kg						
PCBs (Total)	ND		200	ug/kg						
<hr style="border-top: 1px dashed black;"/>										
<i>Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>			67.5	ug/kg	200		33.7	30-100		
<i>Surrogate: Decachlorobiphenyl (DCBP)</i>			76.5	ug/kg	200		38.2	30-105		
<hr style="border-top: 1px dashed black;"/>										
<b>LCS (B3C0521-BS1)</b>										
					Prepared: 03/13/23 Analyzed: 03/15/23					
Aroclor-1016	2130		200	ug/kg	2500		85.4	64-112		
Aroclor-1260	2400		200	ug/kg	2500		96.0	59.4-124		
<hr style="border-top: 1px dashed black;"/>										
<i>Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>			199	ug/kg	200		99.7	30-100		
<i>Surrogate: Decachlorobiphenyl (DCBP)</i>			189	ug/kg	200		94.3	30-105		
<hr style="border-top: 1px dashed black;"/>										
<b>LCS Dup (B3C0521-BSD1)</b>										
					Prepared: 03/13/23 Analyzed: 03/15/23					
Aroclor-1016	2360		200	ug/kg	2500		94.4	64-112	10.0	20
Aroclor-1260	2450		200	ug/kg	2500		97.9	59.4-124	1.91	20
<hr style="border-top: 1px dashed black;"/>										
<i>Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)</i>			71.5	ug/kg	200		35.8	30-100		
<i>Surrogate: Decachlorobiphenyl (DCBP)</i>			133	ug/kg	200		66.5	30-105		

## Notes and Definitions

<b>Item</b>	<b>Definition</b>
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.





## MassDEP Analytical Protocol Certification Form

Laboratory Name: New England Testing Laboratory, Inc.

Project #: 01383.001

Project Location: Sharon, MA

RTN:

**This Form provides certifications for the following data set: list Laboratory Sample ID Number(s):**  
**3C10007**

 Matrices:  Groundwater/Surface Water  Soil/Sediment  Drinking Water  Air  Other:

**CAM Protocol** (check all that apply below):

8260 VOC CAM II A <input type="checkbox"/>	7470/7471 Hg CAM III B <input type="checkbox"/>	MassDEP VPH (GC/PID/FID) CAM IV A <input type="checkbox"/>	8082 PCB CAM V A <input checked="" type="checkbox"/>	9014 Total Cyanide/PAC CAM VI A <input type="checkbox"/>	6860 Perchlorate CAM VIII B <input type="checkbox"/>
8270 SVOC CAM II B <input type="checkbox"/>	7010 Metals CAM III C <input type="checkbox"/>	MassDEP VPH (GC/MS) CAM IV C <input type="checkbox"/>	8081 Pesticides CAM V B <input type="checkbox"/>	7196 Hex Cr CAM VI B <input type="checkbox"/>	MassDEP APH CAM IX A <input type="checkbox"/>
6010 Metals CAM III A <input type="checkbox"/>	6020 Metals CAM III D <input type="checkbox"/>	MassDEP EPH CAM IV B <input type="checkbox"/>	8151 Herbicides CAM V C <input type="checkbox"/>	8330 Explosives CAM VIII A <input type="checkbox"/>	TO-15 VOC CAM IX B <input type="checkbox"/>

### Affirmative Responses to Questions A through F are required for "Presumptive Certainty" status

<b>A</b>	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>B</b>	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>C</b>	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>D</b>	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>E</b>	VPH, EPH, APH, and TO-15 only a. VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications). b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>F</b>	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

### Responses to Questions G, H and I below are required for "Presumptive Certainty" status

<b>G</b>	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <sup>1</sup>
----------	---	--

**Data User Note:** Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.

<b>H</b>	Were <b>all</b> QC performance standards specified in the CAM protocol(s) achieved?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <sup>1</sup>
<b>I</b>	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <sup>1</sup>

<sup>1</sup>All negative responses must be addressed in an attached laboratory narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, is accurate and complete.**

 Signature: 

 Position: Laboratory Director

 Printed Name: Richard Warila

 Date: 3/17/2023

**APPENDIX B**  
**Lead Paint Testing Results**

## XRF PAINT TESTING RESULTS

Well Stations #2, # 3 and #4  
Town of Sharon, Massachusetts

LOCATION	SAMPLE CODE	SUBSTRATE TYPE	PAINT CONDITION	XRF READING (mg/cm <sup>2</sup> )	COLOR/ COMMENTS
Calibration	<0.01			0.00	
	0.31 ± 0.02			0.28	
	0.71 ± 0.08			0.7	
	1.04 ± 0.06			1.0	
	1.53 ± 0.09			1.5	
	3.58 ± 0.39			4.1	
Calibration – Buried Lead	<0.01			0.00	
	0.31 ± 0.02			0.30	
	0.71 ± 0.08			0.6	
	1.04 ± 0.06			0.9	
	1.53 ± 0.09			1.5	
	3.58 ± 0.39			4.0	
Well Station #4, Exterior	Door	Metal	1	0.00	Green
Well Station #4, Exterior	Window Guard	Metal	3	0.40	Green
<b>Well Station #4, Exterior</b>	<b>Window Guard</b>	<b>Metal</b>	<b>3</b>	<b>1.2</b>	<b>Green</b>
Well Station #4, Exterior	Roof Flashing	Metal	1	0.00	Brown
Well Station #4, Interior	Wall	Brick	1	0.8	Blue
<b>Well Station #4, Interior</b>	<b>Generator</b>	<b>Metal</b>	<b>2</b>	<b>1.7</b>	<b>Red</b>
Well Station #4, Interior	Curbing	Block	1	0.00	Gray
Well Station #4, Interior	Water Pipe	Metal	2	0.05	Blue
Well Station #4, Interior	Generator	Metal	1	0.7	Blue
Well Station #4, Interior	Wall	Brick	1	0.04	Blue

**SAMPLE CODE:**

BB-Baseboard; B-Bollards/Bumpers; C/T-Casing/Trim; CL-Ceiling; CR-Chair Rail; D-Door; DC-Door Casing; DJ-Door Jamb; DW-Duct Work; E-Equipment; FL-Floor; HR- Handrail; HVAC-Fans/Air Handlers; P-Piping; R-Railing; RD-Radiator; RC-Radiator Cover; SB-Stair Balusters; SH-Shingles/Siding; SR-Stair Riser; SS-Stair Stringer; SR-Stair Railing; ST, Stair Tread; STC-Structural Column; STB-Structural Beam; STM-Structure Misc; W-Wall; UW-Upper Wall; LW-Lower Wall; WSH-Window Sash; WC-Window Casing; WSL-Window Sill

**SUBSTRATE TYPE:**

W-Wood; G-Gypsum Board; P-Plaster; C-Concrete; CB- Concrete Block; PA-Paneling; T-Tile; M-Metal; B-Brick; U-Unknown

**PAINT CONDITION:**

1 to 5; 1 = Undamaged (< 5% damage) ; 2 = Slight Damage (6-15% Damage) ; 3 = Moderate Damage (16-25% Damage) ; 4 = Extensive Damage (26-50% Damage) ; 5 = Severe Damage (>50% Damage)

## XRF PAINT TESTING RESULTS

**Well Stations #2, # 3 and #4  
Town of Sharon, Massachusetts**

LOCATION	SAMPLE CODE	SUBSTRATE TYPE	PAINT CONDITION	XRF READING (mg/cm <sup>2</sup> )	COLOR/ COMMENTS
Well Station #2, Exterior	Door Frame	Metal	1	0.00	Green
Well Station #2, Exterior	Door	Metal	1	0.00	Green
Well Station #2, Exterior	Door Frame	Metal	1	0.00	Green
Well Station #2, Interior	Floor	Metal	1	0.00	Gray
Well Station #2, Interior	Guardrail	Metal	1	0.00	Yellow
Well Station #2, Interior	Pipe	Metal	1	0.00	Blue
Well Station #3, Exterior	Door	Metal	1	0.00	Green
Well Station #3, Exterior	Painted Wall	Brick	1	0.00	Red
Well Station #3, Exterior	Painted Wall	Brick	1	0.04	Red
Well Station #3, Exterior	Roof	Concrete	1	0.00	White
Well Station #3, Interior	Wall	Brick	1	0.21	Blue
Well Station #3, Interior	Window Frame	Wood	1	0.7	Green
Well Station #3, Interior	Pipe	Metal	1	0.00	Blue

**SAMPLE CODE:**

BB-Baseboard; B-Bollards/Bumpers; C/T-Casing/Trim; CL-Ceiling; CR-Chair Rail; D-Door; DC-Door Casing; DJ-Door Jamb; DW-Duct Work; E-Equipment; FL-Floor; HR- Handrail; HVAC-Fans/Air Handlers; P-Piping; R-Railing; RD-Radiator; RC-Radiator Cover; SB-Stair Balusters; SH-Shingles/Siding; SR-Stair Riser; SS-Stair Stringer; SR-Stair Railing; ST, Stair Tread; STC-Structural Column; STB-Structural Beam; STM-Structure Misc; W-Wall; UW-Upper Wall; LW-Lower Wall; WSH-Window Sash; WC-Window Casing; WSL-Window Sill

**SUBSTRATE TYPE:**

W-Wood; G-Gypsum Board; P-Plaster; C-Concrete; CB- Concrete Block; PA-Paneling; T-Tile; M-Metal; B-Brick; U-Unknown

**PAINT CONDITION:**

1 to 5; 1 = Undamaged (< 5% damage) ; 2 = Slight Damage (6-15% Damage) ; 3 = Moderate Damage (16-25% Damage) ; 4 = Extensive Damage (26-50% Damage) ; 5 = Severe Damage (>50% Damage)

**APPENDIX C**

**Hazardous Buildings Materials  
Summary Tables**

## MISCELLANEOUS HAZARDOUS BUILDING MATERIALS INVENTORY

### Well Stations #2, #3 and #4 Town of Sharon, Massachusetts

#### BULBS & BALLASTS

DESCRIPTION	LOCATION*	MFG./MODEL	BALLAST QUANTITY	BULB QUANTITY	PCB CONTENT
2 x 4, Lay-in Fixture, 3 Bulb	Well Station #4	Various	4	12	Unknown
2 x 4, Lay-in Fixture, 2 Bulb	Well Station #2	Various	8	16	Unknown
1 x 8, Suspended Fixture, 4 Bulb	Well Station #3	Various	2	4	Unknown
1 x 8, Suspended Fixture, 2 Bulb	Well Station #3	Various	1	2	Unknown

#### CFC-CONTAINING ITEMS

DESCRIPTION/LOCATION	HVAC MANUFACTURER	NUMBER OF UNITS	AMOUNT/TYPE OF RCFCS
None Identified			

#### MERCURY-CONTAINING ITEMS

DESCRIPTION	LOCATION	MANUFACTURER	NUMBER OF UNITS
None Identified			

#### MISCELLANEOUS ITEMS

DESCRIPTION	LOCATION	QUANTITY
Potassium Hydroxide Drums	Well Pump Houses 2, 3, 4	6
Back Up Generator Oils and Fuel	Well Pump Houses 2, 3, 4	3
Potassium Hydroxide	Chemical Storage Buildings 2,3,4	12,000 gallons
Sodium Hypochlorite Drums	Well Pump Houses 2, 3, 4	6
Fire Extinguishers	Well Pump Houses 2, 3, 4	4
Transformers (Wet Type) Pole Mounted	Well Pump Houses 2, 3, 4	6

## APPENDIX D

### Photographs





**Photo 1**

View of ACM Door Caulking Well Pump House #4.



**Photo 2**

View of ACM Exterior Window Caulking Well Pump House #4.

## **APPENDIX E**

### **Asbestos and Hazardous Buildings Materials Abatement Cost Estimate**

**Asbestos & Hazardous Building Materials Abatement Cost Estimate  
Occupied Pump House Buildings  
Sharon, MA**

**Asbestos Removal ACMs**

Material	Location(s)	Estimated Quantity	Estimated Removal Cost
Exterior Door Caulking	Exterior of Well Pump House #4	28 LF	\$800
Exterior Window Caulking	Exterior of Well Pump House #4	2 Each	\$500
<b>Subtotal, ACM Removal</b>		<b>\$</b>	<b>4,500<sup>10</sup></b>

**Asbestos Removal, PACMs**

Material	Location	Estimated Quantity	Estimated Removal Cost
Flange Gaskets	Sprinkler System	45 Each	\$4,500
Asphaltic Damp Proofing	On Foundations, Footings	3,000 SF	\$20,000
Buried Pipes	Beneath Buildings or at Site	TBD	\$15,000
Loose Fill Insulation (in CMU walls)	Various Areas of Buildings' Interiors	TBD	NA*
Concealed Caulkings & Sealants Behind Vinyl or Aluminum Window Frames	Various Areas Buildings' Exteriors	TBD	NA*
Electrical Components	Interior of Pump Houses 2,3 &4	500 SF	\$4,000
<b>Subtotal, PACM Removal (Recommended Allowance)</b>			<b>\$ 43,500</b>

\*N/A – Not applicable at this time

**Abatement Cost Estimate Summary**

Description	Estimated Removal Cost
Asbestos Removal, Confirmed ACMs	\$ 4,500
Asbestos Removal, Presumed ACMs	\$ 43,500
Miscellaneous Hazardous Buildings Materials	\$ 15,000
~10% Contingency	\$ 6,000
Estimated Abatement Design/Bid & Monitoring Fee	\$ 3,000
<b>Total Hazardous Buildings Materials Abatement</b>	<b>\$ 72,000</b>

<sup>10</sup> Minimum Charge for an abatement contractor to mobilize and perform abatement.

**Asbestos & Hazardous Building Materials Abatement Cost Estimate  
Occupied Pump House Buildings  
Sharon, MA**

**Cost Estimate Assumptions**

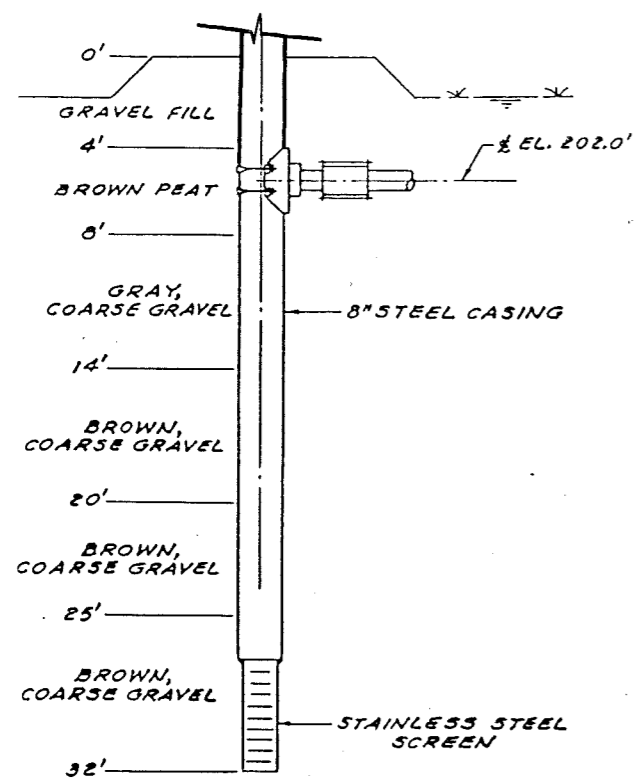
- Based on current market conditions by a non-union contractor.
- Power, water and heat provided by the Owner.
- Does not include demolition to access concealed ACMs.
- Includes materials, labor, equipment, notifications/permits, transportation and disposal.
- Excludes the cost for removal of any other hazardous materials or conditions not identified herein.



## APPENDIX L

### Well Station Record Drawings





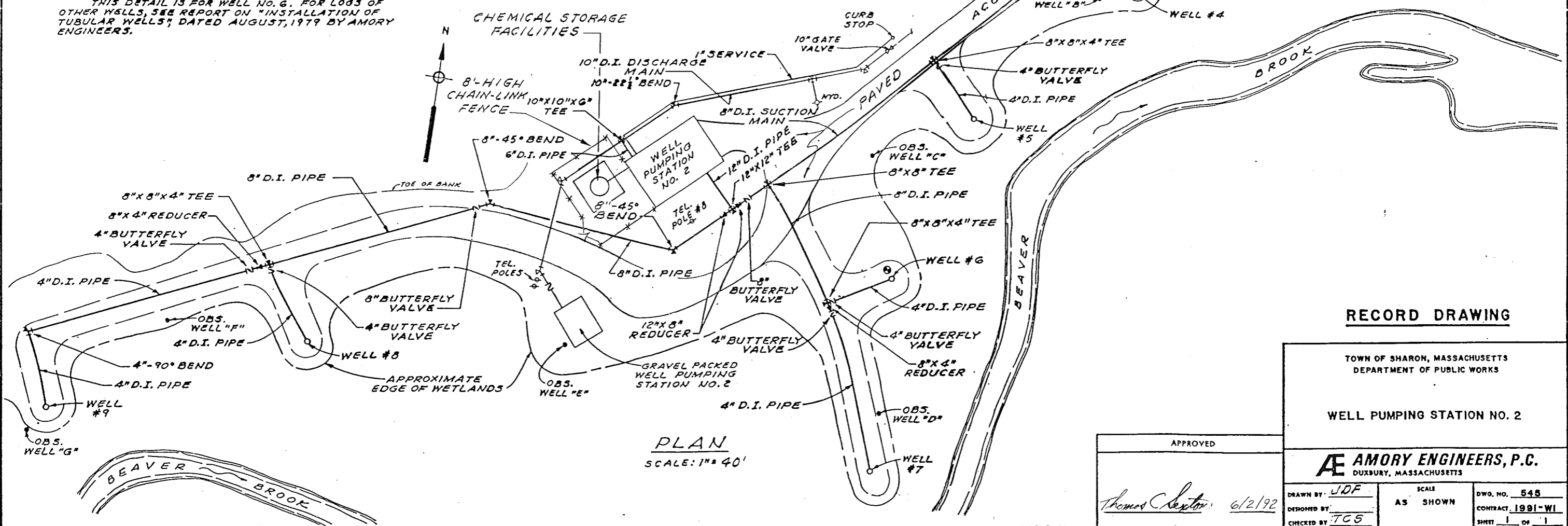
TYPICAL WELL CONSTRUCTION

NO SCALE

NOTE: THIS DETAIL IS FOR WELL NO. 6. FOR LOGS OF OTHER WELLS, SEE REPORT ON "INSTALLATION OF TUBULAR WELLS" DATED AUGUST, 1979 BY AMORY ENGINEERS.

WELL STATISTICS				
WELL NUMBER	DIAMETER	APPROXIMATE DEPTH OF WELL	SCREEN	
			LENGTH	SLOT SIZE
1	8"	40'	5'	60
2	8"	39'	5'	40
3	8"	40'	5'	80
4	8"	28'	3'	40
5	8"	34'	5'	80
6	8"	32'	5'	60
7	8"	42'	5'	60
8	8"	34'	4'	60
9	8"	32'	5'	60
OBS. WELL "A"	2 1/2"	35'	5'	40
OBS. WELL "B"	2 1/2"	26'	5'	40
OBS. WELL "C"	2 1/2"	29'	5'	40
OBS. WELL "D"	2 1/2"	36'	5'	30
OBS. WELL "E"	2 1/2"	—	—	—
OBS. WELL "F"	2 1/2"	30'	5'	40

NOTE: ALL WELLS INSTALLED IN 1979 BY F.G. SULLIVAN DRILLING CO., LANCASTER, MASS. EXCEPT OBS. WELL "E", INSTALLED BY OTHERS DURING TESTING OF GRAVEL PACKED WELL NO. 2.



PLAN SCALE: 1" = 40'

RECORD DRAWING

TOWN OF SHARON, MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

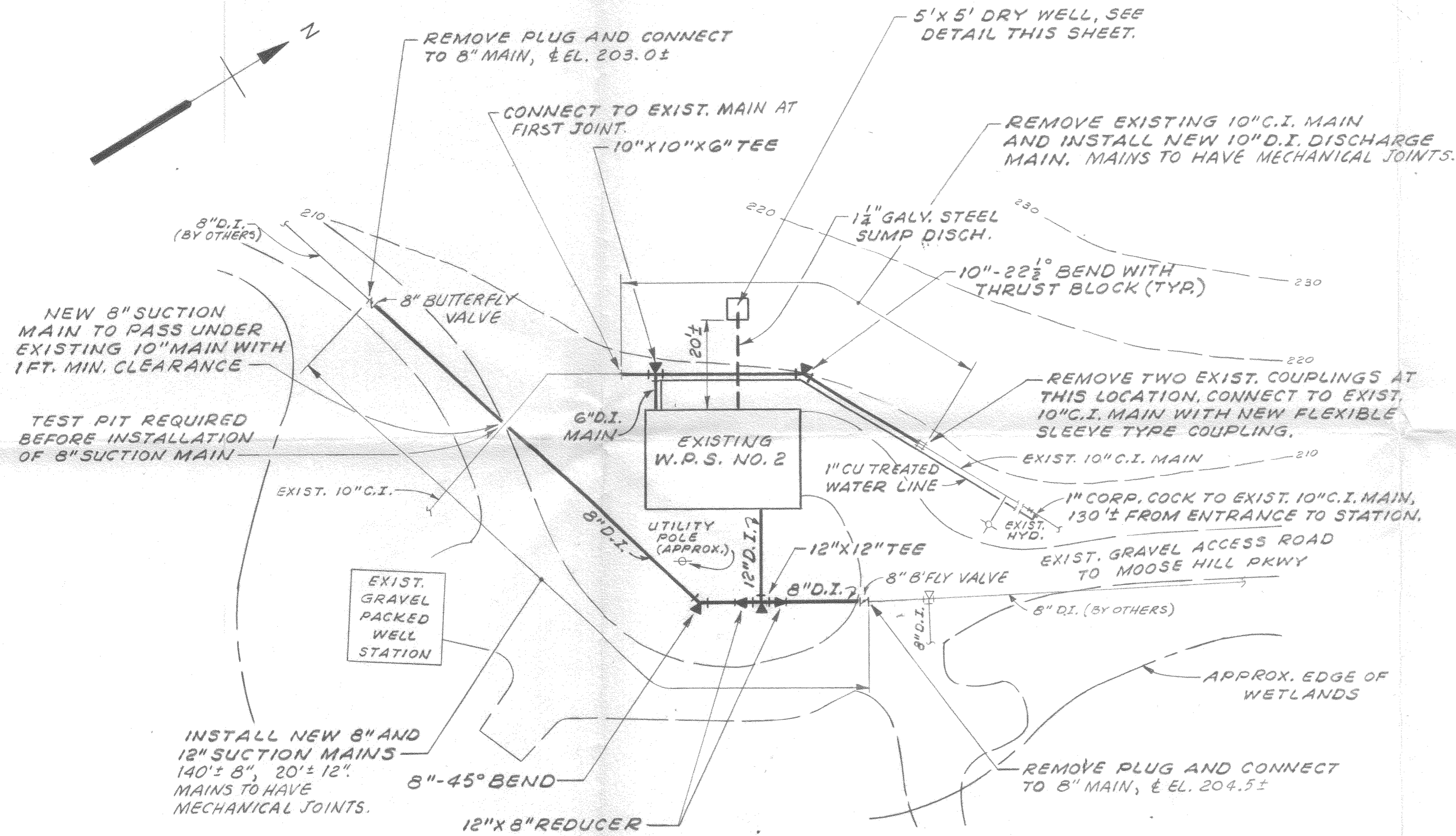
WELL PUMPING STATION NO. 2

APPROVED  
*Thomas Sexton* 6/2/92

**AE AMORY ENGINEERS, P.C.**  
DUXBURY, MASSACHUSETTS

DRAWN BY: JDF  
DESIGNED BY: TCS  
CHECKED BY: TCS  
SCALE: AS SHOWN  
DWO. NO. 545  
CONTRACT: 1991-WI  
SHEET 1 OF 1

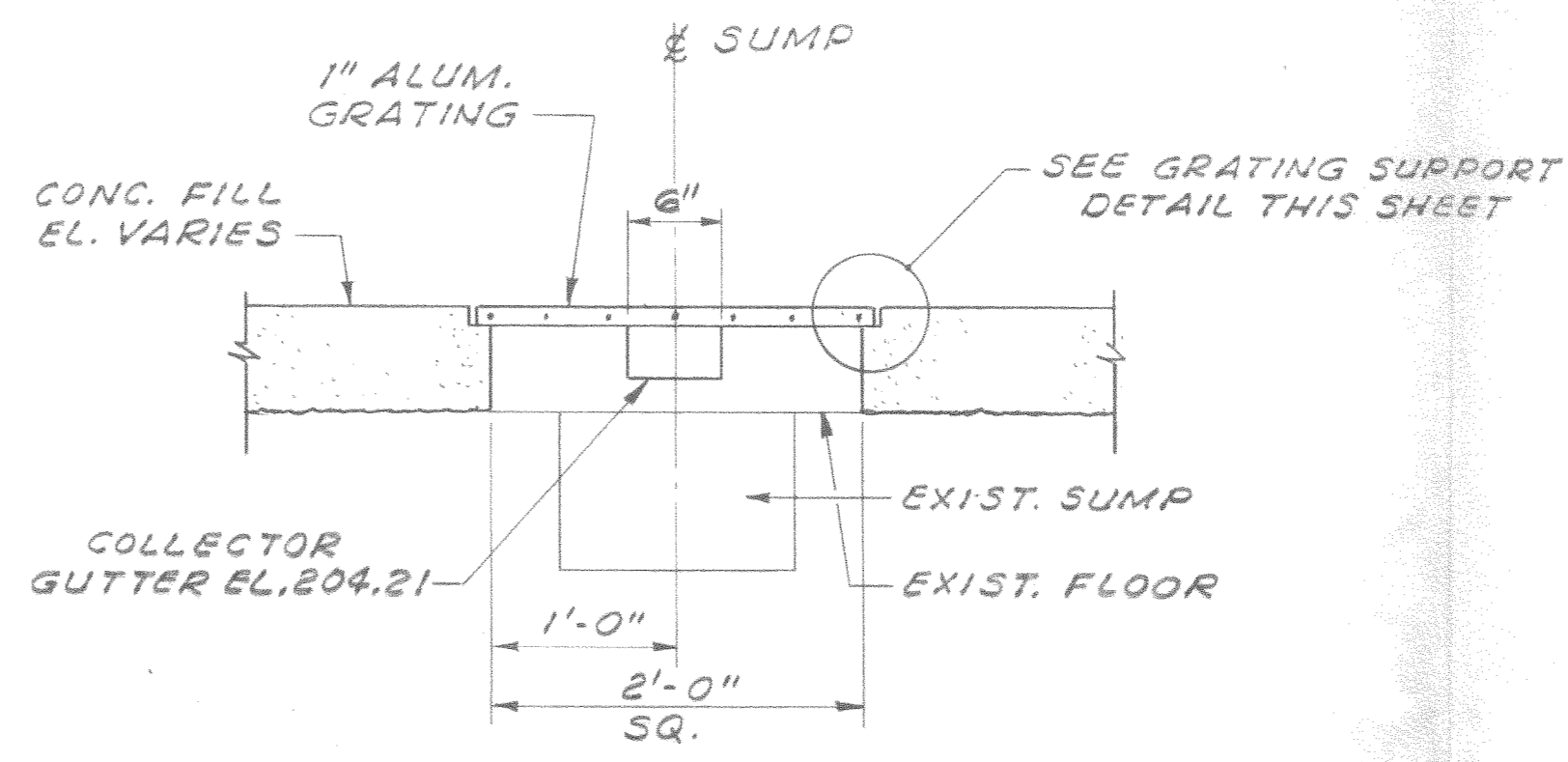




NOTE:  
ABANDONED WATER MAINS ARE LIKELY TO BE ENCOUNTERED WHILE EXCAVATING TRENCHES FOR NEW MAINS ON EAST SIDE OF W.P.S. NO. 2, SEE GENERAL NOTE 3.

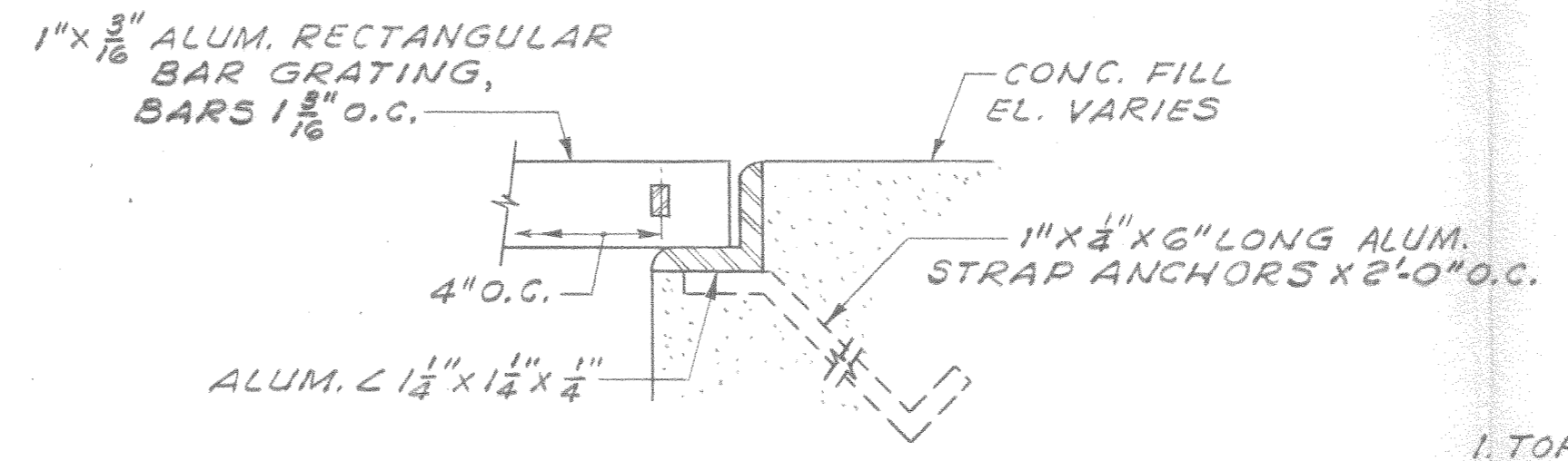
**SITE PLAN**

SCALE: 1" = 20'



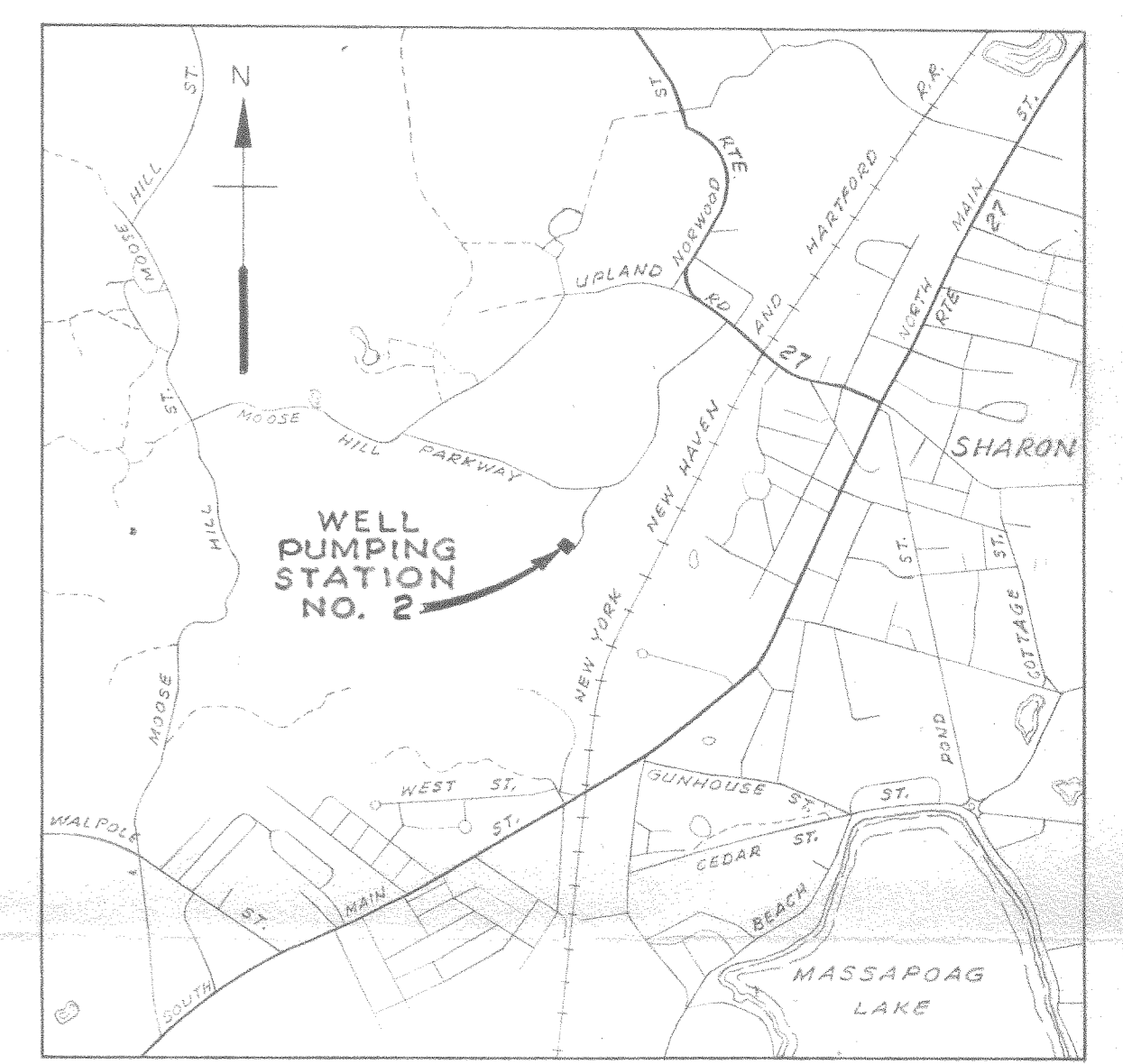
**SUMP PIT DETAIL**

SCALE: 1" = 1'-0"



**GRATING SUPPORT DETAIL**

SCALE: 1/2" = 1"

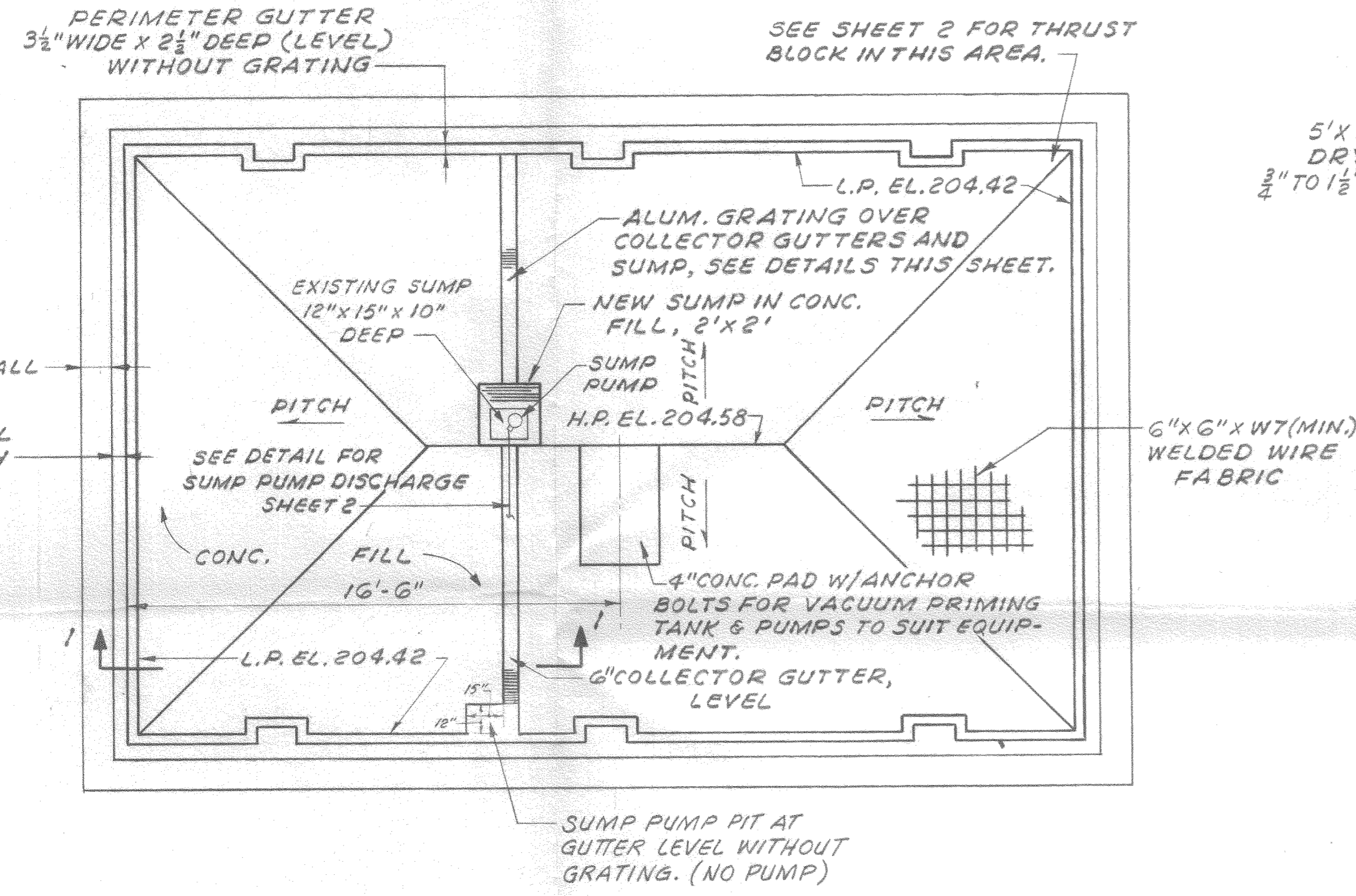


**LOCATION PLAN**

SCALE IN FEET  
0 2000 4000

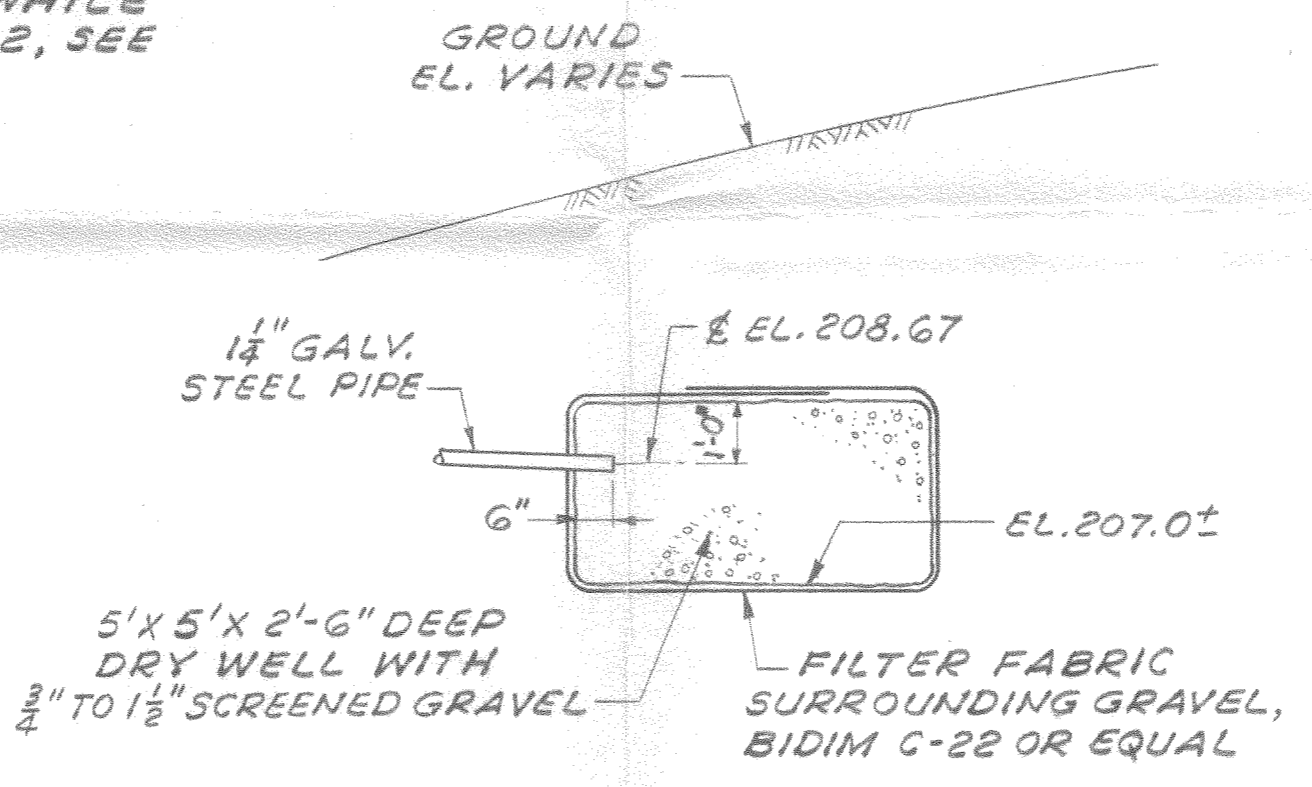
**GENERAL NOTES**

1. TOPOGRAPHIC INFORMATION WAS TAKEN FROM A DRAWING PREPARED FOR THE TOWN OF SHARON ENGINEERING DEPARTMENT BY AVIS AIRMAP, INC.
2. ELEVATION DATUM IS U.S.G.S MEAN SEA LEVEL. A BENCH MARK WILL BE PROVIDED AT THE JOB SITE.
3. ABANDONED PIPING AND CONCRETE STRUCTURES ARE BURIED NEAR WELL PUMPING STATION NO. 2, PARTICULARLY TO THE EAST OF THE BUILDING. THE CONTRACTOR SHALL VERIFY WITH THE OWNER THAT A PIPE OR STRUCTURE UNCOVERED DURING CONSTRUCTION IS ABANDONED BEFORE REMOVAL.
4. ANY EXISTING PIPE OR STRUCTURE, PRESENTLY IN SERVICE, DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR AT NO COST TO THE OWNER.
5. THE PROPOSED PIPELINE LOCATIONS ARE APPROXIMATE. FINAL LOCATIONS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION.
6. FROM THE POINTS OF CONNECTION WITH EXISTING SUCTION MAINS, THE NEW SUCTION MAINS SHALL BE LEVEL OR RISING TOWARD THE STATION WITH NO INTERMEDIATE HIGH POINTS.
7. ALL UNDERGROUND FITTINGS, WHETHER ON SUCTION OR DISCHARGE MAINS SHALL BE BACKED WITH CONCRETE. WHERE ADEQUATE BACKING CANNOT BE ATTAINED, SUITABLE TIE RODS AND CLAMPS SHALL BE USED.
8. CARE SHALL BE TAKEN TO PREVENT DAMAGE TO TREES.
9. GRAVEL ACCESS ROADS, DISTURBED DURING CONSTRUCTION, SHALL BE RESTORED TO A CONDITION AT LEAST EQUAL TO THAT PRIOR TO THE START OF WORK.
10. THE CONTRACTOR'S ATTENTION IS DIRECTED TO APPENDIX A OF THE SPECIFICATIONS FOR TYPICAL DETAILS.
11. THE CONTRACTOR SHALL LOAM AND SEED ALL AREAS OUTSIDE THE GRAVEL ACCESS ROADS DISTURBED BY HIS OPERATIONS, EXCEPT THAT IN THE AREA OF THE DRY WELL THE SURFACE HUMUS AND PINE NEEDLE MULCH SHALL BE RESTORED.
12. THE CONCRETE FILL TO BE USED INSIDE THE STATION SHALL BE COLORED WITH PURE MINERAL OXIDE PIGMENT, FREE OF SOLUBLE SALTS AND ACIDS, FAST TO SUNLIGHT, RESISTANT TO ALKALIES AND WEAK ACIDS AND VIRTUALLY FREE OF CALCIUM SULFATE. THE FINISHED COLOR PRODUCED SHALL BE DEEP BRICK RED OR RED-BROWN. COLOR SAMPLES SHALL BE PROVIDED TO THE OWNER FOR SELECTION. THE PIGMENT SHALL BE ADDED TO THE CONCRETE MIX IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
13. THE CONTRACTOR'S ATTENTION IS CALLED TO THE FACT THAT GROUND-WATER MAY BE ENCOUNTERED DURING WATER MAIN INSTALLATION.



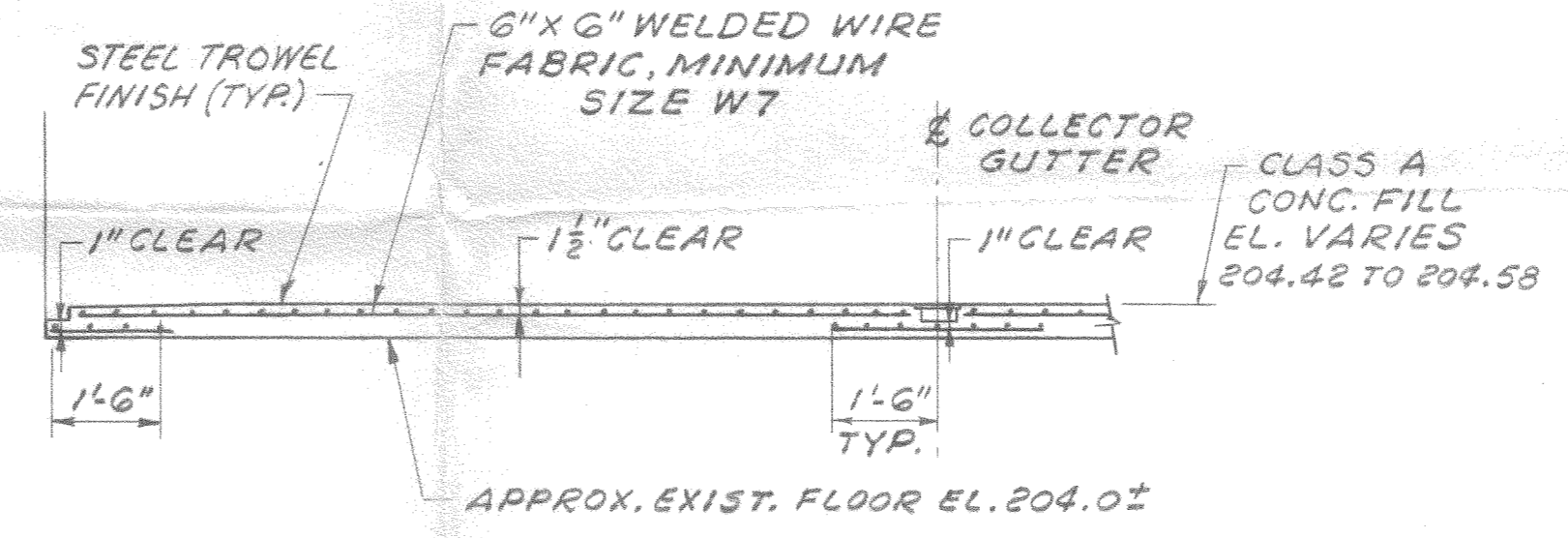
**FLOOR PLAN**

SCALE: 1/4" = 1'-0"



**DRY WELL DETAIL**

SCALE: 3/8" = 1'-0"



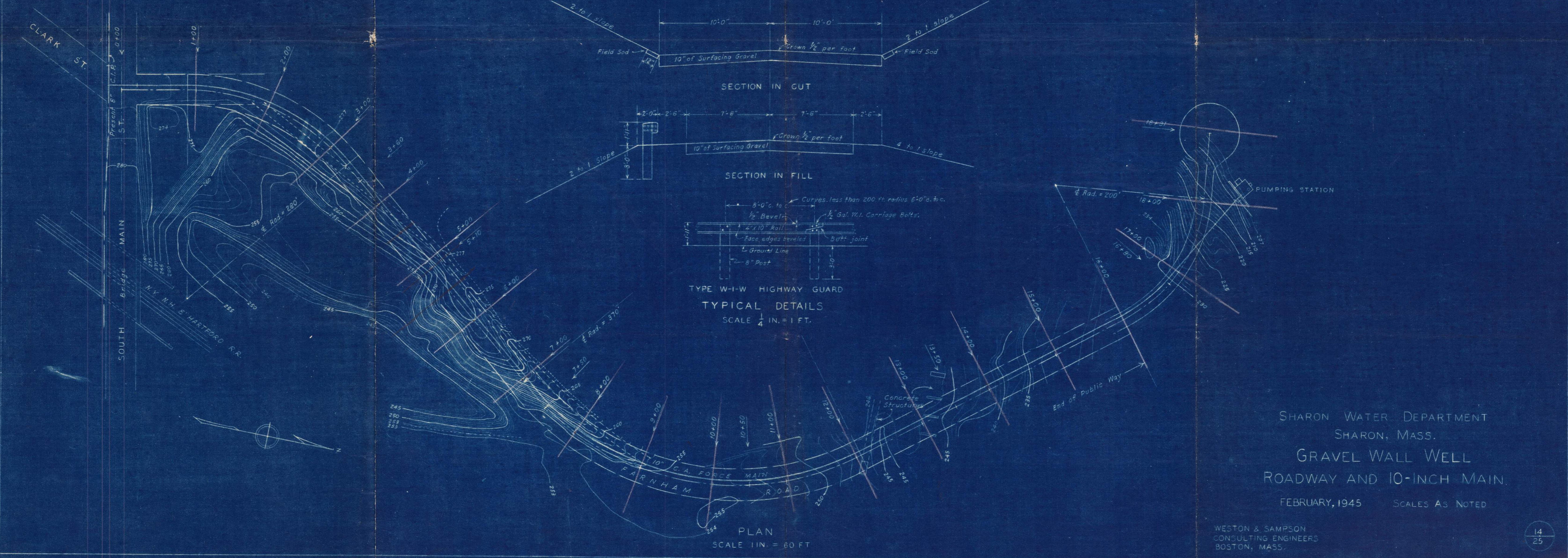
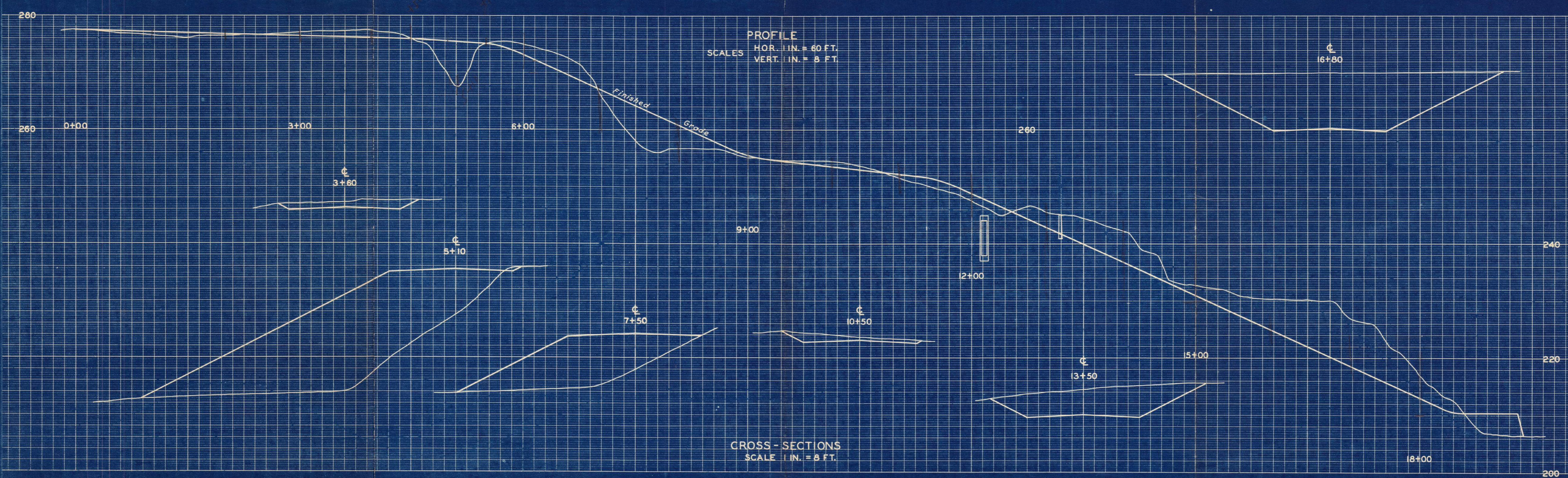
**SECTION I-I**

SCALE: 3/8" = 1'-0"

TOWN OF SHARON, MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS CONTRACT 1979 - W1		
<b>PLANS AND DETAILS REHABILITATION OF WPS NO. 2</b>		
CIVIL & STRUCTURAL		
<b>AMORY ENGINEERS</b> DUXBURY, MASSACHUSETTS		
APPROVED	SCALE	DWG. NO. 166
David R. Jacobson	AS SHOWN	CONTRACT 1979 - W1
AMORY ENGINEERS	DATE	CHECKED BY G.S.M.
		SHEET 1 OF 3

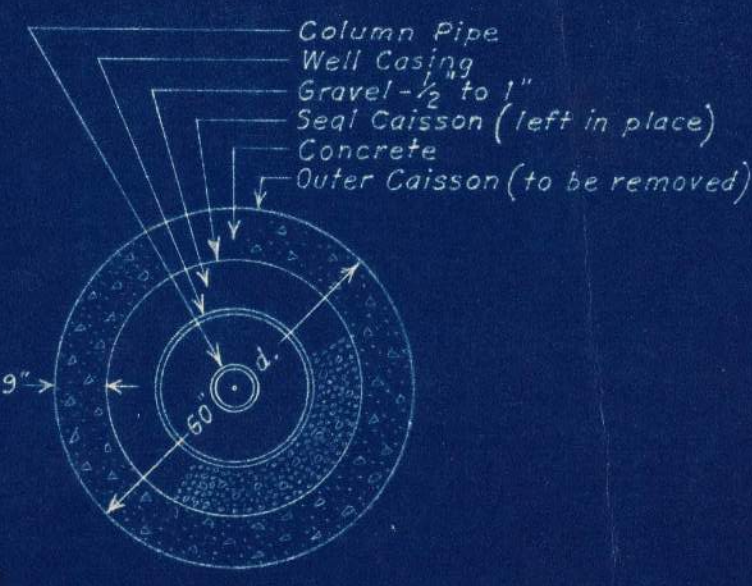
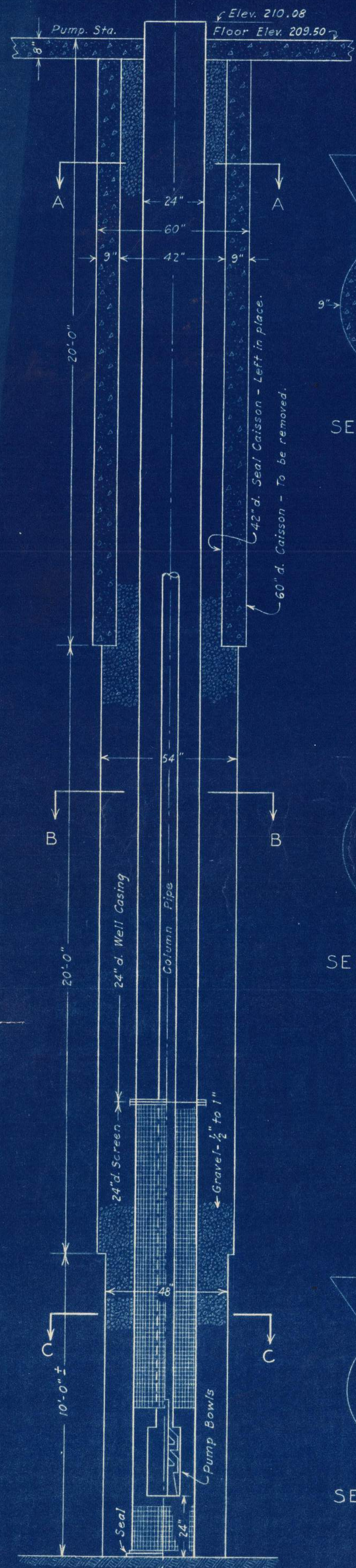




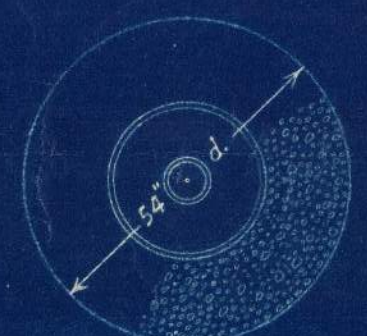


SHARON WATER DEPARTMENT  
 SHARON, MASS.  
 GRAVEL WALL WELL  
 ROADWAY AND 10-INCH MAIN.  
 FEBRUARY, 1945    SCALES AS NOTED

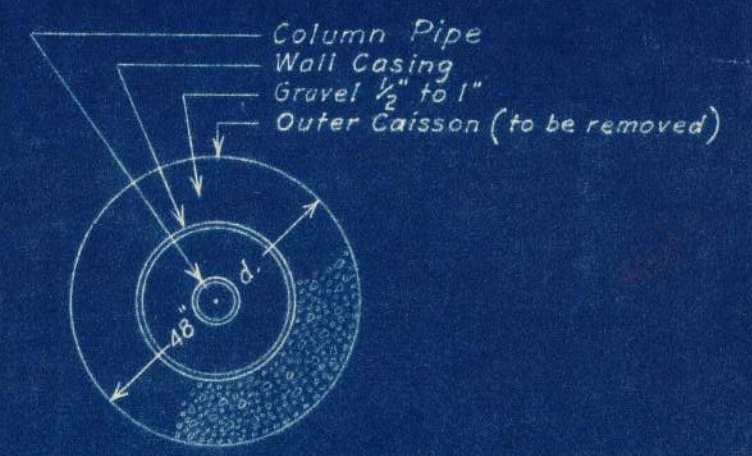
WESTON & SAMPSON  
 CONSULTING ENGINEERS  
 BOSTON, MASS.



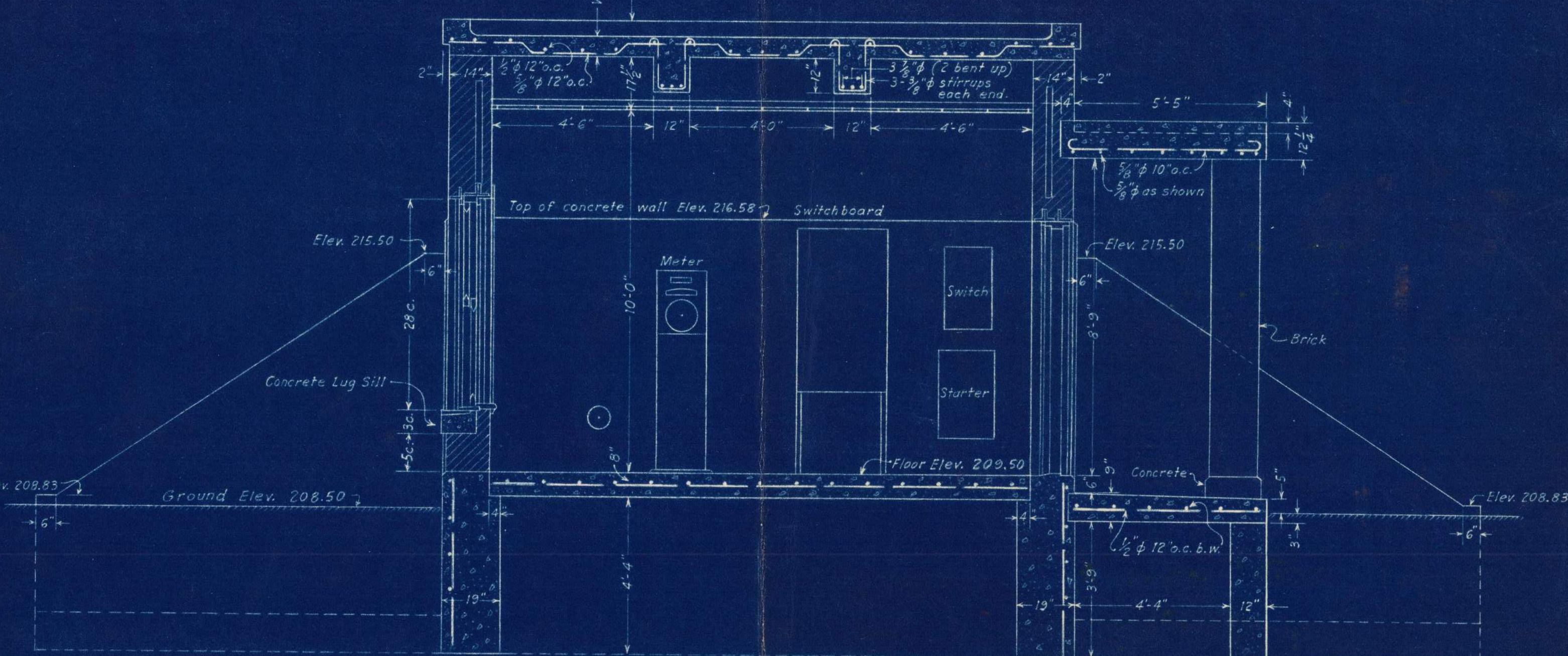
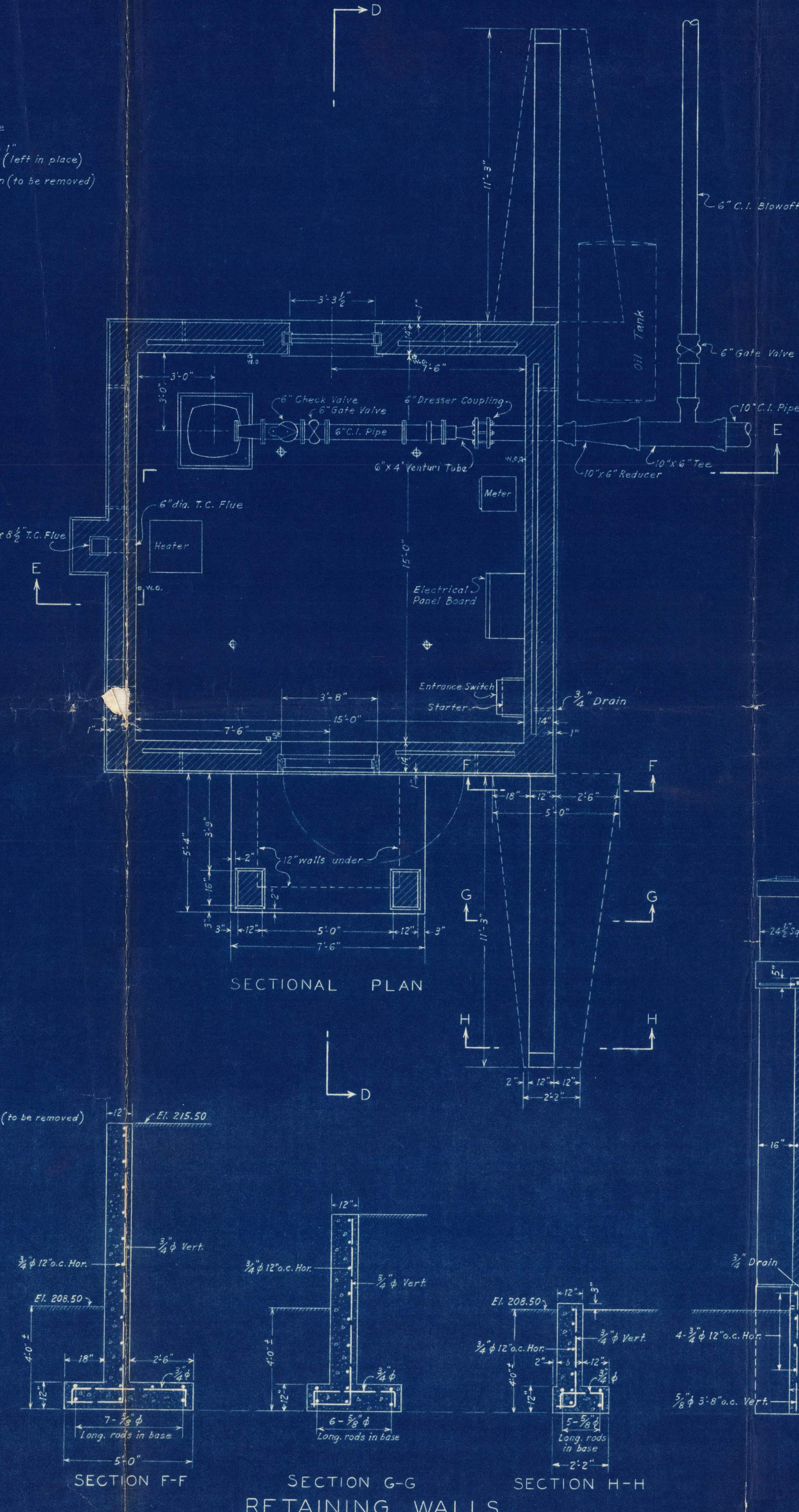
SECTION A-A



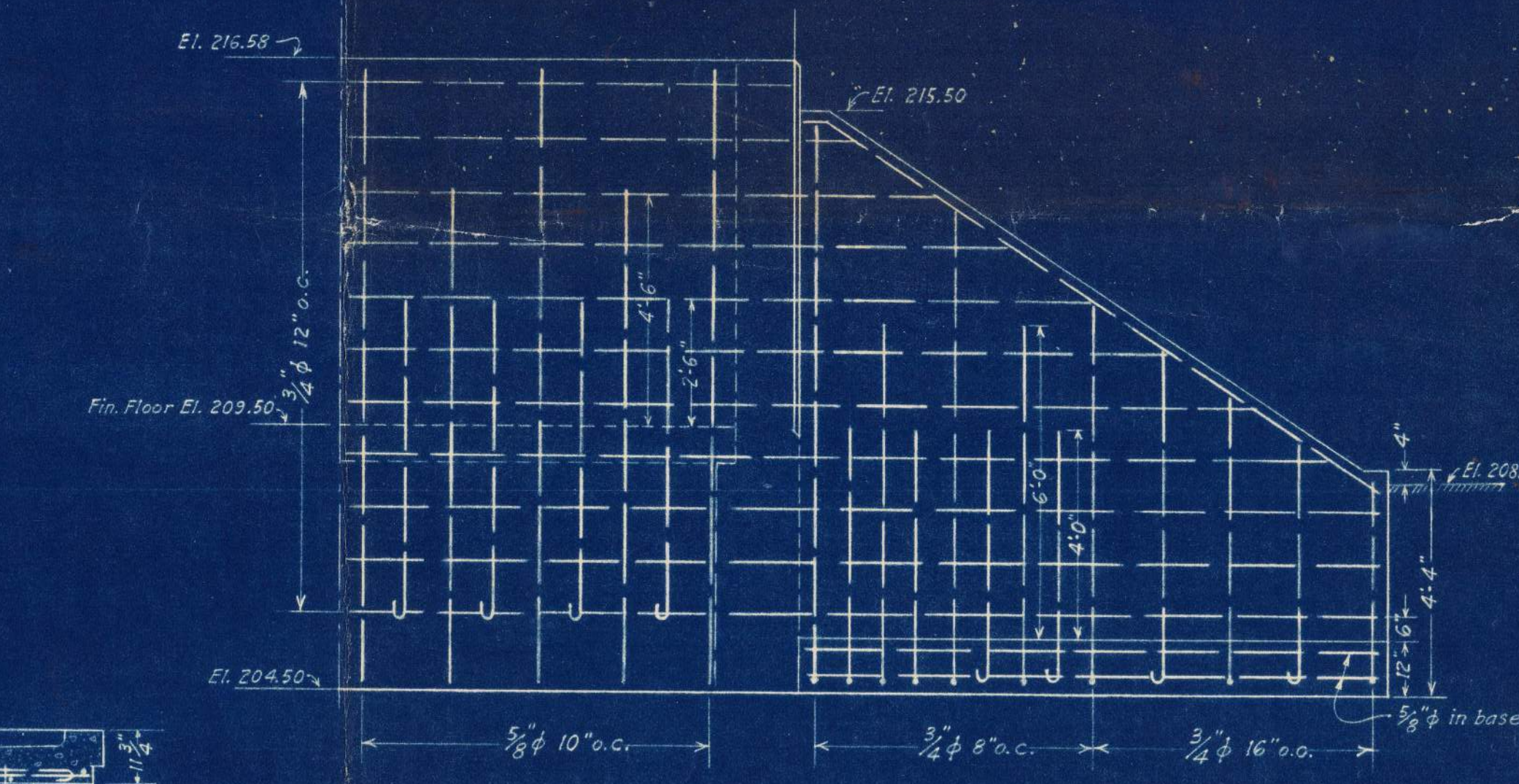
SECTION B-B



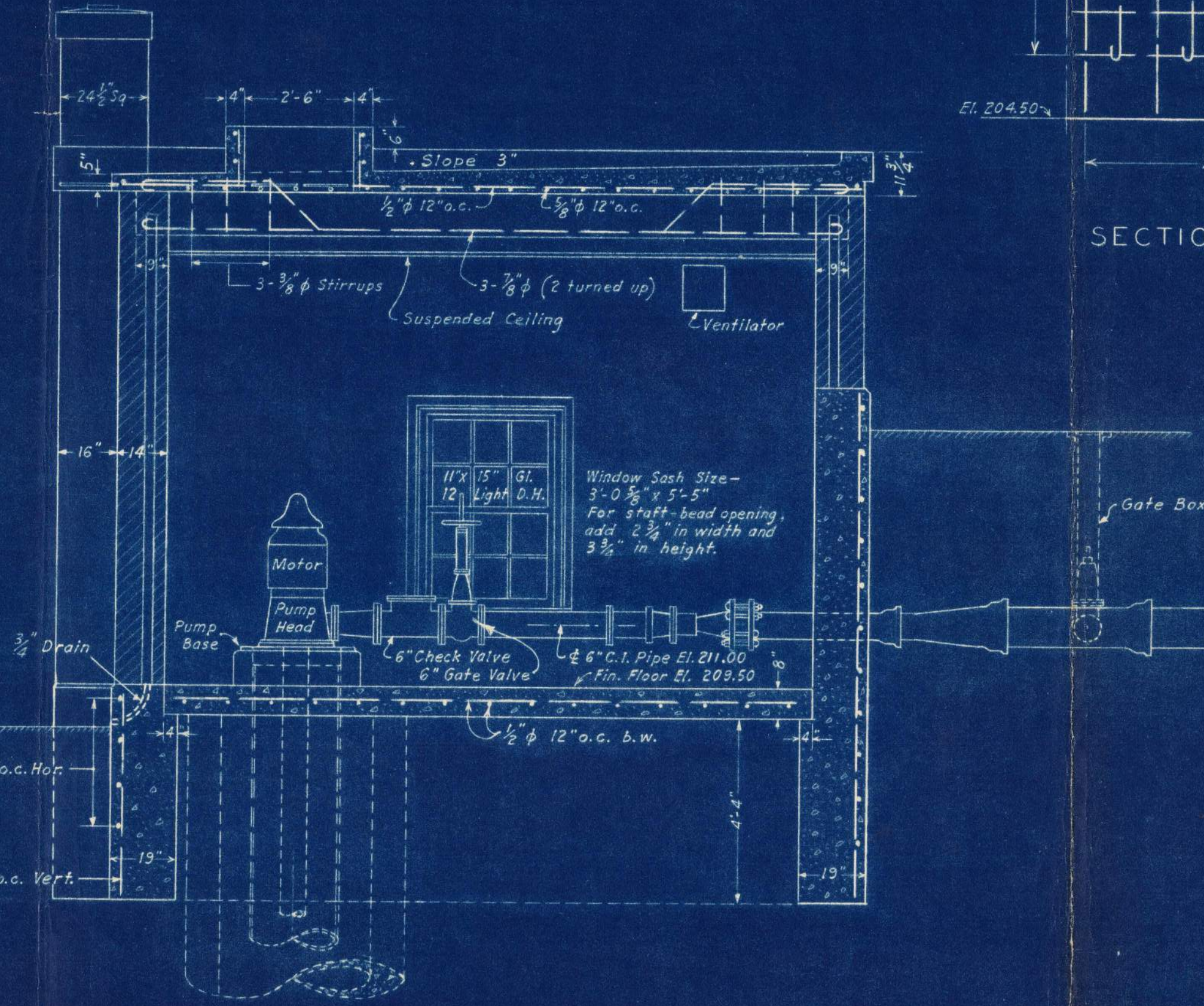
SECTION C-C



SECTIONAL ELEVATION D-D



SECTIONAL ELEVATION D-D — REINFORCEMENT



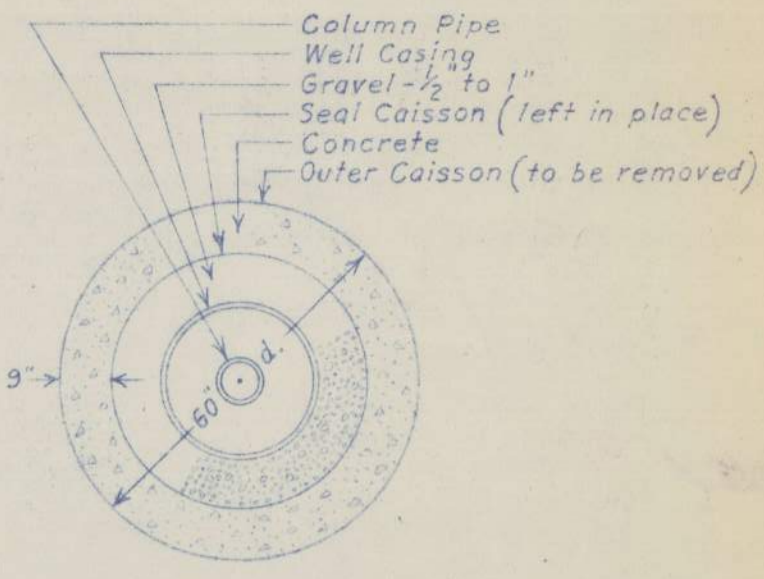
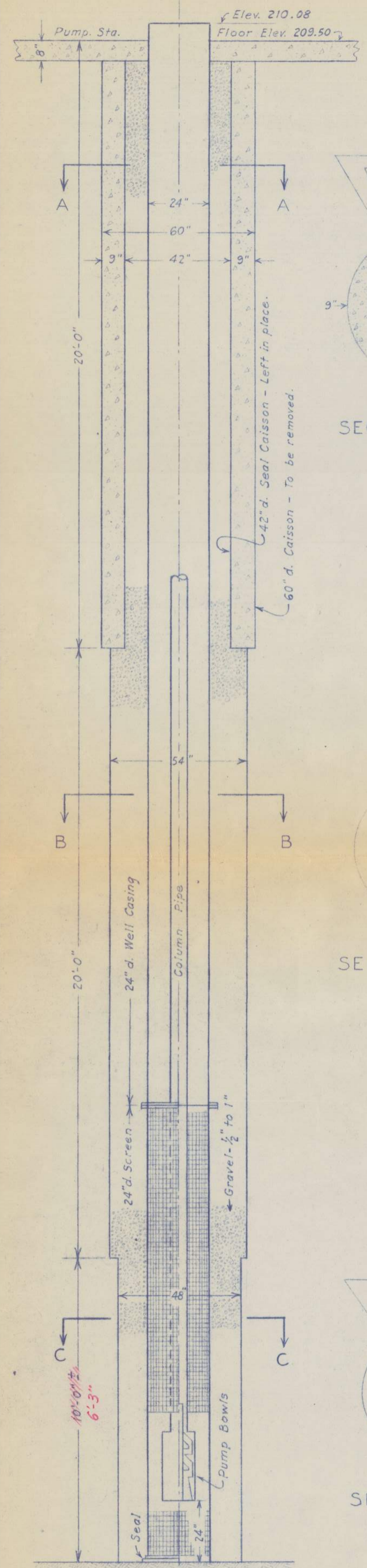
SECTIONAL ELEVATION E-E

GRAVEL WALL WELL

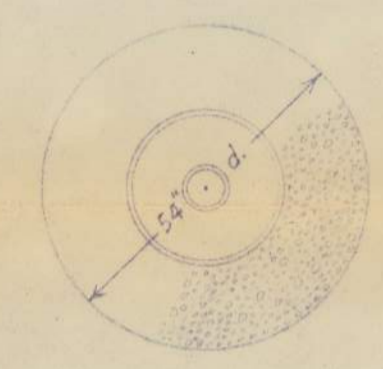
SHARON WATER DEPARTMENT  
 SHARON, MASS.  
 GRAVEL WALL WELL  
 AND  
 PUMPING STATION

SHEET NO. 2  
 FEBRUARY, 1945  
 SCALE 3/8" = 1 FT.

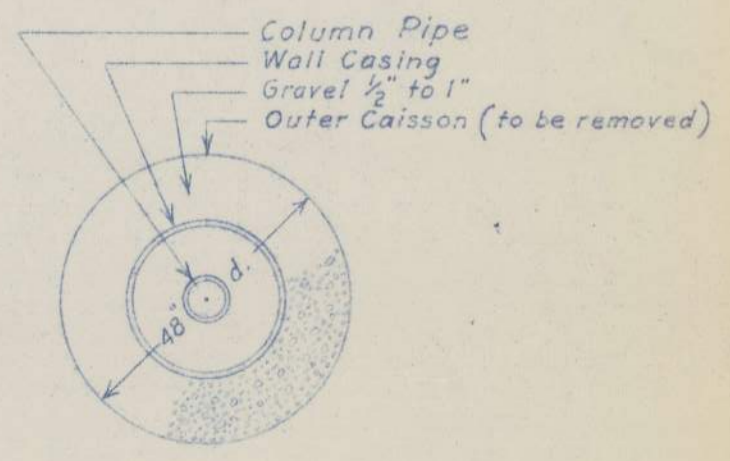
WESTON & SAMPSON  
 CONSULTING ENGINEERS  
 BOSTON, MASS.



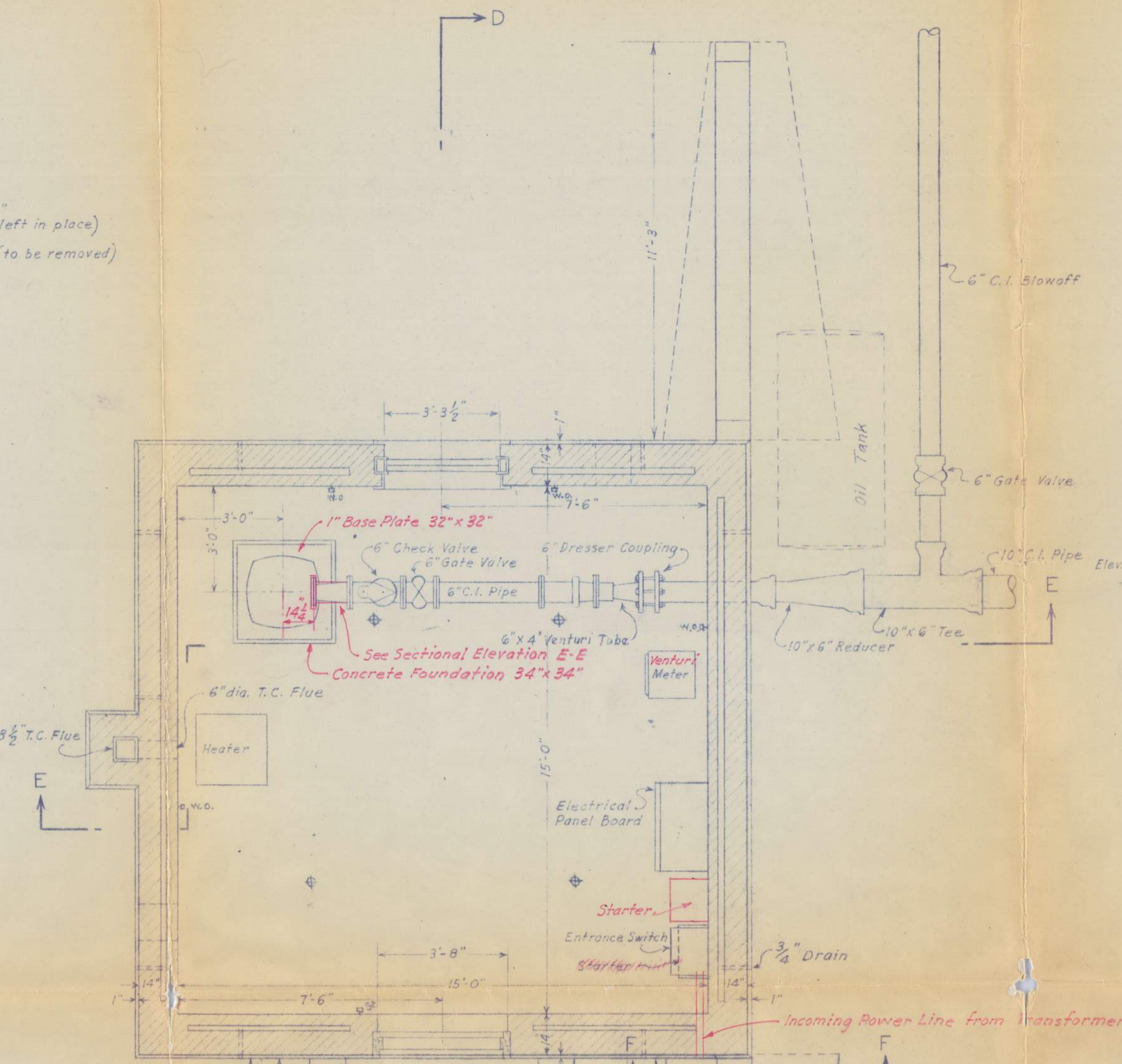
SECTION A-A



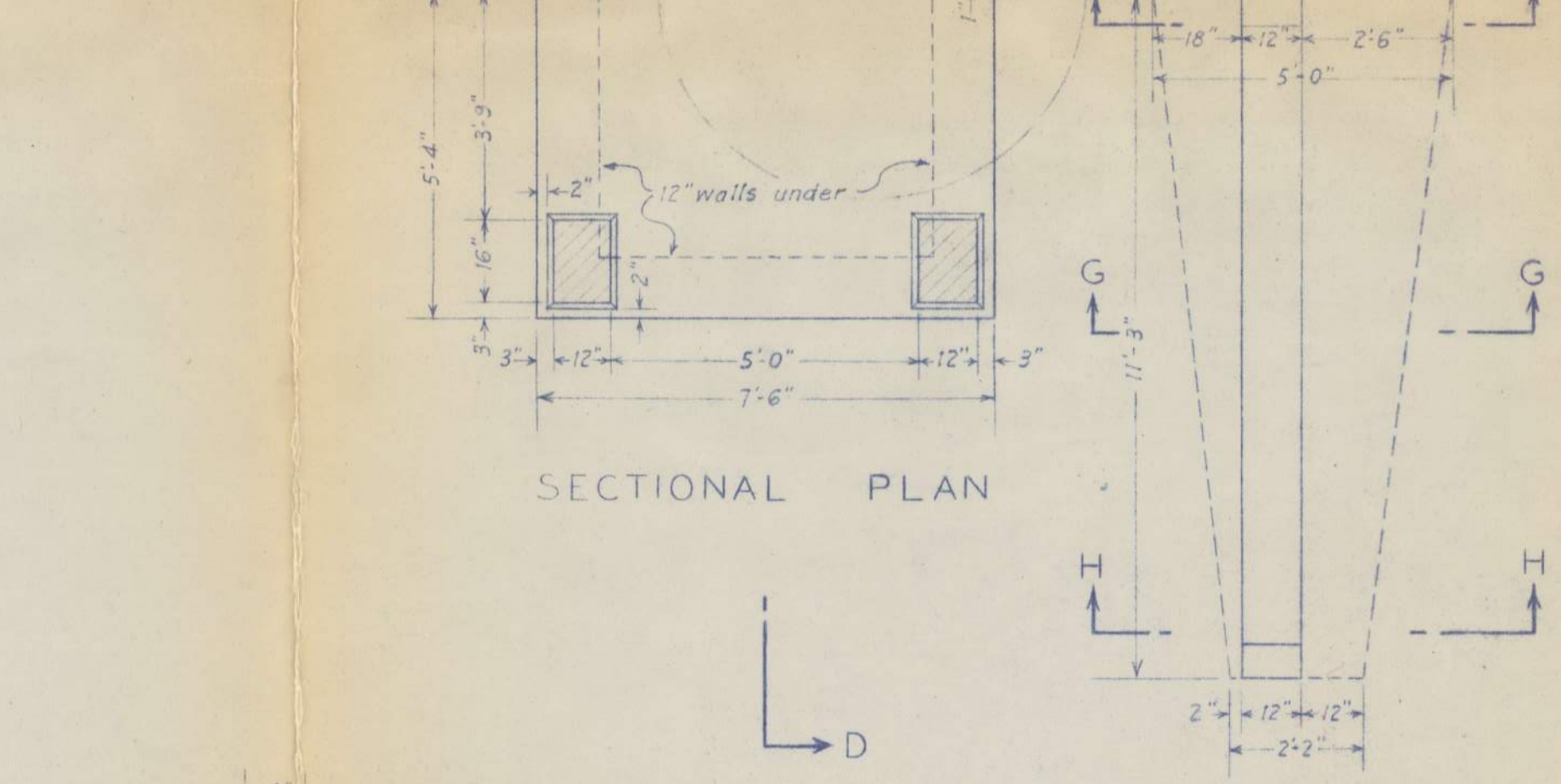
SECTION B-B



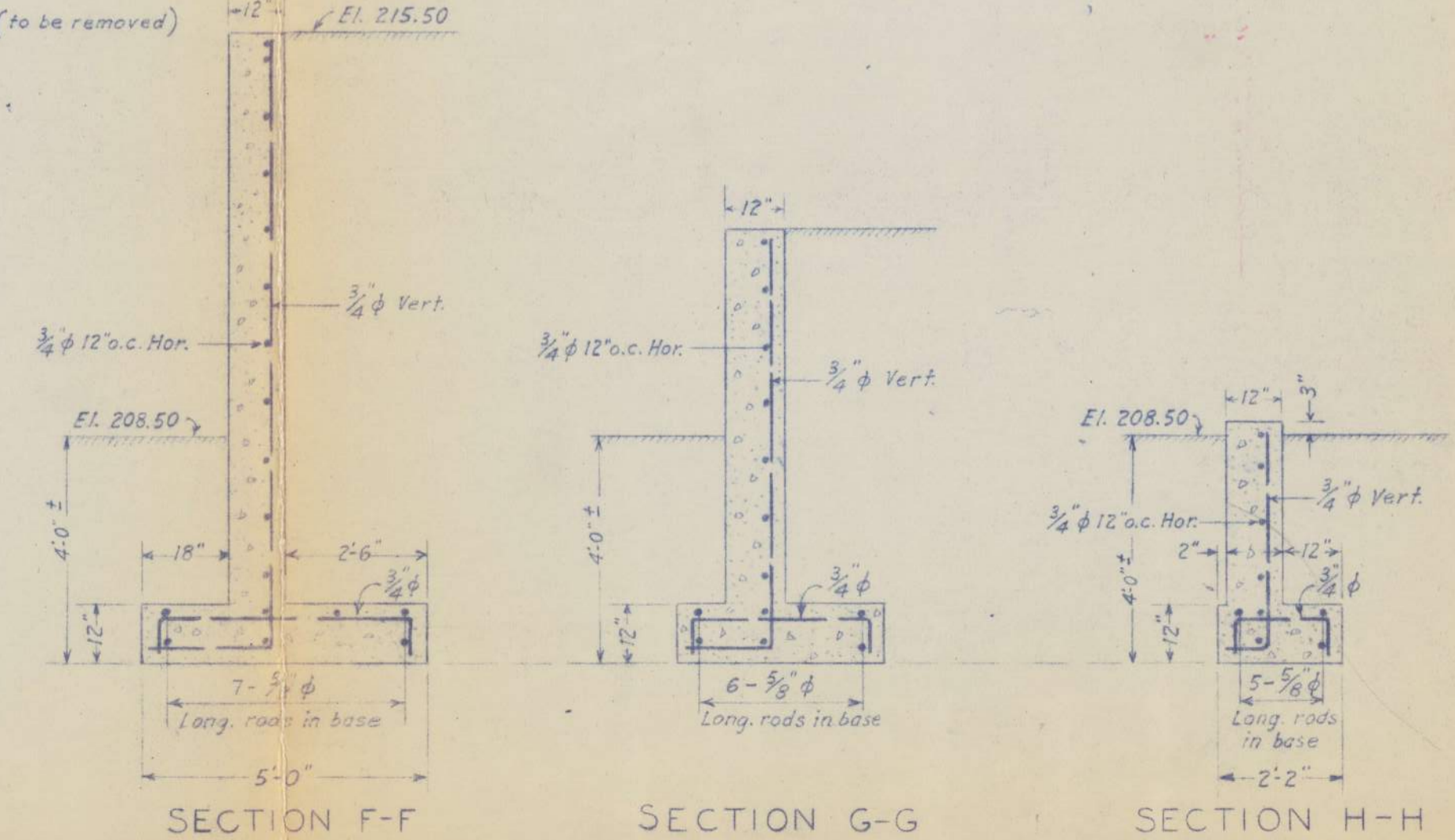
SECTION C-C



SECTIONAL PLAN



SECTIONAL ELEVATION D-D

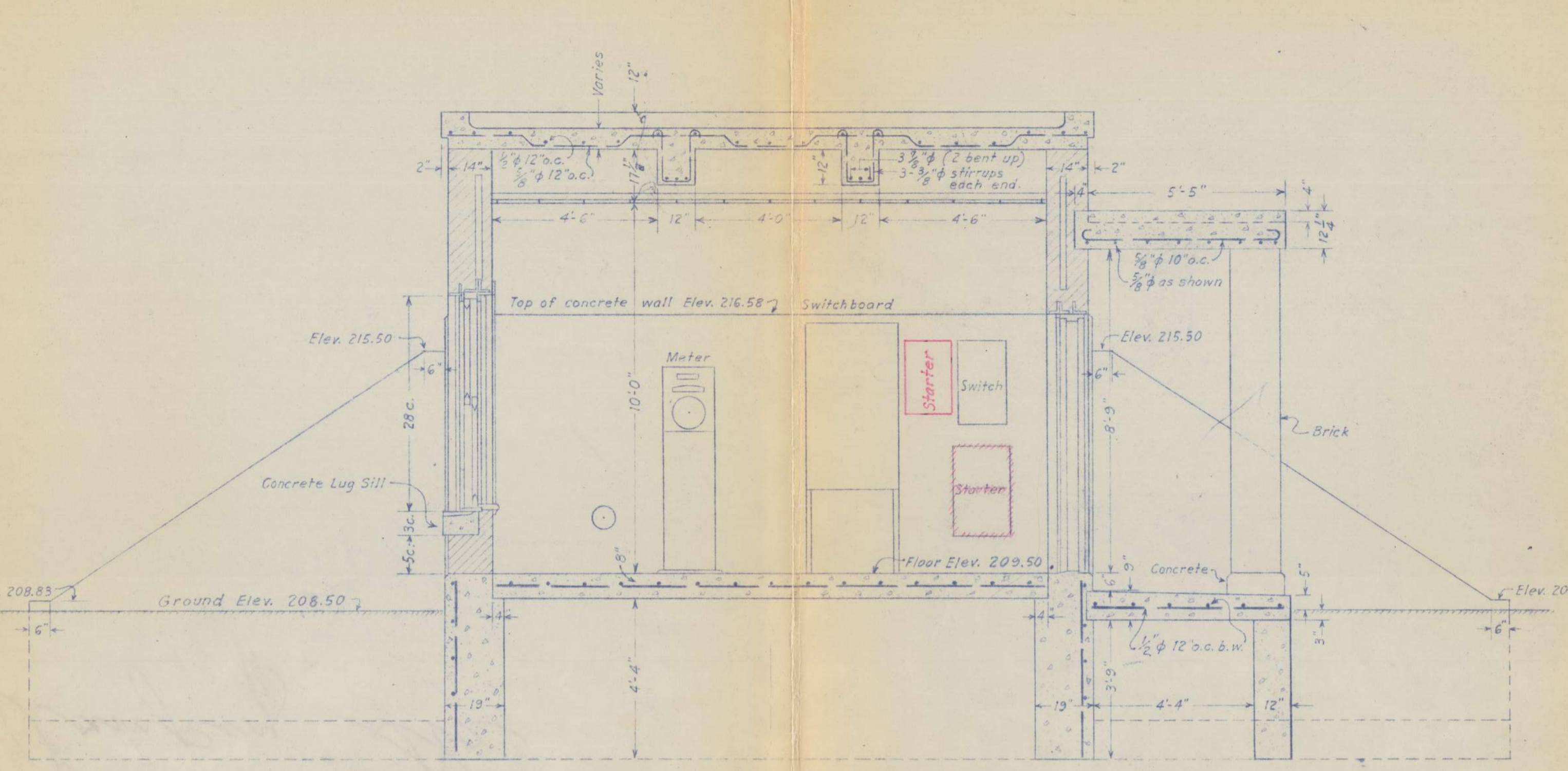


SECTION F-F

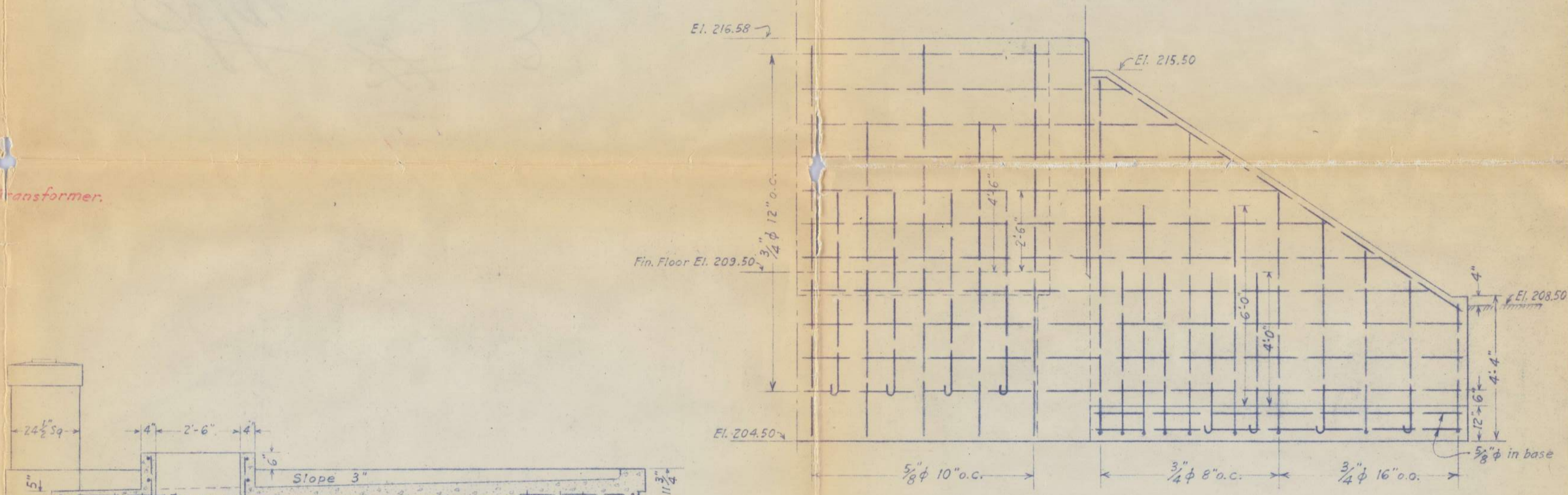
SECTION G-G

SECTION H-H

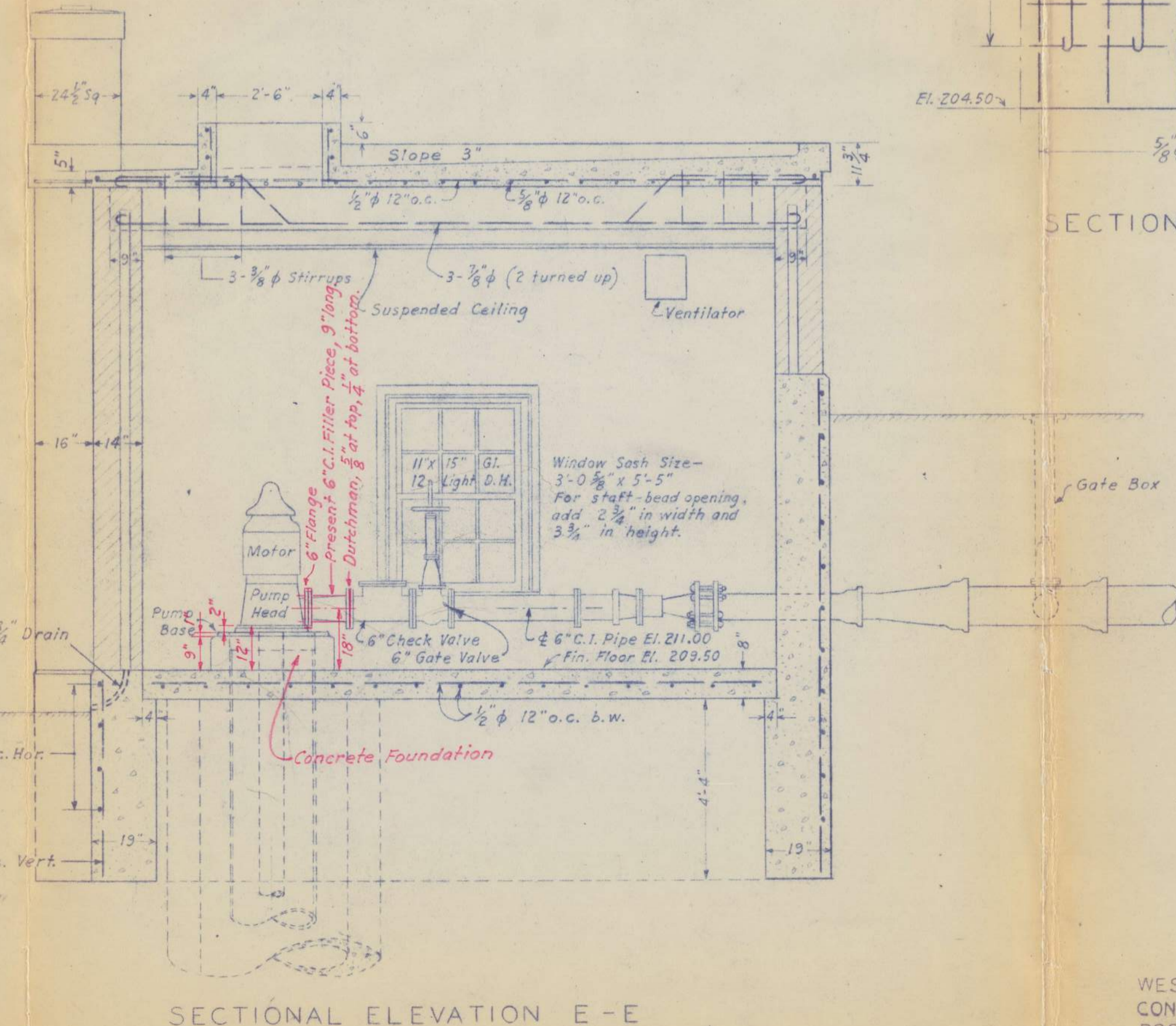
RETAINING WALLS



SECTIONAL ELEVATION D-D



SECTIONAL ELEVATION D-D - REINFORCEMENT



SECTIONAL ELEVATION E-E

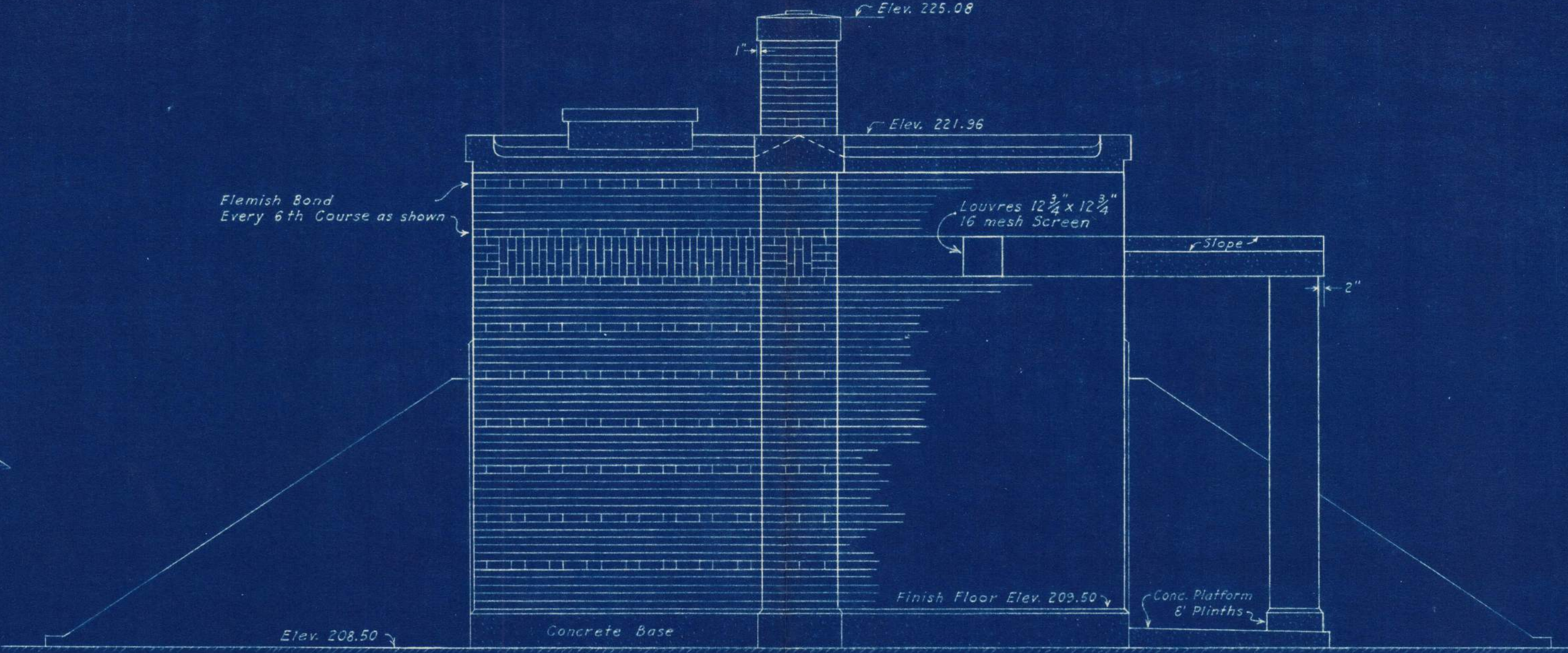
GRAVEL WALL WELL

SHARON WATER DEPARTMENT  
 SHARON, MASS.  
 GRAVEL WALL WELL  
 AND  
 PUMPING STATION  
 SHEET NO. 2  
 FEBRUARY, 1945 SCALE 3/8" IN. = 1 FT.

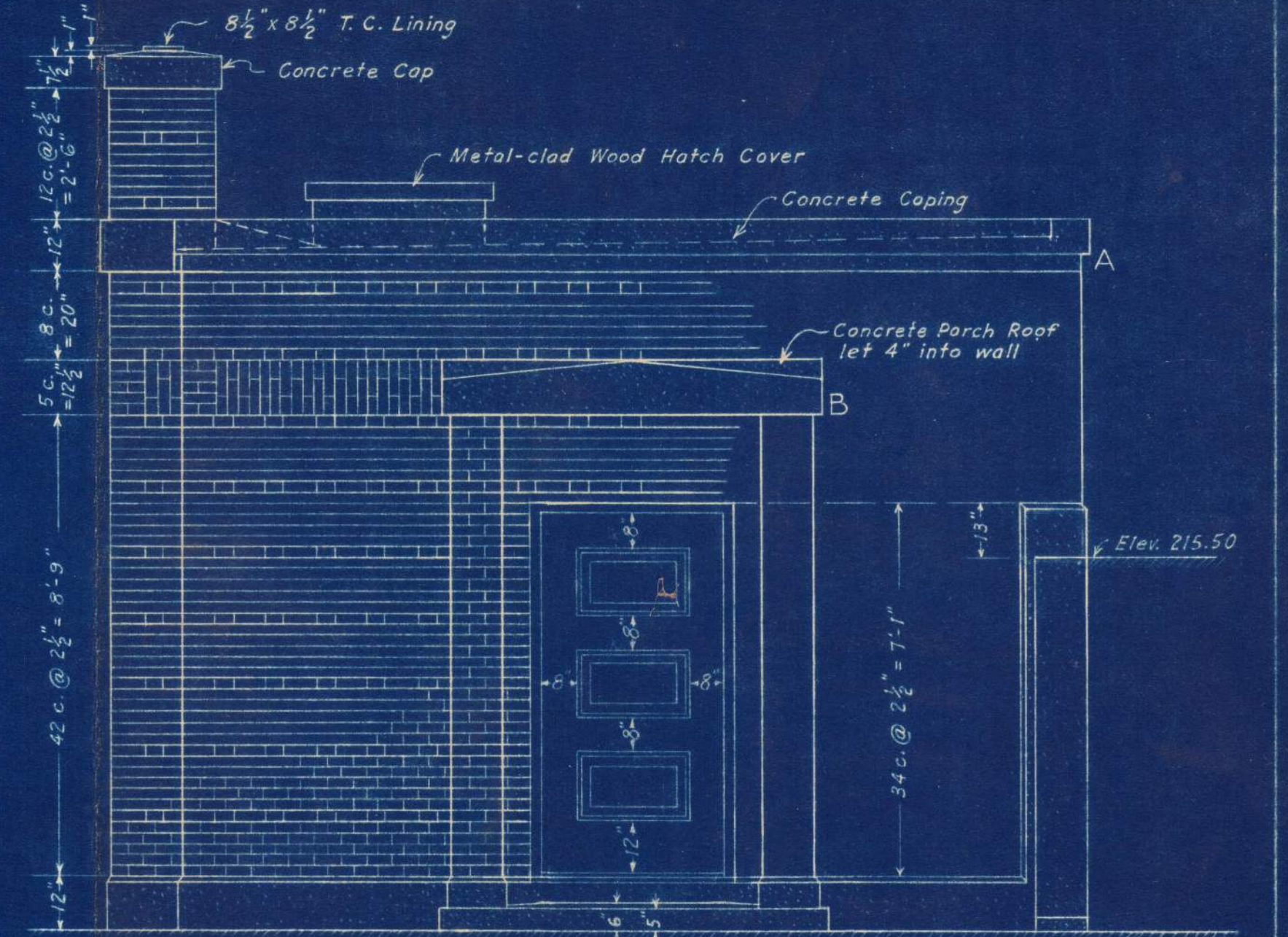
WESTON & SAMPSON  
 CONSULTING ENGINEERS  
 BOSTON, MASS.



EAST ELEVATION



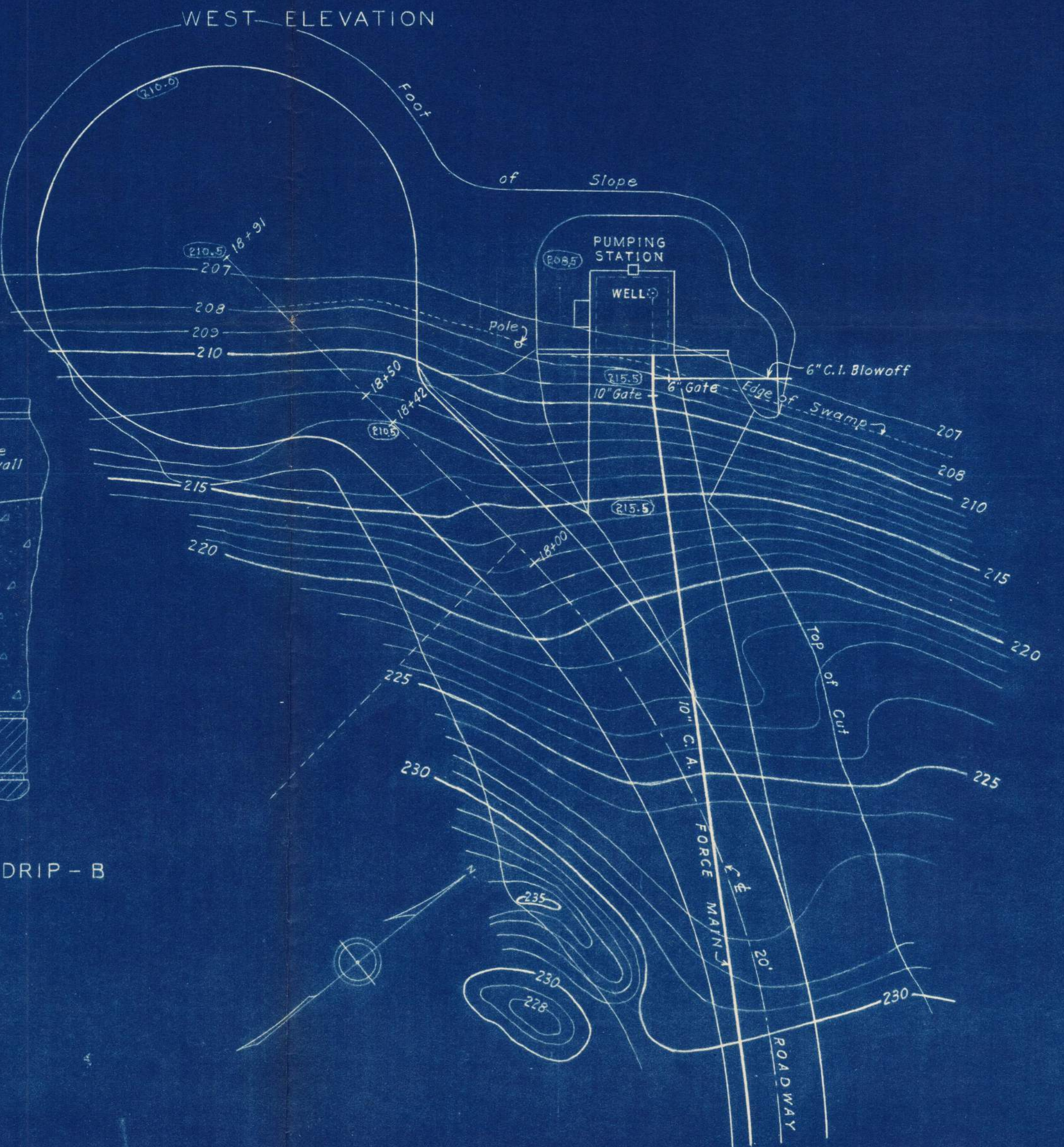
WEST ELEVATION



SOUTH ELEVATION

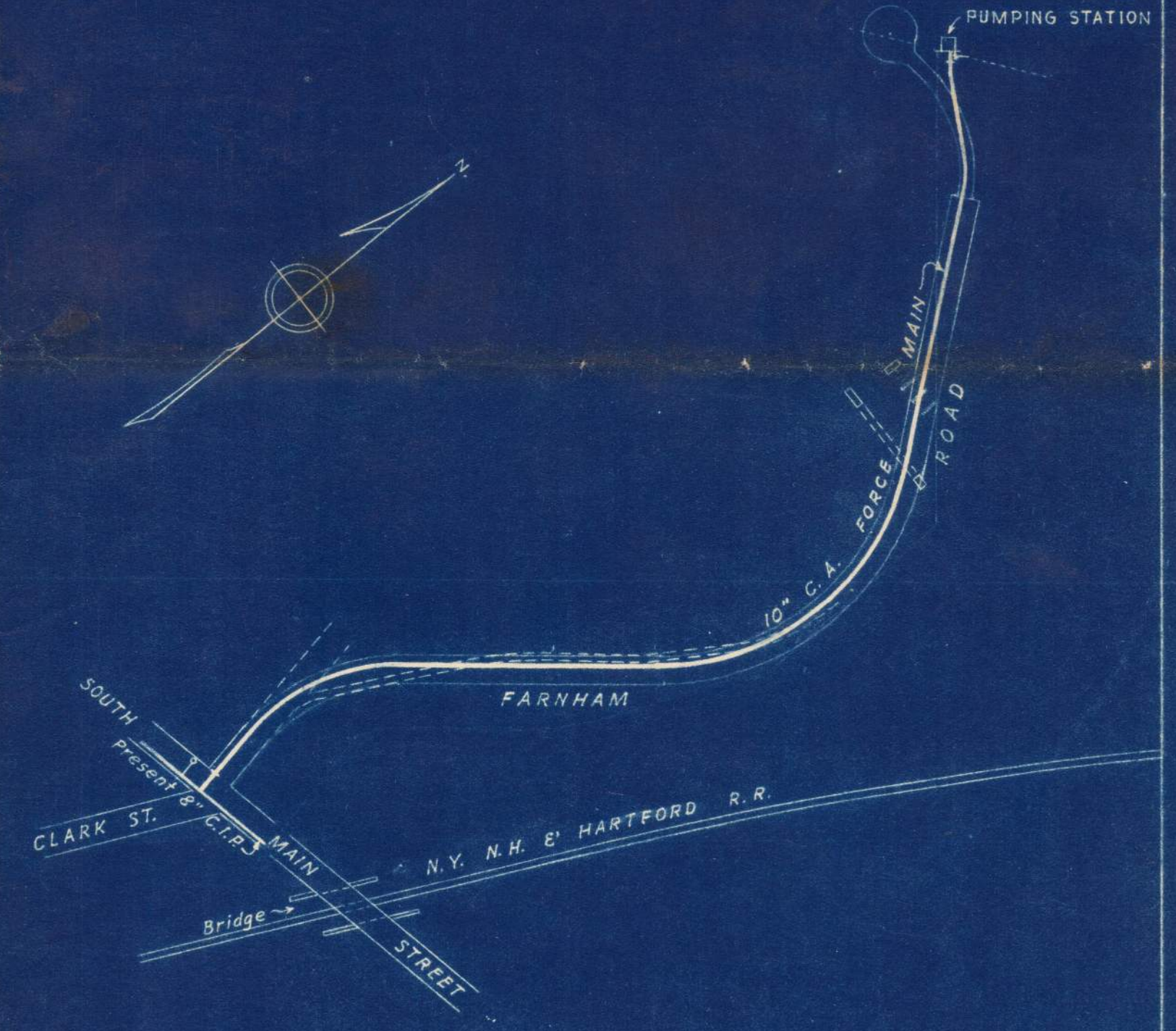
PUMPING STATION

SCALE: 3/8" IN. = 1 FT.



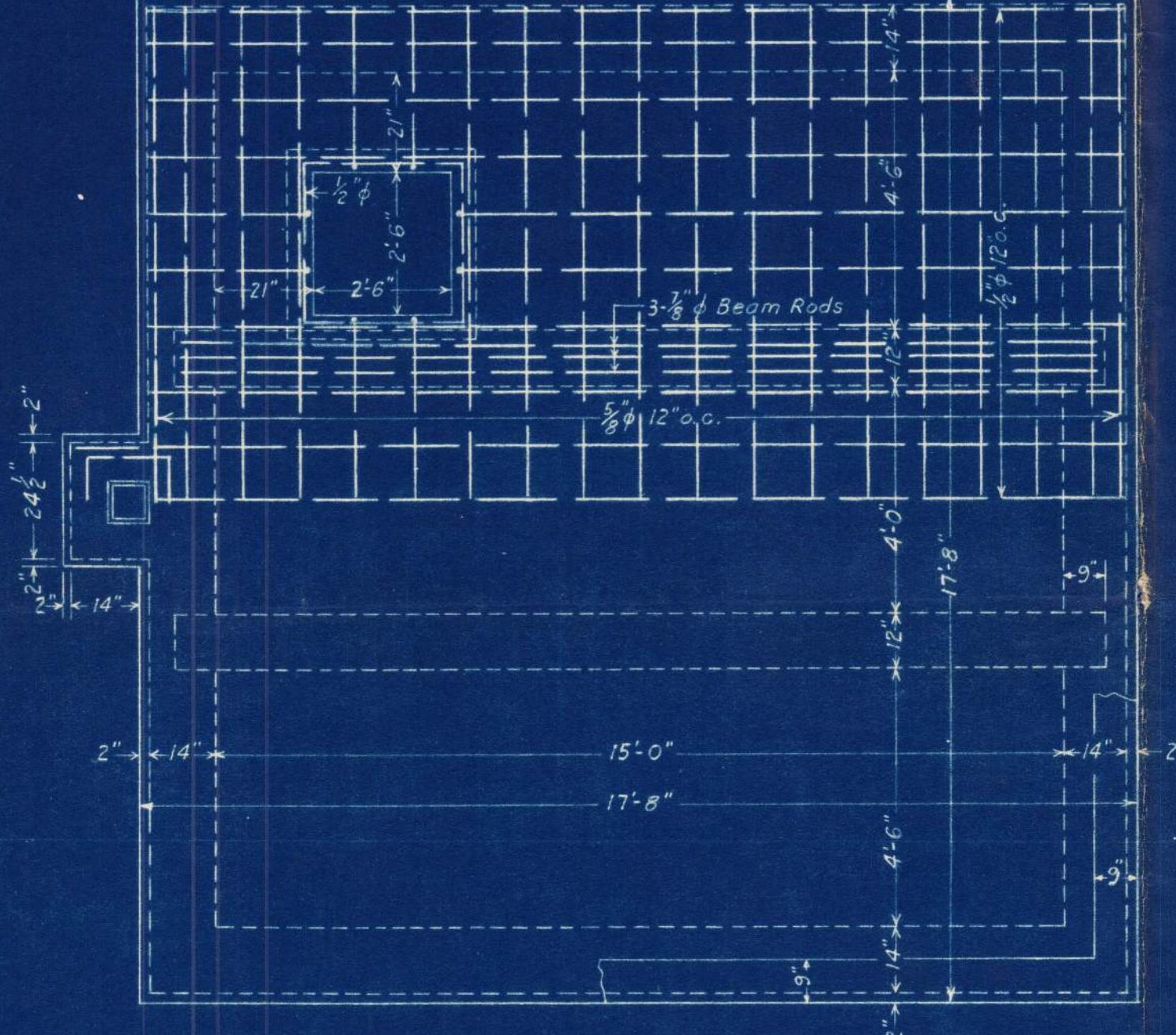
GENERAL PLAN

SCALE: 1" IN. = 20 FT.

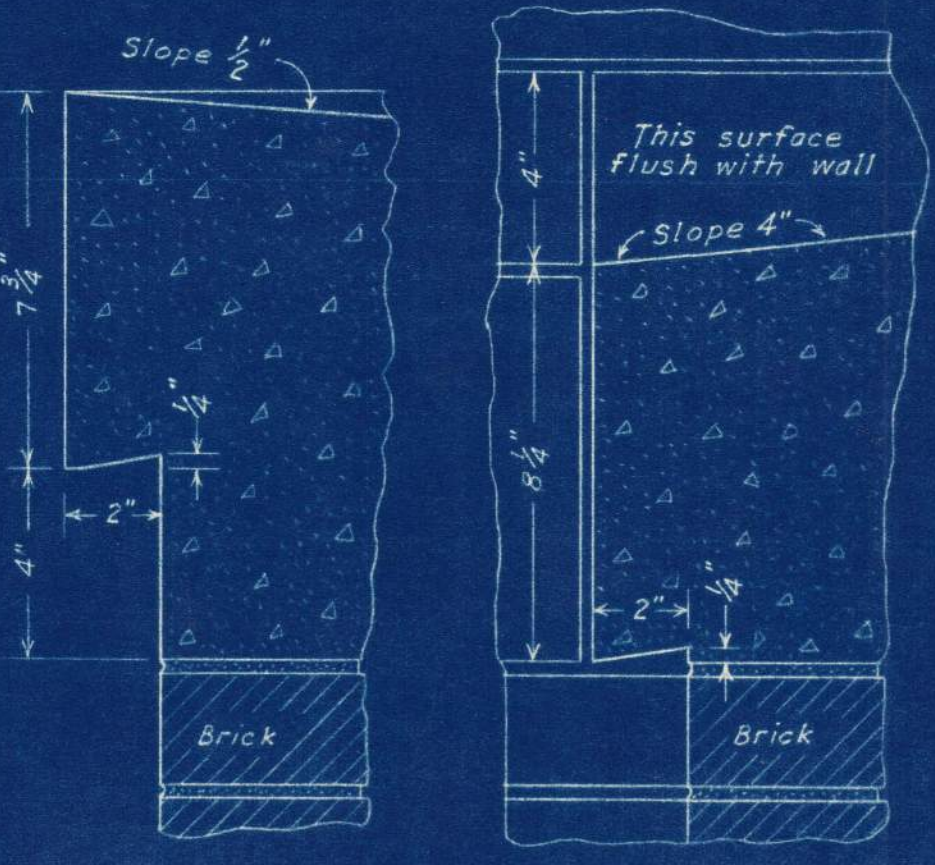


LOCATION PLAN

SCALE: 1" IN. = 200 FT.

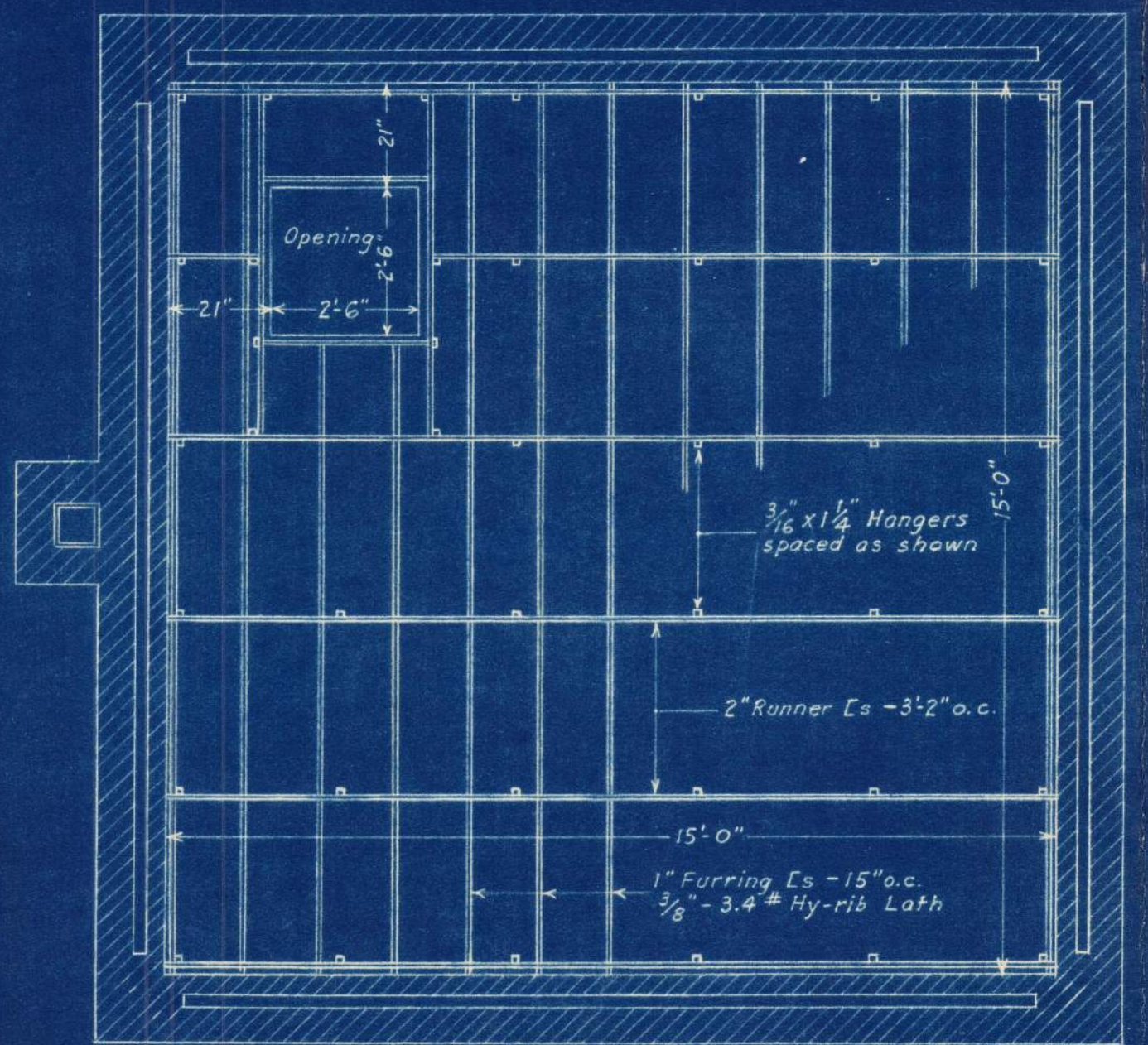


ROOF - PLAN AND REINFORCEMENT



COPING DRIP - A PORCH ROOF DRIP - B

SCALE: 3" IN. = 1 FT.



SUSPENDED CEILING

SHARON WATER DEPARTMENT  
SHARON, MASS.  
GRAVEL WALL WELL  
AND  
PUMPING STATION

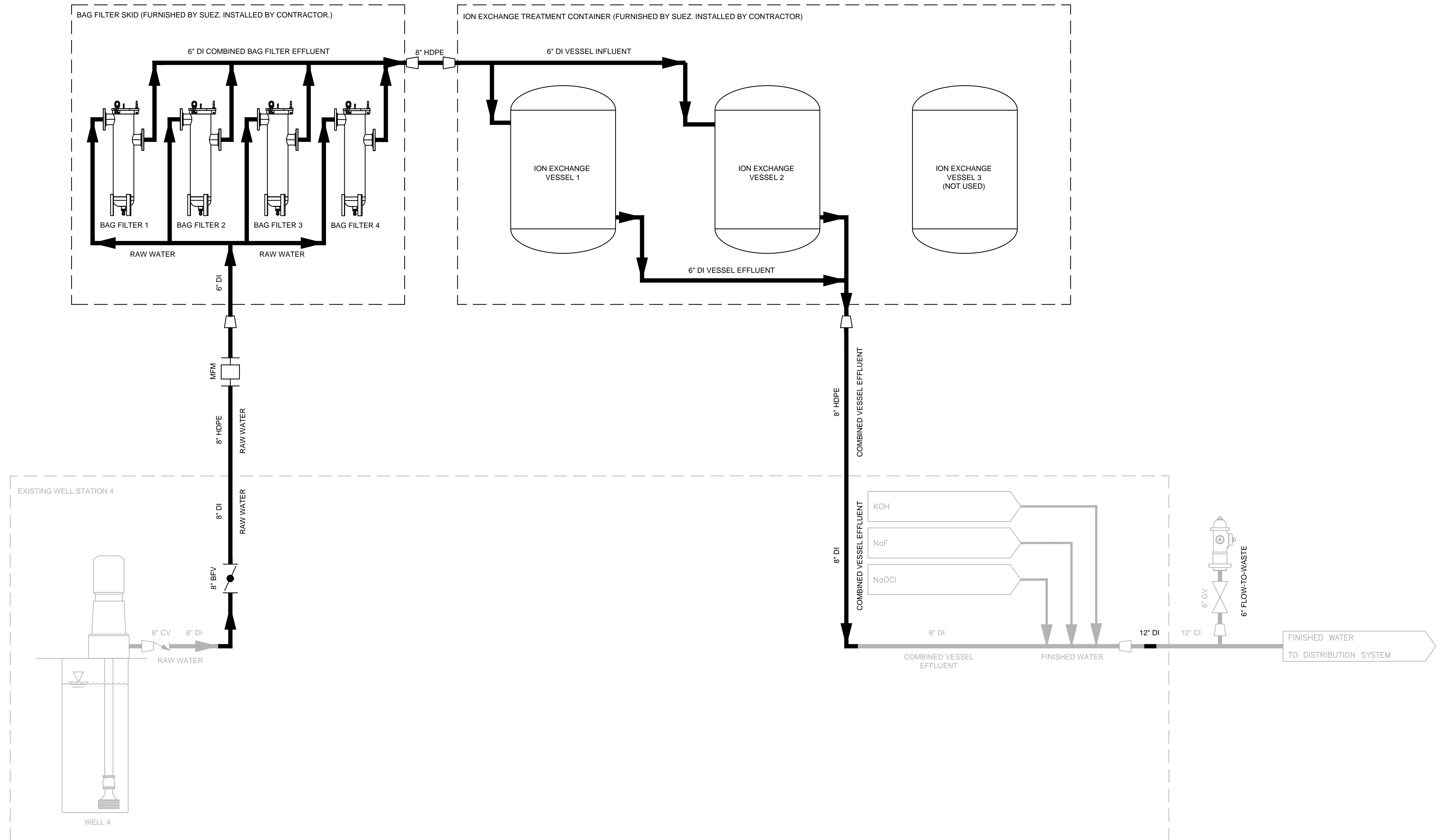
SHEET No. 1

FEBRUARY, 1945 SCALES AS NOTED

WESTON & SAMPSON  
CONSULTING ENGINEERS  
BOSTON, MASS.

**LEGEND**

— EXISTING  
 — PROPOSED



**ENVIRONMENTAL PARTNERS**



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	MAY 2021
Job No.	245-2004
Designed by	AJL
Drawn by	AJL
Checked by	ASK
Approved by	RJT

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM  
 TOWN OF SHARON, MA**

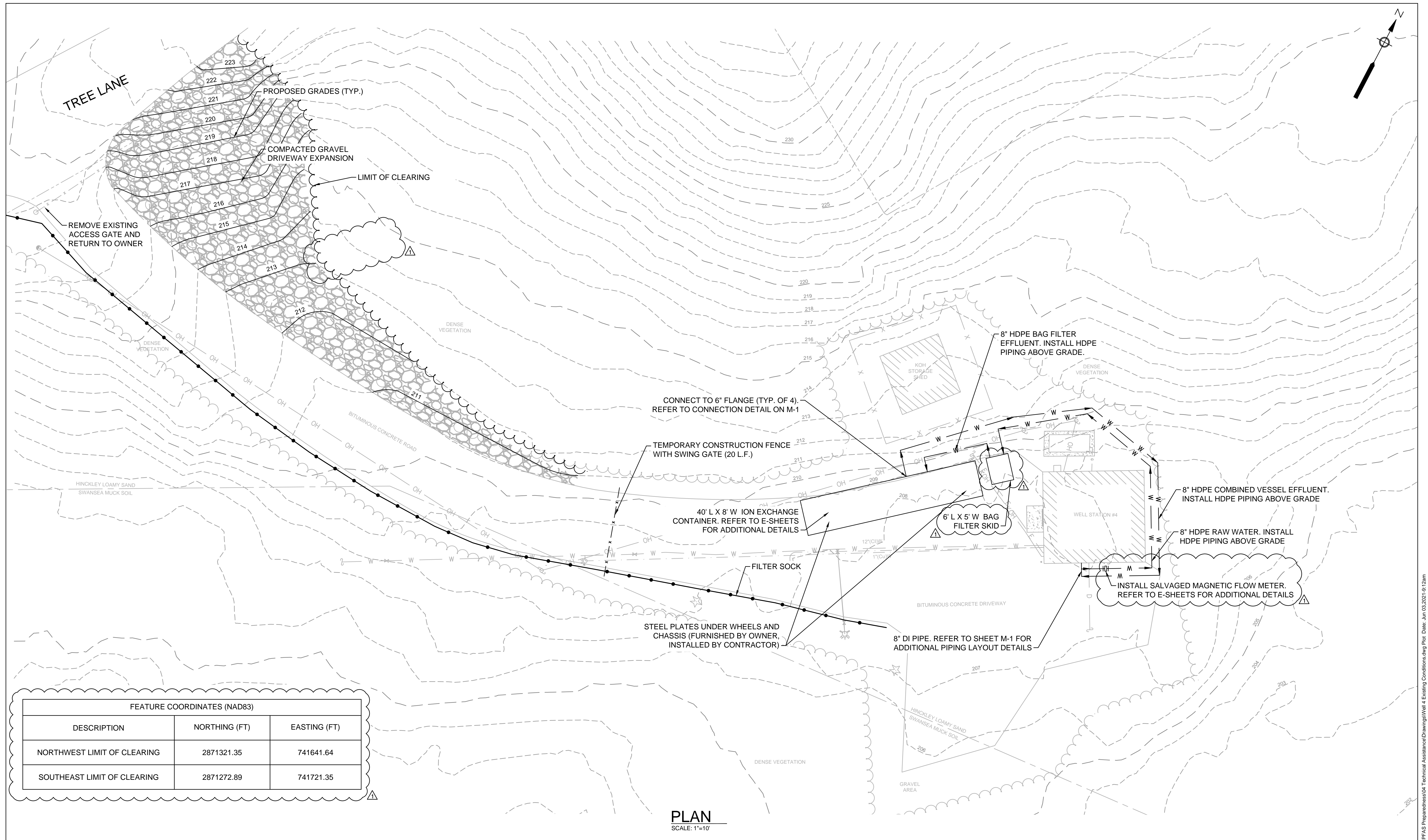
**PROCESS FLOW DIAGRAM**

FOR CONSTRUCTION  
 Sheet No.

**G-1**

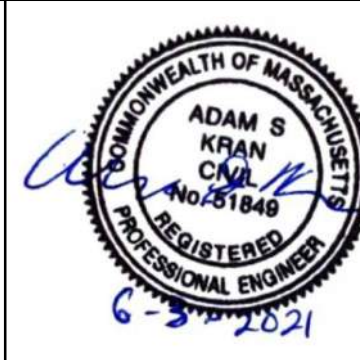
Drawing file: I:\Sharon, MA\245245-2004 PFAS Preparedness\04 Technical Assistance\Drawings\Well 4 Existing Conditions.dwg Plot Date: May 28, 2021 1:15 PM





**PLAN**  
SCALE: 1"=10'

FEATURE COORDINATES (NAD83)		
DESCRIPTION	NORTHING (FT)	EASTING (FT)
NORTHWEST LIMIT OF CLEARING	2871321.35	741641.64
SOUTHEAST LIMIT OF CLEARING	2871272.89	741721.35



6-3-21	ADDENDUM #1	Scale	AS SHOWN
		Date	MAY 2021
		Job No.	245-2004
		Designed by	AJL
		Drawn by	AJL
		Checked by	ASK
		Approved by	RJT
MARK	DATE	DESCRIPTION	

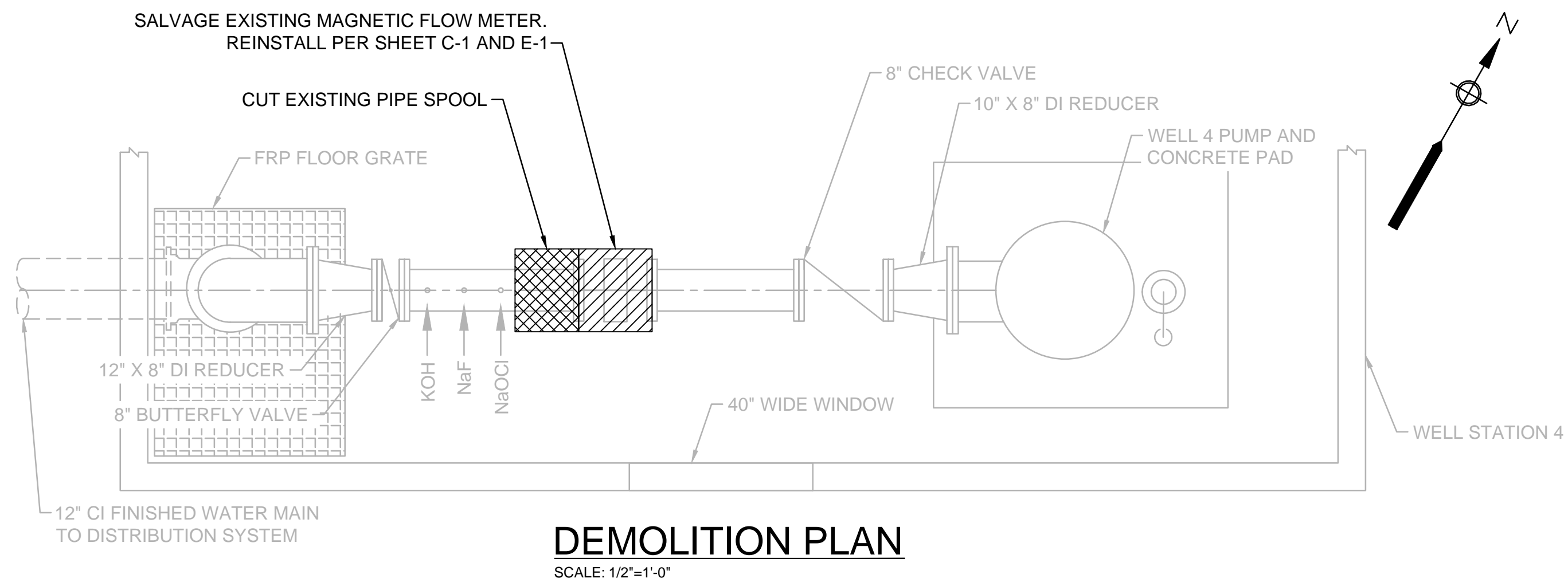
THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM  
TOWN OF SHARON, MA**

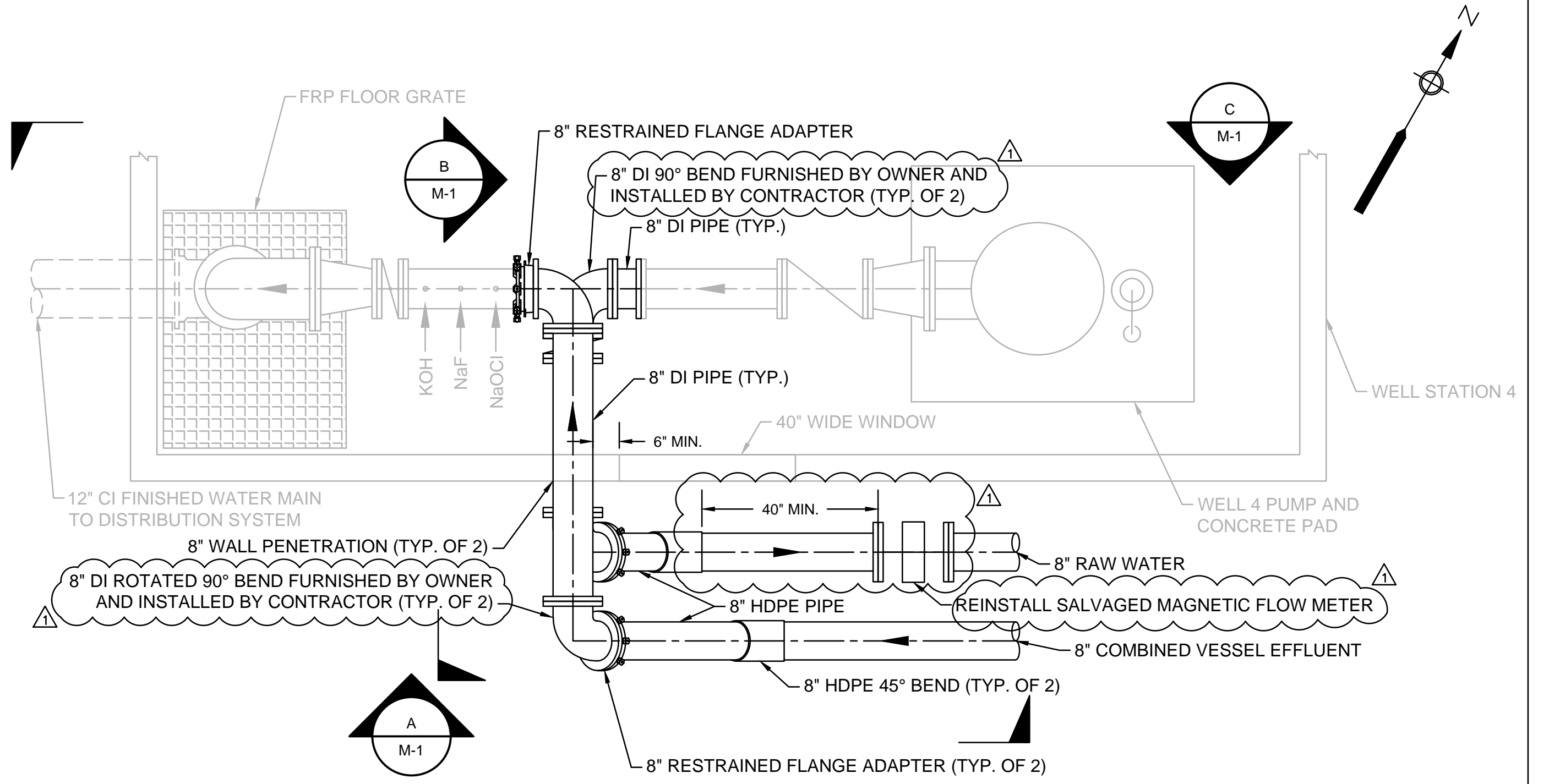
SITE PLAN

FOR CONSTRUCTION
Sheet No.
<b>C-1</b>

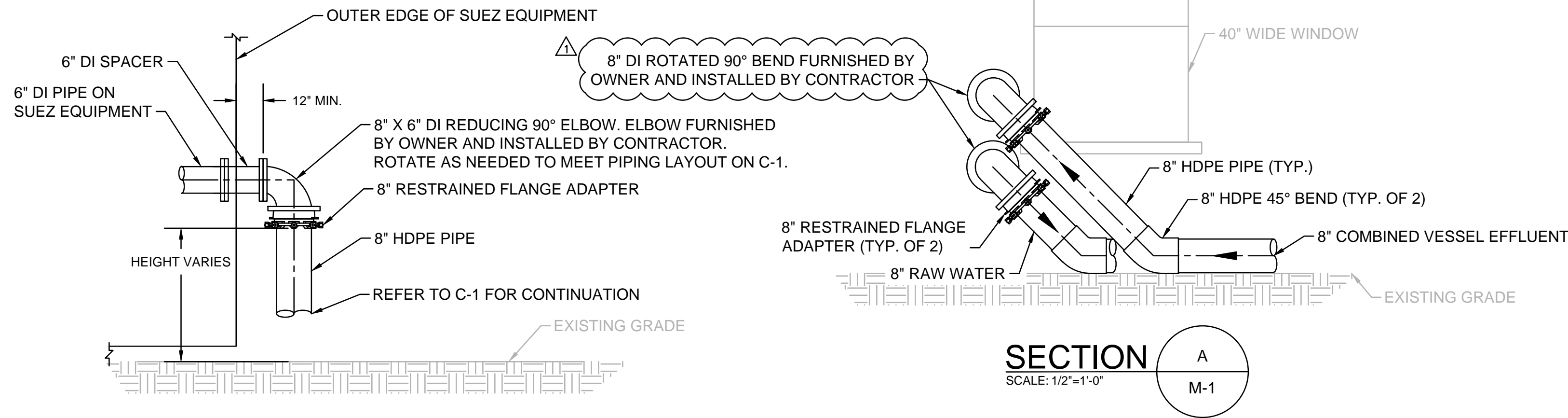
Drawing file: I:\Sharon, MA\245-2004\PPAS\Preparedness\04\_Technical Assistance\Drawings\Well 4\_Existing Conditions.dwg Plot Date: Jun 03 2021 9:12am



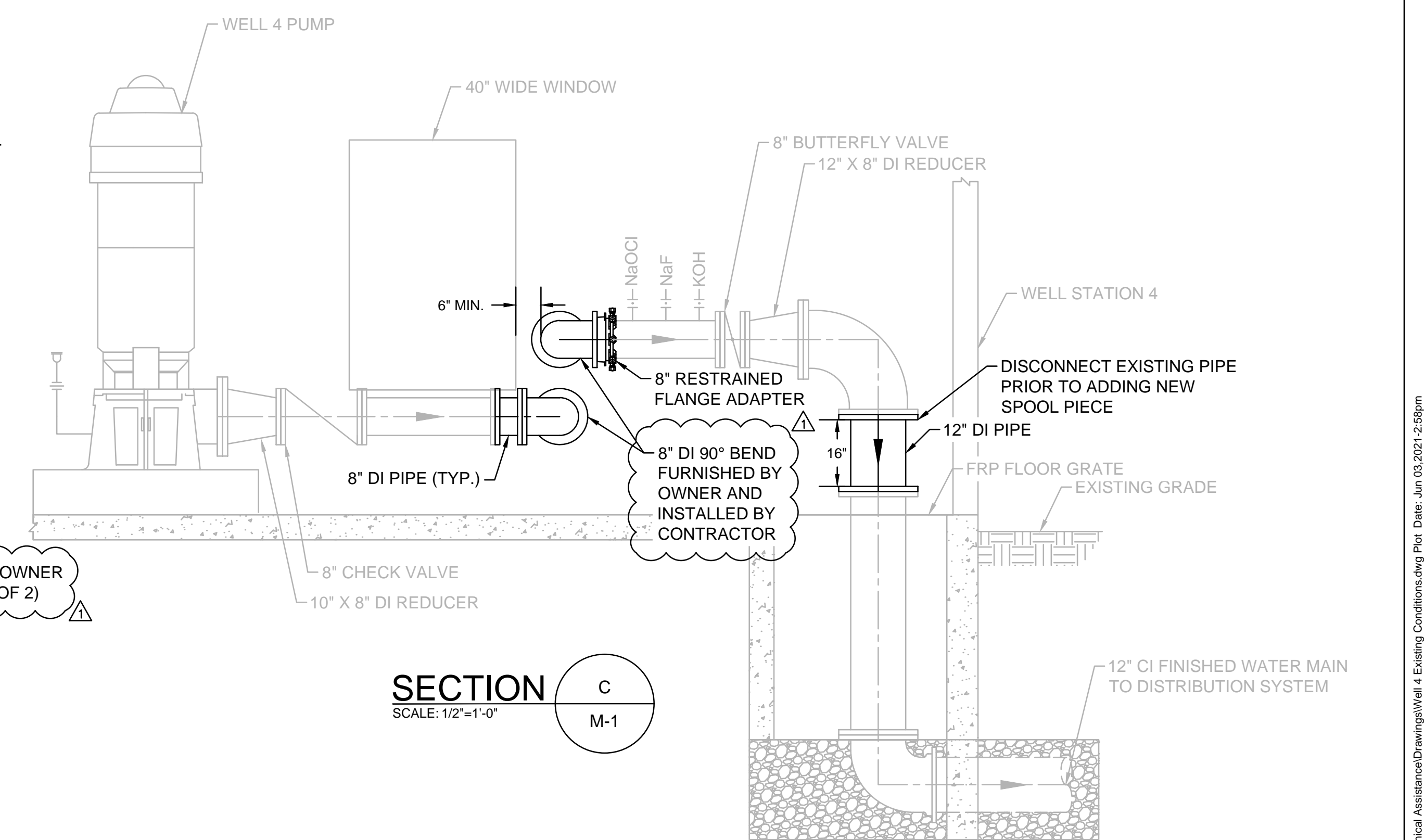
**DEMOLITION PLAN**  
SCALE: 1/2"=1'-0"



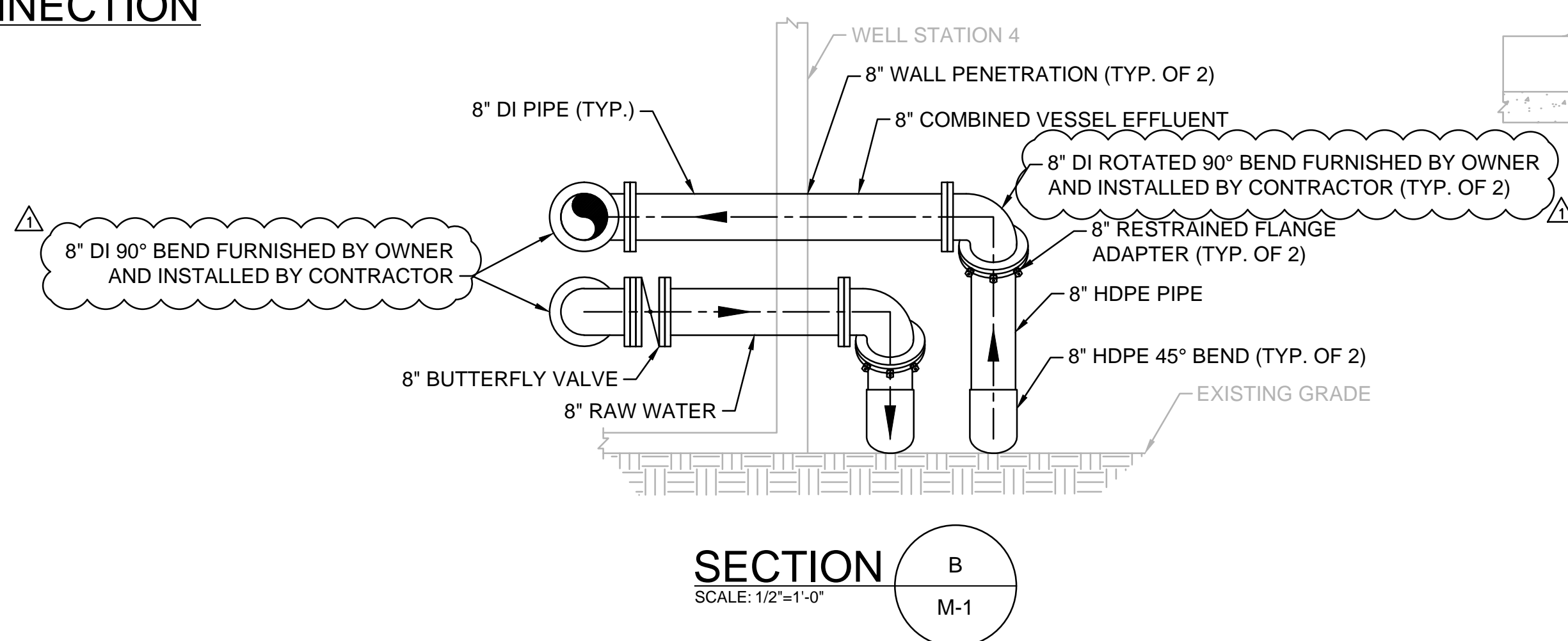
**MODIFICATIONS PLAN**  
SCALE: 1/2"=1'-0"



**SECTION A**  
SCALE: 1/2"=1'-0"



**SECTION C**  
SCALE: 1/2"=1'-0"



**SECTION B**  
SCALE: 1/2"=1'-0"

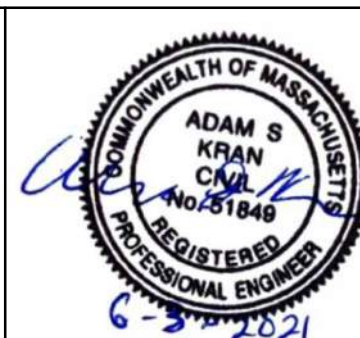
NOTE: CONTRACTOR SHALL FIELD MODIFY PIPING LOCATION AND FITTING ROTATION TO COORDINATE WITH SUEZ EQUIPMENT CONNECTIONS.  
**TYPICAL 6" FLANGE CONNECTION**  
SCALE: N.T.S.

**LEGEND**

	DEMOLITION
	SALVAGE AND PROTECT
	EXISTING
	PROPOSED

NOTE: NEW PIPING SHALL NOT BE PAINTED. CONTRACTOR SHALL FURNISH AND INSTALL PIPE MARKERS WITH FLOW ARROWS. FURNISH AND INSTALL AT LEAST ONE MARKER WITH FLOW ARROW PER NEW PROCESS STREAM, AND EVERY 25 FT THEREAFTER. MARKERS AND FLOW ARROWS SHALL BE RATED FOR OUTDOOR USE. PROVIDE THE FOLLOWING MARKERS WITH FLOW ARROWS FOR EACH PROCESS STREAM:

- (5) "RAW WATER" GREEN MARKERS WITH FLOW ARROWS
- (1) "BAG FILTER EFFLUENT" BLUE MARKER WITH FLOW ARROW
- (6) "IX VESSEL EFFLUENT" BLUE MARKERS WITH FLOW ARROWS



6-3-21	ADDENDUM #1	Scale	N.T.S.
		Date	MAY 2021
		Job No.	245-2004
		Designed by	AJL
		Drawn by	AJL
		Checked by	ASK
		Approved by	RJT
MARK	DATE	DESCRIPTION	

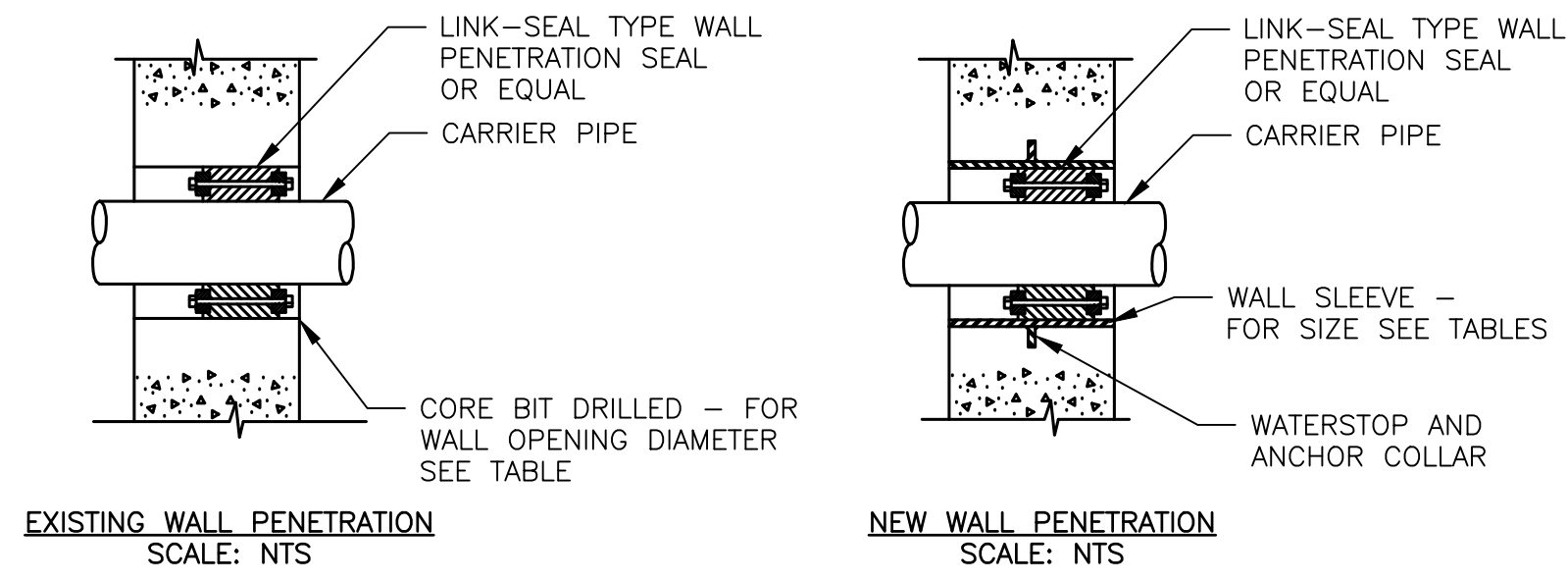
THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM**  
**TOWN OF SHARON, MA**

PROCESS MECHANICAL MODIFICATIONS

FOR CONSTRUCTION  
Sheet No.

**M-1**

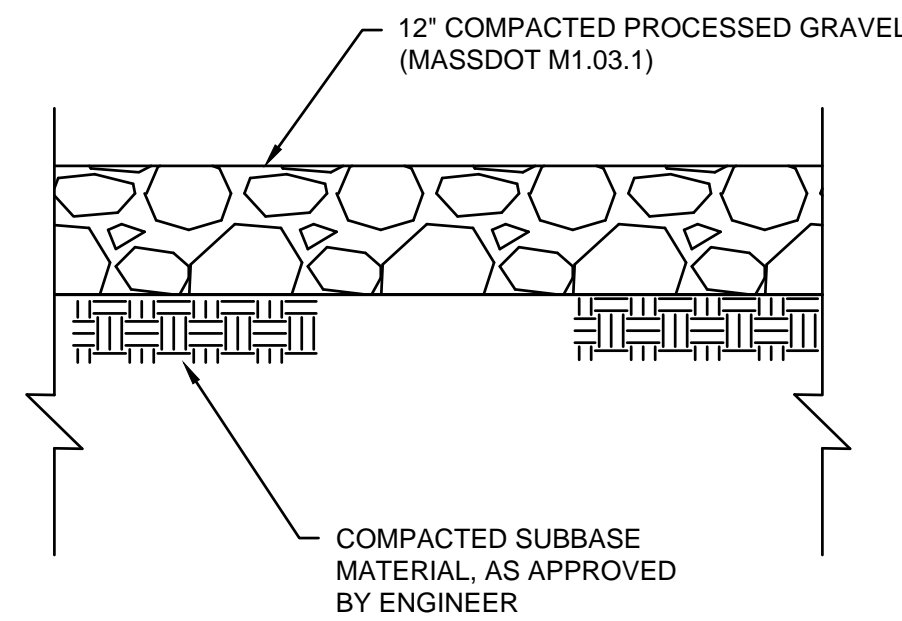


DUCTILE IRON CARRIER PIPE NOMINAL SIZE	DUCTILE IRON CARRIER PIPE O.D.	WALL SLEEVE SIZE	CORE BIT DRILLED I.D.
2"	2.50"	4"	4"
4"	4.80"	8"	8"
6"	6.90"	10"	10"
8"	9.05"	12"	12"
10"	11.10"	14"	14"
12"	13.20"	16"	16"
16"	17.40"	20"	20"
18"	19.50"	24"	24"
24"	25.80"	30"	29"

**NOTES:**

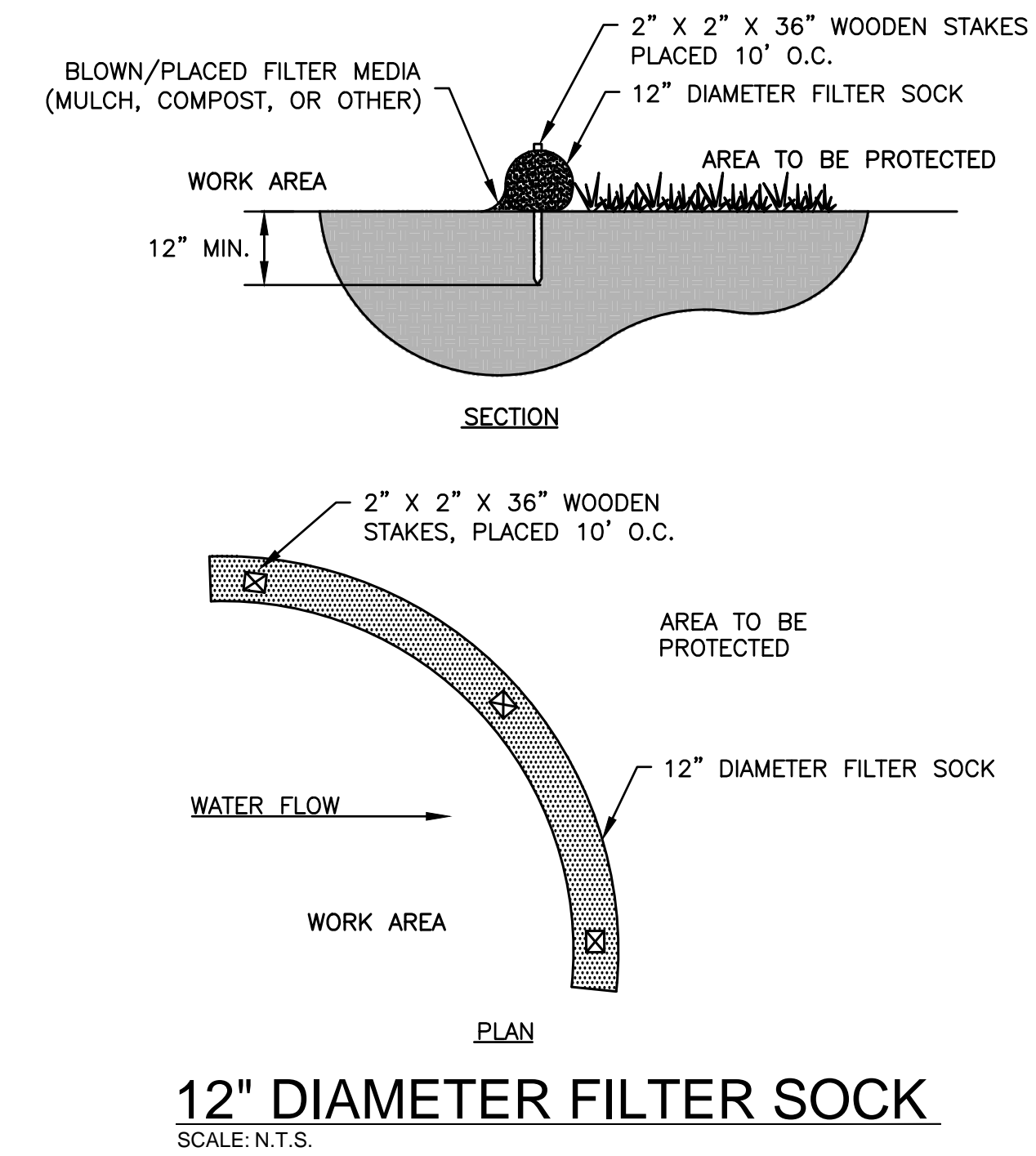
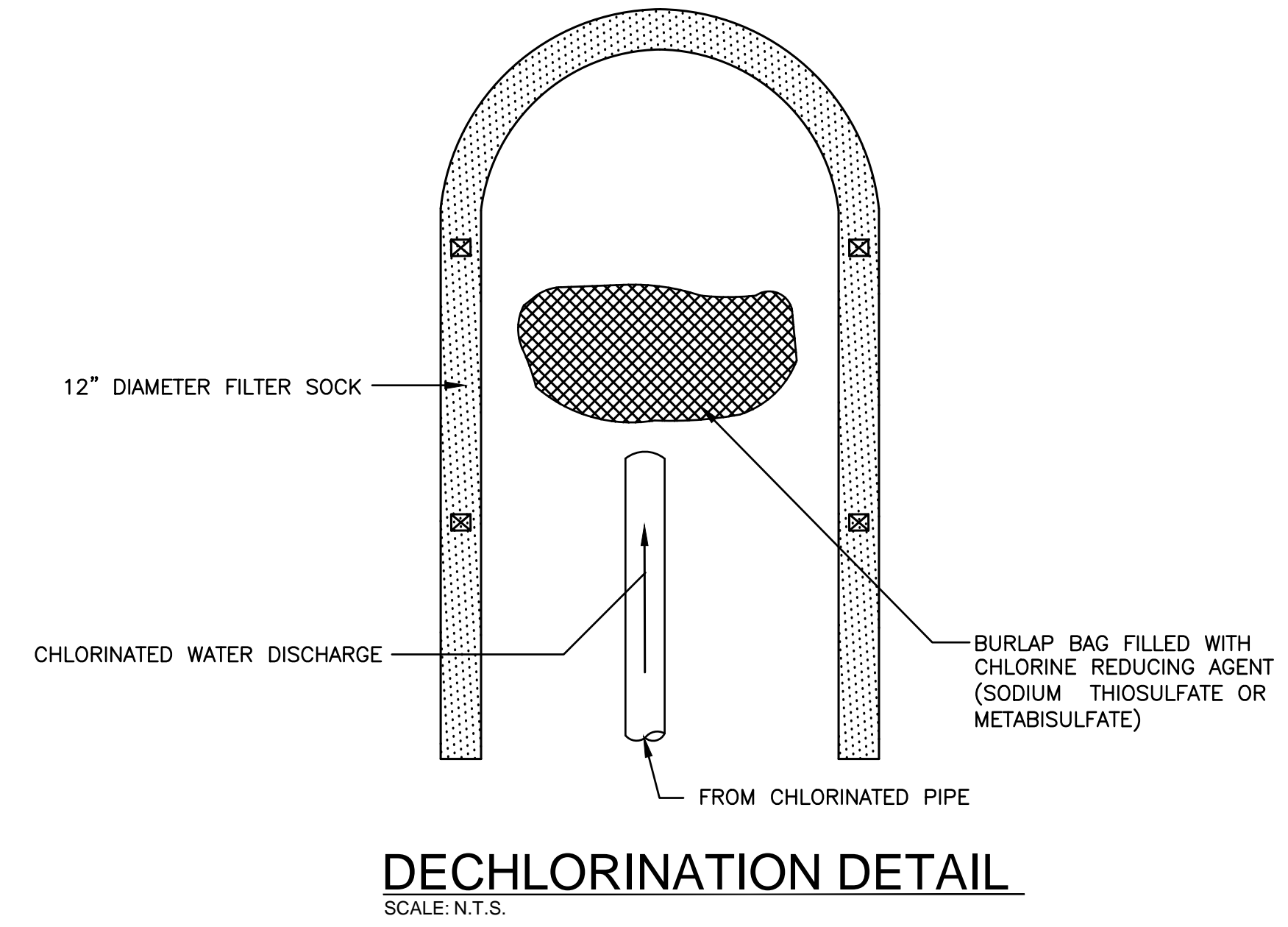
1. SIZES SHOWN ARE FOR DUCTILE IRON PIPE AND COPPER TUBING, FOR OTHER MATERIALS AND PIPE SIZES CONSULT MANUFACTURER'S SPECIFICATIONS.
2. SOME APPLICATIONS MAY REQUIRE STANDARD WALL CASTINGS.
3. FOR ALL APPLICATIONS, PROVIDE NON-SHRINK GROUT ON EXTERIOR (NON-WATER SIDE) OF LINK-SEAL TYPE WALL PENETRATION.
4. LINK SEAL COMPONENTS SHALL BE STAINLESS STEEL.

**TYPICAL WALL PENETRATION DETAIL**  
SCALE: NTS



NOTE: COMPACT SUBBASE TO A MINIMUM OF 95% OF THE MATERIAL'S MAXIMUM DRY DENSITY AS DETERMINED IN THE LABORATORY USING MODIFIED PROCTOR ASTM D1557.

**GRAVEL AREA DETAIL**  
SCALE: N.T.S.



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	MAY 2021
Job No.	245-2004
Designed by	AJL
Drawn by	AJL
Checked by	ASK
Approved by	RJT

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**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM  
TOWN OF SHARON, MA**

**CONSTRUCTION DETAILS**

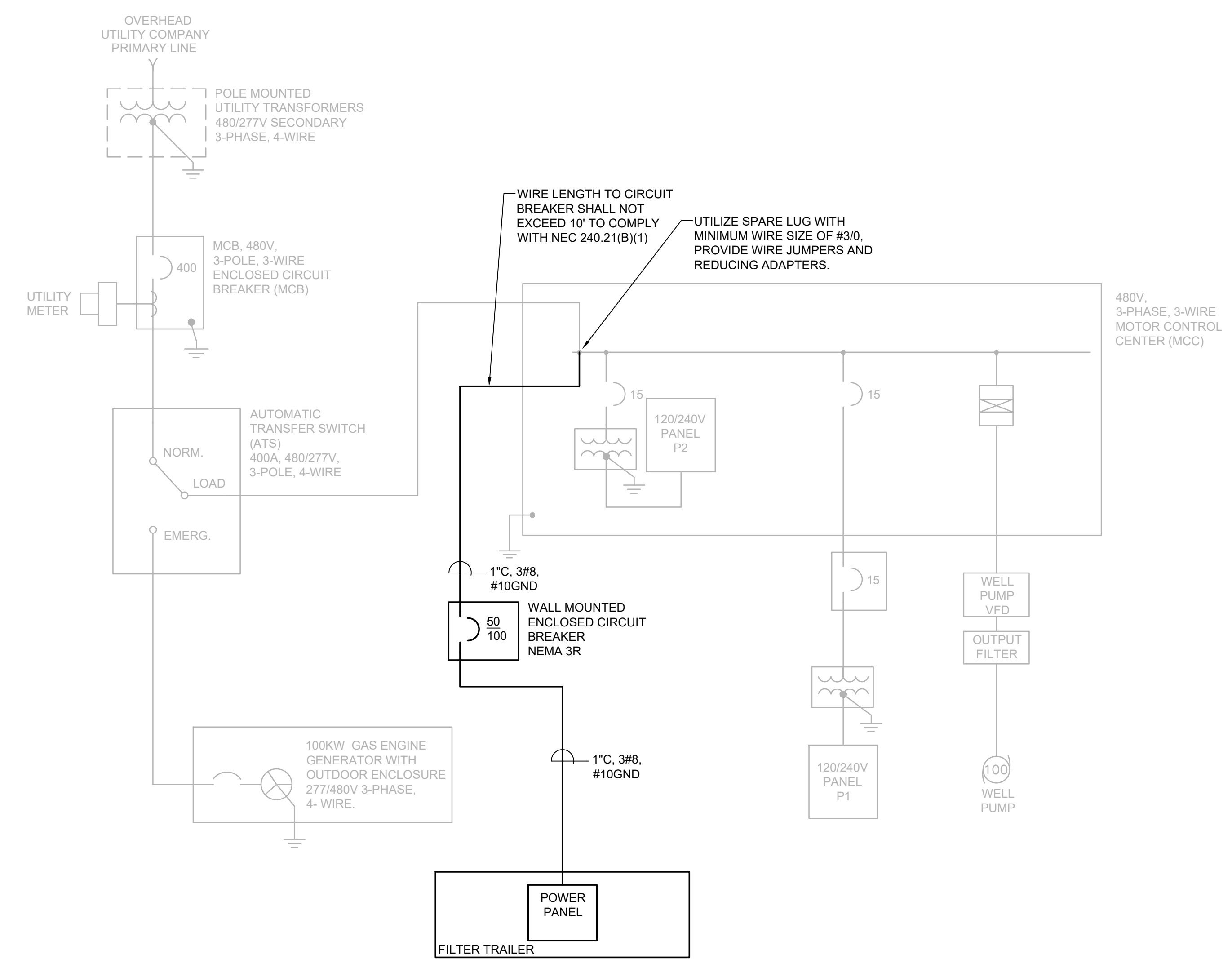
FOR CONSTRUCTION  
Sheet No.

**CD-1**

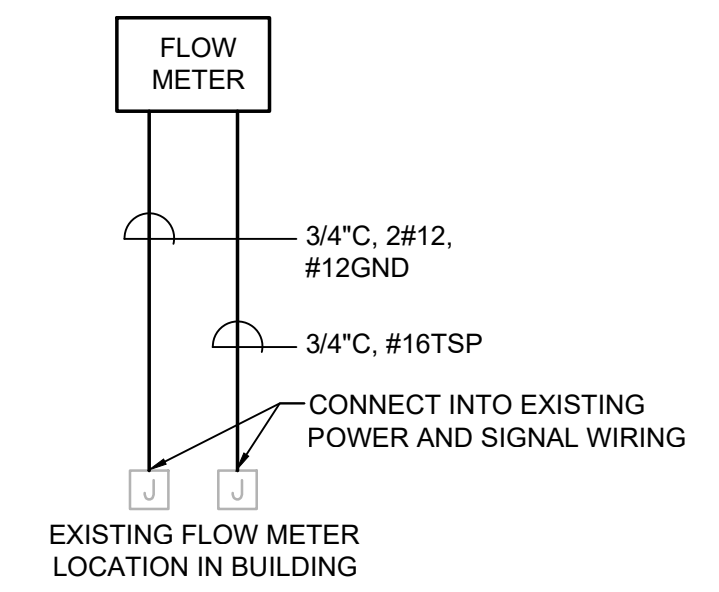
ELECTRICAL SYMBOLS	
	UNFUSED DISCONNECT SWITCH, "30" INDICATES 30 AMP RATING, PROVIDE 3-POLE, UNLESS OTHERWISE INDICATED.
	FUSED DISCONNECT SWITCH, "20" INDICATES 20 AMP FUSE RATING, PROVIDE 3-POLE UNLESS OTHERWISE INDICATED.
	UTILITY POLE
	MOLDED CASE CIRCUIT BREAKER, 3-POLE UNLESS OTHERWISE INDICATED, "20" INDICATES TRIP AMPERE RATING, "100" INDICATES FRAME SIZE, "GFCI" INDICATES CIRCUIT BREAKER TO HAVE GROUND FAULT CIRCUIT INTERRUPT
	DRY TYPE TRANSFORMER
	ENCLOSED VARIABLE FREQUENCY DRIVE
	3/4" X 10'-0" COPPER CLAD GROUND ROD
	BUILDING GROUNDING SYSTEM
	MOTOR, "10" INDICATES HORSEPOWER RATING
	EXPOSED CONDUIT

ABBREVIATIONS	
(2)1" C, 3#8, #10GND	2, 1-INCH CONDUITS EACH CONDUIT CONTAINING 3-#8 AWG WIRES AND 1-#10 GROUND CONDUCTOR
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
ATS	AUTOMATIC TRANSFER SWITCH
DRG. DWG.	DRAWING
EAN	EXCEPT AS NOTED
EC	ELECTRICAL CONTRACTOR
FVNR	FULL VOLTAGE NON-REVERSING
GND, GRD	GROUNDING CONDUCTOR (EQUIPMENT)
J OR JB	JUNCTION BOX
MC	MOTOR CONTROLLER (STARTER)
MCC	MOTOR CONTROL CENTER
NTS	NOT TO SCALE
TSP	TWISTED SHIELDED PAIR CABLE
TYP	TYPICAL
UG	UNDERGROUND

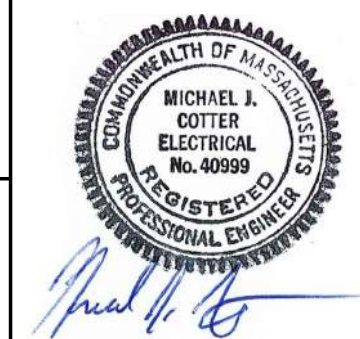
- ### GENERAL NOTES
- FILE ALL DOCUMENTS, PAY ALL PERMIT FEES, AND SECURE ALL INSPECTIONS AND APPROVALS NECESSARY FOR THE ELECTRICAL WORK.
  - ALL CONDUIT AND EQUIPMENT SHALL BE INSTALLED AND GROUNDED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (NEC) AND APPLICABLE LOCAL CODES.
  - BONDING JUMPERS, CONDUIT CLAMPS AND POINTS OF ATTACHMENT ARE NOT SHOWN ON DRAWINGS. SIZE BONDING JUMPERS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. THE POINTS OF ATTACHMENT OF THE GROUND CLAMPS SHALL BE ACCESSIBLE LOCATIONS.
  - EQUIPMENT & CONDUIT INSTALLATIONS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURAL CONDITIONS. EXPOSED CONDUITS SHALL BE INSTALLED PARALLEL TO BEAMS AND WALLS.
  - CONDUITS SHALL BE TERMINATED SO AS TO PERMIT NEAT CONNECTIONS TO MOTORS AND OTHER EQUIPMENT.
  - NO CONDUIT SMALLER THAN 3/4" PIPE SIZE NOR WIRE SMALLER THAN NO. 12 A.W.G. SHALL BE USED UNLESS OTHERWISE NOTED
  - BACK BOXES, JUNCTION BOXES, AND ELECTRICAL ENCLOSURES SHALL BE OF PRESSED SHEET STEEL, TYPE NEMA 3R FOR BUILDING EXTERIOR AND NEMA 1 FOR BUILDING INTERIOR.
  - EXTERIOR RACEWAY SHALL BE LIQUID TIGHT FLEXIBLE METAL CONDUIT, INTERIOR RACEWAY SHALL BE FLEXIBLE METAL CONDUIT. PROVIDE A COMPLETE CONDUIT SYSTEM INCLUDING ALL CONDUIT, CLAMPS, FITTINGS, MOUNTING EQUIPMENT, AND ECT.
  - PROVIDE ALL WIRE AND CABLE CONNECTIONS, TERMINATIONS AND SPLICES. WIRE TO BE 600V, COPPER, THWN. UTILIZE TWIST ON TYPE WIRE NUTS FOR SPLICES.
  - PROVIDE ALL CORES FOR CONDUITS AND MAKE WATERTIGHT WITH SEALANT AROUND CONDUIT.
  - ALL WORK SHOWN IS NEW (FURNISHED AND INSTALLED) UNLESS OTHERWISE NOTED.
  - ALL MATERIALS SHALL BE UL LISTED.



**ONE LINE DIAGRAM**  
NOT TO SCALE



**FLOW METER WIRING BLOCK DIAGRAM**  
NOT TO SCALE



MARK	DATE	DESCRIPTION

Scale	AS SHOWN
Date	MAY 2021
Job No.	245-2004
Designed by	RLB
Drawn by	RLB
Checked by	MC
Approved by	

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM**  
TOWN OF SHARON, MA

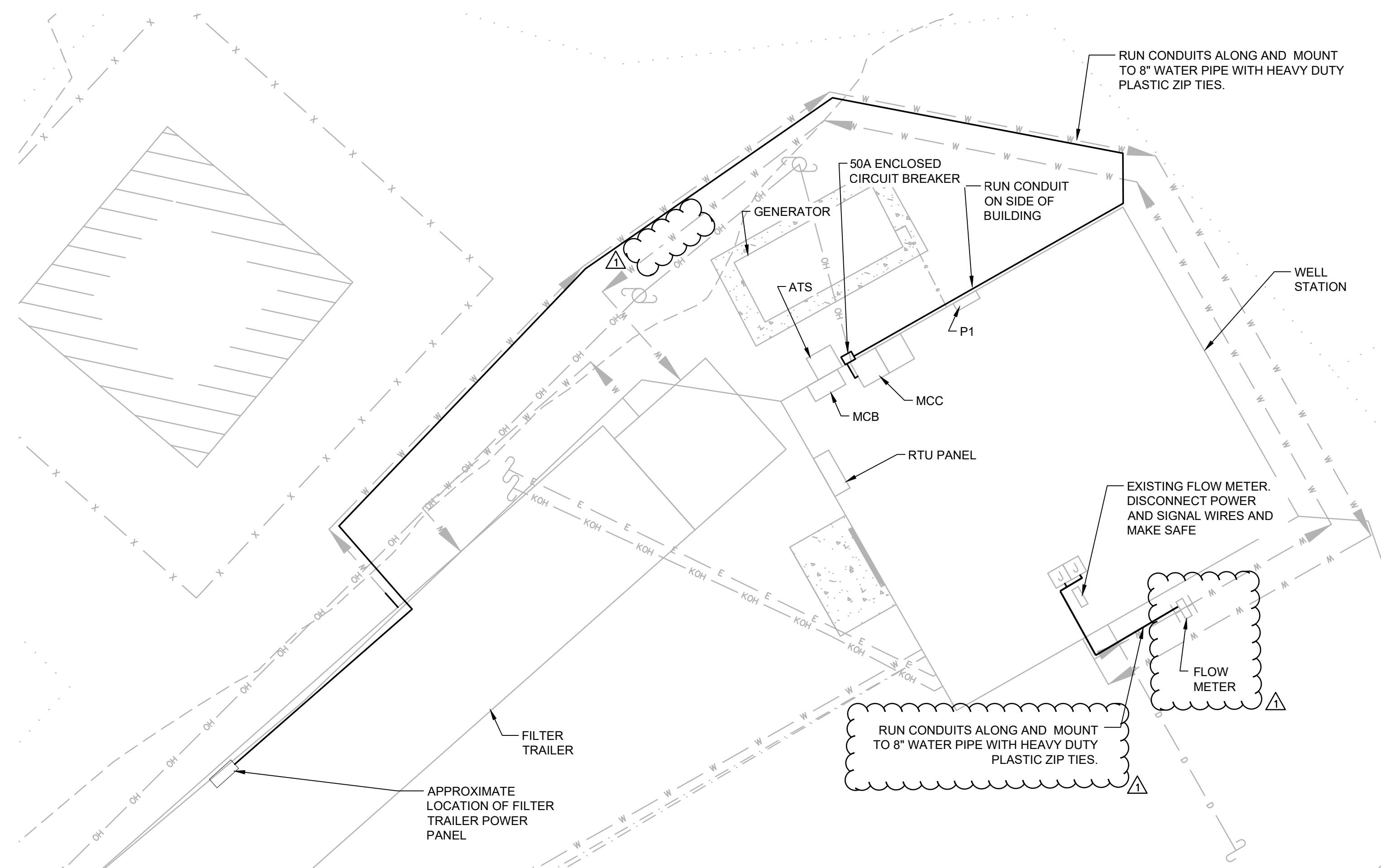
**ELECTRICAL**  
LEGEND, ABBREVIATIONS, NOTES, & DIAGRAMS

FOR CONSTRUCTION

Sheet No. **E-1**

**NOTES:**

1. REFER TO ONE LINE AND FLOW METER WIRING BLOCK DIAGRAMS FOR CONDUIT/WIRE REQUIREMENTS.

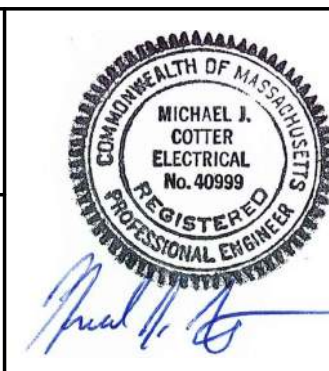


**PLAN**  
SCALE: 1" = 10'-0"



**ENVIRONMENTAL PARTNERS**

**SAR ENGINEERING, INC.**  
Mechanical/Electrical Engineers  
150 Greenwood Drive, Suite 309  
Braintree, Massachusetts 02184  
617.328.0212  
www.sar.com



6-3-21	ADDENDUM #1	Scale	AS SHOWN
		Date	MAY 2021
		Job No.	245-2004
		Designed by	RLB
		Drawn by	RLB
		Checked by	MC
		Approved by	
MARK	DATE	DESCRIPTION	

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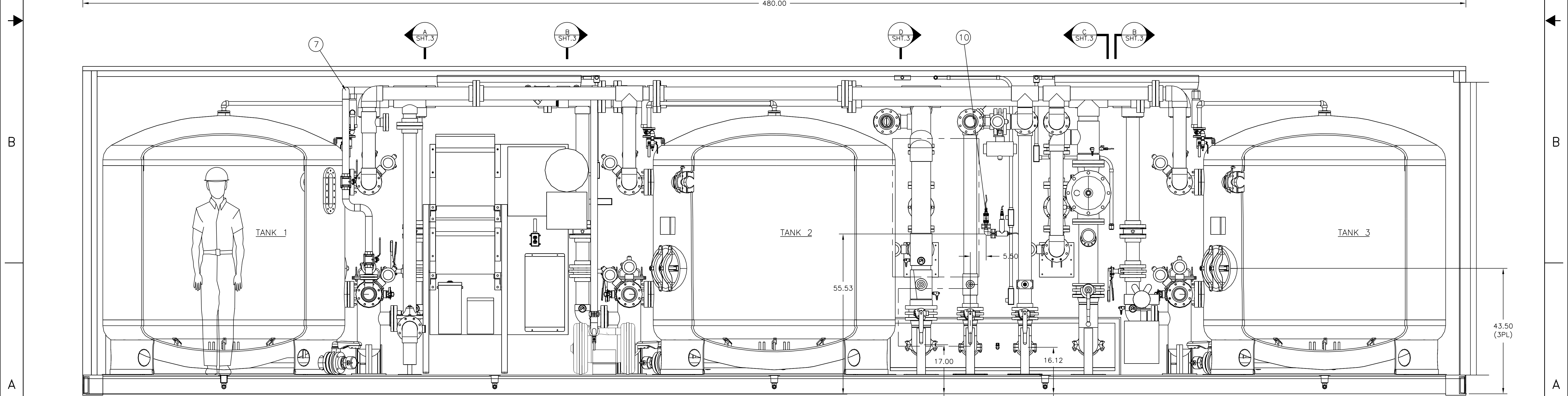
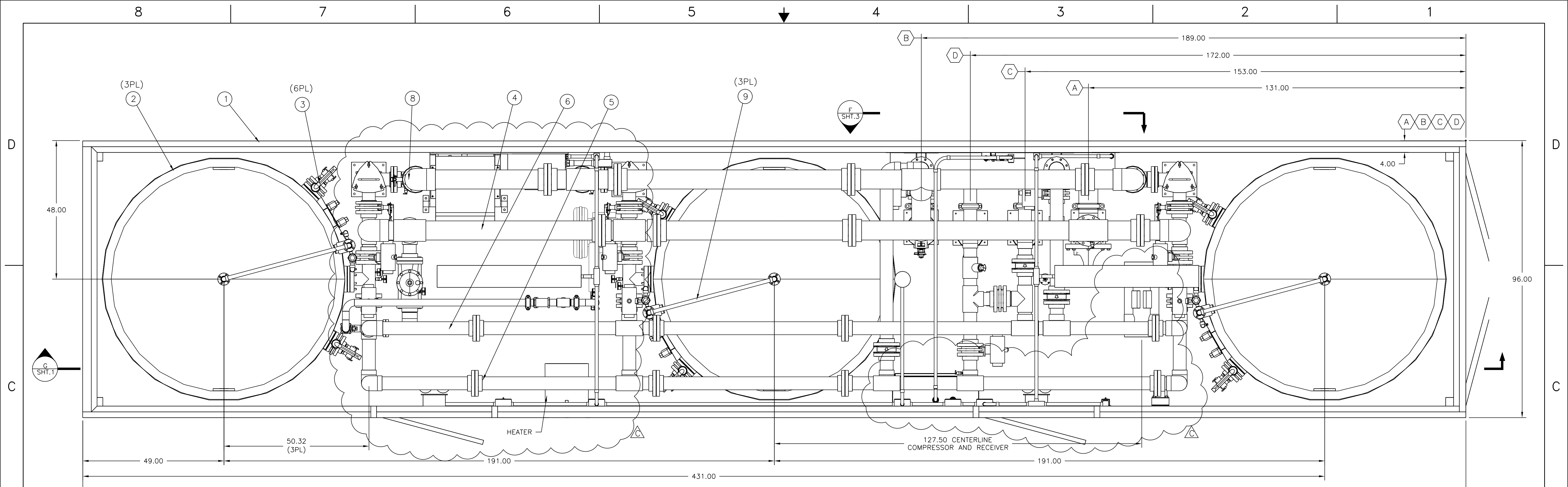
**WELL STATION 4 TEMPORARY PFAS TREATMENT SYSTEM  
TOWN OF SHARON, MA**

**ELECTRICAL PLAN**

FOR CONSTRUCTION

Sheet No.

**E-2**



6'-0" [1829mm]  
(REF PERSON)

SECTION G-G  
SCALE: NONE

REV	DESCRIPTION	ECO	DWN	APVD	DATE	CHKD
C	REVISED AS NOTED	-	SJ	HG	02AUG12	KW
B	REVISED AS NOTED	-	DJS	HG	09JUL12	JC
A	INITIAL RELEASE	-	BN	HG	11MAY12	JC

TOLERANCES UNLESS NOTED	DRAWN BY	DATE
DECIMALS .X ±	BN	03APR12
ANGLES ± 0.5	CHECKED BY	DATE
.XX ± 0.50	JC	16MAY12
FRAC .XXX ±	APPROVED BY	DATE
± ?"	KW	11MAY12
	APPROVED BY	DATE
	HG	11MAY12

DIMENSIONS IN INCHES	THIRD ANGLE
DO NOT SCALE	

GE	Water & Process Technologies
GLOBAL HEADQUARTERS : TREVOSE, PA USA +1-215-355-3300 WWW.GEWATER.COM	

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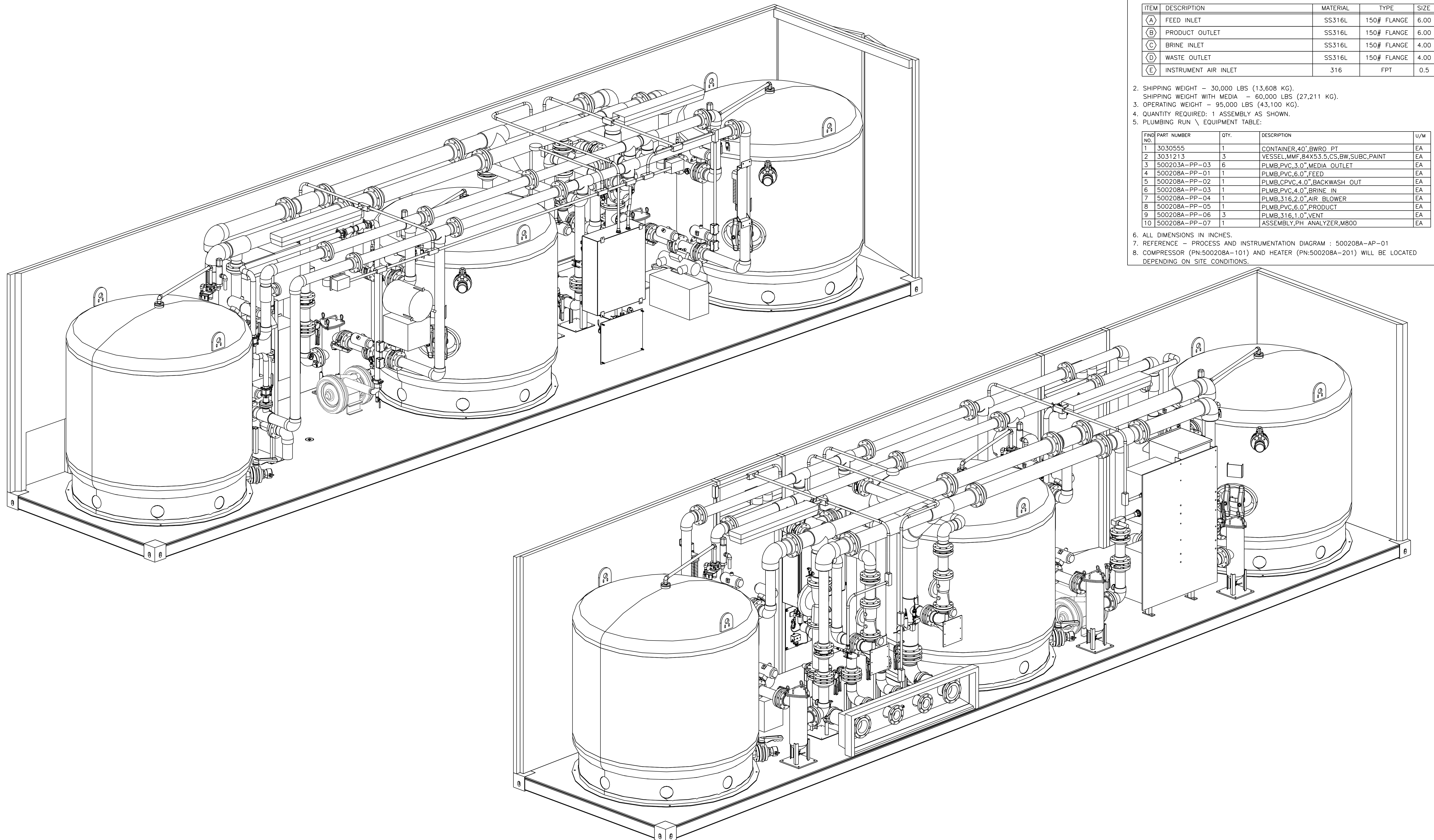
CLIENT/JOB	TITLE
GE MOBILE WATER AUTOFILTER 3X7	GENERAL ARRANGEMENT SYS, PRETREATMENT, BWRO, CE

FILE	MATERIAL
AUTOCAD	500208A-PG-02

SIZE	DRAWING NO.	REV
D	500208A-PG-02	C
PROJECT	500208	
SCALE	1:16	SHEET 1 OF 3

8 7 6 5 4 3 2 1

D  
C  
B  
A



1. CONNECTION TABLE

ITEM	DESCRIPTION	MATERIAL	TYPE	SIZE
(A)	FEED INLET	SS316L	150# FLANGE	6.00
(B)	PRODUCT OUTLET	SS316L	150# FLANGE	6.00
(C)	BRINE INLET	SS316L	150# FLANGE	4.00
(D)	WASTE OUTLET	SS316L	150# FLANGE	4.00
(E)	INSTRUMENT AIR INLET	316	FPT	0.5

2. SHIPPING WEIGHT - 30,000 LBS (13,608 KG).  
 SHIPPING WEIGHT WITH MEDIA - 60,000 LBS (27,211 KG).  
 3. OPERATING WEIGHT - 95,000 LBS (43,100 KG).  
 4. QUANTITY REQUIRED: 1 ASSEMBLY AS SHOWN.  
 5. PLUMBING RUN \ EQUIPMENT TABLE:

FIND NO.	PART NUMBER	QTY.	DESCRIPTION	U/M
1	3030555	1	CONTAINER,40',BWRO PT	EA
2	3031213	3	VESSEL,MMF,84X53.5,CS,BW,SUBC,PAINT	EA
3	500203A-PP-03	6	PLMB,PVC,3.0",MEDIA OUTLET	EA
4	500208A-PP-01	1	PLMB,PVC,6.0",FEED	EA
5	500208A-PP-02	1	PLMB,CPVC,4.0",BACKWASH OUT	EA
6	500208A-PP-03	1	PLMB,PVC,4.0",BRINE IN	EA
7	500208A-PP-04	1	PLMB,316,2.0",AIR BLOWER	EA
8	500208A-PP-05	1	PLMB,PVC,6.0",PRODUCT	EA
9	500208A-PP-06	3	PLMB,316,1.0",VENT	EA
10	500208A-PP-07	1	ASSEMBLY,PH ANALYZER,M800	EA

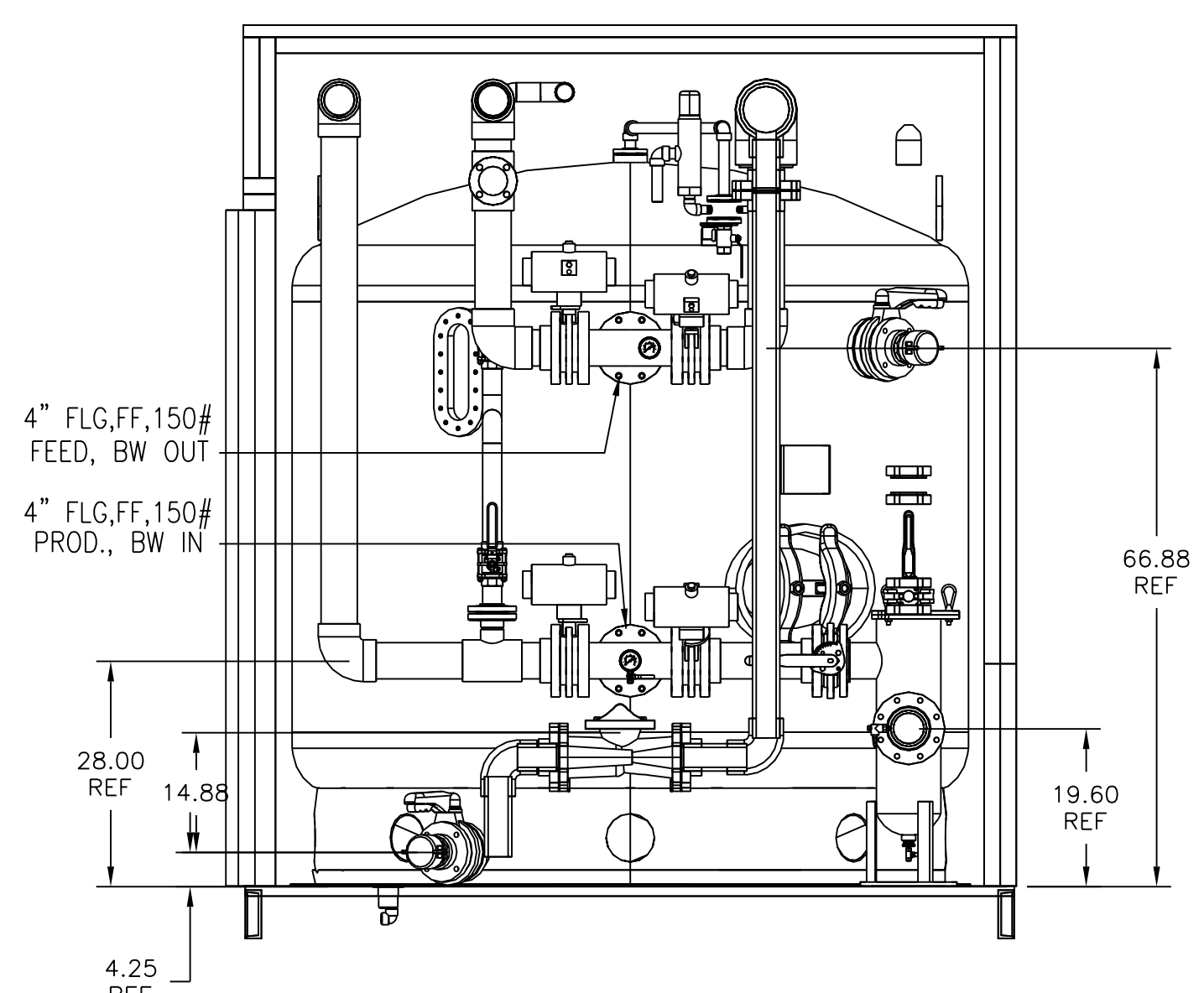
6. ALL DIMENSIONS IN INCHES.  
 7. REFERENCE - PROCESS AND INSTRUMENTATION DIAGRAM : 500208A-AP-01  
 8. COMPRESSOR (PN:500208A-101) AND HEATER (PN:500208A-201) WILL BE LOCATED DEPENDING ON SITE CONDITIONS.

REV	DESCRIPTION	ECO	DWN	APVD	DATE	CHKD	TOLERANCES UNLESS NOTED DECIMALS .X ± .XX ± 0.50 .XXX ±	ANGLES ± 0.5 FRAC ± ?"	DRAWN BY BN	DATE 03APR12	CLIENT/JOB GE MOBILE WATER AUTOFILTER 3X7	TITLE GENERAL ARRANGEMENT SYS,PRETREATMENT,BWRO,CE	SIZE D	DRAWING NO. 500208A-PG-02	REV C
C	REVISED AS NOTED	-	SJ	HG	02AUG12	KW	DIMENSIONS IN INCHES DO NOT SCALE	THIRD ANGLE	CHECKED BY JC	DATE 16MAY12	FILE AUTOCAD	MATERIAL 500208A-PG-02	PROJECT 500208	SCALE 1:16	SHEET 2 OF 3
B	REVISED AS NOTED	-	DJS	HG	09JUL12	JC			APPROVED BY KW	DATE 11MAY12					
A	INITIAL RELEASE	-	BN	HG	11MAY12	JC			APPROVED BY HG	DATE 11MAY12					

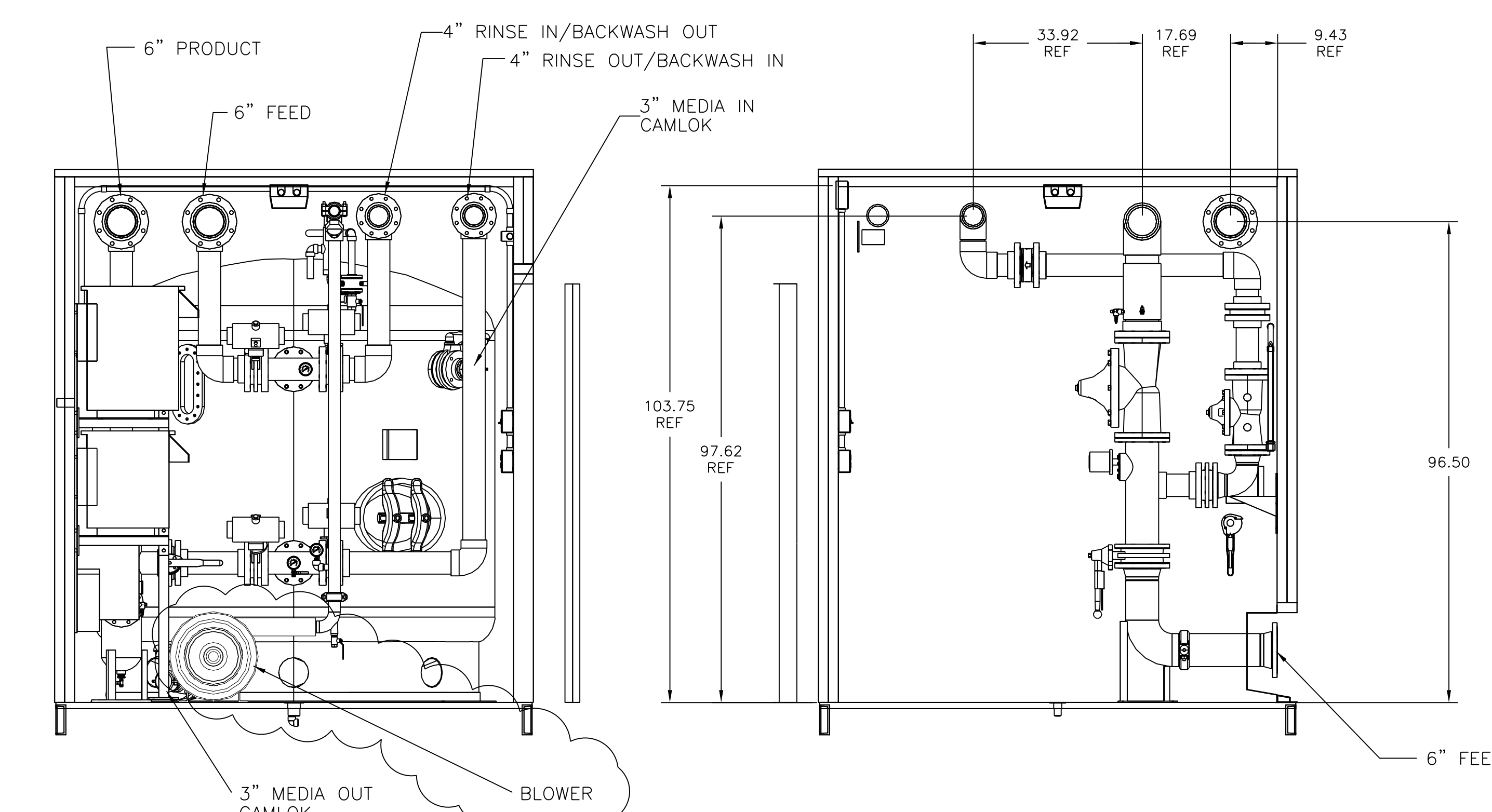
**GE**  
 Water & Process Technologies  
 GLOBAL HEADQUARTERS : TREVOSE, PA USA +1-215-355-3300 WWW.GEWATER.COM

THIS DRAWING, THE DESIGN AND THE PATENTS IT COVERS, IS THE PROPERTY OF GENERAL ELECTRIC COMPANY AND ITS AFFILIATES AND THE INFORMATION CONTAINED HEREIN IS PROPRIETARY INFORMATION WHICH IS NOT TO BE DISCLOSED TO ANYONE WITHOUT PRIOR WRITTEN CONSENT OF SAID COMPANY. THIS DRAWING IS TO BE USED EXCLUSIVELY FOR THE PURPOSES EXPRESSLY AUTHORIZED BY GENERAL ELECTRIC COMPANY AND ITS AFFILIATES THROUGH ITS OFFICERS AND QUALIFIED REPRESENTATIVES AND FOR NO OTHER PURPOSE. NEITHER THIS DRAWING, NOR ANY PORTION THEREOF, SHALL BE REPRODUCED WITHOUT THE PRIOR WRITTEN CONSENT OF SAID COMPANY, AND ANY SUCH REPRODUCTION SHALL BEAR THIS NOTICE.

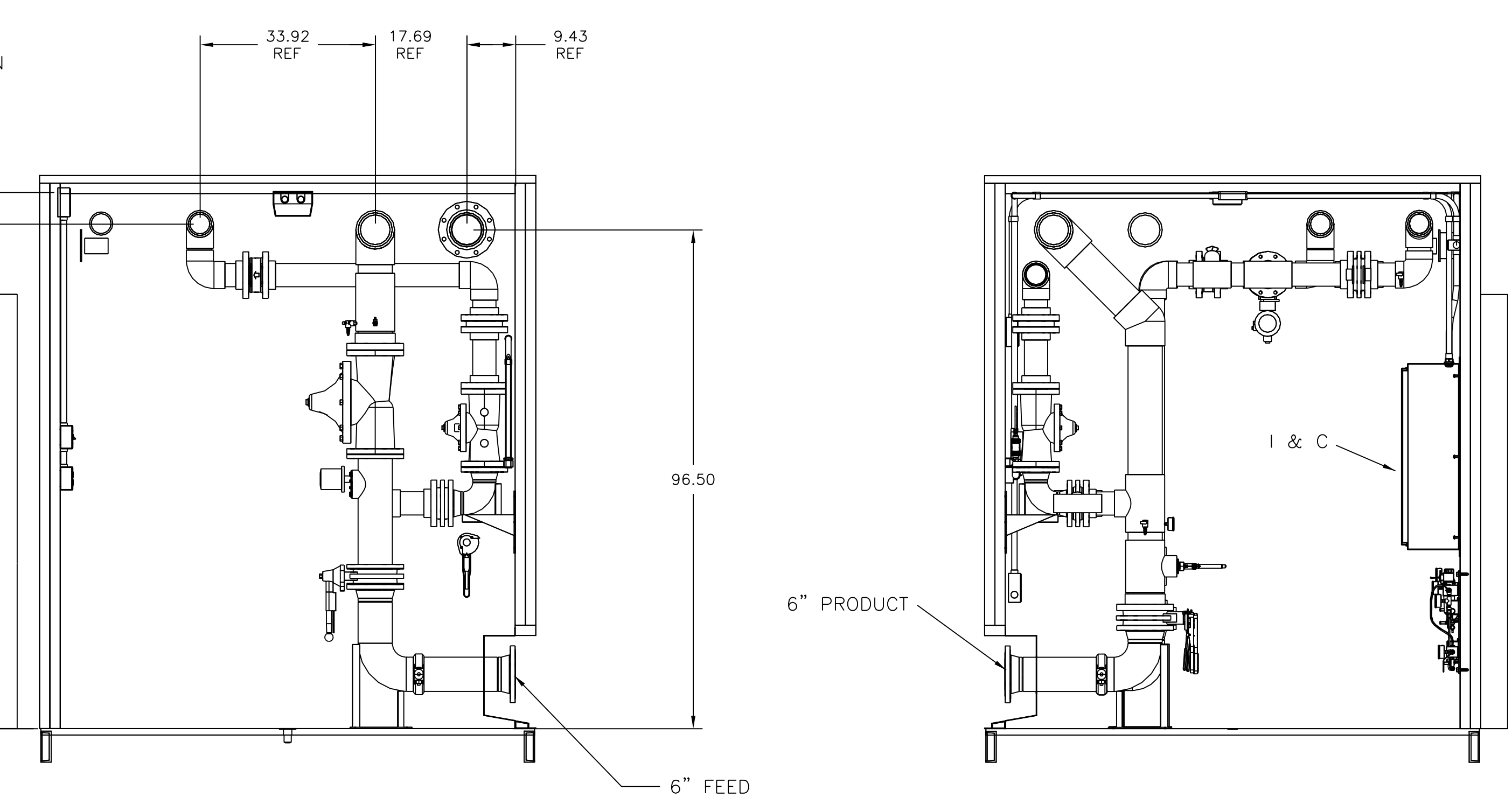
8 7 6 5 4 3 2 1



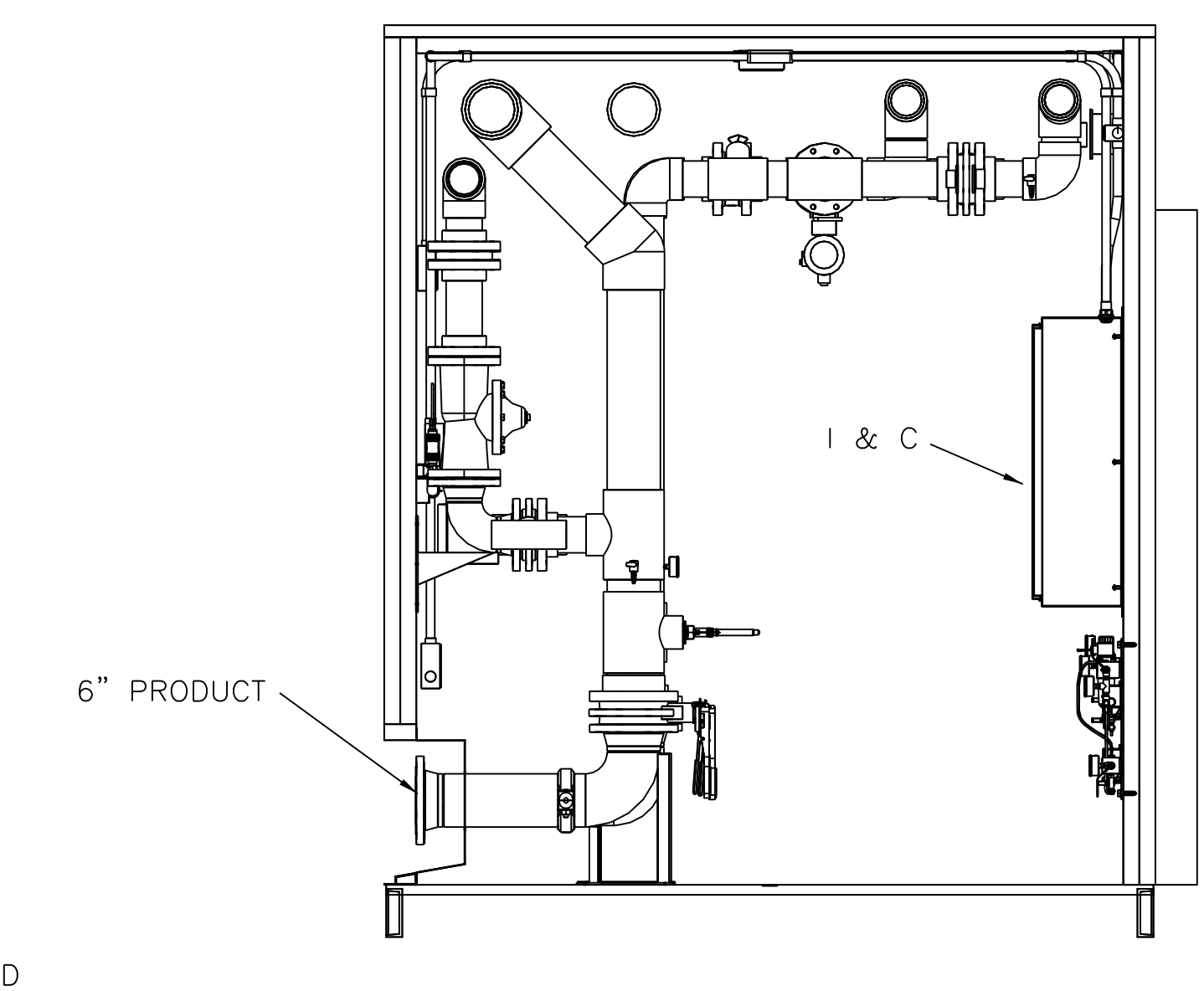
**A** SECTION A-A  
SHT.1 SCALE: 1:20



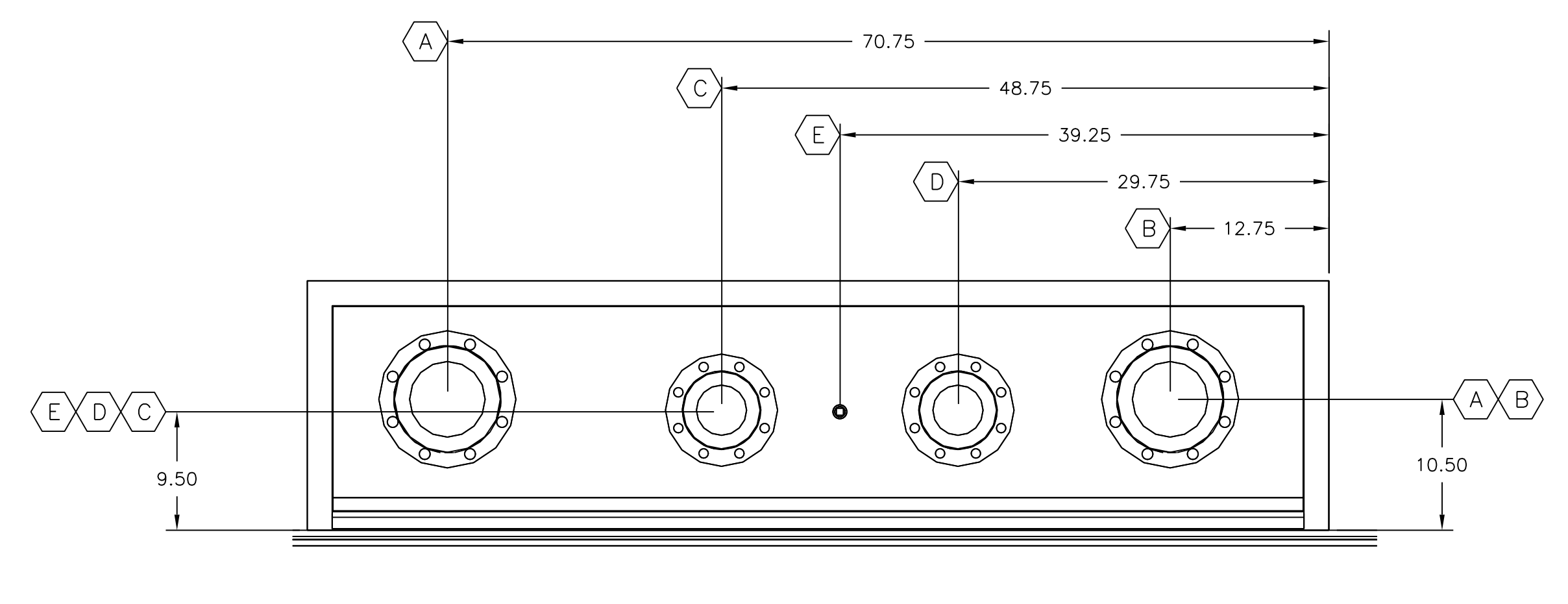
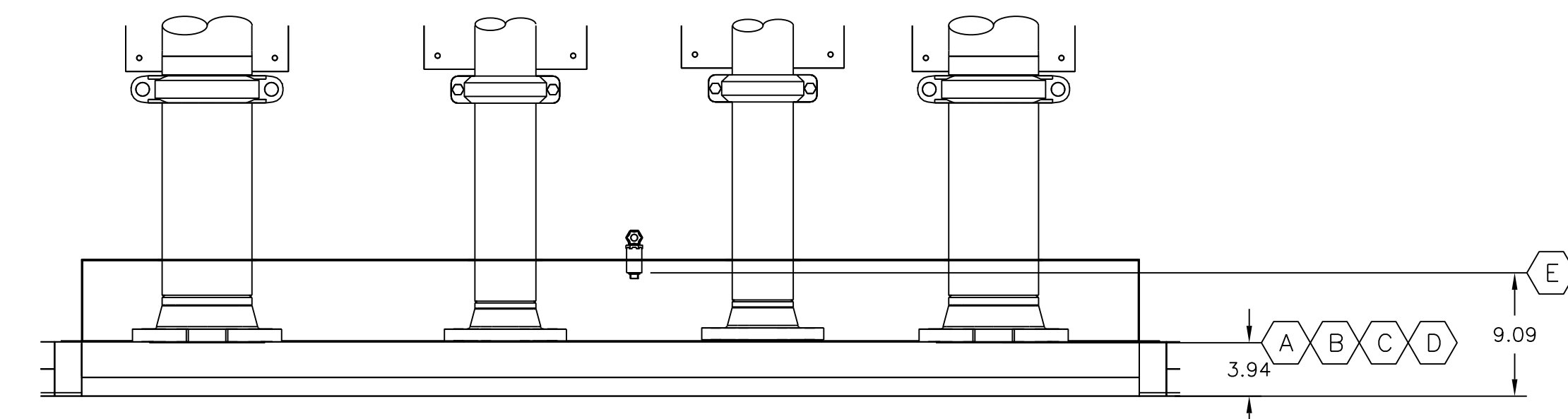
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SHT.1 SCALE: 1:20



**C** SECTION C-C  
SHT.1 SCALE: 1:20



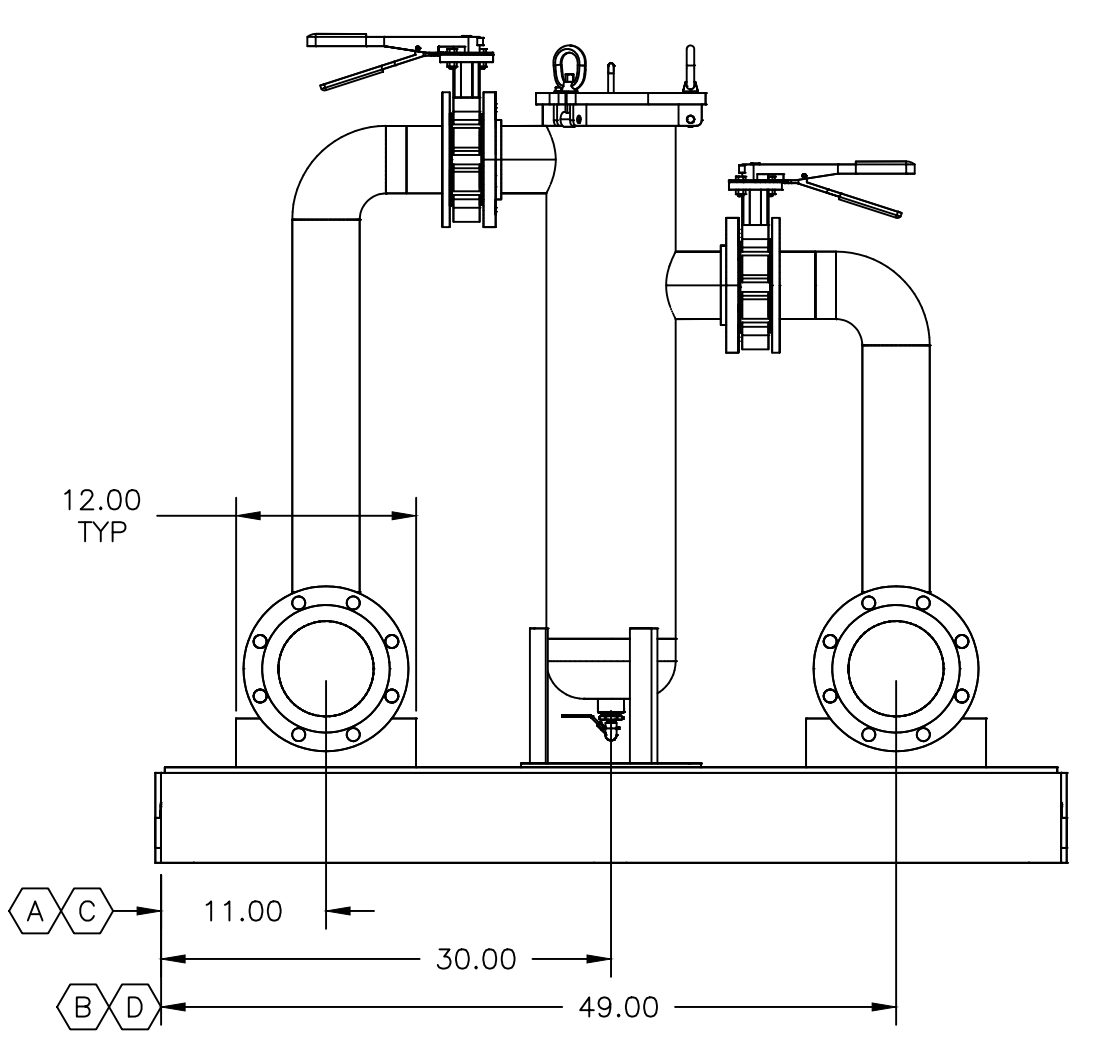
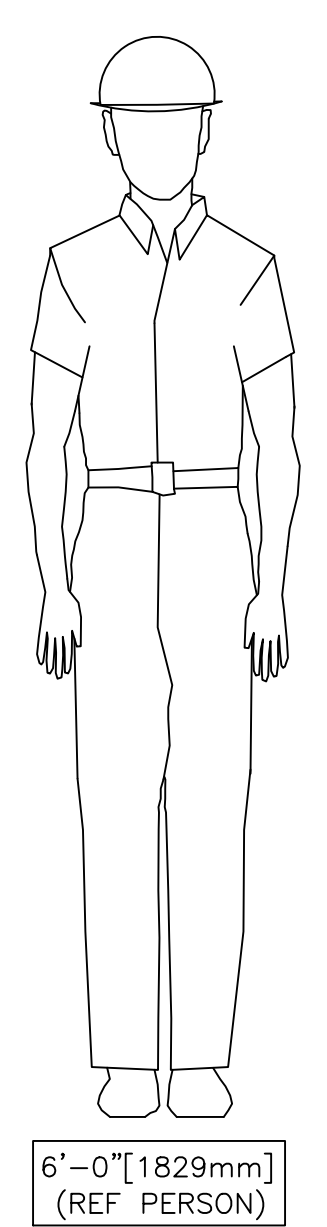
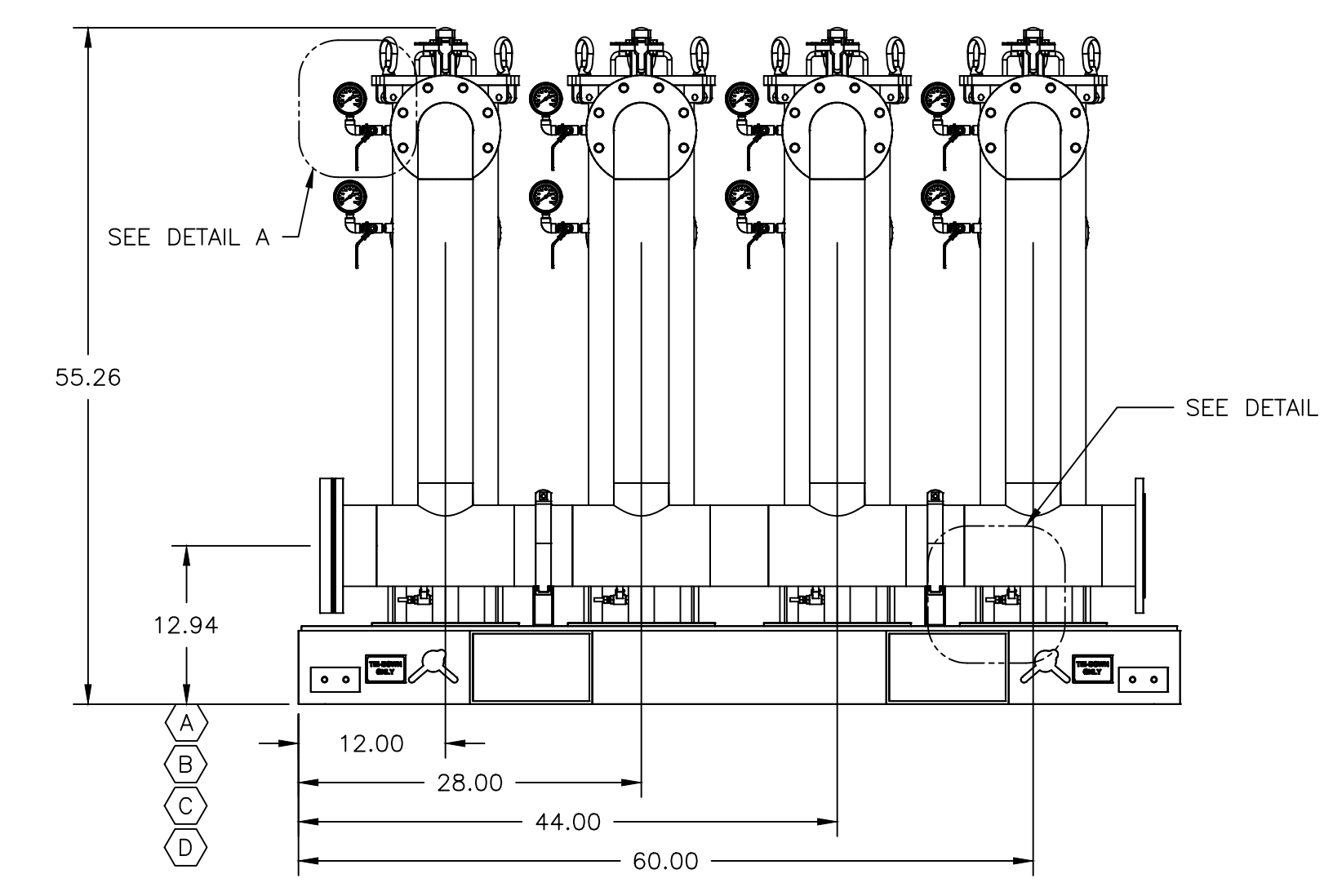
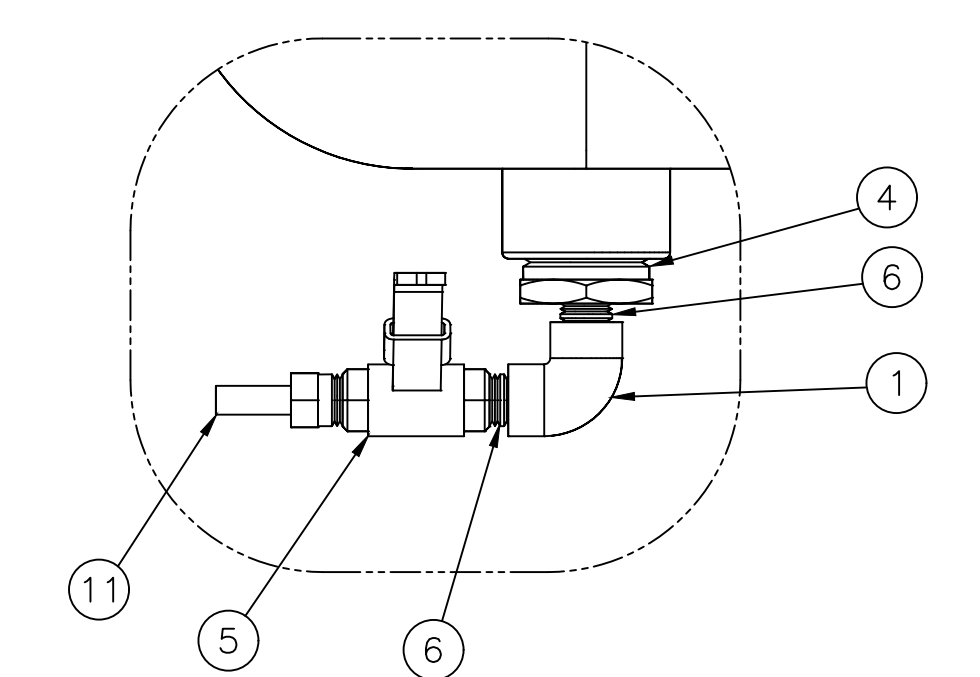
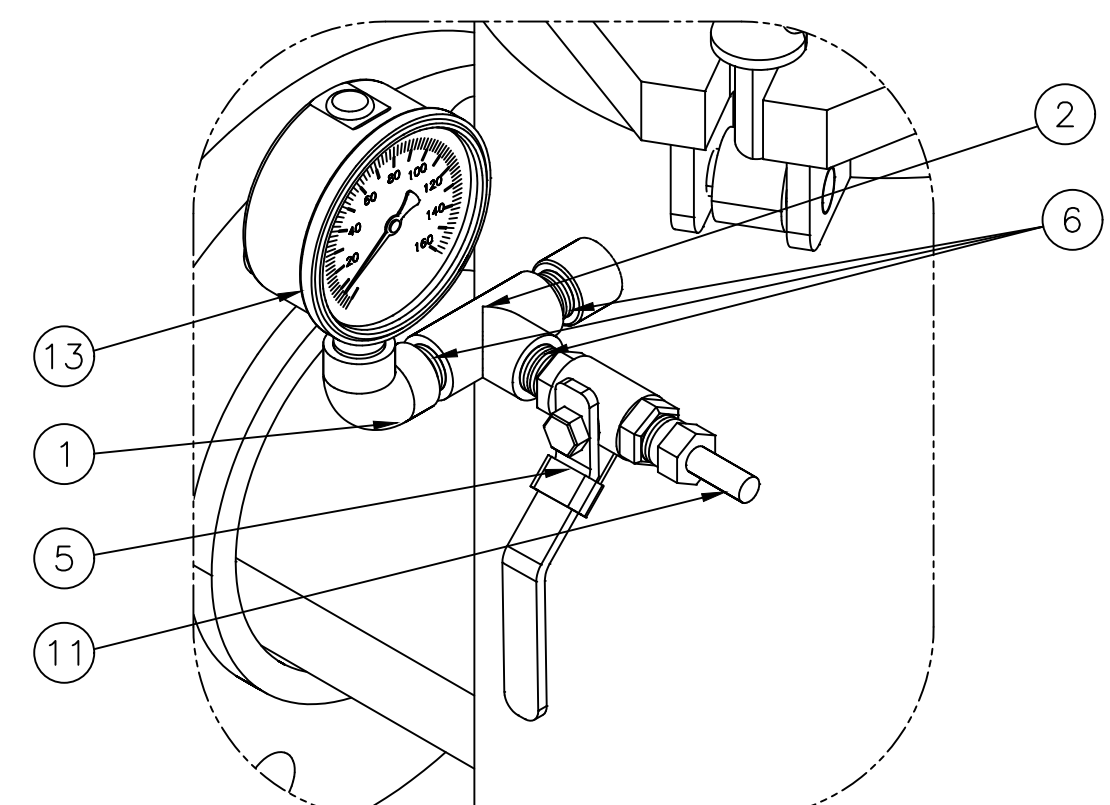
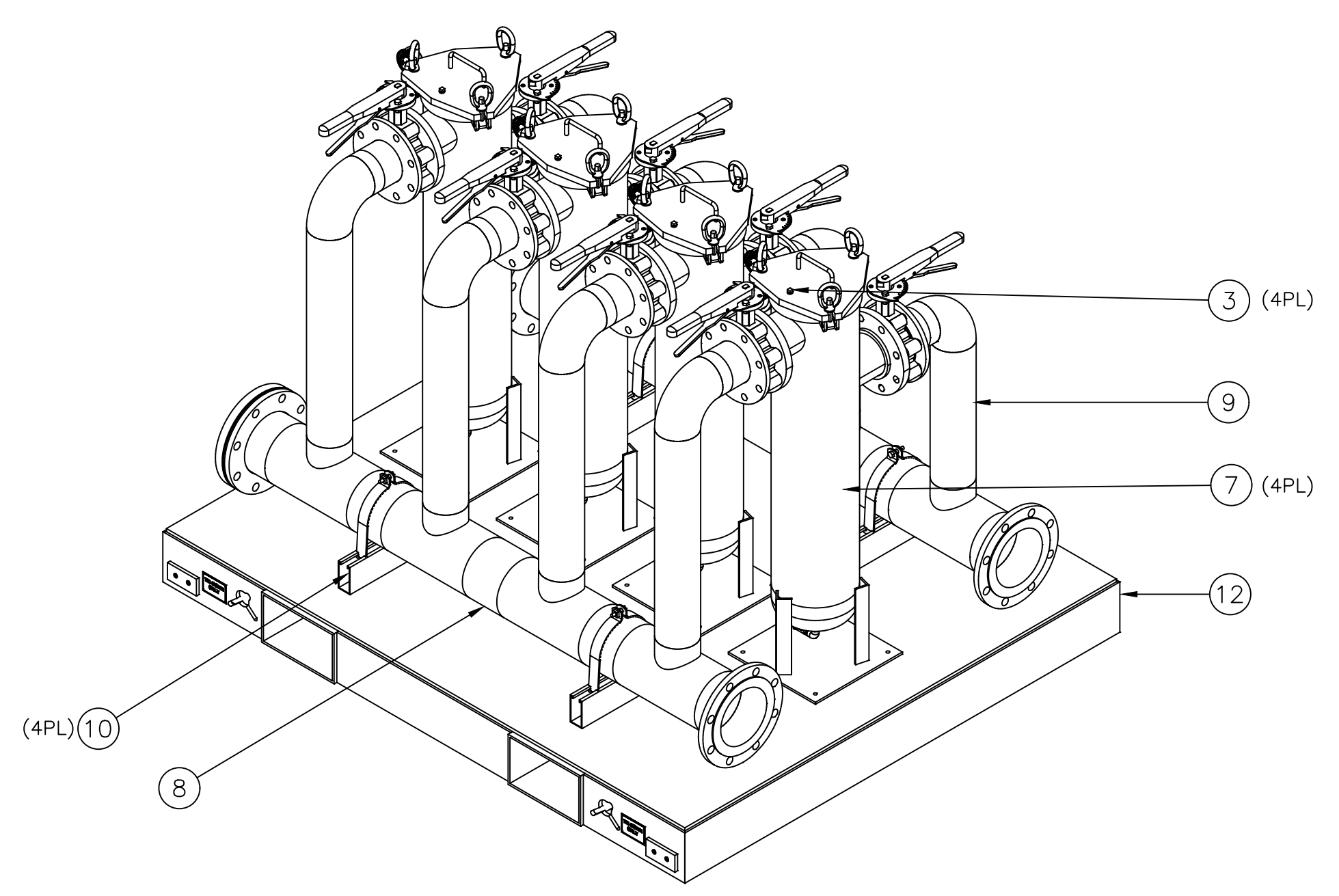
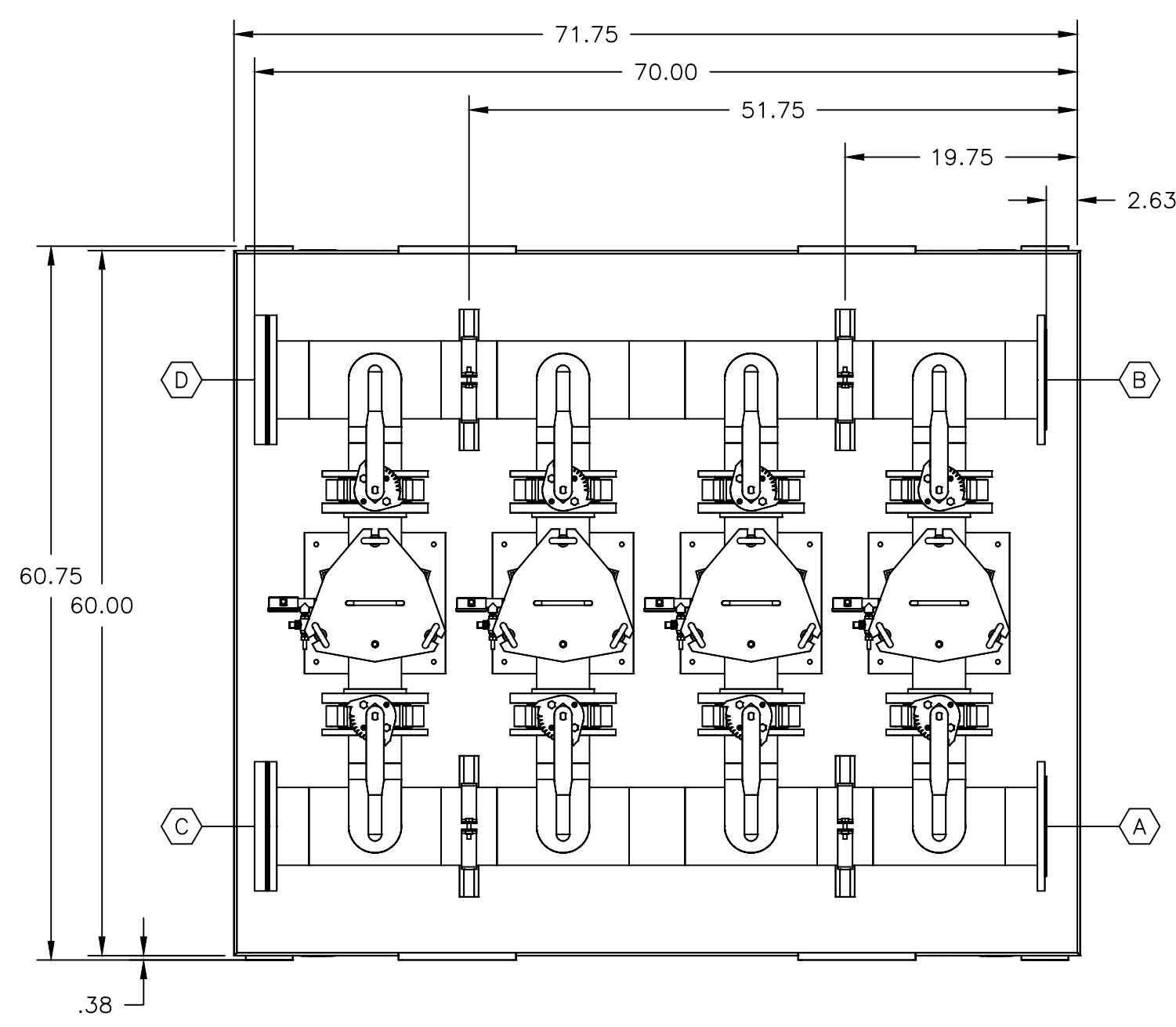
**D** SECTION D-D  
SHT.1 SCALE: 1:20



**F** SECTION F-F  
SHT.1 SCALE: 1:10

REV	DESCRIPTION	ECO	DWN	APVD	DATE	CHKD	TOLERANCES UNLESS NOTED DECIMALS .X ± .XX ± 0.50 .XXX ±	ANGLES ± 0.5 FRAC ± 1/2"	DRAWN BY BN	DATE 03APR12	<b>GE</b> Water & Process Technologies GLOBAL HEADQUARTERS : TREVOSE, PA USA +1-215-355-3300 WWW.GEWATER.COM	CLIENT/JOB	TITLE	SIZE	DRAWING NO.	REV	
C	REVISED AS NOTED	-	SJ	HG	02AUG12	KW	DIMENSIONS IN INCHES DO NOT SCALE	THIRD ANGLE	CHECKED BY JC	DATE 16MAY12		GE MOBILE WATER AUTOFILTER 3X7	GENERAL ARRANGEMENT SYS,PRETREATMENT,BWRO,CE	D	500208A-PG-02	C	
B	REVISED AS NOTED	-	DJS	HG	09JUL12	JC			APPROVED BY KW	DATE 11MAY12		FILE	AUTOCAD	MATERIAL	500208A-PG-02	PROJECT 500208	SCALE AS NOTED
A	INITIAL RELEASE	-	BN	HG	11MAY12	JC			APPROVED BY HG	DATE 11MAY12							





**Approved**  
By John Livers @ 2020-03-06T10:35

1. CONNECTION TABLE

ITEM	DESCRIPTION	MATERIAL	TYPE	SIZE
A	FILTER FEED A	304	150# FLANGE	6.00
B	FILTER PRODUCT A	304	150# FLANGE	6.00
C	FILTER FEED B	304	150# FLANGE	6.00
D	FILTER PRODUCT B	304	150# FLANGE	6.00

2. SHIPPING WEIGHT - 2,700 LB/[1,224 Kg].  
 3. OPERATING WEIGHT - 3,400 LB/[1,541 Kg].  
 4. PLUMBING RUN \ EQUIPMENT TABLE:

FIND NO.	PART NUMBER	QTY.	DESCRIPTION	U/M
1	1113366	12	ELBOW-90,316, FNPT,0.25	EA
2	1113536	8	TEE,316, FNPT,0.25	EA
3	1115055	4	PLUG-PIPE,316,3000#, MNPT,0.25, SQH	EA
4	1118037	4	BUSHING,316, MNPTXFNPT,1.00X0.25	EA
5	1261002	12	VALVE-BALL,316,0.25,MAN,1PC FPT,GEN,800	EA
6	1264567	32	NIPPLE,316,S40,MNPT,0.25XCLS,TBE	EA
7	2660901FD-MZ-01	4	ASSY-HSG,304,BAG,FLT LEGS,BASE	EA
8	2660901FD-PP-01	1	PLMB-INLET,304,6.00	EA
9	2660901FD-PP-02	1	PLMB-OUTLET,304,6.00	EA
10	3026579	4	CHANNEL-STRUT,304,1.63X3.25,12GA,EH,UNI	FT
11	3104716	12	ADPTR-HOSE,316,MNPTXHSB,0.25	EA
12	3108538	1	FRAME-BASE,CS,60.75X72.00X6.38,BMS	EA
13	3109007	8	GAUGE-PRESS,316,BTM,GO.25,160PSI,WI	EA

5. REFERENCE - PIPING AND INSTRUMENTATION DIAGRAM: 2660901FD-AP-01

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
A	INITIAL RELEASE		BG	RM	JL	06 Mar 20

TOLERANCES UNLESS NOTED  
 DECIMALS ANGLES  
 .X +/-0.5  
 XX +/-0.50 FRAC.  
 XXX +/-1/2"



CUSTOMER INFORMATION  
 BMS Equipment  
 Norfolk, VA

SYS-FLT,304,6.00,FLG,BAG,  
 ROSE,4HSG,BMS

DRAWING NUMBER				REVISION
2660901FD-PG-01				A
REF: -	PROJECT NO. 2660901	PART/MATERIAL NO. SEE BOM	SCALE 5:84	SIZE D
DOC. OWNER: -			SHEET 1 OF 1	DATE LAST SAVED: Friday, March 6, 2020 11:36:41 AM

CONFORMED DRAWINGS  
JANUARY 2022

# WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK

TOWN OF SHARON, MA  
CONTRACT #2021-10

FOR CONSTRUCTION  
DECEMBER 2021

PUBLIC WORKS SUPERINTENDENT

ERIC HOOPER, P.E.

TOWN ENGINEER

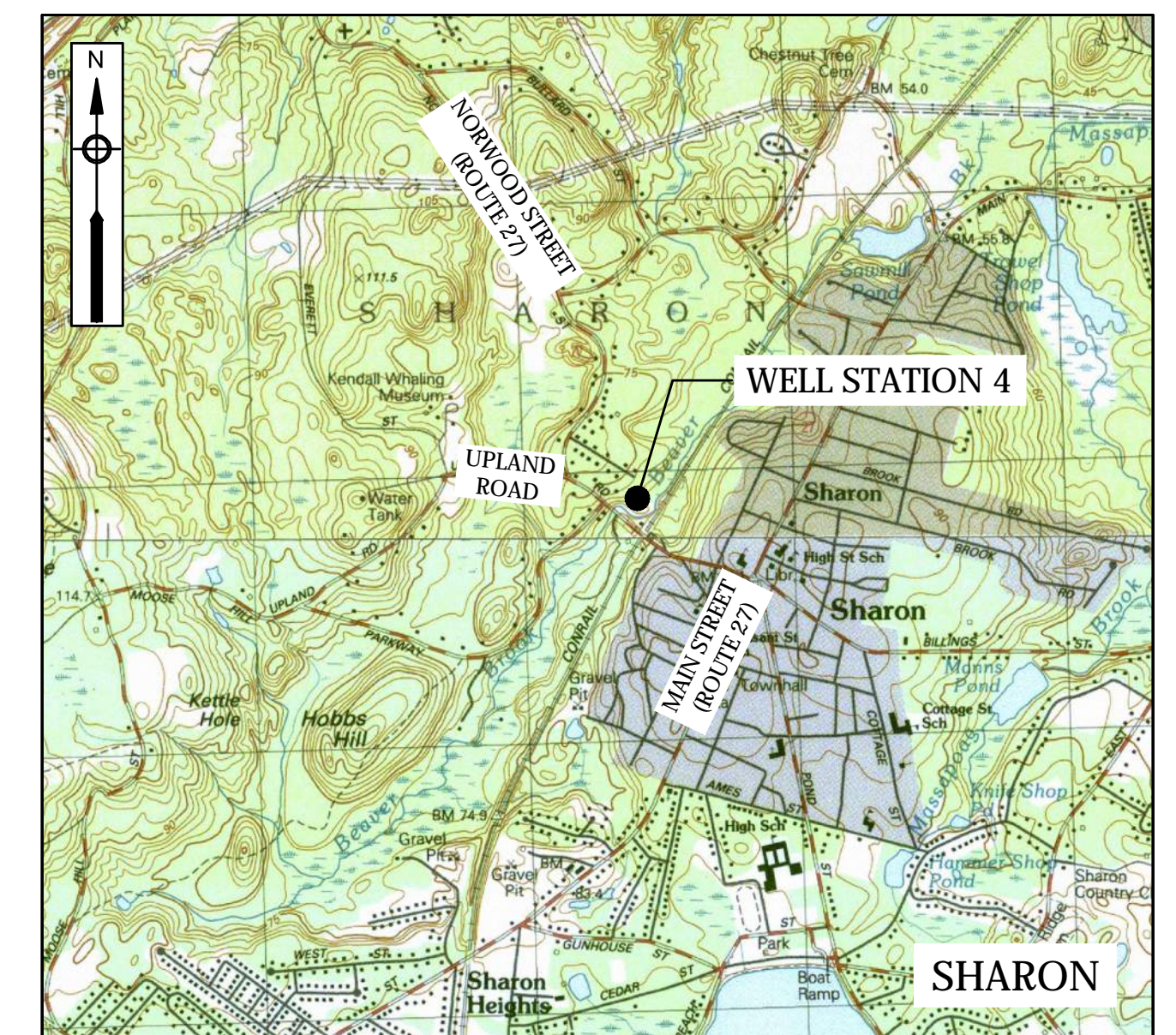
PETER O'CAIN, P.E.

WATER DIVISION SUPERVISOR

ROB TERPSTRA



**ENVIRONMENTAL  
PARTNERS**  
— An Apex Company —



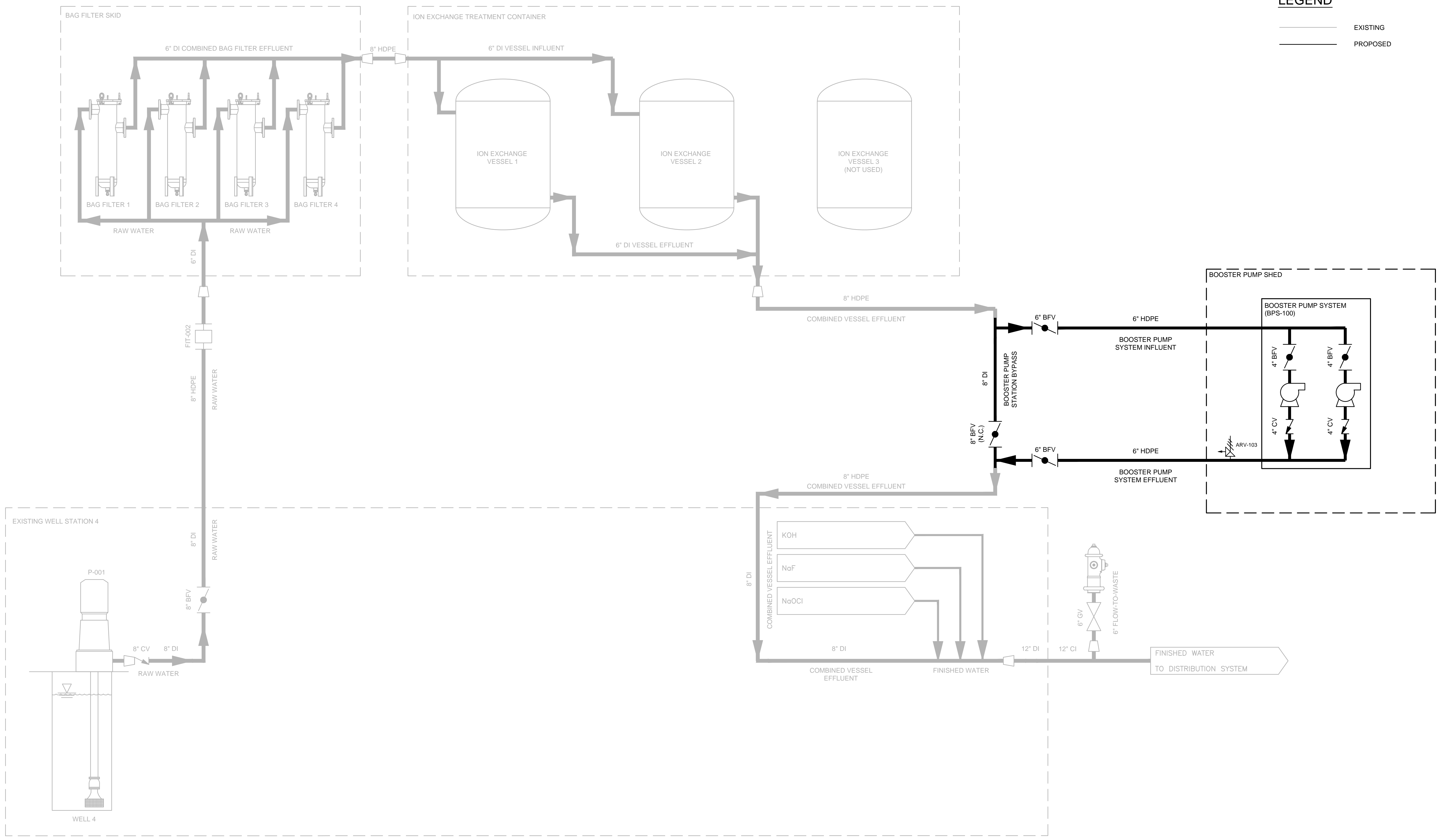
VICINITY MAP

1" = 2000'

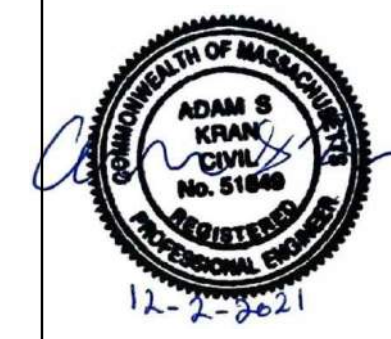


**LEGEND**

— EXISTING  
 — PROPOSED



**ENVIRONMENTAL PARTNERS**  
 — An Apex Company —



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	DECEMBER 2021
Job No.	245-2104
Designed by	MDB
Drawn by	MDB
Checked by	RJA
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

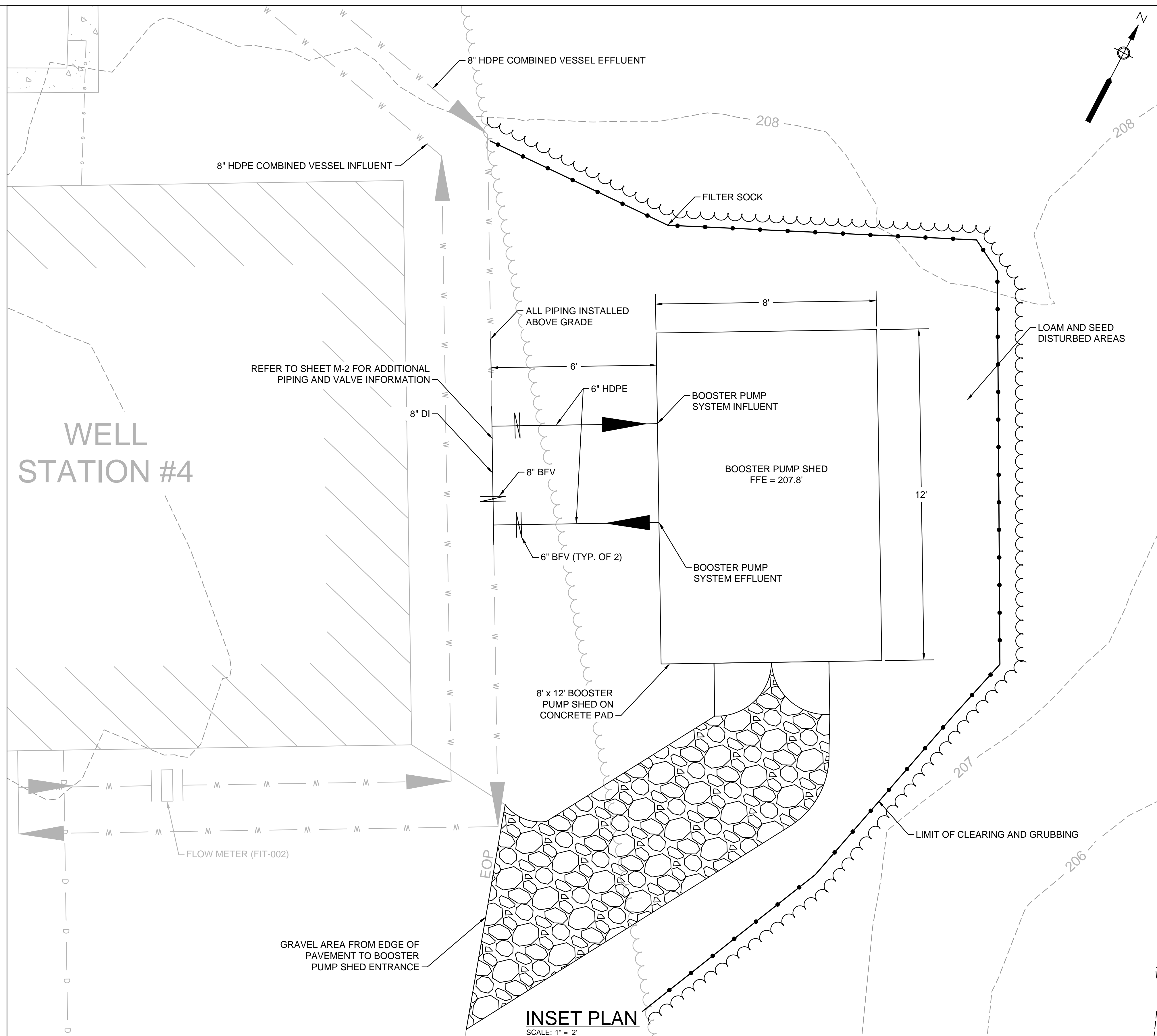
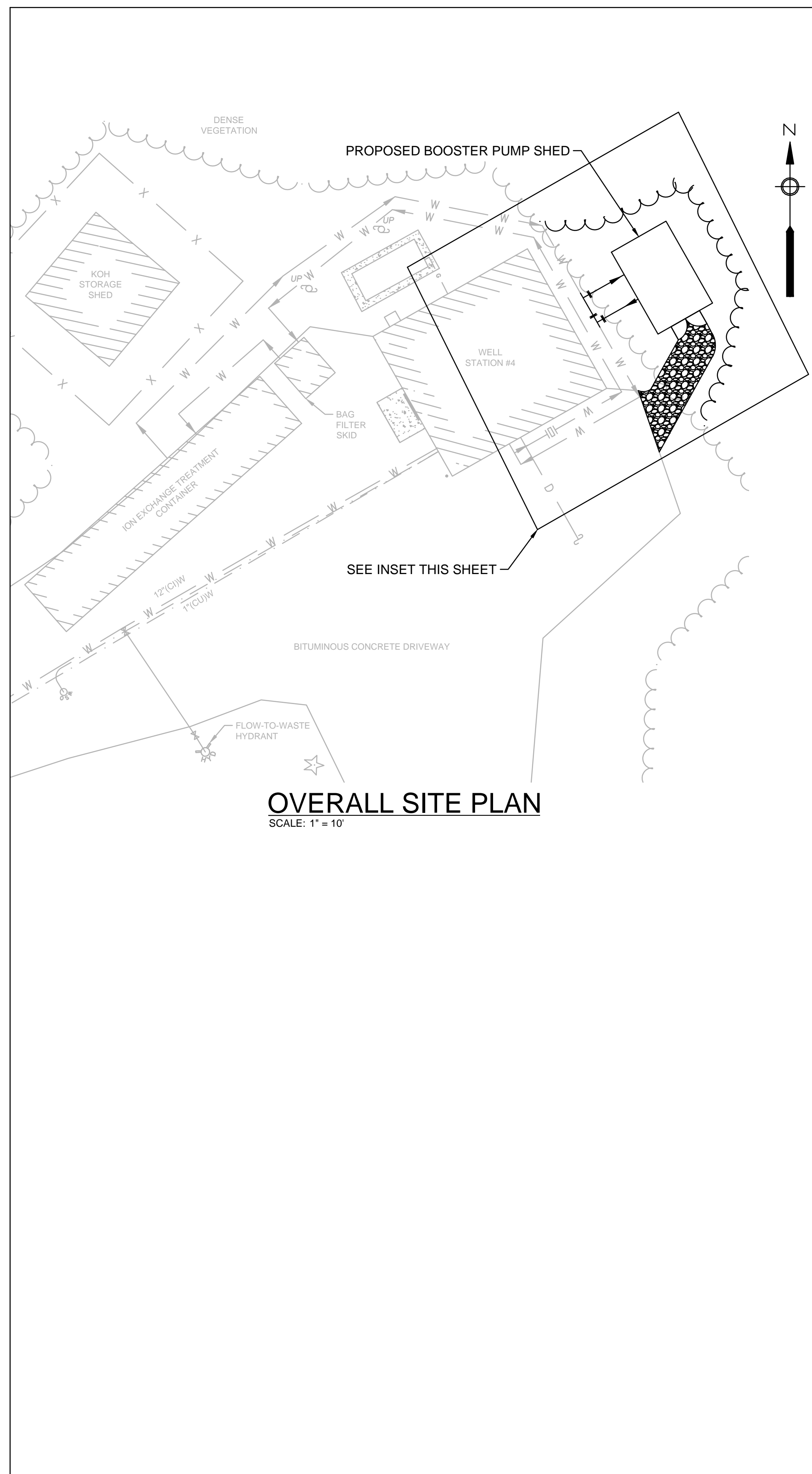
**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
 TOWN OF SHARON, MA**

**PROCESS FLOW DIAGRAM**

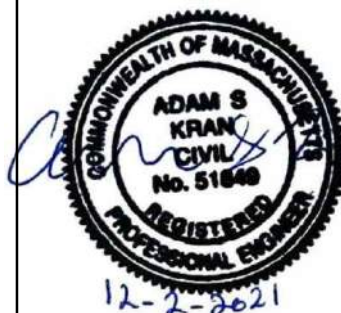
FOR CONSTRUCTION  
 Sheet No.

**G-2**

Drawing file: I:\Sharon, MA, 245-245-2104 Well 4 Booster Pump\01 Design\Drawings\Well 4 Proposed Conditions 12-1.dwg Plot Date: Dec 02 2021 3:22 pm



**ENVIRONMENTAL PARTNERS**  
— An Apex Company —



MARK	DATE	DESCRIPTION

Scale	AS SHOWN
Date	DECEMBER 2021
Job No.	245-2104
Designed by	AJL
Drawn by	AJL
Checked by	RJA
Approved by	ASK

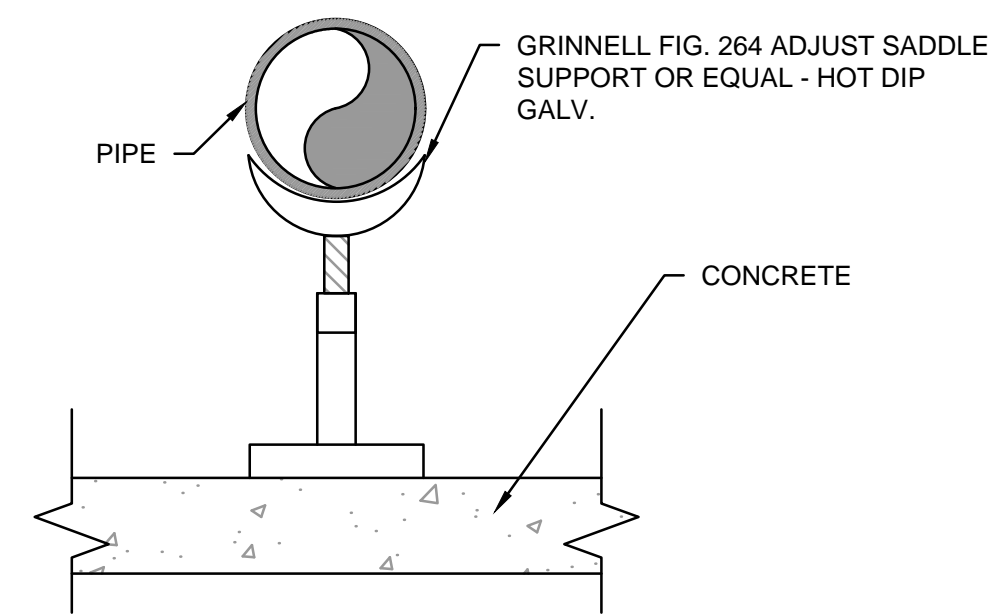
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**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK**  
TOWN OF SHARON, MA

SITE PLAN

FOR CONSTRUCTION  
Sheet No. **C-1**

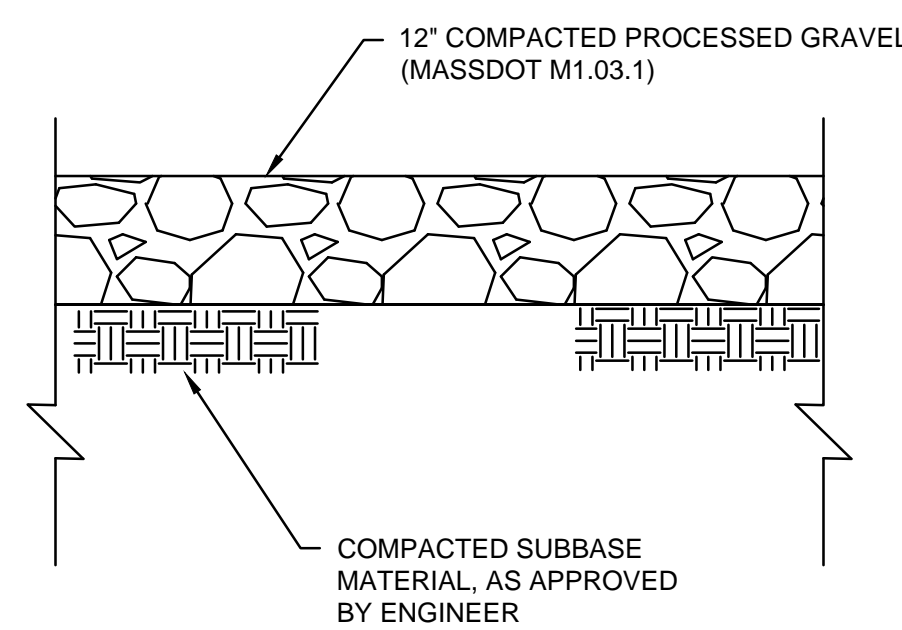
Drawing file: I:\Sharon, MA, 245\245-2104 Well #4 Booster Pump\01 Design\Drawings\Well #4 Proposed Conditions 12-1.dwg Plot Date: Dec 02 2021 3:22pm



**INTERIOR PIPE SUPPORT DETAIL**  
SCALE: N.T.S.

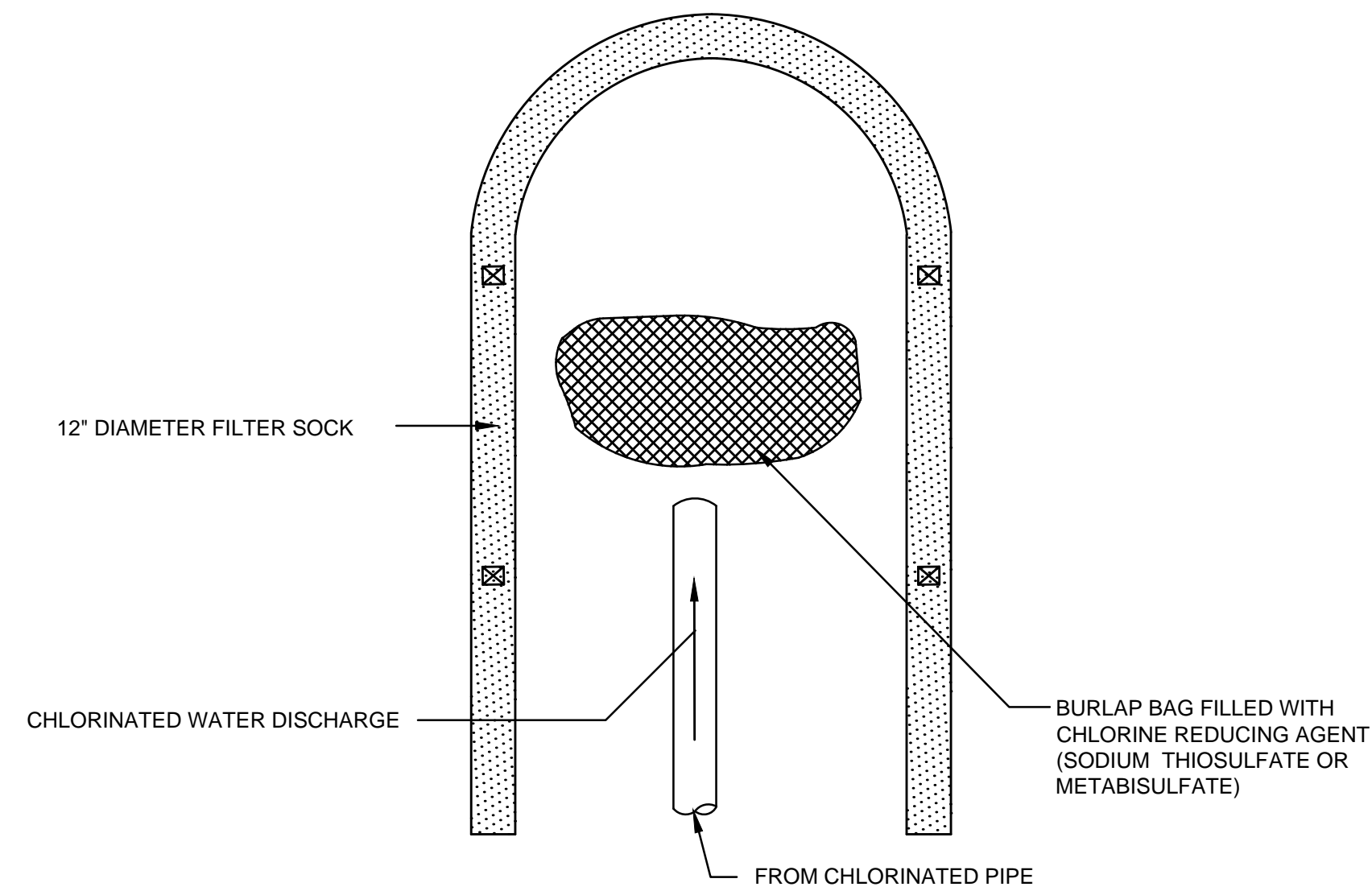
**NOTES:**

1. ALL METAL SHALL BE HOT DIPPED GALVANIZED.

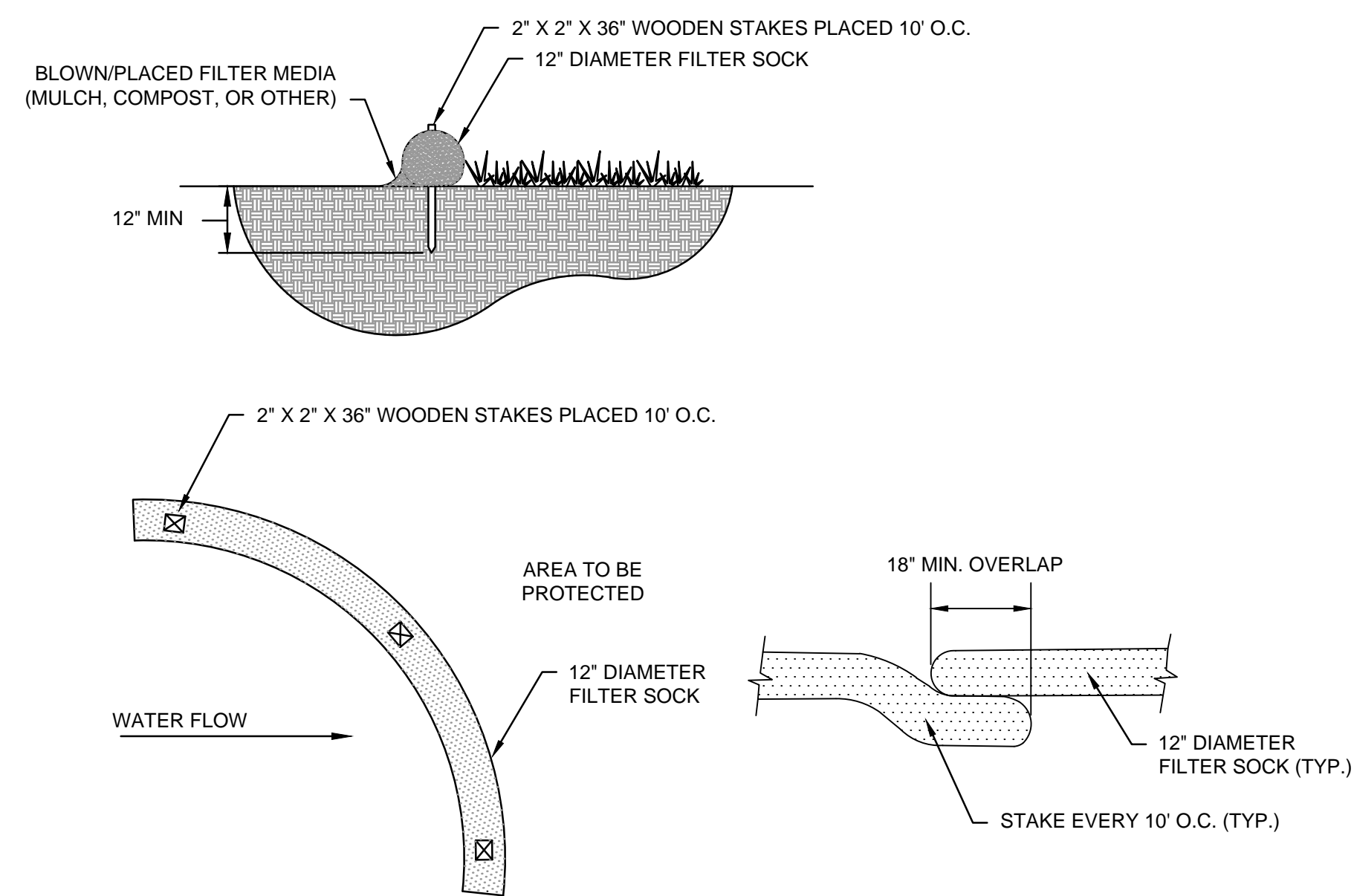


NOTE: COMPACT SUBBASE TO A MINIMUM OF 95% OF THE MATERIAL'S MAXIMUM DRY DENSITY AS DETERMINED IN THE LABORATORY USING MODIFIED PROCTOR ASTM D1557.

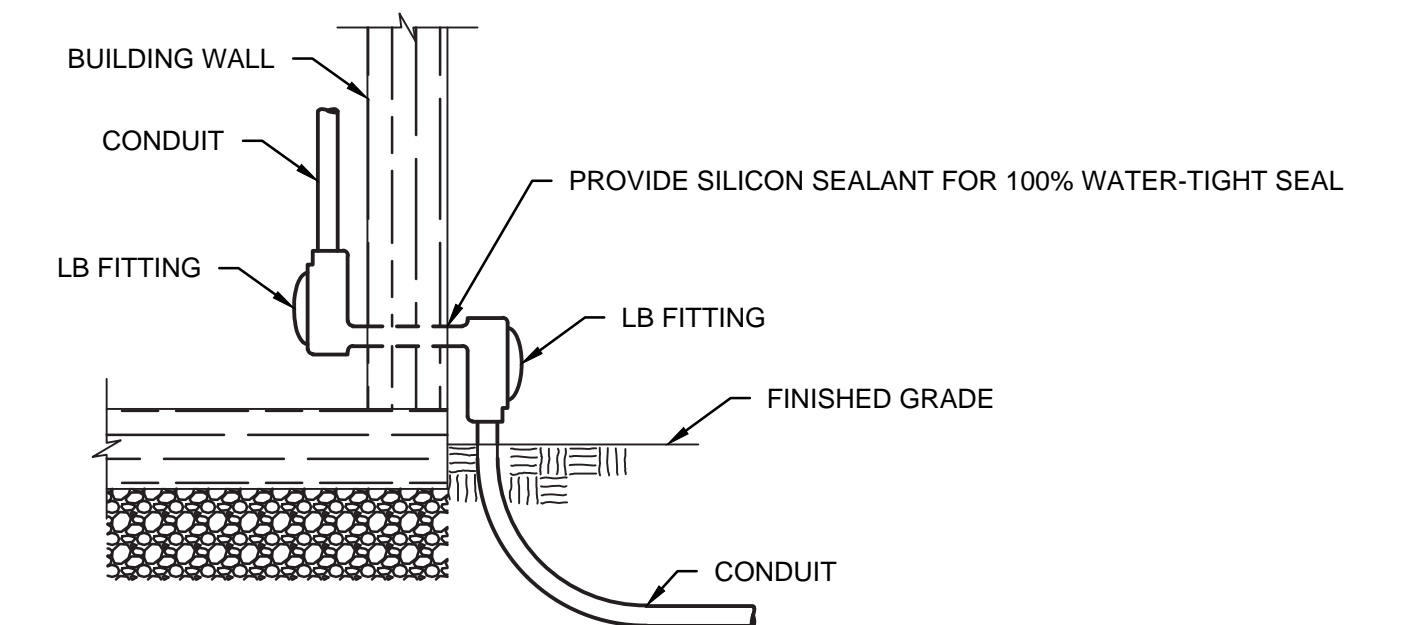
**GRAVEL AREA DETAIL**  
SCALE: N.T.S.



**DECHLORINATION DETAIL**  
SCALE: N.T.S.



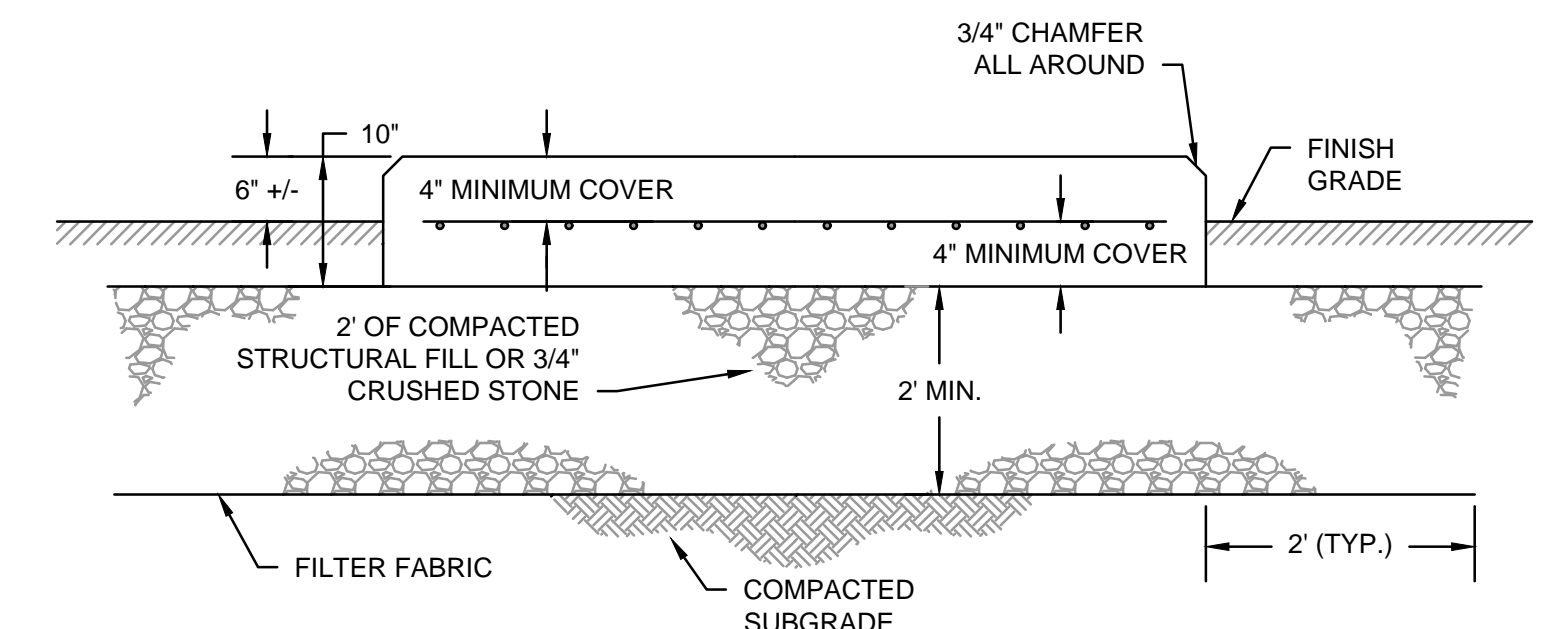
**12" DIAMETER FILTER SOCK**  
SCALE: N.T.S.



**CONDUIT PENETRATION DETAIL**  
SCALE: N.T.S.

**NOTES:**

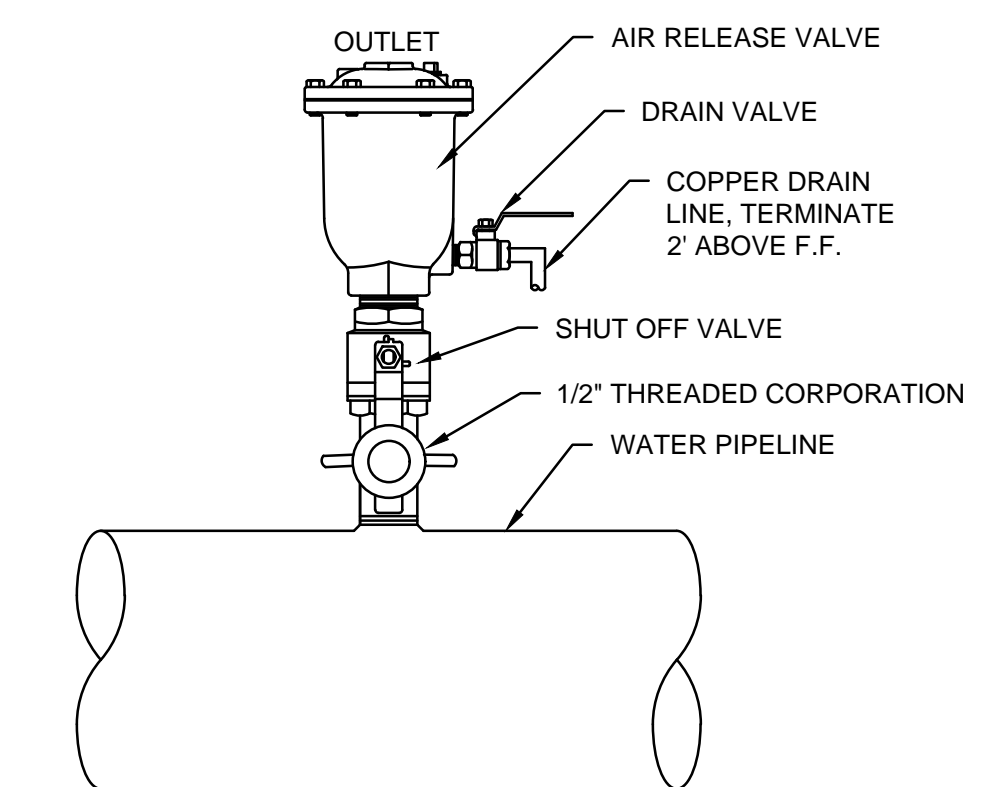
1. INSTALL CONDUITS THROUGH EXISTING WALLS IN ACCORDANCE WITH THIS DETAIL IF NOT OTHERWISE INDICATED.
2. DRILL HOLE USING METHODS THAT LEAVE A SMOOTH OPENING. SEAL OPENING AROUND CONDUIT, INSIDE AND OUTSIDE.



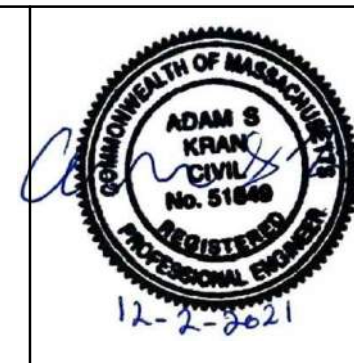
**NOTES:**

1. MINIMUM CONCRETE PAD REQUIREMENTS FOR EQUIPMENT AND THE SHED IS SHOWN.
2. FINAL DIMENSIONS, DEPTH AND REINFORCING SHALL BE #4 REBAR @ 12" O.C. EACH WAY WITH 3" OF REBAR CLEARANCE.. MINIMUM 4" OF COVER

**CONCRETE PAD DETAIL**  
SCALE: N.T.S.



**AIR RELEASE VALVE**  
SCALE: N.T.S.



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	DECEMBER 2021
Job No.	245-2104
Designed by	AJL
Drawn by	AJL
Checked by	RJA
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

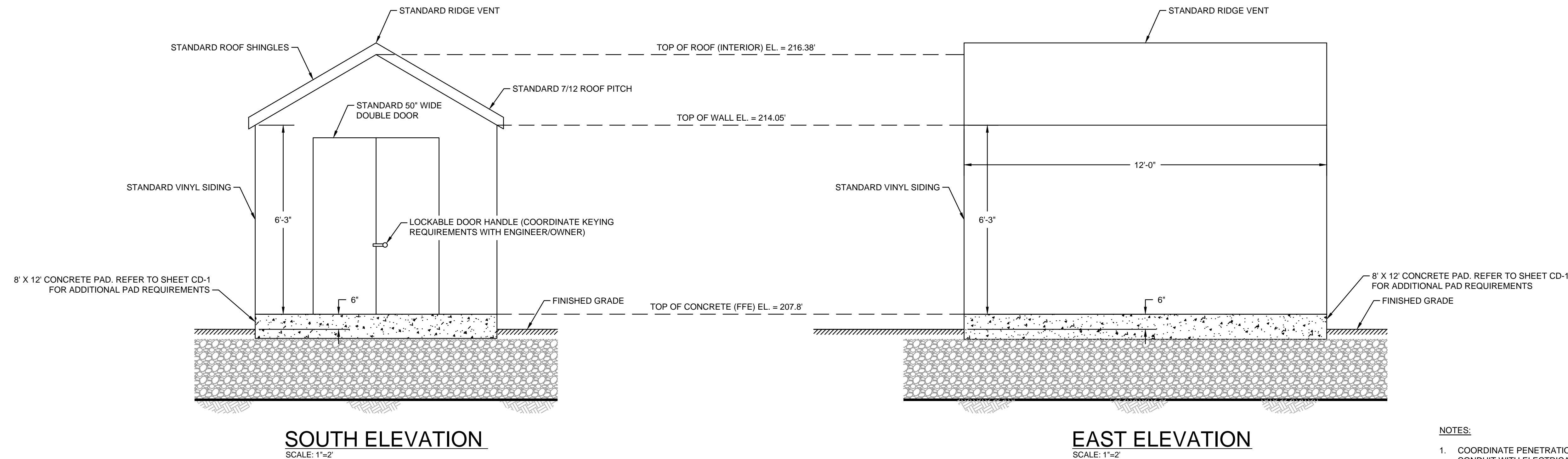
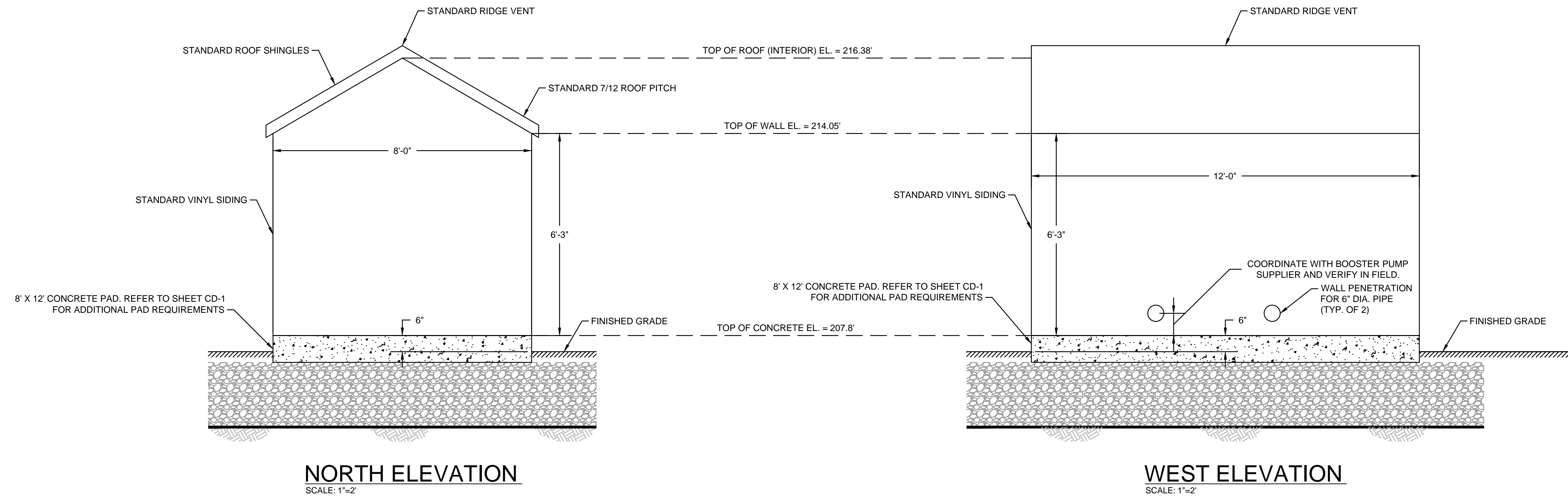
WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA

CONSTRUCTION DETAILS I

FOR CONSTRUCTION

Sheet No.

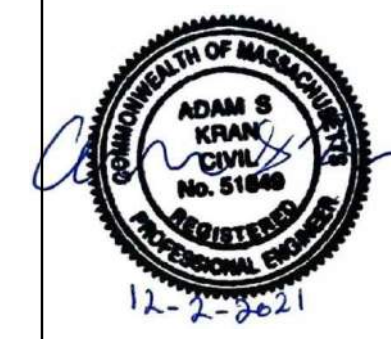
CD-1



- NOTES:**
1. COORDINATE PENETRATIONS FOR ELECTRICAL AND CONTROLS CONDUIT WITH ELECTRICAL DRAWINGS AND ENGINEER PRIOR TO CONCRETE PAD INSTALLATION.
  2. SHED SHALL BE FURNISHED AND INSTALLED BY SHED MANUFACTURER. REFER TO CONTRACT SPECIFICATIONS FOR ADDITIONAL SHED REQUIREMENTS.
  3. COLOR OF ROOF SHINGLES AND VINYL SIDING SHALL BE SELECTED BY OWNER DURING SUBMITTALS PROCESS.



**ENVIRONMENTAL PARTNERS**  
— An Apex Company —



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	DECEMBER 2021
Job No.	245-2104
Designed by	AJL
Drawn by	AJL
Checked by	RJA
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA

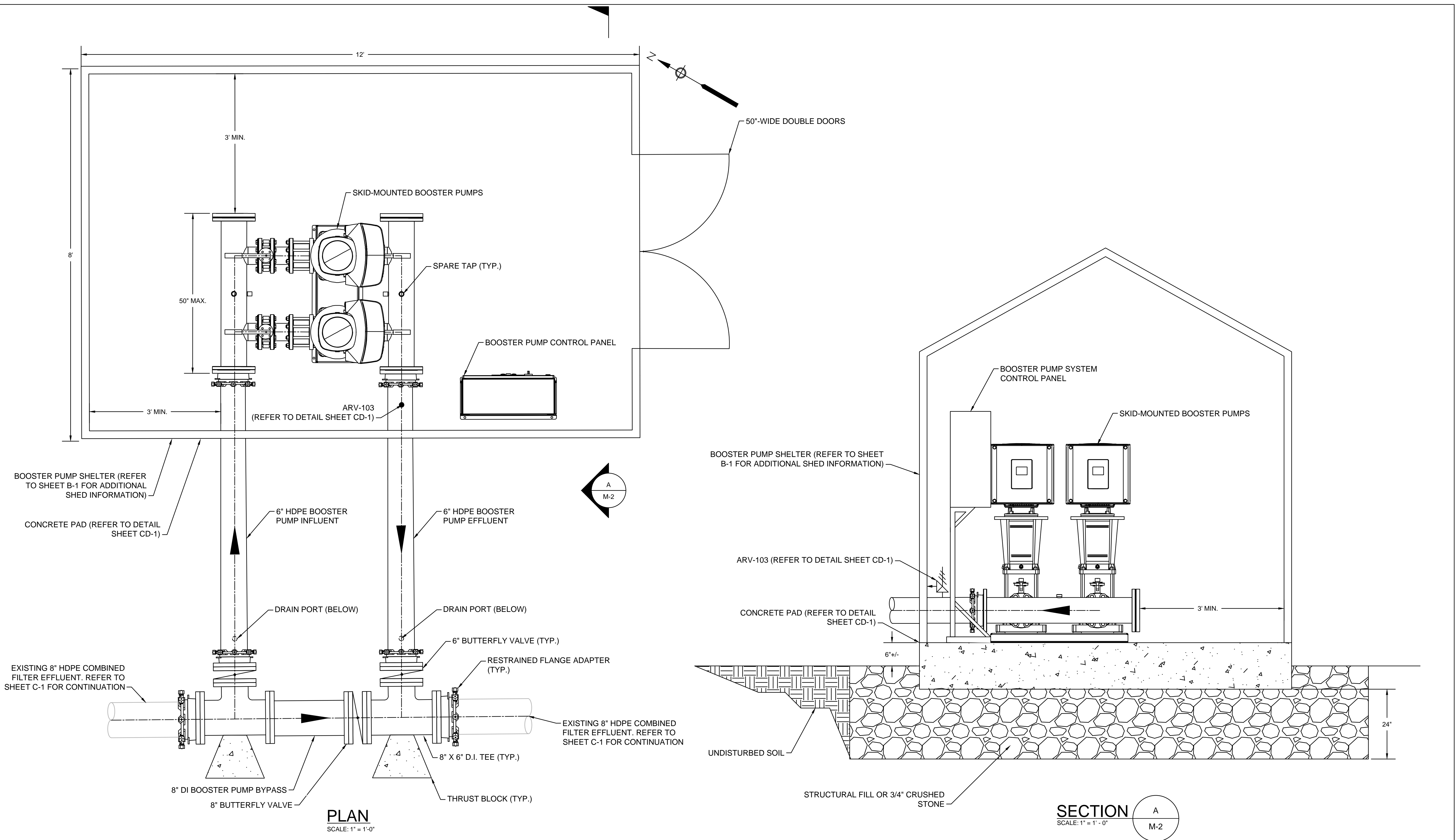
BOOSTER PUMP SHED ELEVATIONS

FOR CONSTRUCTION  
Sheet No.  
**B-1**

Drawing file: I:\Sharon, MA, 245-245-2104 Well #4 Booster Pump\01 Design\Drawings\Well #4 Building Plan 12-1.dwg Plot Date: Dec 02, 2021 4:05pm



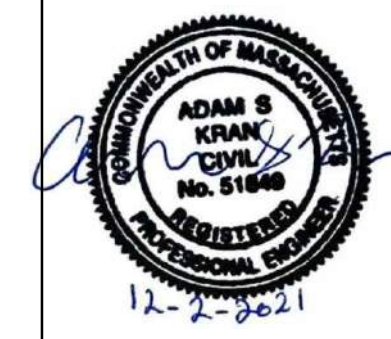




NOTES:  
 1. PROVIDE PIPE SUPPORTS AS NEEDED TO PREVENT SAGGING AND MOVEMENT OF PIPE.



**ENVIRONMENTAL PARTNERS**  
 — An Apex Company —



MARK	DATE	DESCRIPTION

Scale	
Date	DECEMBER 2021
Job No.	245-2104
Designed by	MDB
Drawn by	MDB
Checked by	RJA
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
 TOWN OF SHARON, MA**

**PROCESS MECHANICAL PLAN AND SECTION**

FOR CONSTRUCTION  
 Sheet No.

**M-2**

Drawing file: I:\Sharon, MA\_245245-2104 Well #4 Booster Pump\01 Design\Drawings\Well #4 Proposed Conditions 12-1.dwg Plot Date: Dec 02 2021 3:24pm

### ELECTRICAL SYMBOLS

	LINEAR LIGHTING FIXTURES "F1" INDICATES FIXTURE TYPE - TYPICAL FOR ALL FIXTURES "1" INDICATES CIRCUIT NUMBER - TYPICAL FOR ALL FIXTURE "a" INDICATES THE SWITCH CONTROL - TYPICAL FOR ALL FIXTURES
	WALL MOUNTED LIGHTING FIXTURE.
	EMERGENCY LIGHTING BATTERY UNIT WITH TWO LIGHT HEADS
	REMOTE EMERGENCY LIGHTING UNIT WITH TWO LIGHTING HEADS PROVIDE 3/4", 2#10, 1#10GND TO NEAREST THE EMERGENCY LIGHTING BATTERY UNIT
	SINGLE POLE SWITCH 120V, 20A "a" INDICATES THE SWITCH CONTROL
	DUPLEX RECEPTACLE, WEATHER-RESISTANT 120V, 20A WITH WEATHERPROOF COVER "1" INDICATES CIRCUIT NUMBER - TYPICAL FOR ALL RECEPTACLES
	DUPLEX RECEPTACLE 120V, 20A
	(2) DUPLEX (QUAD) RECEPTACLES, 120V, 20A "WP" INDICATES WITH WEATHERPROOF COVER
	SIMPLEX RECEPTACLE, WEATHER-RESISTANT 120V, 20A WITH WEATHERPROOF COVER "TL" INDICATES TWIST LOCK TYPE
	UNFUSED DISCONNECT SWITCH, "30" INDICATES 30 AMP RATING, PROVIDE 3-POLE, UNLESS OTHERWISE INDICATED.
	FUSED DISCONNECT SWITCH, "20" INDICATES 20 AMP FUSE RATING, PROVIDE 3-POLE UNLESS OTHERWISE INDICATED.
	3-PHASE RECEPTACLE
	DUPLEX RECEPTACLE FOR MICROWAVE 120V, 20A
	DUPLEX RECEPTACLE FOR UNDER COUNTER REFRIGERATOR 120V, 20A
	SINGLE POLE SWITCH 120V, 20A "a" INDICATES THE SWITCH CONTROL
	ALARM RELAY, "AR1" REFERS TO RELAY NAME DESIGNATION
	CONTROL RELAY, "CR1" REFERS TO RELAY NAME DESIGNATION
	MOTOR START RELAY
	TIMING RELAY, "TR1" REFERS TO RELAY NAME DESIGNATION
	NORMALLY OPEN RELAY CONTACT
	NORMALLY CLOSED RELAY CONTACT
	OPERATOR PUSH BUTTON NORMALLY OPEN CONTACT
	OPERATOR PUSH BUTTON NORMALLY CLOSED CONTACT
	PRESSURE SWITCH - CLOSSES ON HIGH PRESSURE
	PRESSURE SWITCH - CLOSSES ON LOW PRESSURE
	OPERATOR STATION (SUPPLIED BY OTHER DIV. 16 UNO ), "XXXX" REFERS TO TAGNAME ID, "YYY" REFERS TO THE TYPE OF OPERATOR STATION
	UNLESS OTHERWISE NOTED INSTRUMENTATION OR PROCESS EQUIPMENT (SUPPLIED BY OTHER DIVISIONS) "XX-XXXX" REFERS TO TAGNAME ID
	SPRING RETURN OPEN/CLOSE PUSHBUTTON WITH LOCKOUT, DUAL CONTACT FOR EACH POSITION (SUPPLIED BY OTHER DIV. 16 UNO ), "XXXX" REFERS TO TAGNAME ID
	GENERATOR EMERGENCY STOP
	METERING PUMP CONTROL PANEL (SUPPLIED BY DIV. 13)
	INTRINSICALLY SAFE BARRIER PANEL (SUPPLIED BY DIV. 13)

### ELECTRICAL SYMBOLS

	UNDERGROUND CONDUIT DUCT BANK
	HOMERUN DESIGNATION TO PANEL LP1 CIRCUIT #1, WITH THE FOLOWING CONDUIT/WIRES UNLESS OTHERWISE NOTED: <ul style="list-style-type: none"> <li>3/4"C WITH 2#12, 1#12GND FOR 20AMP SINGLE PHASE CIRCUITS.</li> <li>3/4"C WITH 3#12, 1#12GND FOR 20AMP THREE PHASE CIRCUITS.</li> <li>3/4"C WITH 2#10, 1#10GND FOR 30AMP SINGLE PHASE CIRCUITS.</li> <li>3/4"C WITH 3#10, 1#10GND FOR 30AMP THREE PHASE CIRCUITS.</li> <li>3/4"C WITH 2#8, 1#10GND FOR 40AMP &amp; 50AMP SINGLE PHASE CIRCUITS.</li> <li>3/4"C WITH 3#8, 1#10GND FOR 40AMP &amp; 50AMP THREE PHASE CIRCUITS.</li> </ul>
	EYS TYPE CONDUIT SEAL, FILL WITH ELECTRICAL PUTTY SEAL FOR NON-NEMA 7 AREAS AND EXPLOSION PROOF PUTTY SEAL FOR NEMA 7 AREAS
	SURGE PROTECTION DEVICE
	MOLDED CASE CIRCUIT BREAKER, 3-POLE UNLESS OTHERWISE INDICATED, "20" INDICATES TRIP AMPERE RATING, "100" INDICATES FRAME SIZE, "GFCI" INDICATES CIRCUIT BREAKER TO HAVE GROUND FAULT CIRCUIT INTERRUPT
	DRY TYPE TRANSFORMER
	WALL MOUNTED COMBINATION MOTOR STARTER WITH MOTOR CIRCUIT PROTECTOR, "FVNR" INDICATES TYPE OF MOTOR STARTER
	MOTOR STARTER WITH MOTOR CIRCUIT PROTECTOR, "FVNR" INDICATES TYPE OF MOTOR STARTER
	ENCLOSED VARIABLE FREQUENCY DRIVE
	MANUAL MOTOR STARTER 120V, 20A
	JUNCTION BOX
	BUILDING GROUNDING SYSTEM
	MOTOR, "10" INDICATES HORSEPOWER RATING

(2)1"C, 3#8, #10GND	2, 1-INCH CONDUITS EACH CONDUIT CONTAINING 3-#8 AWG WIRES AND 1-#10 GROUND CONDUCTOR
3/4" CE	EMPTY CONDUIT. NUMERAL DENOTES SIZE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AR	ALARM RELAY
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
CR	CONTROL RELAY
CP	CONTROL PANEL
DRG. DWG.	DRAWING
EAN	EXCEPT AS NOTED
EC	ELECTRICAL CONTRACTOR
EOV	ELECTRICALLY OPERATED VALVE
ETM	ELAPSED TIME METER
FE	FLOW ELEMENT
FIT	FLOW INDICATOR TRANSMITTER
FS	FLOW SWITCH
FSB	FILE SUB-BID CONTRACTOR
FT	FLOW TRANSMITTER
FVNR	FULL VOLTAGE NON-REVERSING
GND, GRD	GROUNDING CONDUCTOR (EQUIPMENT)
HOA	HAND-OFF-AUTOMATIC
HH	HANDHOLE
J OR JB	JUNCTION BOX
JPB	JOG PUSHBUTTON
LE	LEVEL ELEMENT
LIT	LEVEL INDICATOR TRANSMITTER
LL	LOW LEVEL
LS	LEVEL SWITCH
LT	LEVEL TRANSMITTER
MC	MOTOR CONTROLLER (STARTER)
MCC	MOTOR CONTROL CENTER
MH	MANHOLE
MFR	MANUFACTURER
MOV	MOTOR OPERATED VALVE

### ABBREVIATIONS

MPCP	METERING PUMP CONTROL PANEL
MS	MOTION SENSOR
MTS	MANUAL TRANSFER SWITCH
NTS	NOT TO SCALE
OEM	ORIGINAL EQUIPMENT MANUFACTURE SUPPLIED
OH	OVERHEAD
OL	MOTOR OVERLOAD HEATER
OS	OPERATOR STATION
PB	PUSHBUTTON CONTROL STATION MOMENTARY CONTACT TYPE, STOP START
PBE	PUSHBUTTON CONTROL STATION MAINTAINED EMERGENCY STOP TYPE, TWIST TO RELEASE
PBL	PUSHBUTTON CONTROL STATION MOMENTARY TYPE WITH LOCK-OUT DEVICE, STOP-START
PBM	PUSHBUTTON CONTROL STATION MAINTAINED CONTACT TYPE, STOP START
PIT	PRESSURE INDICATOR TRANSMITTER
PL	PUSHBUTTON CONTROL STATION MOMENTARY TYPE WITH LOCK-OUT DEVICE, STOP
PS	PRESSURE SWITCH
PT	PRESSURE TRANSMITTER
PV	PHOTOVOLTAIC
RGS	RIGID GALVANIZED STEEL
RVNR	REDUCED VOLTAGE NON-REVERSING
SPD	SURGE SUPPRESSOR DEVICE
SOV	SOLENOID VALVE
S/S	SOFT STARTER
TB	TERMINAL BOX
TD	MOTOR TEMPERATURE DETECTOR
TR	TIMING RELAY
TS	TEMPERATURE SWITCH
TSP	TWISTED SHIELDED PAIR
TSTW	TWO SPEED TWO WINDING
TYP	TYPICAL
UG	UNDERGROUND
UNO	UNLESS OTHERWISE NOTED
VFD	VARIABLE FREQUENCY DRIVE
WP	WATER PROOF
WHM	WATT HOUR UTILITY METER
XFMR	TRANSFORMER
ZS	POSITION SWITCH

### GENERAL NOTES

- ALL CONDUIT AND EQUIPMENT SHALL BE INSTALLED AND GROUNDED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE AND APPLICABLE LOCAL CODES.
- BONDING JUMPERS, CONDUIT CLAMPS AND POINTS OF ATTACHMENT ARE NOT SHOWN ON DRAWINGS. SIZE BONDING JUMPERS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. THE POINTS OF ATTACHMENT OF THE GROUND CLAMPS SHALL BE ACCESSIBLE LOCATIONS.
- EQUIPMENT & CONDUIT INSTALLATIONS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURAL CONDITIONS. EXPOSED CONDUITS SHALL BE INSTALLED PARALLEL TO BEAMS AND WALLS.
- CONDUITS SHALL BE TERMINATED SO AS TO PERMIT NEAT CONNECTIONS TO MOTORS AND OTHER EQUIPMENT.
- NO CONDUIT SMALLER THAN 3/4" PIPE SIZE NOR WIRE SMALLER THAN NO. 12 A.W.G. SHALL BE USED UNLESS OTHERWISE NOTED.
- RECEPTACLES AND SWITCHES SHALL BE MOUNTED 45" AFF EXCEPT FOR RECEPTACLES.
- THE WIRING AND BLOCK DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL AND PROCESS EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE ENGINEER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.



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Scale	NONE	
Date	DECEMBER 2021	
Job No.	245-2004	
Designed by	MJC	
Drawn by	RLB	
Checked by	MJC	
Approved by	MJC	
MARK	DATE	DESCRIPTION

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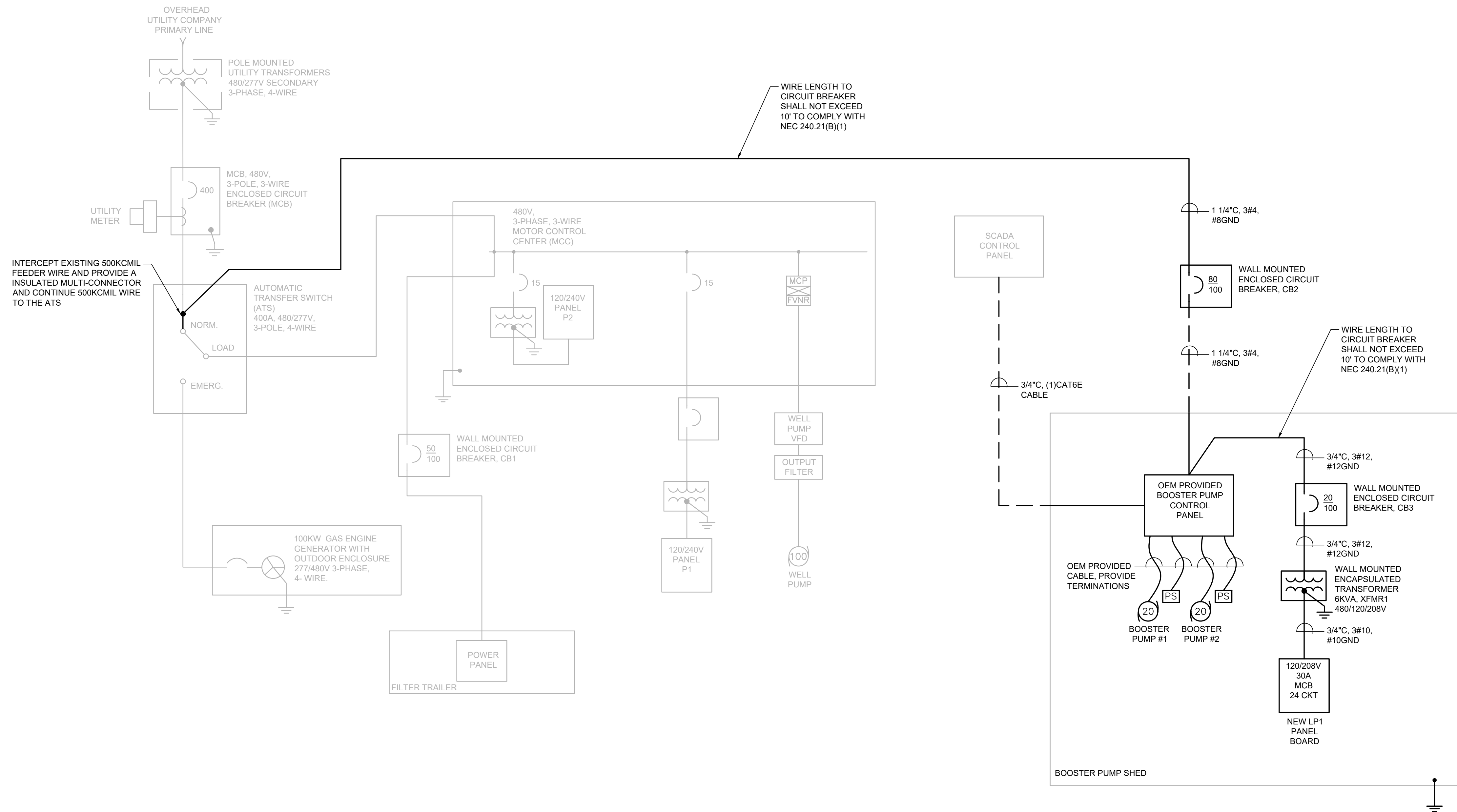
WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA

ELECTRICAL LEGEND,  
GENERAL NOTES, & SCHEDULES

FOR CONSTRUCTION

Sheet No.

E-1

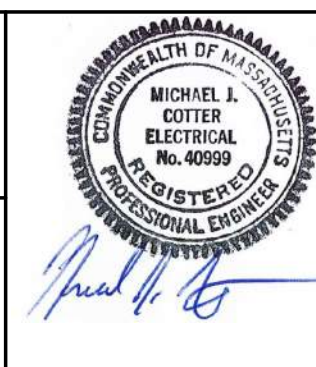


**ONE LINE DIAGRAM**  
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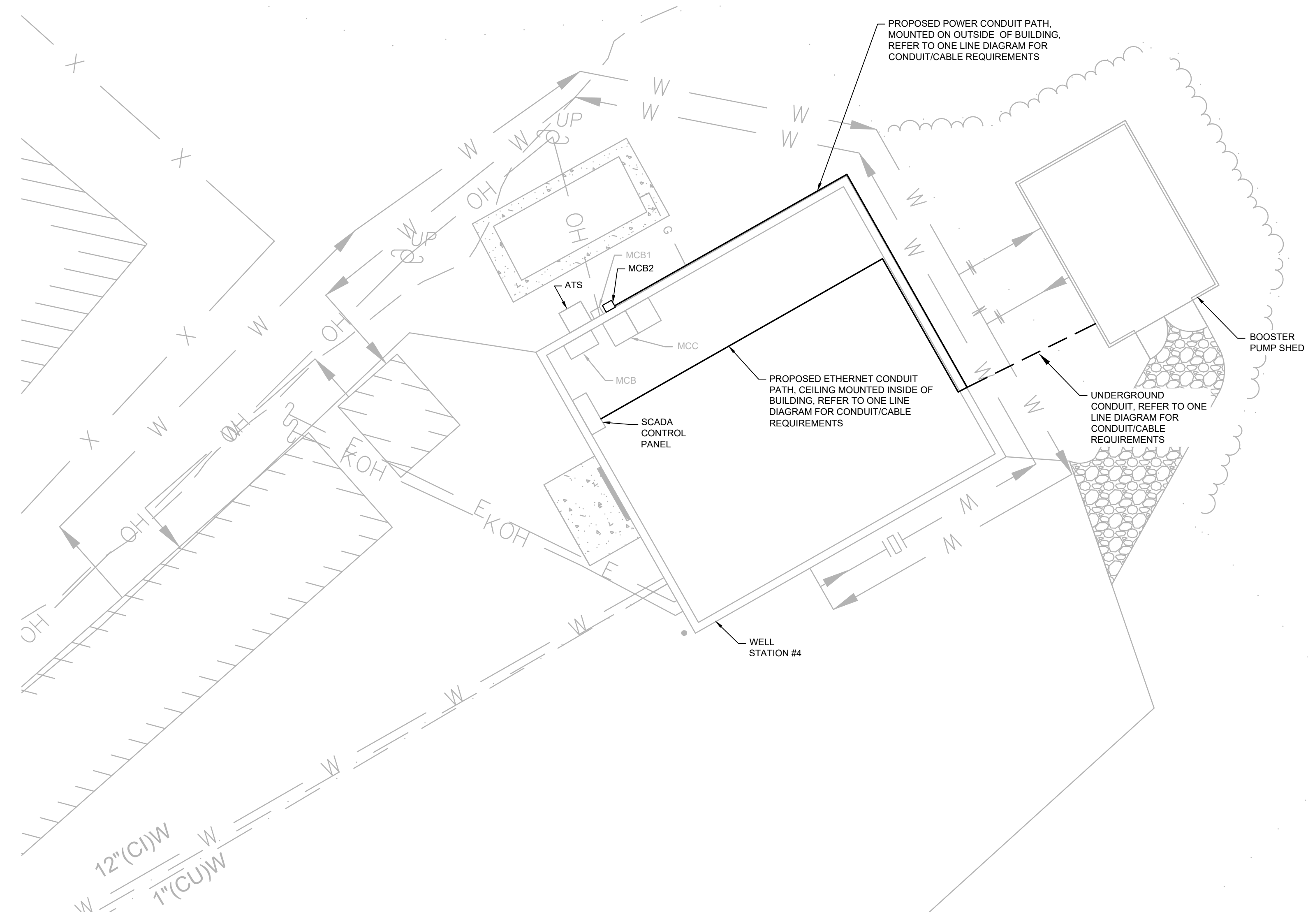
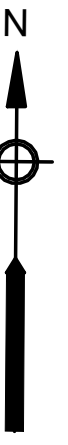
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**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA**

**ELECTRICAL BLOCK WIRING DIAGRAMS,  
CABLE/CONDUIT SCHEDULES, AND DETAILS**

FOR CONSTRUCTION  
Sheet No.

**E-2**

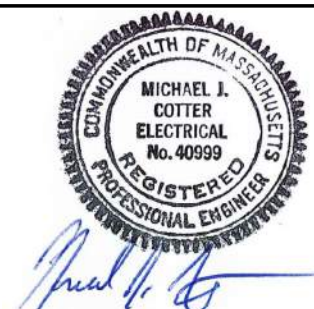


**PLAN**  
SCALE: 1"=5'



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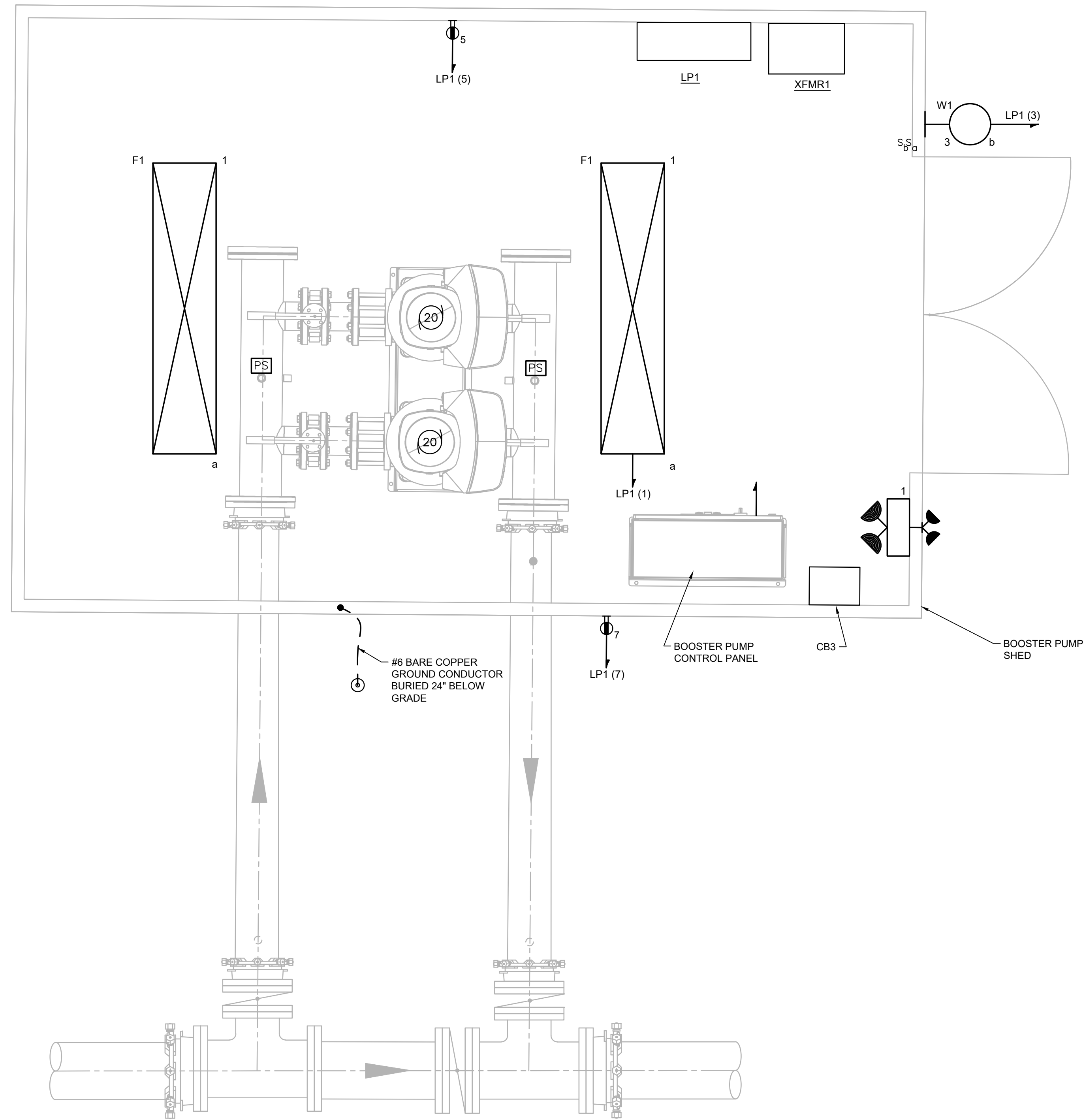
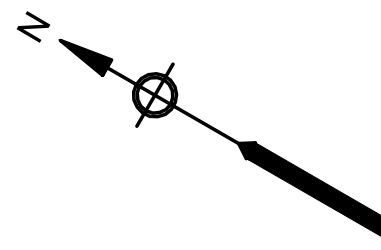
**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA**

**ELECTRICAL  
SITE PLAN**

FOR CONSTRUCTION  
Sheet No.

**E-3**

Drawing file: W:\Year - 2021\12\10\12-00 - Sharon Tree Lane Well Station PFAS Filters\Electrical Department\21012.00 Electrical Booster Pump Site Plan.dwg Plot Date: Dec 02, 2021 12:39pm



**PLAN**  
SCALE: 1"=1'-0"



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MARK	DATE	DESCRIPTION

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**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA**

**ELECTRICAL  
WELL NO. 4 PUMPING STATION PLAN**

FOR CONSTRUCTION  
Sheet No.

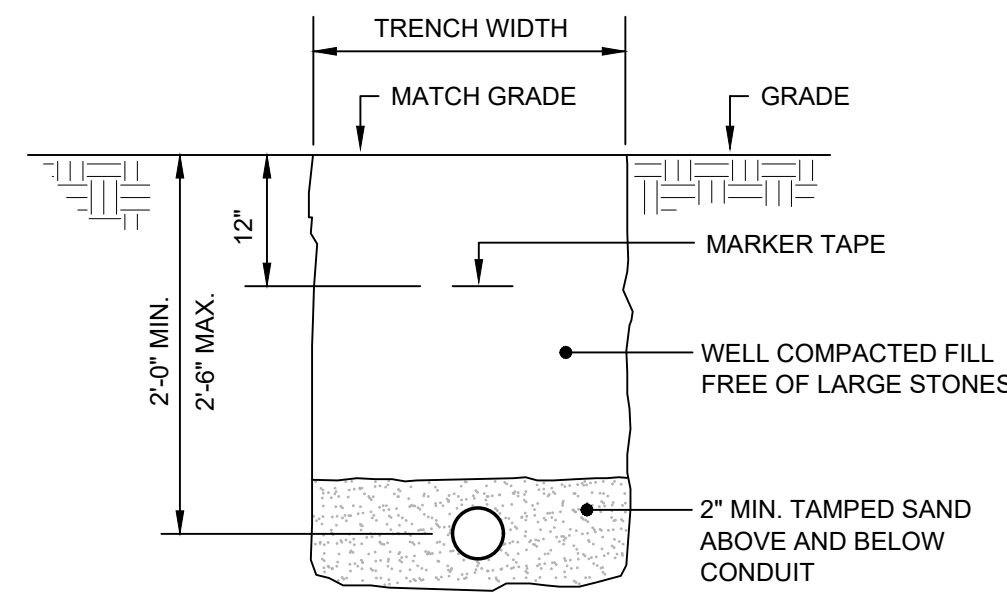
**E-4**

### LIGHTING FIXTURE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER & CATALOG SERIES	LAMPS		VOLTS	WATTS	MOUNTING		REMARKS
			LED	LUMENS			TYPE	HEIGHT	
F1	48" LED ENCLOSED AND GASKETED INDUSTRIAL LIGHTING FIXTURE.	LITHONIA FEM-L48-4000LM-IMAFL-MVOLT-35K-80CRI	LED 3500K	4000lm	120	31	SURFACE		
W1	EXTERIOR BUILDING MOUNTED LED MINI WALL PACK LIGHT FIXTURE DARK BRONZE	LITHONIA WEDGE1-LED-P1-30K 80CRI-VF-	LED 3000K	1161lm	120	10	WALL	8'-0" ABOVE FINISHED GRADE UNLESS OTHERWISE NOTED	
	SELF CONTAINED EMERGENCY LIGHTING BATTERY UNIT NEMA 4 WITH TWO LIGHTING HEADS	REFER TO SPECIFICATIONS			120	8W	WALL		INSTALL 3/4"C. 2#12, 1#12GND TO REMOTE HEADS
	SEALED-BEAM WEATHERPROOF REMOTE LIGHTING FIXTURE WITH TWO LIGHTING HEADS	REFER TO SPECIFICATIONS			120	8W	WALL	8'-0" ABOVE FINISHED GRADE UNLESS OTHERWISE NOTED	

### PANELBOARD SCHEDULE

NO. LP1		LOCATION: BOOSTER PUMP SHED												
120/208 V, 3 PH, 4 W, 100 A MAINS		100 A SOLID NEUTRAL;				30 A MCB								
10,000 AIC AT 120 V		100 GROUND BUS				A MLO SURFACE MOUNTING								
CIRCUIT	DESCRIPTION OF LOAD	LOAD (KVA)			BREAKER		CIRCUIT	BREAKER		LOAD (KVA)			CIRCUIT	
		AØ	BØ	CØ	TRIP	POLE		POLE	TRIP	AØ	BØ	CØ		
1	LIGHTING	0.07			20	1		1	20	-	-	-	SPARE	2
3	EXTERIOR LIGHTING		0.01		20	1		1	20	-	-	-	SPARE	4
5	RECEPTACLES			0.20	20	1		1	20	-	-	-	SPARE	6
7	EXTERIOR RECEPTACLE	0.20			20	1		1	20	-	-	-	SPARE	8
9	SPACE												SPACE	10
11	SPACE												SPACE	12
13	SPACE												SPACE	14
15	SPACE												SPACE	16
17	SPACE												SPACE	18
19	SPACE												SPACE	20
21	SPACE												SPACE	22
23	SPACE												SPACE	24
SUB-TOTAL CONNECTED		0.27	0.01	0.20							SUB-TOTAL CONNECTED			
* PROVIDE GFCI BREAKER														
SUB-TOTAL CONNECTED										KVA AØ = 0.27				
SUB-TOTAL CONNECTED										KVA BØ = 0.01				
SUB-TOTAL CONNECTED										KVA CØ = 0.20				
TOTAL CONNECTED										KVA = 0.48				



**NOTES:**

- BACKFILL IN LAYERS AND MANUALLY TAMP. PROVIDE RED DUCT BANK MARKER TAPE, READING "CAUTION - ELECTRICAL LINES BELOW", OVER ENTIRE LENGTH OF DUCTLINE. LOCATE TAPE 12 INCHES BELOW GRADE. PROVIDE A TAPE FOR EVERY 12 INCHES OF WIDTH OF DUCTLINE.

### UNDERGROUND CONDUIT SECTION

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WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA

ELECTRICAL  
SCHEDULES AND DETAILS

FOR CONSTRUCTION

Sheet No.

**E-5**

ISA INSTRUMENT IDENTIFICATION TABLE													
SUCCEEDING LETTERS													
MEASURED OR INITIATING VARIABLE	FIRST LETTER MEAS. VARI.	SWITCH (H, L, O, OPEN, CLOSE)	PRIM. ELEM. (SENSOR)	INDICATOR	INDICATING CONTROLLER	CONTROL OR CONTR. (BLIND)	RECORDER	INTEGRATOR (TOTALIZER)	TRANSMITTER (INDICATING)	TRANSMITTER	VALVE OR ACTUATOR	RELAY	SOURCE
ANALYSIS	A	ASL	AE	AI			AR		AIT	AT		AY	
BURNER, COMBUSTION	B		BE			BC						BY	
CONDUCTIVITY	C	CSH	CE	CI	CIC	CC	CR		CIT	CT		CY	
DENSITY	D	DSH	DE	DI	DIC	DC	DR		DIT	DT		DY	DX
VOLTAGE	E		EE	EI					EIT	ET		EY	
FLOW RATE	F	FSHL	FE	FI	FIC	FC	FR	FQ	FIT	FT	FV	FY	
USER'S CHOICE	G												
HAND	H	HS											
CURRENT (ELECTRICAL)	I	IS	IE	II	IIC	IC				IT		IY	
POWER	J	JSH	JE	JI	JIC	JC	JR	JQ				JY	
TIME, TIME SCHEDULE	K			KI	KIC	KC		KQ				KY	KS
LEVEL	L	LSH	LE	LI	LIC	LC	LR		LIT	LT	LV	LY	
HUMIDITY	M		ME	MI	MIC	MC	MR		MIT	MT		MY	
USER'S CHOICE	N												
USER'S CHOICE	O												
PRESSURE, VACUUM	P	PSH	PE	PI	PIC	PC	PR		PIT	PT	PV	PY	
QUANTITY	Q						QR						
RADIATION	R												
SPEED, FREQUENCY	S	SSL	SE	SI		SC			SIT	ST		SY	
TEMPERATURE	T	TSL	TE	TI	TIC	TC	TR		TIT	TT	TV	TY	
MULTIVARIABLE	U			UI			UR					UY	
MECHANICAL ANALYSIS	V												
WEIGHT, FORCE	W	WS	WE	WI	WIC		WR		WIT	WT			
VIBRATION	X		XE	XI								XY	
EVENT	Y	YS		YI			YR		YIT	YT		YY	
POSITION, DIMENSION	Z	ZSO	ZE	ZI			ZR		ZIT	ZT		ZY	

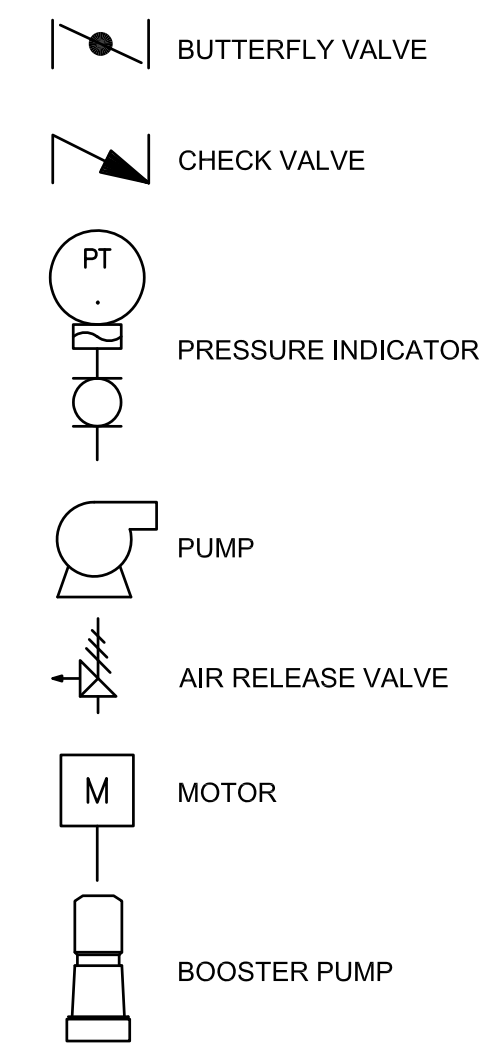
### INSTRUMENTATION NOTES

- ALL INSTRUMENTS SHALL BE MOUNTED, PIPED, AND CONNECTED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- WALL PENETRATIONS TO BE FRAMED AND SEALED PER BUILDING MANUFACTURER'S STANDARD DETAILS AND SPECIFICATIONS
- ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL NECESSARY POWER AND SIGNAL WIRING WITH CONDUITS SHOWN ON E-DRAWINGS, M-DRAWINGS, AND I-DRAWINGS BETWEEN POWER PANELS, PLC'S, CONTROL PANELS, AND FIELD INSTRUMENTS AS REQUIRED. REFER TO E-DRAWINGS.
- LOCATION OF PROCESS EQUIPMENT, MOTORS, VALVE, INSTRUMENTS, AND SIMILAR SHOWN ON THE DRAWINGS ARE APPROXIMATE. FINAL LOCATIONS TO BE DETERMINED IN FIELD TO MATCH EQUIPMENT.
- REFER TO POWER PLANS FOR INSTRUMENTATION POWER REQUIREMENTS.
- DURING ROUGH IN AND FINISHED STAGES OF CONSTRUCTION, THE GENERAL AND ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT AND KEEP CLEAN ALL ELECTRICAL EQUIPMENT, PANELS, FIXTURES, AND DEVICES AS WELL AS ALL EXISTING EQUIPMENT AND RELATED WORK AREAS.
- THE CONTRACTOR SHALL PROVIDE ALL INFORMATION ABOUT EQUIPMENT WHICH THEY ARE FURNISHING TO THE ENGINEER/OWNER FOR REVIEW PURPOSES. THE CONTRACTOR SHALL PROVIDE ALL INSTRUMENTATION DETAILS AND SUPPORT COMPONENTS SO THAT THESE MAY BE BUILT INTO THE CONSTRUCTION IN A TIMELY MANNER.
- REFER TO E-DRAWINGS FOR ADDITIONAL DETAILS FOR CONDUIT, DEVICE LOCATIONS, AND POWER CIRCUITS.
- DRAWINGS SHOW A LAYOUT OF SCADA/INSTRUMENTATION SYSTEMS AND EQUIPMENT DIAGRAMMATICALLY. EXACT LOCATION OF EQUIPMENT AND ROUTING OF RACEWAYS SHALL BE DETERMINED BY FIELD CONDITIONS AND DIRECTION BY ENGINEER AND OWNER. BY SUBMITTING A BID, CONTRACTOR WARRANTS THAT HE/SHE HAS VISITED THE SITE WHERE WORK IS TO BE PERFORMED, AND HAS EXAMINED THE EXISTING CONDITIONS AND EXTENT OF LABOR AND MATERIALS TO BE PROVIDED. COORDINATION WITH ALL TRADES, UTILITIES, ETC. SHALL BE PROVIDED.
- CONTRACTOR SHALL REVIEW THE INSTRUMENTATION P&ID, SPECIFICATION SECTION 13465 - SEQUENCE OF OPERATIONS, I&C INPUTS/OUTPUTS, AND INSTRUMENTATION SCHEDULES IN A COMBINED MANNER FOR A COMPLETE PROCESS OVERVIEW.
- ELECTRICAL CONTRACTOR AND/OR SUBCONTRACTOR TO OBTAIN ALL PERMITS AND INSPECTIONS.

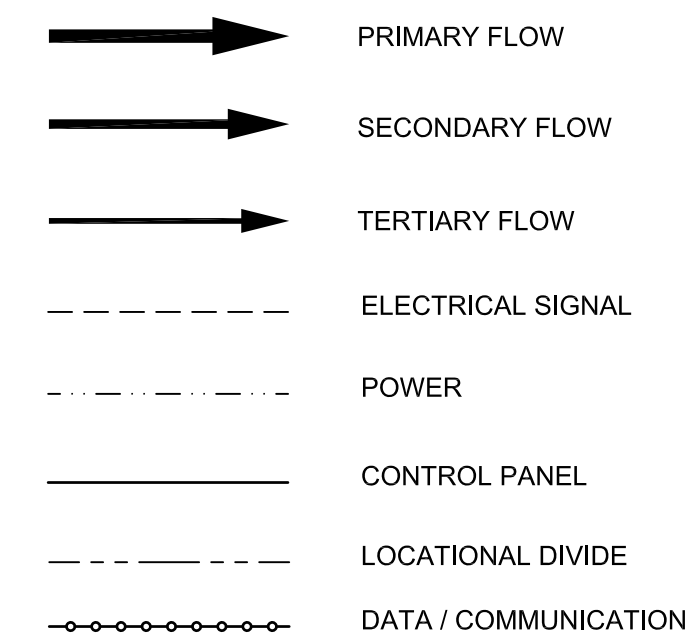
### PROCESS AND INSTRUMENTATION ABBREVIATIONS

ALK	ALKALINITY	O/O	ON/OFF
A/L/L	AUTO/LEAD/LAG	O/S/C	OPEN/STOP/CLOSE
BPS	BOOSTER PUMP SYSTEM	O/S/C/A	OPEN/STOP/CLOSE/AUTOMATIC
BPSCP	BOOSTER PUMP SYSTEM CONTROL PANEL	PC	PARTIAL COUNTER
DPIT	DIFFERENTIAL PRESSURE INDICATOR TRANSMITTER	PFAS	PER- AND POLYFLUOROALKYL SUBSTANCES
EFF	EFFLUENT	PH	pH
FCP	FIELD CONTROL PANEL	PLC	PROGRAMABLE LOGIC CONTROLLER
FCV	FLOW CONTROL VALVE	POS	POSITION
F/R	FORWARD/REVERSE	RS	RUN STATUS
FS	FLOW SWITCH	Ⓢ	SAMPLE PORT
H/A	HAND/AUTOMATIC	SA	SPEED ADJUST
H/O/A	HAND/OFF/AUTOMATIC	SP	SET POSITION
INF	INFLUENT	S/S	START/STOP
L/R	LOCAL/REMOTE	TV	TEMPERATURE VALVE
L/R/O	LOCAL/REMOTE/OFF	YL	EVENT ALARM LOW
MCP	MAIN CONTROL PANEL	YLL	EVENT ALARM LOW LOW
N/A	NORMAL/ALARM	YH	EVENT ALARM HIGH
O/C	OPEN/CLOSE OR OPEN/CLOSED	YHH	EVENT ALARM HIGH HIGH
O/C/A	OPEN/CLOSE/AUTOMATIC	YNF	EVENT

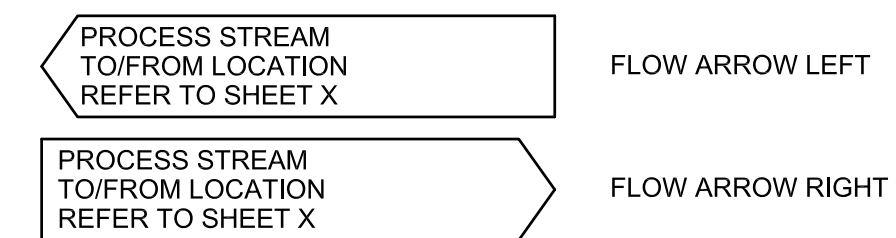
### VALVES & EQUIPMENT



### FLOWS AND LINES

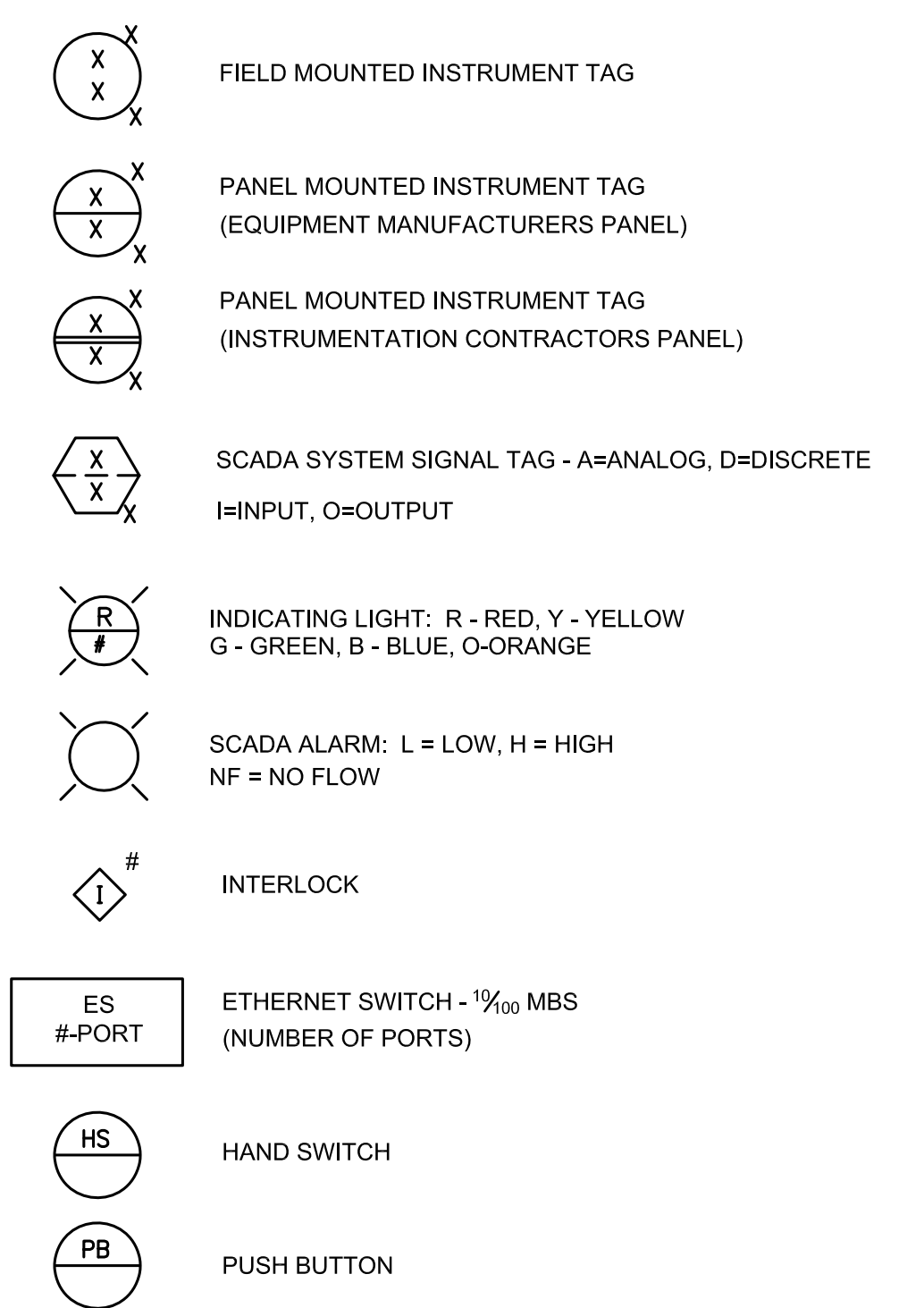


### ANNOTATION

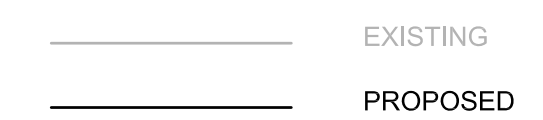


### LEGEND

### INSTRUMENTATION AND ELECTRICAL

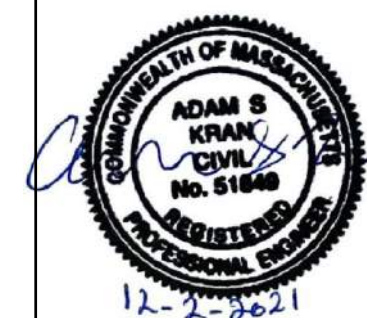


### LINE DESIGNATIONS



### INTERLOCK SCHEDULE

INTERLOCK #	EVENT	ACTION
1	WELL 4 PUMP OFF (P-001)	TURN OFF BPS-100
2	FLOW = 0 (FIT-002)	TURN OFF BPS-100
3	LO-LO SUCTION PRESSURE AT BPS (PT-101)	TURN OFF BPS-100
4	HI-HI DISCHARGE PRESSURE AT BPS (PT-102)	TURN OFF BPS-100, TURN OFF WELL 4 PUMP (P-001)



MARK	DATE	DESCRIPTION

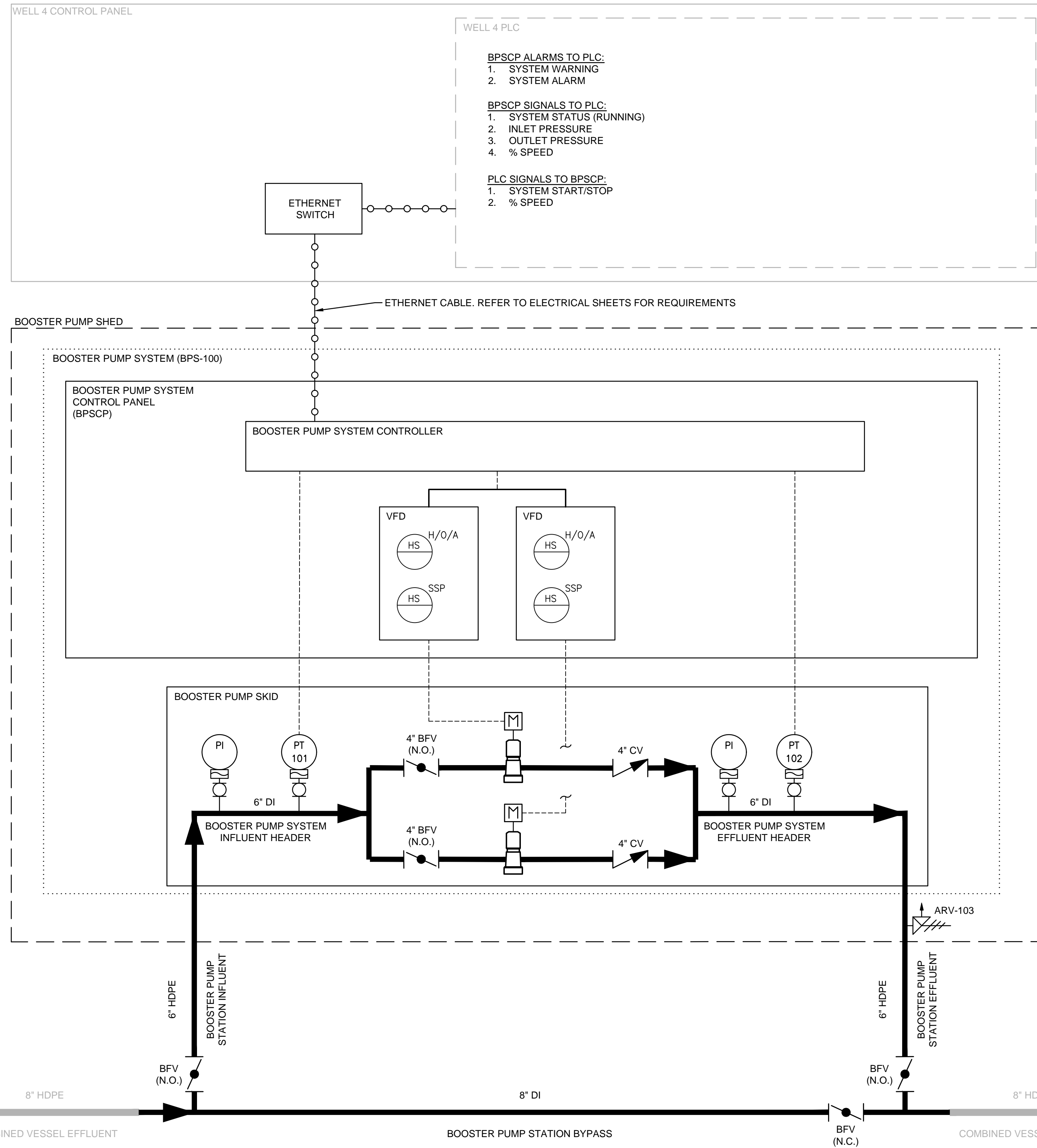
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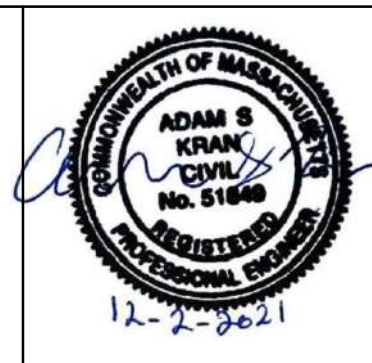
### WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK TOWN OF SHARON, MA

### PROCESS AND INSTRUMENTATION CONTROL NOTES, ABBREVIATIONS, LEGEND, AND INTERLOCK SCHEDULE

FOR CONSTRUCTION
Sheet No.
1-1



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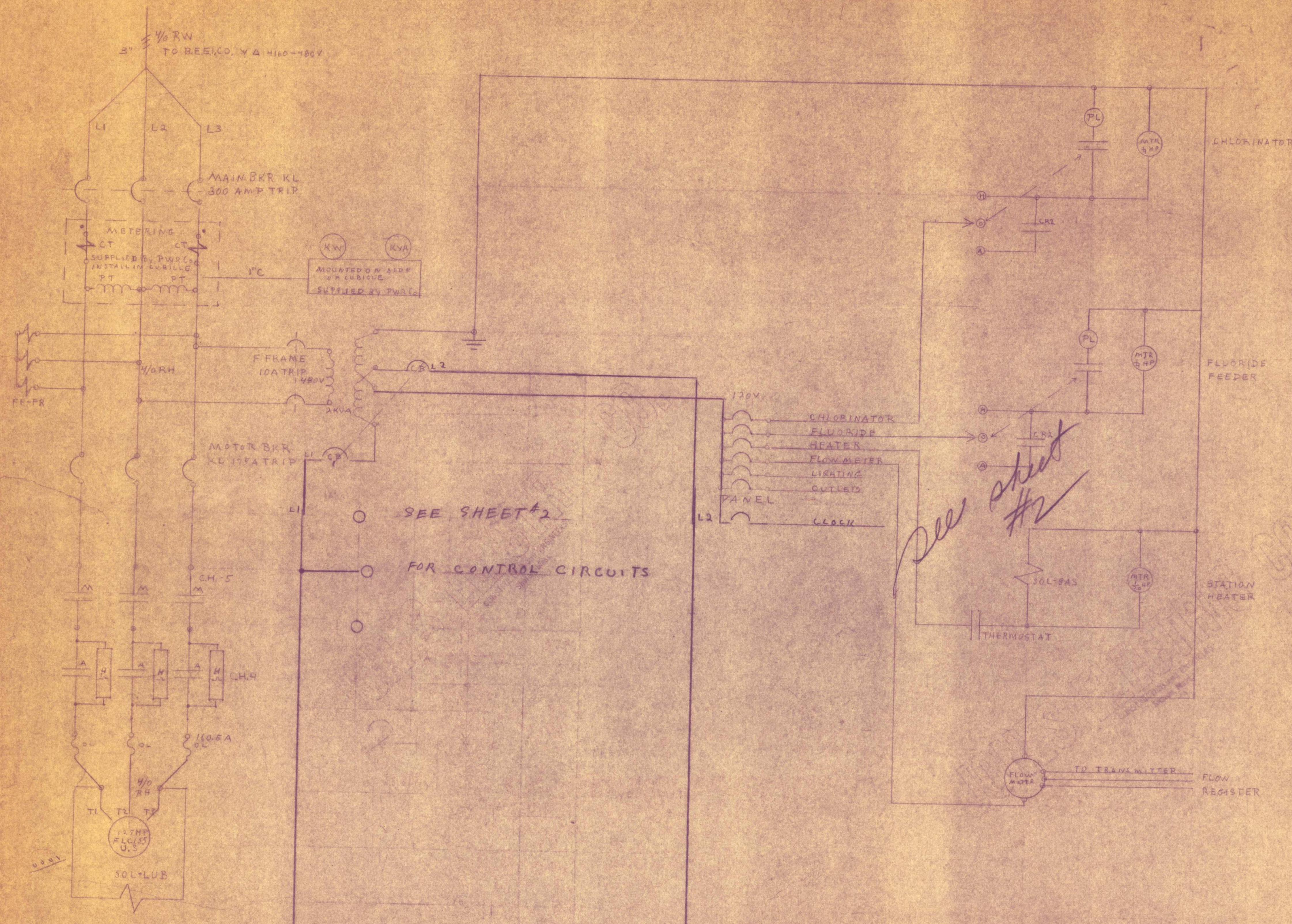
**WELL STATION 4 BOOSTER PUMP AND APPURTENANT WORK  
TOWN OF SHARON, MA**

**PROCESS AND INSTRUMENTATION DIAGRAM**

FOR CONSTRUCTION  
Sheet No. **1-2**

Drawing file: I:\Sharon, MA, 245245-2104 Well 4 Booster Pump\01 Design\Drawings\Well 4 Proposed Conditions 12-1.dwg Plot Date: Dec 02 2021 3:28pm





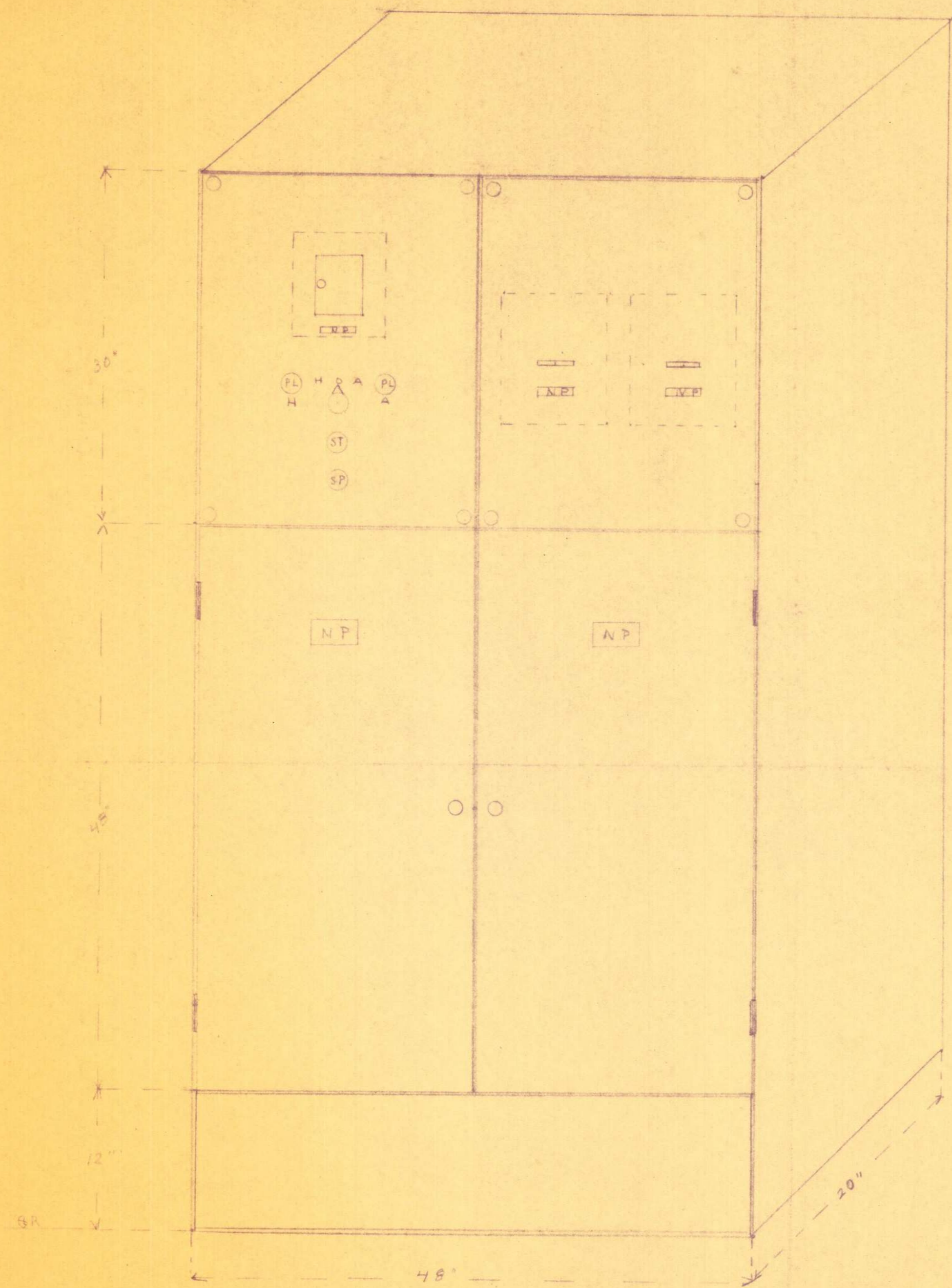
*See sheet #2*

R. W. JONES ELECTRICAL CO. INC.  
CONTRACTORS AND ENGINEERS  
18 BILLINGS STREET  
SHARON, MASS.

FOR TREE LAKE PUMPING STA  
SHARON MASS.

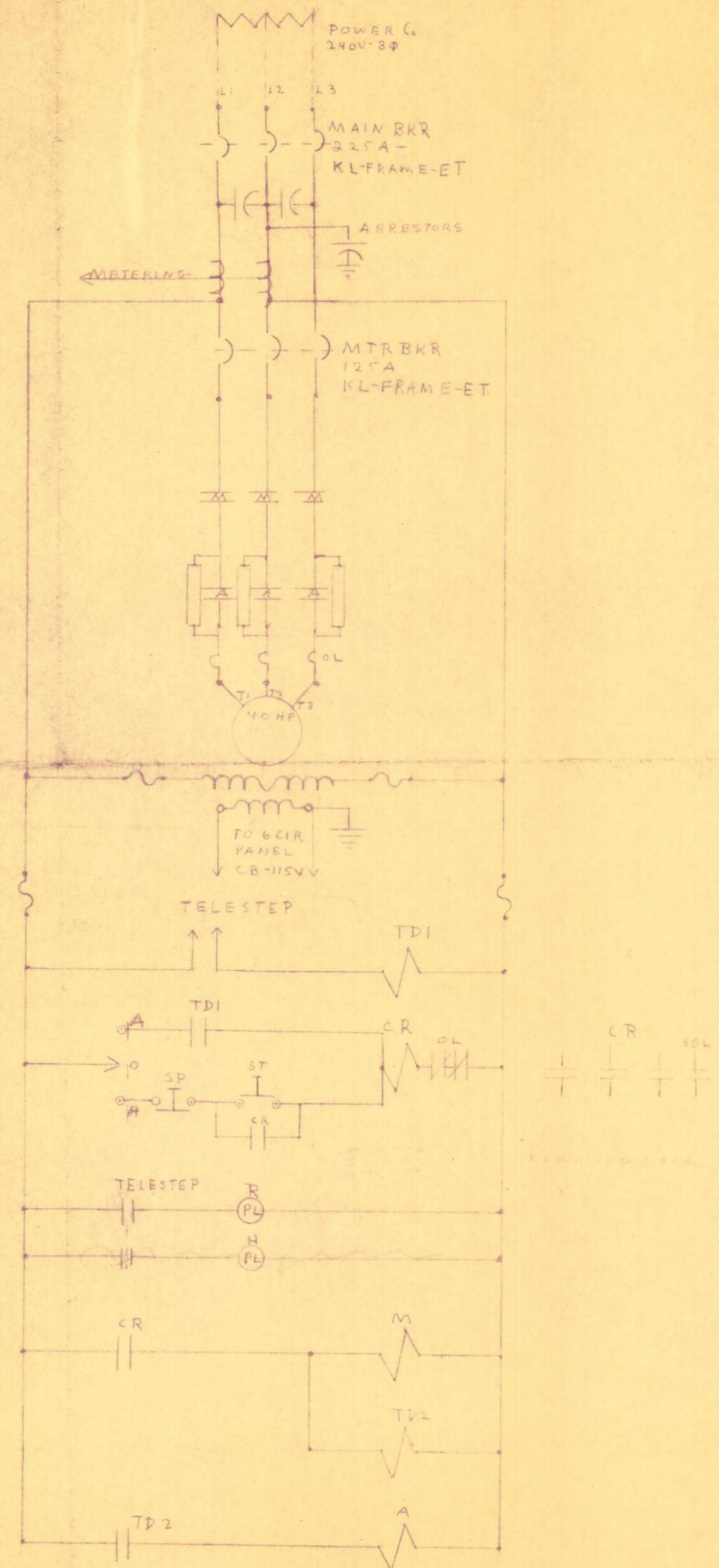
DATE 6-15-57  
TIME 4/10/4

WIRING DIAGRAM



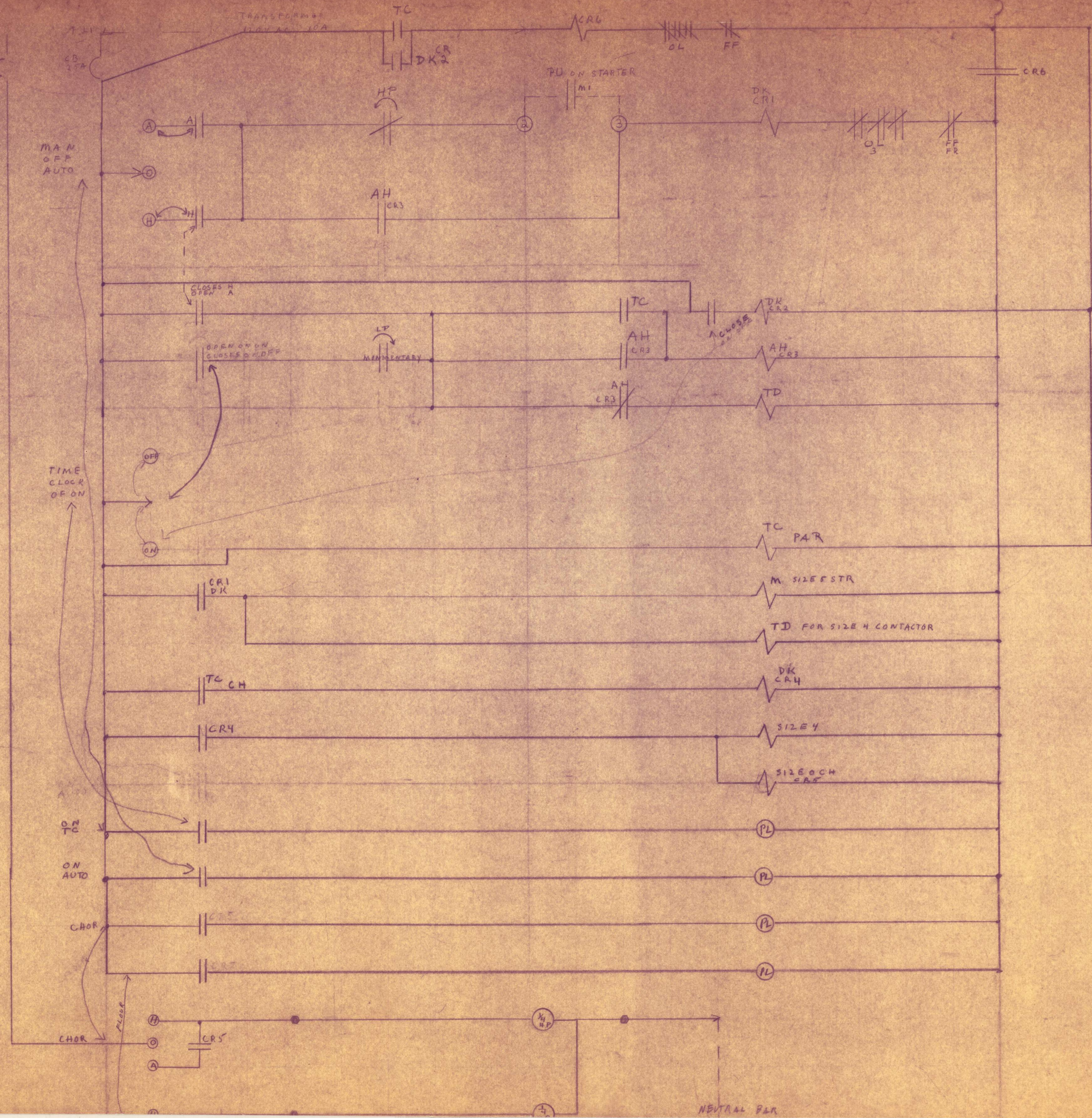
ALL SHEETS IN SA.  
 FRONT PAN TYPE CONSTRUCTION.  
 FRAMED WITH SHAPES 1/4" MIN.  
 ACCESSIBLE FRONT SIDES.  
 W.H.C. TO NEMA 1 SPEC'S.  
 DECREASED - 2 COATS PRIME - 2 FINISH COATS GREY  
 ALL COMPONENTS 12" FROM GRADE  
 ALL COMPONENTS FLUSH MOUNTED

- 1- ET 225A-3P- KLFRAME (MAIN)  
 3 THERMAL + MAGNETIC TRIPS  
 40,000 A-INT @ 250V
- 1- ET 125A-3P- KLFRAME (MOTOR)  
 3 THERMAL + MAGNETIC TRIPS  
 40,000 A-INT @ 250V
- 1- SP-21 F830 GE CAPACITOR
- 1- 3P-94A15B13 GE ARRESTOR
- 1- 40HP-240V-30-60cps - PRI RGS  
 STARTER-3 OLS C.H. 960T SIZE 4
- 1- RELAY-250V-NO (FOR CALSON)
- 1- H.O.A.
- 1- TIME DELAY RELAY - W.H.
- 2- PILOT LIGHTS
- 1- 2 KVA 220-120V TRANSFORMER
- 1- 6 CIRCUIT BREAKER PANEL
- 2- RELAYS-278- FOR CONTROL OF  
 BUTTERFLY VALVES - SURGE CONTROL  
 VALVES - TELEMETERING - ETC



SHARON PUMP  
 STA H

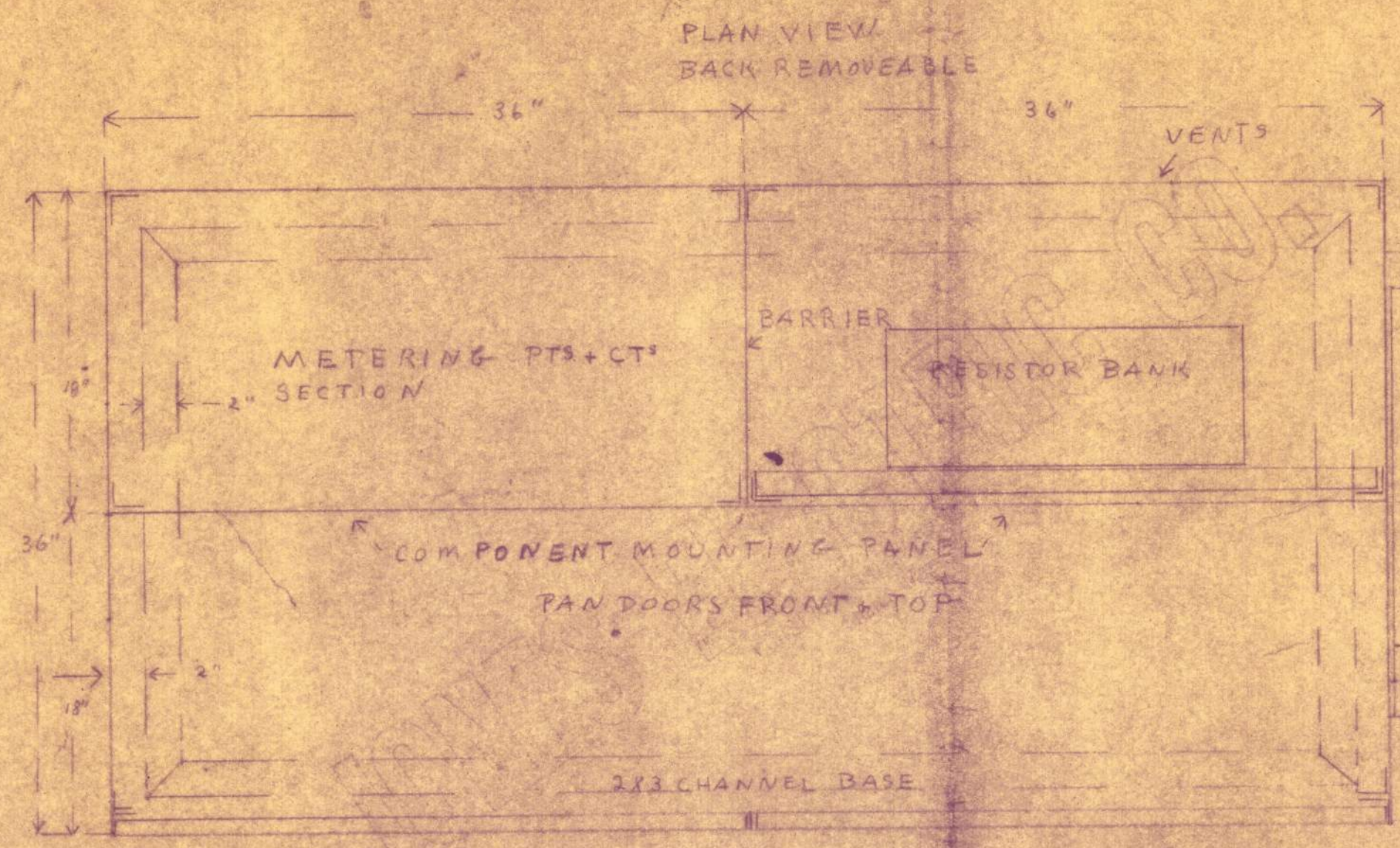
DATE 08/19/57



DK = DUROCOOL  
 AH = ARROW HEART  
 TC = TIME CLOCK  
 TD = TIME DELAY  
 ● = TERMINAL BLOCK

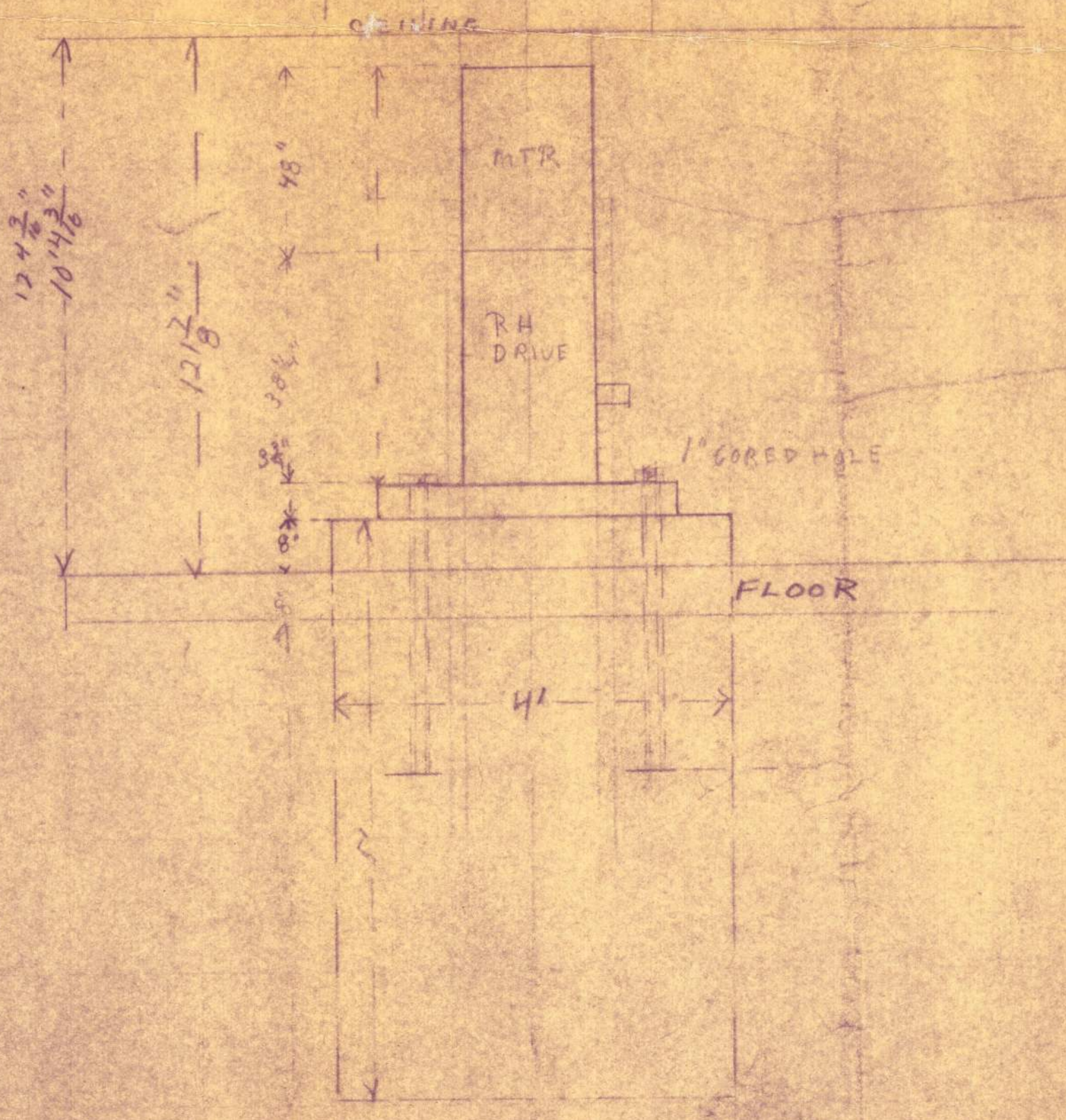
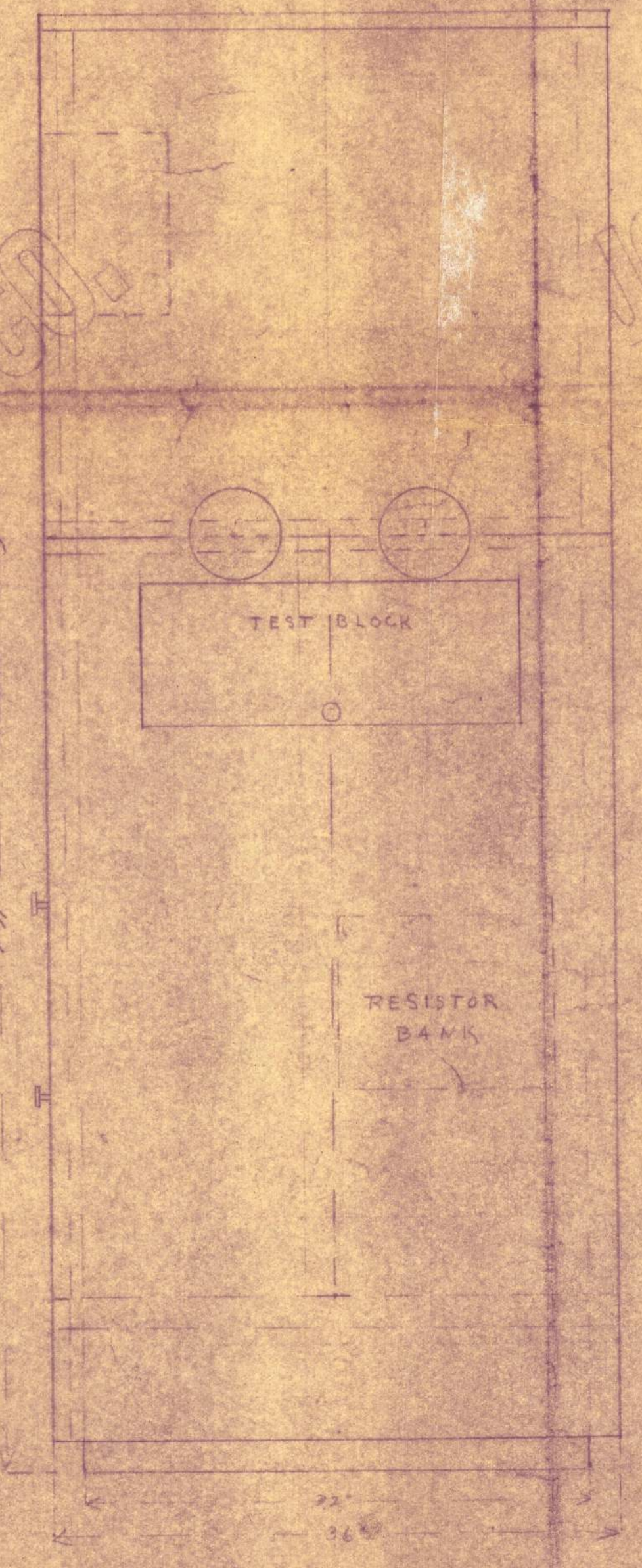
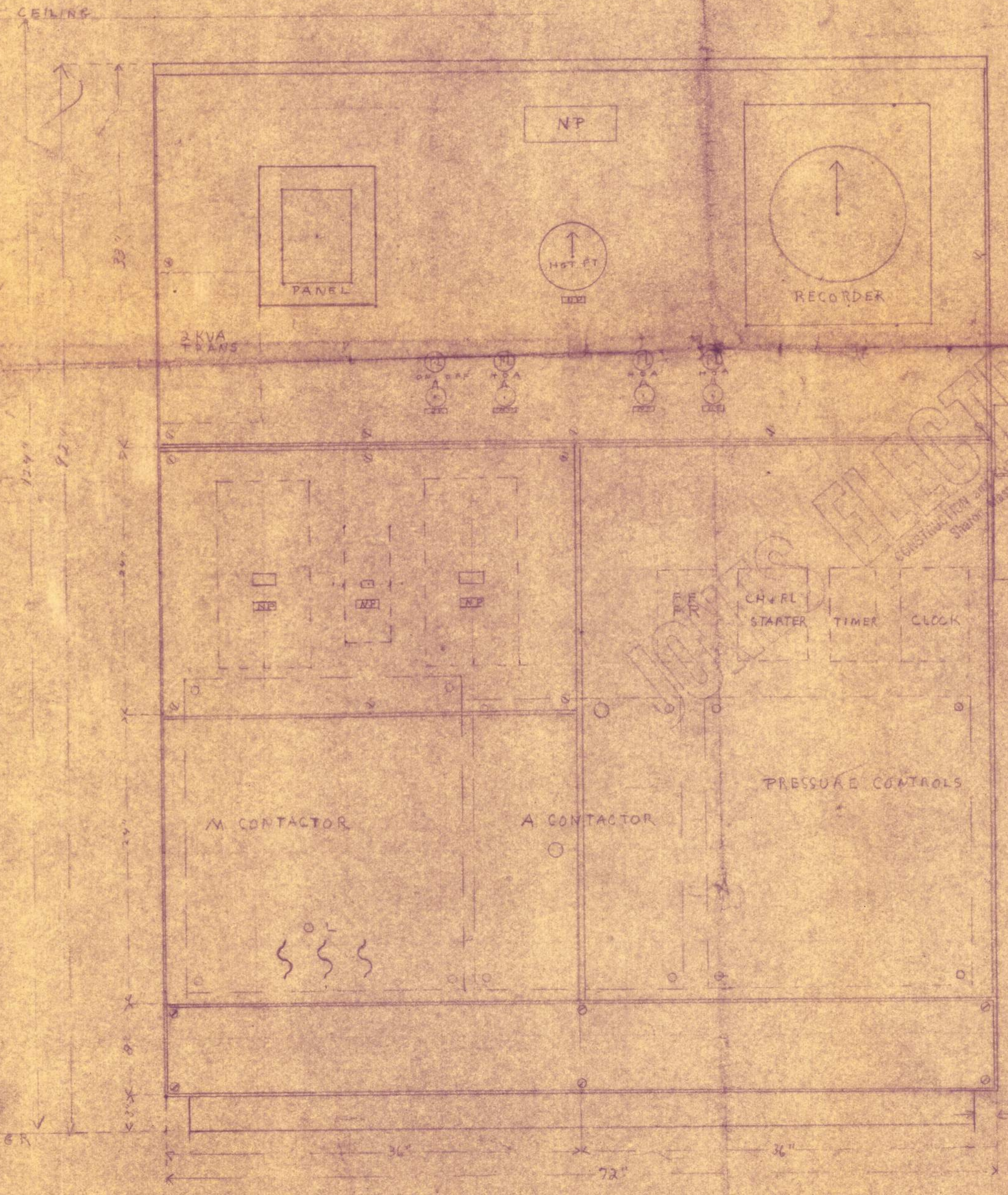
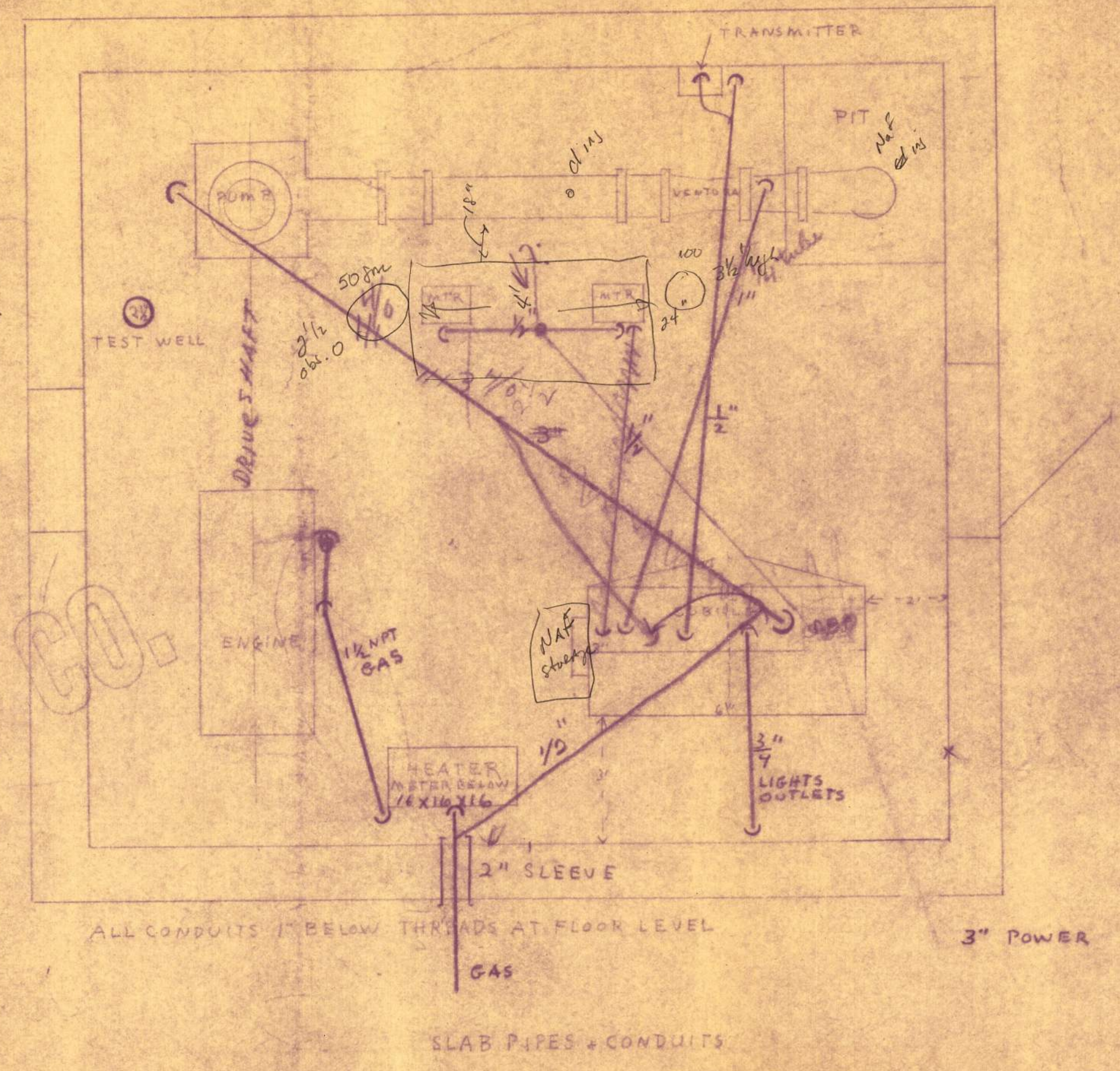
R. W. JONES ELECTRICAL CO. INC.  
 CONTRACTORS AND ENGINEERS  
 18 BILLINGS STREET  
 SHARON, MASS.

FOR SHARON PUMP  
 FINAL



ALL SHEETS + PANS 12G HR STEEL  
 ALL DEAD FRONT  
 BACK REMOVABLE  
 ALL COMPONENTS ACCESSIBLE FROM FRONT  
 2 COATS PRIME  
 2 FINISH COATS GREY  
 NAME PLATE ALL FUNCTIONS

SEE W+S DWG APRIL 1959  
 SCALE 3/4" = 1"



<b>R. W. JONES ELECTRICAL CO. INC.</b> CONTRACTORS AND ENGINEERS 16 BILLINGS STREET SHARON, MASS.	
FOR TREE LAKE PUMPING STATION SHARON, MASS.	
BY <i>[Signature]</i>	DATE 6-15-59
APR <i>[Signature]</i>	DATE 7/10/9
REV	DATE
AS NOTED	



# APPENDIX M

Reserved



## APPENDIX N

### DCAMM Updated Statement





**PRIME UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND  
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)**

**TO ALL BIDDERS AND AWARDING AUTHORITIES**

A COMPLETED AND SIGNED PRIME CONTRACTOR UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY PRIME BID FOR A CONTRACT PURSUANT TO M.G.L. c.149, §44A AND M.G.L. c. 149A. ANY PRIME BID SUBMITTED WITHOUT AN APPROPRIATE UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

***Caution: This form is to be used for submitting Prime Contract bids. It is not to be used for submitting Filed Sub-Bids or Trade Sub-Bids.***

**AWARDING AUTHORITIES**

**If the Awarding Authority determines that the bidder does not demonstrably possess the skill, ability and integrity necessary to perform the work on the project, it must reject the bid.**

---

**BIDDER'S AFFIDAVIT**

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Prime Contractor Update Statement on behalf of the bidder named below, that I have read this Prime Contractor Update Statement, and that all of the information provided by the bidder in this Prime Contractor Update Statement is true, accurate, and complete as of the bid date.

Bid Date	Print Name of Prime Contractor
Project Number (or name if no number)	Business Address
Awarding Authority	Telephone Number

**SIGNATURE⇒**

---

**Bidder's Authorized Representative**

**INSTRUCTIONS**

## **INSTRUCTIONS TO BIDDERS**

- This form must be completed and submitted by all Prime contractors bidding on projects pursuant to M.G.L. c. 149, §44A and M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. **MAKING A MATERIALLY FALSE STATEMENT IN THIS UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.**
- **This Update Statement must include all requested information that was not previously reported on the Application used for your firm's most recently issued (not extended or amended) Prime Contractor Certificate of Eligibility. The Update Statement must cover the entire period since the date of your Application, NOT since the date of your Certification.**
- You must use this official form of Update Statement. Copies of this form may be obtained from the awarding authority and from the Division of Capital Asset Management and Maintenance Web Site: [www.mass.gov/DCAMM](http://www.mass.gov/DCAMM).
- If additional space is needed, please copy the appropriate page of this Update Statement and attach it as an additional sheet.
- See the section entitled "Bidding Limits" in the *Instructions to Awarding Authorities* for important information concerning your bidding limits.

## **INSTRUCTIONS TO AWARDING AUTHORITIES**

### ***Determination of Bidder Qualifications***

- It is the awarding authority's responsibility to determine who is the lowest eligible and responsible bidder. You must consider all of the information in the low bidder's Update Statement in making this determination. **Remember:** this information was not available to the Division of Capital Asset Management and Maintenance at the time of certification.
- The bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- **AWARDING AUTHORITIES ARE STRONGLY ENCOURAGED TO REVIEW THE LOW BIDDER'S ENTIRE CERTIFICATION FILE AT THE DIVISION OF**

CAPITAL ASSET MANAGEMENT AND MAINTENANCE. Telephone (617) 727-9320 for an appointment.

### ***Bidding Limits***

**Single Project Limit:** The total amount of the bid, including all alternates, may not exceed the bidder's Single Project Limit.

**Aggregate Work Limit:** The annual value of the work to be performed on the contract for which the bid is submitted, when added to the annual cost to complete the bidder's other currently held contracts, may not exceed the bidder's Aggregate Work Limit. Use the following procedure to determine whether the low bidder is within its Aggregate Work Limit:

**Step 1** Review Update Statement Question #2 to make sure that all requested information is provided and that the bidder has accurately calculated and totaled the annualized value of all incomplete work on its currently held contracts (column 9).

**Step 2** Determine the annual dollar value of the work to be performed on your project. This is done as follows:

(i) If the project is to be completed in less than 12 months, the annual dollar value of the work is equal to the full amount of the bid.

(ii) If the project will take more than 12 months to complete, calculate the number of years given to complete the project by dividing the total number of months in the project schedule by 12 (calculate to 3 decimal places), then divide the amount of the bid by the calculated number of years to find the annual dollar value of the work.

**Step 3** Add the annualized value of all of the bidder's incomplete contract work (the total of column 9 on page 5) to the annual dollar value of the work to be

performed on your project. **The total may not exceed the bidder's Aggregate Work Limit.**

***Correction of Errors and Omissions in Update Statements***

Matters of Form: An awarding authority shall not reject a contractor's bid because there are mistakes or omissions of form in the Update Statement submitted with the bid, provided the contractor promptly

corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.05(1)].

Correction of Other Defects: An awarding authority may, in its discretion, give a contractor notice of defects, other than mistakes or omissions of form, in the contractor's Update Statement, and an opportunity to correct such defects, provided the correction of such defects is not prejudicial to fair competition. An awarding authority may reject a corrected Update Statement if it contains unfavorable information about the contractor that was omitted from the Update Statement filed with the contractor's bid. [810 CMR 8.05(2)].

**PART 1 - COMPLETED PROJECTS**

LIST ALL PUBLIC AND PRIVATE *BUILDING* PROJECTS YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) DCAMM CERTIFICATE OF ELIGIBILITY. YOU MUST REPORT ALL REQUESTED INFORMATION NOT PREVIOUSLY REPORTED ON THAT DCAMM APPLICATION\*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

\* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship?  YES  NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship?  YES  NO

If you have answered YES to either question, explain. \_\_\_\_\_

**PART 2 - CURRENTLY HELD CONTRACTS**

LIST ALL PUBLIC AND PRIVATE BUILDING AND NON-BUILDING *CONSTRUCTION* PROJECTS YOUR COMPANY HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7	8	9
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)	NO. OF YEARS REMAINING (see note below)	ANNUALIZED VALUE OF INCOMPLETE WORK (col. 7 ÷ col. 8) (divided by)

ANNUALIZED VALUE OF ALL INCOMPLETE CONTRACT WORK (Total of Column 9)

\$ \_\_\_\_\_

- Column 8
- If less than one year is left in the project schedule, write 1.
  - If more than 12 months are left in the project schedule, divide the number of months left in the project schedule by 12 (calculate to three decimal places).

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH CURRENTLY HELD PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship?  YES  NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship?  YES  NO

If you have answered YES to either question, explain. \_\_\_\_\_



For **Parts 3 and 4**, if you answer YES to any question, please provide on a separate page a complete explanation. You must report all requested information not previously reported on your most recent DCAMM Application for Prime Certificate of Eligibility. Information must supplement all judicial and administrative proceedings involving bidder's firm, which were instituted or concluded (adversely or otherwise) since your firm's Application for your most recently issued (not extended or amended) Certificate of Eligibility. Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

**PART 3 – GENERAL PERFORMANCE**

Part 3 of the Update Statement corresponds to Section 5 of the Prime Application. The numbering below refers back to the numbered questions in the application for your reference.

**Prime Application Section 5 - General Performance**

	YES	NO
5.A. Has your Company been terminated prior to completion of a Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5.B. Has your Company failed or refused to perform or complete any of its Scope of Work under any Contract prior to substantial completion?	<input type="checkbox"/>	<input type="checkbox"/>
5.C. Has your Company and/or any principal, officer, or individual with a Financial Interest in your Company filed for bankruptcy?	<input type="checkbox"/>	<input type="checkbox"/>
5.D. Has a surety for your Company taken over or been asked to complete your Scope of Work under any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5.E. Has a payment or performance bond been invoked against your Company on any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5.F. Has any surety for your Company made payment under a payment bond to a vendor or supplier or other party on any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5.G. Has any subcontractor filed a demand for direct payment on any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5.H. Has a lawsuit been filed by any of your subcontractors or suppliers to enforce a mechanic's lien in connection with any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5.I. Has there been a death of any Company employee or other person in connection with (or as the result of) performing your Company's Scope of Work on any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5.J. Has any Company employee or other person suffered an injury while performing any tasks within the Scope of Work on any of your Contracts resulting in his/her inability to return to work for a period in excess of one year?	<input type="checkbox"/>	<input type="checkbox"/>

**PART 4 – LEGAL OR ADMINISTRATIVE PROCEEDINGS; COMPLIANCE WITH LAWS**

Part 4 of the Update Statement corresponds to section 6 of the Prime Application. The numbering below refers back to the numbered questions in the application for your reference.

**Prime Application Section 6 -Legal or Administrative Proceedings; Compliance with Laws**

The term “administrative proceeding” as used in this Prime Contractor Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term “anyone with a financial interest in your firm” as used in this Section “I”, shall mean any person and/or entity with a 5% or greater ownership interest in the applicant’s firm.

	YES	NO
6.A. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
6.B. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal construction procurement laws?	<input type="checkbox"/>	<input type="checkbox"/>
6.C. Have any criminal charges involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts (e.g., fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records or receipt of stolen property)?	<input type="checkbox"/>	<input type="checkbox"/>
6.D. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state ethics laws (in Massachusetts: M.G.L. Chapter 268A)?	<input type="checkbox"/>	<input type="checkbox"/>

**Section 6 - Legal or Administrative Proceedings; Compliance with Laws (continued)**

	YES	NO
6.E. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker’s compensation?	<input type="checkbox"/>	<input type="checkbox"/>
6.F. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in hiring and/or employment?	<input type="checkbox"/>	<input type="checkbox"/>
6.G. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled for violation of any state or federal law regulating labor relations, including collective bargaining agreements, employee welfare benefit plans, employee pension benefit plans, other ERISA and non-ERISA plans?	<input type="checkbox"/>	<input type="checkbox"/>
6.H. Have any proceedings by a local, state, or federal agency been brought, concluded, or settled relating to decertification, debarment or suspension of your Company and/or any principal or officer or individual with a Financial Interest in your Company from construction contracting?	<input type="checkbox"/>	<input type="checkbox"/>
6.I. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state or federal environmental laws?	<input type="checkbox"/>	<input type="checkbox"/>
6.J. Has your Company been fined or sanctioned by OSHA and/or any other state or federal agency for violations of any laws or regulations related to occupational health or safety?	<input type="checkbox"/>	<input type="checkbox"/>
6.K. Has your Company ever (i) failed to meet applicable workforce and/or diversity program goals, benchmarks or other requirements, and/or (ii) been sanctioned, fined and/or penalized for non-compliance with workforce policies and/or diversity programs (e.g., for MBEs, WBEs, SDVOBEs and DBEs) and/or failure to maintain and/or submit required reports, such as certified payrolls.	<input type="checkbox"/>	<input type="checkbox"/>
6.L. Other than previously reported in the above questions, have any Judicial Actions or Administrative Proceedings or investigations involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	<input type="checkbox"/>	<input type="checkbox"/>

**PART 5 - SUPERVISORY PERSONNEL**

List all supervisory personnel, such as project managers and superintendents, who will be assigned to the project if your firm is awarded the contract. **Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION

**PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION**

Have there been any changes in your company’s business organization (**including changes in ownership, mergers, or asset/stock sales**), financial condition or bonding capacity since the date your current Certificate of Eligibility was issued?  Yes  No

**If YES, attach a separate page providing complete details.**

**PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT AND MAINTENANCE.**

**Attach here a copy of the list of completed construction projects which was submitted with your firm’s DCAMM Application for your most recently issued (not extended or amended) DCAMM Certificate of Eligibility. The Attachment must include a complete copy of the entire Projects Table – “Completed Projects” and the final page – “Certification” (Signature Page) containing the signature and date that the Completed Projects list was submitted to the Division of Capital Asset Management and Maintenance.**



**SUB-BIDDERS' UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND  
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)**

## Sub-Bidder Update Statement

### TO ALL SUB-BIDDERS, TRADE CONTRACTORS AND AWARDING AUTHORITIES

A COMPLETED AND SIGNED SUB-BIDDER UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY FILED SUB-BID PURSUANT TO M.G.L. c.149, §44F AND EVERY TRADE SUB-BID PURSUANT TO M.G.L. c. 149A. ANY FILED SUB-BID OR TRADE SUB-BID SUBMITTED WITHOUT AN APPROPRIATE SUB-BIDDER UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

*Caution: This form is to be used for submitting Filed Sub-Bids and Trade Sub-Bids Only*

### AWARDING AUTHORITIES

If the Awarding Authority determines that the Sub-Bidder is not competent to perform the work as specified on the project, it should reject the bid.

---

### SUB-BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Sub-Bidder Update Statement on behalf of the bidder named below, that I have read this Sub-Bidder Update Statement, and that all of the information provided by the bidder in this Sub-Bidder Update Statement is true, accurate, and complete as of the bid date.

---

Bid Date

---

Print Name of Sub-Bidder or Trade Contractor

---

Project Number  
(or name if no number)

---

Business Address

---

Awarding Authority

---

Telephone Number

**SIGNATURE⇒**

---

**Bidder's Authorized Representative**

## INSTRUCTIONS

### INSTRUCTIONS TO SUB-BIDDERS

- This form must be completed and submitted by all Filed Sub-Bidders bidding on projects pursuant to M.G.L. c. 149, §44F and Trade Contractors bidding on projects pursuant to M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. **MAKING A MATERIALLY FALSE STATEMENT IN THIS SUB-BIDDER UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.**
- **This Sub-Bidder Update Statement must include all requested information that was not previously reported on the Application used for your company's most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Sub-Bidder Update Statement must cover the entire period since the date of that Application, NOT since the date of your Certification.**
- You must use this official form of Sub-Bidder Update Statement. Copies of this form may be obtained from the awarding authority or from the DCAMM Web Site:  
[www.mass.gov/DCAMM/certification](http://www.mass.gov/DCAMM/certification).
- If additional space is needed, please copy the appropriate page of this Sub-Bidder Update Statement and attach it as an additional sheet.

### INSTRUCTIONS TO AWARDING AUTHORITIES

#### ***Determination of Sub-Bidder Qualifications***

- It is the awarding authority's responsibility to determine each responsible bidder. You must consider all of the information in the bidder's Sub-Bidder Update Statement in making this determination. Remember: this information was not available to the Division of Capital Asset Management and Maintenance at the time of certification.
- The Sub-Bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- Awarding Authorities are strongly encouraged to review the Sub-Bidder's entire certification file at the Division of Capital Asset Management and Maintenance, telephone (857) 204-1305 or via email at [certification.DCAMM@mass.gov](mailto:certification.DCAMM@mass.gov) for an appointment.

#### ***Correction of Errors and Omissions in Sub-Bidder Update Statements***

Matters of Form: An awarding authority shall not reject a Sub-Bidder's bid because there are mistakes or omissions of form in the Sub-Bidder Update Statement submitted with the bid pursuant to M.G.L. c.149, §44D, provided the Sub-Bidder promptly corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.13(1)]

Correction of Other Defects: An awarding authority may, in its discretion, give a Sub-Bidder notice of minor defects and omissions as to form in the Sub-Bidder's Update Statement and provide an opportunity to correct its Sub-Bidder Update Statement. However, the Sub-Bidder shall not be allowed to make corrections to a Sub-Bidder Update Statement if material information about the Sub-Bidder was omitted from the Sub-Bidder Update Statement filed with the Sub-Bidder's bid. The Awarding Authority shall advise DCAMM of any material omissions in a Sub-Bidder's Update Statement. [810 CMR 8.13(2)]

**PART 1 - COMPLETED PROJECTS**

List All Public And Private Projects Of \$20,000 or more your company has completed since the date of application for your most recently issued (not extended or amended) Sub-Bidder Certificate Of Eligibility\*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

\* If your company has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Sub-Bidder Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE		COMPANY NAME	CONTACT PERSON	TELEPHONE	EMAIL ADDRESS
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship?  YES  NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship?  YES  NO

If you have answered YES to either question, explain. \_\_\_\_\_



**PART 2 – PROJECTS IN PROGRESS CONTRACTS**

List all public and private projects of \$20,000 or more your company has under contract on this date regardless of when or whether the work commenced.

1	2	3	4	5	6	7
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES (MM/YYYY)	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE		COMPANY NAME	CONTACT PERSON	TELEPHONE	EMAIL ADDRESS
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship?  YES  NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship?  YES  NO

If you have answered YES to either question, explain. \_\_\_\_\_

**PART 3 - GENERAL PERFORMANCE**

**For Parts 3 and 4, if you answer YES to any question, please provide on a separate page a complete explanation. Information you provide herein must supplement the application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that application.**

Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

	YES	NO
5A. Has your Company been terminated prior to completion of a Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5B. Has your Company failed or refused to perform or complete any of its Scope of Work under any Contract prior to substantial completion?	<input type="checkbox"/>	<input type="checkbox"/>
5C. Has your Company and/or any principal, officer, or individual with a Financial Interest in your Company filed for bankruptcy?	<input type="checkbox"/>	<input type="checkbox"/>
5D. Has a surety for your Company taken over or been asked to complete your Scope of Work under any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5E. Has a payment or performance bond been invoked against your Company on any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5F. Has any surety for your Company made payment under a payment bond to a vendor or supplier or other party on any Contract?	<input type="checkbox"/>	<input type="checkbox"/>
5G. Has any subcontractor filed a demand for direct payment on any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5H. Has a lawsuit been filed by any of your subcontractors or suppliers to enforce a mechanic's lien in connection with any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5I. Has there been a death of any Company employee or other person in connection with (or as the result of) performing your Company's Scope of Work on any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
5J. Has any Company employee or other person suffered an injury while performing any tasks within the Scope of Work on any of your Contracts resulting in his/her inability to return to work for a period in excess of one year?	<input type="checkbox"/>	<input type="checkbox"/>

**PART 4 - Legal or Administrative Proceedings; Compliance with Laws**

**Please answer the following questions. Information must supplement all judicial and administrative proceedings involving bidder’s company, which were instituted or concluded (adversely or otherwise) since your company’s Application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that DCAMM Application.**

The term “administrative proceeding” as used in this Sub-Bidder Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term “anyone with a financial interest in your company” as used in this Section “1”, shall mean any person and/or entity with a 5% or greater ownership interest in the applicant’s company.

**If you answer YES to any question, on a separate page provide a complete explanation of each proceeding or action and any judgment, decision, fine or other sanction or result. Include all details (name of court or administrative agency, title of case or proceeding, case number, date action was commenced, date judgment or decision was entered, fines or penalties imposed, etc.).**

	YES	NO
6.A. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts?	<input type="checkbox"/>	<input type="checkbox"/>
6.B. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal construction procurement laws?	<input type="checkbox"/>	<input type="checkbox"/>
6.C. Have any criminal charges involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts (e.g., fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records or receipt of stolen property)?	<input type="checkbox"/>	<input type="checkbox"/>
6.D. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state ethics laws (in Massachusetts: M.G.L. Chapter 268A)?	<input type="checkbox"/>	<input type="checkbox"/>

**PART 4 - Legal or Administrative Proceedings; Compliance with Laws (continued)**

	YES	NO
6.E. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker’s compensation?	<input type="checkbox"/>	<input type="checkbox"/>
6.F. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in hiring and/or employment?	<input type="checkbox"/>	<input type="checkbox"/>
6.G. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled for violation of any state or federal law regulating labor relations, including collective bargaining agreements, employee welfare benefit plans, employee pension benefit plans, other ERISA and non-ERISA plans?	<input type="checkbox"/>	<input type="checkbox"/>
6.H. Have any proceedings by a local, state, or federal agency been brought, concluded, or settled relating to decertification, debarment or suspension of your Company and/or any principal or officer or individual with a Financial Interest in your Company from construction contracting?	<input type="checkbox"/>	<input type="checkbox"/>
6.I. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state or federal environmental laws?	<input type="checkbox"/>	<input type="checkbox"/>
6.J. Has your Company been fined or sanctioned by OSHA and/or any other state or federal agency for violations of any laws or regulations related to occupational health or safety?	<input type="checkbox"/>	<input type="checkbox"/>
6.K. Has your Company ever (i) failed to meet applicable workforce and/or diversity program goals, benchmarks or other requirements, and/or (ii) been sanctioned, fined and/or penalized for non-compliance with workforce policies and/or diversity programs (e.g., for MBEs, WBEs, SDVOBEs and DBEs) and/or failure to maintain and/or submit required reports, such as certified payrolls.	<input type="checkbox"/>	<input type="checkbox"/>
6.L. Other than previously reported in the above questions, have any Judicial Actions or Administrative Proceedings or investigations involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	<input type="checkbox"/>	<input type="checkbox"/>

**PART 5 - SUPERVISORY PERSONNEL**

List all supervisory personnel who will be assigned to the project if your company is awarded the contract.

**Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION

**PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION**

Have there been any changes in your company’s business organization (**including changes in ownership, mergers, or asset/stock sales**), financial condition or bonding capacity since the date your current Certificate of Eligibility was issued?  Yes  No

**If YES, attach a separate page providing complete details.**

**PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT AND MAINTENANCE ALONG WITH CERTIFICATION SIGNATURE PAGE.**

Attach here a copy of the list of completed construction projects which was submitted with your company’s application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Attachment must include a complete copy of the entire Completed Projects spreadsheet and the final page Certification (Signature) Page of the online application, containing the signature and date the completed projects list was submitted to the Division of Capital Asset Management and Maintenance.

## APPENDIX O

### Well Redevelopment Records





F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 2-4-20 Date Finished: 2-7-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #1

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 41.50 Length of screen: 5ft Size of well: 8"

Original GPM: 200 With 13.80 (14.4gpf) Feet of drawdown

Static before treatment: 2.80

Depth of well before treatment: 41.50

Capacity of the well before treatment: 120 Drawdown before treatment: 20.50

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 205gpm Drawdown after treatment: 13.60 (15.0gpf)

Static water level after treatment: 2.80

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 2-10-20 Date Finished: 2-13-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #2

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 40.10 Length of screen: 5ft Size of well: 8"

Original GPM: 150 With 11.40 (13.10gpf) Feet of drawdown

Static before treatment: 4.50

Depth of well before treatment: 40.10

Capacity of the well before treatment: 80 Drawdown before treatment: 19.20

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 192gpm Drawdown after treatment: 16.60 (11.5gpf)

Static water level after treatment: 4.50

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 2-4-20 Date Finished: 2-7-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #3

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 40.90 Length of screen: 5ft Size of well: 8"

Original GPM: 150 With 13.90 (10.70gpf) Feet of drawdown

Static before treatment: 3.00

Depth of well before treatment: 40.90

Capacity of the well before treatment: 95 Drawdown before treatment: 18.65

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 172gpm Drawdown after treatment: 19.10 (9.0gpf)

Static water level after treatment: 3.00

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 1-30-20 Date Finished: 2-4-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #4

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 29.20 Length of screen: 3ft Size of well: 8"

Original GPM: 130 With 14.1 (9.2gpf) Feet of drawdown

Static before treatment: 4.30

Depth of well before treatment: 29.20

Capacity of the well before treatment: 30 Drawdown before treatment: 22.50

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 115gpm Drawdown after treatment: 15.90 (7.2gpf)

Static water level after treatment: 4.30

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 1-30-20 Date Finished: 2-4-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #5

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 35.60 Length of screen: 5ft Size of well: 8"

Original GPM: 200 With 9.20 Feet of drawdown

Static before treatment: 3.20

Depth of well before treatment: 35.60

Capacity of the well before treatment: 110 Drawdown before treatment: 14.70

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 235gpm Drawdown after treatment: 12.90 (18.2gpf)

Static water level after treatment: 3.20

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 1-27-20 Date Finished: 1-30-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #6

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 32.20 Length of screen: 5ft Size of well: 8"

Original GPM: 160 With 15.5 Feet of drawdown

Static before treatment: 2.10

Depth of well before treatment: 32.10

Capacity of the well before treatment: 50 Drawdown before treatment: 19.20

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 150gpm Drawdown after treatment: 15.50 (9.67gpf)

Static water level after treatment: 2.10

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

F.G. Sullivan Drilling Co., Inc.  
Log of Well Rehabilitation

Date Started: 1-23-20 Date Finished: 1-27-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #7

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: Dan Sullivan Helper: Kyle Dirico

Depth of well: 41.75 Length of screen: 5ft Size of well: 8"

Original GPM: 200 With 9.2 Feet of drawdown

Static before treatment: 1.90

Depth of well before treatment: 41.75

Capacity of the well before treatment: 95 Drawdown before treatment: 17.20

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 235gpm Drawdown after treatment: 15.7 (14.9gpf)

Static water level after treatment: 1.80

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no

**F.G. Sullivan Drilling Co., Inc.**  
Log of Well Rehabilitation

Date Started: 1-17-20 Date Finished: 1-22-20

Name and Address of Job: Sharon, MA

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Pump Station #2 well #9

Well originally installed by: F.G Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of Driller: DanSullivan Helper: Kyle Direco

Depth of well: 31.00 Length of screen: 5ft Size of well: 8"

Original GPM: 170 With 16.0 Feet of drawdown

Static before treatment: 2.50

Depth of well before treatment: 30.90

Capacity of the well before treatment: 110 Drawdown before treatment: 15.30

Kind of treatment used: Hydrochloric Acid HTH

Amount of treatment used: 55gal 20lbs

Capacity of well after treatment: 222gpm Drawdown after treatment: 16.9 (13.1gpf)

Static water level after treatment: 2.50

Pump test: Before: no After: no Sample Taken: no

Hours Removing and resetting the pump: 0 vacuum system

Hours Surging and Brushing: 20hrs

Make of pump: \_\_\_\_\_ Type: \_\_\_\_\_ Model: \_\_\_\_\_ Serial #: \_\_\_\_\_

Column pipe length: \_\_\_\_\_ Size: \_\_\_\_\_ Shaft: \_\_\_\_\_

Pump Bowl Assembly: \_\_\_\_\_ Size: \_\_\_\_\_ GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: \_\_\_\_\_ HP: \_\_\_\_\_ PH: \_\_\_\_\_ Volts: \_\_\_\_\_ Amps: \_\_\_\_\_ RPM: \_\_\_\_\_

Transducer Setting: \_\_\_\_\_ Pump Intake Setting: \_\_\_\_\_

Was pump reconditioned: \_\_\_\_\_

Remarks: \_\_\_\_\_

Signature of Driller: Dan Sullivan Video Inspection: no



**LETTER REPORT  
ON  
REDEVELOPMENT OF WELL NO. 2 WELLFIELD**

**DEPARTMENT OF PUBLIC WORKS  
SHARON, MASSACHUSETTS**

Amory Engineers, P.C.  
Duxbury, Massachusetts

AMORY ENGINEERS, P.C.

P.O. BOX 1768, 25 DEPOT STREET, DUXBURY, MASSACHUSETTS 02331-1768  
(781) 934-0178 • FAX (781) 934-6499

WALTER AMORY  
DAVID A. JACOBSEN  

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RICHARD S. JOHNSON

WATER WORKS	REPORTS
WATER RESOURCES	DESIGN
CIVIL WORKS	ADVICE
LAND USE	CONSTRUCTION
WATER RATES	SERVICES

July 15, 1998

John A. Sulik, P.E., Superintendent  
Department of Public Works  
P. O. Box 517  
Sharon, MA 02067-0517

Subject: **Redevelopment of Well No. 2 Wellfield**

Dear Mr. Sulik:

In accordance with our proposal of September 26, 1997, we submit this letter report on results of redevelopment of the nine wells in the Station No. 2 Wellfield. The purpose of well redevelopment was to restore deteriorated well capacity to the 1992 level, the year the wells were last cleaned.

**Well Redevelopment**

Bids for redevelopment of the wells were received on February 4, 1998, and the work awarded to F.G. Sullivan Drilling Company, the low bidder. Bids included two alternative methods of redevelopment, conventional and a new process called Aqua Freed. Because the cost of the Aqua Freed alternative was the lower of the two, the Contractor was directed to proceed with this method of redevelopment.

The Aqua Freed method employs carbon dioxide injection under pressure into each well. After a contact period of 16 hours or more, the wells are then surged and water pumped to waste until the wells pump freely. The carbon dioxide acidifies the water, which dissolves iron and manganese around the well and opens passageways for water to flow to the wells more freely.

Work began on May 22. All nine wells were pumped individually in order to determine specific capacity before redevelopment. Results are presented in Table 1. The before-cleaning specific capacity results, along with specific capacities after the most recent prior cleaning in 1992, were used to evaluate the effectiveness of cleaning under this contract.

**TABLE 1. RESULTS OF REDEVELOPMENT**

Well	1992 <sup>2</sup>	Specific Capacity - gpm/ft.		Regained Specific Capacity <sup>1</sup>
		Before Cleaning	After Cleaning	
1	11.5	15.3	15.2	132
2	12.2	0.9	10.7	88
3	10.2	8.5	9.4	92
4	6.8	0.6	5.1	75
5	18.8	1.1	17.8	95
6	10.2	0.6	9.5	93
7	19.8	1.2	18.0	91
8	10.3	0.5	10.3	100
9	10.9	1.1	10.9	100

Work under the contract was completed on June 19.

### Results

Results show that eight of the nine wells recovered approximately 90 percent or more of the 1992 target specific capacities. Only Well 4 failed to approach the target. However, this well has

<sup>1</sup> As percent of 1992 specific capacities.

<sup>2</sup> Date of most recent prior redevelopment. Results shown are specific capacities after cleaning.

always been the least productive well in the wellfield. The failure of Well 4 to return to 1992 capacity should not affect total wellfield production.

In the process of the work, Well 8 was found to have a broken saddle at the connection between well casing and discharge main. This condition can allow entrance of surface water contaminants, such as sediment and bacteria, into the water system. Well 8 must be shut off until the saddle is repaired.

Upon completion of redevelopment, the nine wells were disinfected in preparation for returning the wells to service. Samples taken after disinfection showed absence of coliform bacteria in Wells 1, 2, 3, 4, 5 and 9 but the presence of coliform bacteria in Wells 6, 7 and 8. Wells 6 and 7 should be rechlorinated before use and Well 8 disinfected after repairs are complete. Laboratory analyses for bacteria are included in Appendix B. As a continuing routine, we recommend that monthly samples be taken from the raw water pumped from the wellfield to monitor bacterial quality.

In addition to bacteria analyses, water samples were also tested for secondary contaminants (see Appendix B). Samples were taken from all nine wells plus the adjacent stream (Beaver Brook). Well sample results were compared with the stream sample to evaluate whether a possible direct connection exists between surface water and the wells. This precaution was taken to assess the concern that cleaning might have created an interconnection between surface water and the wells.<sup>1</sup> Review of the results of secondary contaminant analyses indicates no apparent interconnection.

Secondary contaminant results also indicate the presence of high concentrations of iron and manganese. From past experience it appears that elevated concentrations of these contaminants is

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<sup>1</sup> Cleaning by the Aqua Freed process reportedly extends much further into the aquifer around the wells than conventional cleaning, giving opportunity for opening a direct connection between surface and groundwater.

a common result of redevelopment by the Aqua Freed process. But the concentrations typically decrease over a short period of pumping. We expect this pattern of decreasing concentrations will be evident at Well 2. We recommend monitoring iron and manganese from this source on a routine basis.

**Conclusions and Recommendations**

We offer the following conclusions and recommendations:

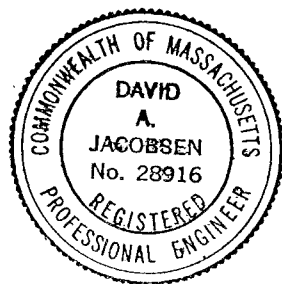
1. The Aqua Freed redevelopment process restored overall specific capacity to within 3.5 percent of 1992 levels.
2. Well 8 must not be used until the broken saddle connection is repaired.
3. Wells 6 and 7 should be disinfected again before being pumped to the system.
4. Raw water samples should be obtained from the wellfield monthly and tested for bacteria.
5. Analyses for iron and manganese should be performed on this source on a regular basis.
6. Suction pressures and pumping water levels in the wells should be monitored at regular intervals to assess when redevelopment should next be required.

Please call if you have any question.

Very truly yours,

AMORY ENGINEERS, P.C.

By:



A handwritten signature in cursive script that reads "David A. Jacobsen".

David A. Jacobsen, P.E.

DAJ:vs

**APPENDIX A**

Redevelopment Logs

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523

Date Started: 6-1-98 Date Finished: 6-2-98

Name and Address of Job: TOWN OF SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: Pump STA #2 8" well #1

Well installed originally by: F.G. SULLIVAN DRILLING CO

Type of work to be done: AQUA FREEZ TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 41.50 From top of pipe Length of screen: 5' Size of well: 8"

Original GPM: 200 with 13.8' (14.4' PF) feet of drawdown from top of pipe

Static before treatment: 3.10 from top of pipe A.G - 0.50

Depth of well before treatment: 41.25 from top of pipe

Capacity of well before treatment: 100 GPM Drawdown before treatment:

Kind of treatment used: AQUA FREEZ PROCESS

Amount of treatment used:

Capacity of well after treatment: 160 GPM Drawdown after treatment: 10.5 (15.0 GPM)

Static water level after treatment: 3.40 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job: 1 Hr

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 13 HRS

Remarks:

Total hours to complete job: 14 HRS

Condition of well on completion of work: 100%

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

The well WAS CHLORINATED UPON COMPLETION

Signature of driller: [Signature] Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-4-98 Date Finished: 6-5-98

Name and Address of Job: TOWN OF SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: Pump STA #2 8" well - #2

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR. Helpers: CARLOS TORO

Depth of well: 40.20 From top of pipe Length of screen: 5' Size of well: 8"

Original GPM: 150 with 11.4 (1.31 GPF) feet of drawdown from top of pipe

Static before treatment: 4.90 From top of pipe AG - 1.50

Depth of well before treatment: 38.80 From top of pipe

Capacity of well before treatment: 20 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 145 GPM Drawdown after treatment: 13.60 (10.60 GPF)

Static water level after treatment: 4.90 From top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 12 HRS

Remarks:

Total hours to complete job: 13

Condition of well on completion of work: 80% of ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: [Signature] Signature of customer:



LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-2-98 Date Finished: 6-4-98

Name and Address of Job: TOWN of SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: Pump STA #2 8" well #3

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR. Helpers: CARLOS TORO

Depth of well: 41.25 from top of pipe Length of screen: 5' Size of well: 8"

Original GPM 150 with 13.9 (10' GPF) feet of drawdown from top of pipe

Static before treatment: 3.30 from top of pipe A.G. - 150

Depth of well before treatment: 40.75 from top of pipe

Capacity of well before treatment: 100 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 150 GPM Drawdown after treatment: 15.9 (9.4 GPF)

Static water level after treatment: 3.30 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 13 HRS

Remarks: WHILE SURGING AND PUMPING THE WELL PUMPED ALOT OF FINE SAND. WHEN THE WELL WAS BEING PUMPED WITHOUT SURGING THE WATER CLEARED UP.

Total hours to complete job: 14 HRS

Condition of well on completion of work: 87% of ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIAL SAMPLES WERE TAKEN THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Francis Sullivan Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523

Date Started: 6-5-98 Date Finished: 6-10-98

Name and Address of Job: TOWN OF SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: PUMP STA #2 8" WELL #4

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 29.2 from top of pipe Length of screen: 3' Size of well: 8"

Original GPM: 130 with 14.1 (9.2 GPM) feet of drawdown from top of pipe

Static before treatment: 4.80 from top of pipe AG-0.80

Depth of well before treatment: 27.90 from top of pipe

Capacity of well before treatment: 10 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 90 GPM Drawdown after treatment: 17.80 (5.06 FF)

Static water level after treatment: 4.70 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 16 HRS

Remarks:

Total hours to complete job: 17 HRS

Condition of well on completion of work: 54% OF ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Francis Sullivan Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-10-98 Date Finished: 6-11-98

Name and Address of Job: TOWN of SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: PUMP STA #2 8" WELL #5

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 35.60 from top of pipe Length of screen: 5' Size of well: 8"

Original GPM: 200 with 9.2 (21' OPF) feet of drawdown from top of pipe

Static before treatment: 3.70 from top of pipe A.G. 1.20

Depth of well before treatment: 34.60 from top of pipe

Capacity of well before treatment: 20 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 187 GPM Drawdown after treatment: 10.5 (17.80'F)

Static water level after treatment: 3.70 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 12 HRS

Remarks:

Total hours to complete job: 13 HRS

Condition of well on completion of work: 82% OF ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Frank Sullivan Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-11-98 Date Finished: 6-15-98

Name and Address of job: TOWN OF SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: PUMP STA #2 8" WELL #10

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 32.2 from top of pipe Length of screen: 5' Size of well: 8"

Original GPM: 160 with 15.50 (10.30 GPF) feet of drawdown from top of pipe

Static before treatment: 240 from top of pipe A.G. - 1.10

Depth of well before treatment: 31.60 from top of pipe

Capacity of well before treatment: 156 GPM Drawdown before treatment: 23.65

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 160 GPM Drawdown after treatment: 16.9 (9.4 GPF)

Static water level after treatment: 1.50 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 13 HRS

Remarks: While pumping and surging the well pumped fine + some med sand when the surging was stopped the water cleared

Total hours to complete job: 14 HRS

Condition of well on completion of work: 91% OF ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: [Signature] Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523

Date Started: 6-18-98 Date Finished: 6-19-98

Name and Address of Job: TOWN OF SHARON MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: Pump STA #2 8' WE 1 #7

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 42.5 from top of pipe Length of screen: 5' Size of well: 8"

Original GPM: 200 with 9.3 (at 1 PF) feet of drawdown from top of pipe

Static before treatment: 1.00 from top of pipe A.G.-1.50

Depth of well before treatment: 42.5 from top of pipe

Capacity of well before treatment: 25 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 180 GPM Drawdown after treatment: 10.0 (18 GPM)

Static water level after treatment: 1.00 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job: 1 HR

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 14 HRS

Remarks:

Total hours to complete job: 15 HRS

Condition of well on completion of work: 85% OF ORIGINAL

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Francis Sullivan Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-16-98 Date Finished: 6-17-98

Name and Address of Job: TOWN of SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: PUMP STA #2 8" WELL # 8

Well installed originally by: F.G. SULLIVAN DRILLING Co INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TARO

Depth of well: 36.2 from top of pipe Length of screen: 4 Size of well: 8"

Original GPM 160 with 15.8 (10.1 GPF) feet of drawdown from top of pipe

Static before treatment: 2.60 from top of pipe AG - 2.50

Depth of well before treatment: 36.20 from top of pipe

Capacity of well before treatment: 10 GPM Drawdown before treatment:

Kind of treatment used: AQUA-FREED PROCESS

Amount of treatment used:

Capacity of well after treatment: 155 GPM Drawdown after treatment: 15.10 (10.2 GPF)

Static water level after treatment: 2.60 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 10 HRS

Remarks: When the main valve closed and the water level in the well pumped down a leak of about 50 GPM was detected at the pipe connection to the well

Total hours to complete job: 11 HRS

Condition of well on completion of work: 100% of original

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA samples were taken

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Frank Sullivan Signature of customer:

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 6-15-98 Date Finisher: 6-16-98

Name and Address of Job: TOWN OF SHARON, MA

Customer's representative in charge of this work: AMORY ENGINEERS

Well number and location: PUMP STA #2 8" well #9

Well installed originally by: F.G. SULLIVAN DRILLING CO INC

Type of work to be done: AQUA-FREED TREATMENT AND REDEVELOPMENT

Name of driller: FRANK SULLIVAN JR Helpers: CARLOS TORO

Depth of well: 34' from top of pipe Length of screen: 5' Size of well: 8"

Original GPM 170 with 16.0 (10.6 GPF) feet of drawdown from top of pipe

Static before treatment: 2.40 from top of pipe A.G-110

Depth of well before treatment: 31.70 from top of pipe

Capacity of well before treatment: 256pm Drawdown before treatment:

Kind of treatment used: AQUA-FREED process

Amount of treatment used:

Capacity of well after treatment: 1476pm Drawdown after treatment: 13.50 (10.8 GPF)

Static water level after treatment: 2.50 from top of pipe

Type of condition of pump: VACUUM SYSTEM

Hours moving to and from job:

Hours removing and resetting pump:

Hours surging and installing and removing surge pump: 11 HRS

Remarks:

Total hours to complete job: 12 HRS

Condition of well on completion of work: 100% of original

Was pump reconditioned before reinstalling:

Remarks: SECONDARY AND BACTERIA SAMPLES WERE TAKEN

THE WELL WAS CHLORINATED UPON COMPLETION

Signature of driller: Dennis J. Sullivan Signature of customer:







**F.G. SULLIVAN DRILLING CO., INC.**

408 Parker Road  
Lancaster, MA 01523  
Tel. (978) 385-2932

SHARON Pump STA #2

BEFORE CLEANING

CUSTOMER Town of SHARON MA 8" Well #3

PAGE

WELL NO.	WEILL	OBS	OBS	OBS	OBS	OBS	OBS
	No. #3	No.	No.	No.	No.	No.	No.
PIPE ABOVE GROUND	1.50						
STATIC WATER LEVEL	3.00						

WEATHER and DATE	ORFICE TIME	INCHES	G.P.M.				
5-22-98	2min		100	13.40			
	3		100	13.70			
	4		100	13.90			
	5		100	14.10			
	10		100	14.70			
	20		100	14.70			
	30		100	14.75			
	40		100	14.80			
	50		100	14.80			
	60		100	14.80			
			RECOVERY				
	2min			4.50			
	5min			3.80			
					From top of pipe		
			STATIC - 3.00	"	"		
			AG - 1.50	"	"		
			DEPTH - 40.75	"	"		
			Top of screen - 34.45	"	"		



**F.G. SULLIVAN DRILLING CO., INC.**

408 Parker Road  
Lancaster, MA 01523  
Tel. (978) 365-2932

Pump STA #2

BEFORE CLEANING

CUSTOMER TOWN OF SHARON MA 8" WELL # 5

PAGE

	WELL	OBS	OBS	OBS	OBS	OBS	OBS
	No.	No.	No.	No.	No.	No.	No.
WELL NO.	45						
PIPE ABOVE GROUND	1.20						
STATIC WATER LEVEL	3.60						

WEATHER and DATE	ORFICE TIME	INCHES	G.P.M.				
5-26-98	1min		20	13.00			
	2		20	17.10			
	3		20	21.00			
	4		20	21.80			
	5		20	22.40			
	10		20	22.65			
	20		20	22.65			
	30		20	22.60			
	40		20	22.63			
	50		20	22.63			
	60		20	22.63			
			RECOVERY READINGS				
	1min			17.30			
	3			11.20			
	5			8.30			
			STATIC - 3.60				
			AG - 1.20				
			DEPTH - 34.60				











**APPENDIX B**

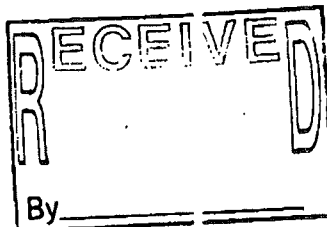
Water Quality Analyses

**ANALYTICAL BALANCE CORP.**

422 WEST GROVE STREET  
 MIDDLEBORO, MA 02346  
 508-946-2225  
 Fax 508-946-3335

Environmental Chemistry  
 Site Assessment  
 Quality Assurance Services

Environmental Services  
 Site Sampling  
 Data Analysis



17 June 1998

Sharon Water Department  
 217 R. South Main St.  
 Sharon, MA 02067

COLLECTED BY: P. Desalliers  
 TIME: see below  
 LOCATION: wells - not in service

SAMPLE DATE: 6/11/98  
 DATE RECEIVED: 6/11/98

**Results of Analysis**

Lab. I.D. No.	Sample I.D.	Coliform count/ 100 mL @ 35°C* - membrane filter	H.P.C./mL @ 35°C**	Date Analyzed
98-06-04840-1	Well #1 @ (time) 1300	Absent	16	6/11/98
98-06-04840-2	Well #2 @ 1100	Absent	24	6/11/98
98-06-04840-3	Well #3 @ 1030	Absent	220	6/11/98
98-06-04840-4	Well #4 @ 1200	Absent	67	6/11/98
98-06-04840-5	Well #5 @ 1100	Absent	3	6/11/98

NA=Not Applicable

\* The maximum contaminant level (MCL) as adopted by the Commonwealth of Massachusetts in drinking water is absent (based on the presence/absence of total coliform).

\*\* Currently there are no limits (recommended or mandated) for this parameter. The Department of Public Health guideline is <500 per mL (this is merely presented for guidance).

Bacteriologically, this water meets the Maximum Contaminant Level requirement as established by the Commonwealth of Massachusetts for drinking water.

Analytical method:

Coliform count: Standard Methods 9222B - 18<sup>th</sup> ed.

Heterotrophic plate count: Standard Methods 9215B - 18<sup>th</sup> ed.

*[Signature]*  
 Laboratory Manager / Date

**ANALYTICAL BALANCE CORP.**

422 WEST GROVE STREET  
 MIDDLEBORO, MA 02341  
 508-946-2225  
 Fax 508-946-3335

Environmental Chemistry  
 Site Assessment  
 Quality Assurance Services

Environmental Services  
 Site Sampling  
 Data Auditing

29 June 1998

Sharon Water Dept.  
 217 R. S. Main St.  
 Sharon, MA 02067

COLLECTED BY: P. Desalliers  
 TIME: See Below  
 LOCATION: Special Samples

SAMPLE DATE: 06/19/98  
 DATE RECEIVED: 06/19/98

**RESULTS OF ANALYSIS**

Lab. I.D. No.	Sample I.D.	Coliform count/ 100 mL @ 35°C - membrane filter	H.P.C./mL@ 35°C**	Date Analyzed
98-06-05129-1	Well #6 @1000	Present (1)	290	6/20/98
98-06-05129-2	Well #7 @1100	Present (1)	150	6/20/98
98-06-05129-3	Well #8 @1100	Present (9)	22	6/20/98
98-06-05129-4	Well #9 @1200	Absent	4	6/20/98

\* The maximum contaminant level (MCL) as adopted by the Commonwealth of Massachusetts in drinking water is absent (based on the presence/absence of total coliform).

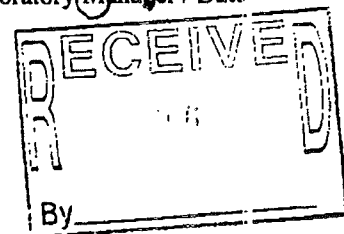
\*\* Currently there are no limits (recommended or mandated) for this parameter. The Department of Public Health guideline is <500 per mL (this is merely presented for guidance).

Analytical method:

Coliform count: Standard Methods 9222B - 18<sup>th</sup> ed.

Heterotrophic plate count: Standard Methods 9215B - 18<sup>th</sup> ed.

*[Signature]* 6/19/98  
 Laboratory Manager / Date



**ANALYTICAL BALANCE CORP.**

422 WEST GROVE STREET  
 MIDDLEBORO, MA 02341  
 508-946-2225  
 Fax 508-946-3335

Environmental Chemistry  
 Site Assessment  
 Quality Assurance Services

Environmental Services  
 Site Sampling  
 Data Auditing

25 June 1998

Sharon Water Department  
 P.O. Box 517  
 Sharon, MA 02067

COLLECTED BY: P. Desalliers  
 TIME: 0950 & 1245  
 LOCATION: 1) Well #1  
 2) Beaver Brook

SAMPLE DATE: 06/02/98  
 DATE RECEIVED: 06/03/98  
 SAMPLE ID: 98-06-04525

**RESULTS OF ANALYSIS**

PARAMETER	ANALYTICAL METHOD	DET. LIMIT	DATE ANALYZED	RESULT #1	RESULT #2
Turbidity (NTU)	S.M. 2130 B	0.25	6/4/98	1.0	0.85
TDS	S.M. 60.1	4.2	6/10/98	184	103
Color (color units)	S.M. 2120B	----	6/4/98	2	60
Odor (TON)	S.M. 2150B	----	6/3/98	NOO	100
pH	S.M. 4500-H'B	----	6/4/98	6.0	6.7
Alkalinity - Total	S.M. 2320 B	1.0	6/4/98	64.0	20.0
Hardness (CaCO <sub>3</sub> )	S.M. 2340 C	4.0	6/22/98	112	38.0
Calcium (Ca)	S.M. 3500-Ca D	2.0	6/22/98	27.2	9.6
Magnesium (Mg)	S.M. 3111B	0.01	6/11/98	11.9	3.20
Aluminum (Al)	S.M. 3113B	0.005	6/5/98	0.005	0.046
Potassium (K)	S.M. 3111B	0.10	6/10/98	1.01	0.86
Iron (Fe)	S.M. 3111B	0.02	6/11/98	0.24	0.19
Manganese (Mn)	S.M. 3111B	0.01	6/11/98	0.03	0.03
Sulfate (SO <sub>4</sub> )	S.M. 4500-SO <sub>4</sub> E	10.0	6/22/98	15.5	<10.0

RECEIVED  
 JUN 11 1998  
 By \_\_\_\_\_

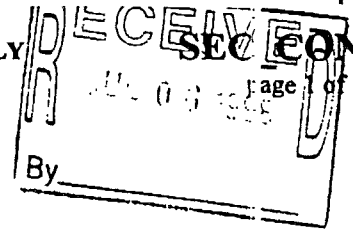
PARAMETER	ANALYTICAL METHOD	DET. LIMIT	DATE ANALYZED	RESULT #1	RESULT #2
Chloride (Cl)	S.M. 4500CIB	2.0	6/22/98	32.5	28.0
Silver (Ag)	S.M. 3111B	0.01	6/9/98	ND	ND
Copper (Cu)	S.M. 3111B	0.02	6/9/98	ND	0.02
Zinc (Zn)	S.M. 3111B	0.005	6/9/98	0.007	0.036

Standard Methods, 18<sup>th</sup> edition, 1992

*Frank B. Beck 6/25/98*

MASSACHUSETTS DEP/DIVISION OF WATER SUPPLY

SECONDARY CONTAMINANT REPORT  
(FORM #12.2)



I PWS INFORMATION:

1. PWS ID#: 4266000  
 2. City/Town: Sharon  
 3. PWS Name: Sharon Water Department  
 4. PWS Class (circle one): COM NTNC NC  
 5. Source ID#                      6. Sample Location                      7. Date Collected                      8. Collected by                       
 A: 4266000-01G Well #2 6/11/98 P. Desalliers  
 B: 4266000-02G Well #3 6/11/98 P. Desalliers  
 C: 4266000-03G Well #4 6/11/98 P. Desalliers  
 D: 4266000-04G Well #5 6/11/98 P. Desalliers

9. Is the source treated? N 10. Was the sample collected after treatment?                       
 11. Manifoldd [ ] If applicable, list the connected sources:                     

Notes:                     

II LABORATORY ANALYTICAL INFORMATION:

Lab Name: ANALYTICAL BALANCE CORP. Lab Cert.#: M-M-1022  
 Subcontracted? (Y, N) N (use symbols to relate each analyte to a specific lab)  
 Sub. Lab Name:                      Lab Cert. #:                      Lab Symbol:                       
 Notes:                     

Lab Sample ID	Analytical method	Detection Limit	Date Analyzed	Results (mg/L)				Lab Symbc
				A	B	C	D	
4817-1								
Turbidity (NTU)	S.M. 2130 B	0.25	6/22/98	2.0	1.0	5.1	25	
TDS	S.M. 60.1	4.2	6/19/98	94	230	80	96	
Color (color units)	S.M. 2120B	-----	6/22/98	7	0	10	80	
Odor (TON)	S.M. 2150B	-----	6/11/98	NOO	NOO	NOO	NOO	
pH	S.M. 4500-H+B	-----	6/13/98	5.0	6.0	5.7	6.0	
Alkalinity - Total (CaCO <sub>3</sub> )	S.M. 2320 B	1.0	6/13/98	32.0	58.0	35.0	40.5	
Hardness (CaCO <sub>3</sub> )	S.M. 2340 C	4.0	6/22/98	49.0	128	42.0	46.0	
Calcium (Ca)	S.M. 3500-Ca D	2.0	6/22/98	12.0	31.2	10.4	10.4	
Magnesium (Mg)	S.M. 3111B	0.01	6/22/98	3.14	14.5	2.64	4.04	
Aluminum (Al)	S.M. 3113B	0.005	6/19/98	0.06	ND	ND	0.008	
Potassium (K)	S.M. 3111B	0.10	6/19/98	0.5	1.09	0.71	0.63	
Iron (Fe)	S.M. 3111B	0.02	6/22/98	1.5	0.16	3.80	6.00	
Manganese (Mn)	S.M. 3111B	0.01	6/22/98	0.6	0.50	0.37	0.26	
Sulfate (SO <sub>4</sub> )	S.M. 4110B	10.0	6/29/98	10.1	21.3	<10.0	10.3	


PWS ID #: 4266000

Town: Sharon

**SEC\_CON**

page 2 of

	Analytical method	Detection Limit	Date Analyzed	Results (mg/L)				Lab Symbol
				A	B	C	D	
Chloride (Cl)	S.M. 4500ClB	2.0	6/22/98	8.5	44.0	4.5	9.0	
Silver (Ag)	S.M. 3111B	0.01	6/18/98	ND	ND	ND	ND	
Copper (Cu)	S.M. 3111B	0.02	6/18/98	ND	ND	ND	ND	
Zinc (Zn)	S.M. 3111B	0.005	6/18/98	0.02	0.007	0.007	ND	

Laboratory Director Signature and Date  2 July 1998

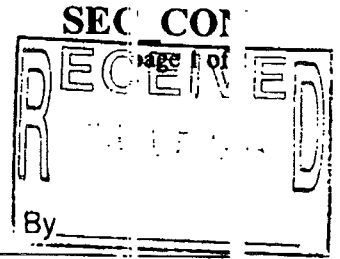
Attention: Mail TWO copies of this report to your DEP Regional Office within 30 days of receipt of results and no later than 10 days after the end of the reporting period.

*For DEP/DWS use only: Please initial and date as completed.*

Accepted:	Disapproved:	Date entered into WQTS:
Comments:		

MASSACHUSETTS DEP/DIVISION OF WATER SUPPLY

SECONDARY CONTAMINANT REPORT  
(FORM #12.2)



I PWS INFORMATION:

1. PWS ID#: 4266000 2. City/Town: Sharon  
 3. PWS Name: Sharon Water Dept. 4. PWS Class (circle one): COM NTNC NC  
 5. Source ID# 6. Sample Location 7. Date Collected 8. Collected by  
 A: 4266000-05G Well #6 6/ 9/98 P. Desalliers  
 B: 4266000-06G Well #7 6/ 9/98 P. Desalliers  
 C:                      Well #8 6/ 9/98 P. Desalliers  
 D:                      Well #9 6/ 9/98 P. Desalliers

9. Is the source treated? N 10. Was the sample collected after treatment?                       
 11. Manifoldd [  ] If applicable, list the connected sources:                     

Notes:                     

II LABORATORY ANALYTICAL INFORMATION:

Lab Name: ANALYTICAL BALANCE CORP. Lab Cert.#: M-M.1022  
 Subcontracted? (Y, N) N (use symbols to relate each analyte to a specific lab)  
 Sub. Lab Name:                      Lab Cert. #:                      Lab Symbol:                       
 Notes:                     

Lab Sample ID	Analytical method	Detection Limit	Date Analyzed	Results (mg/L)				Lab Symbo
				A	B	C	D	
				5130-1	5130-2	5130-3	5130-4	
Turbidity (NTU)	S.M. 2130 B	0.25	7/6/98	23.0	3.0	10.0	7.1	
TDS	S.M. 60.1	4.2	6/25/98	150	216	84	64	
Color (color units)	S.M. 2120B	-----	7/6/98	75	20	50	40	
Odor (TON)	S.M. 2150B	-----	6/19/98	NO	NOO	NOO	NOO	
pH	S.M. 4500-H*B	-----	6/20/98	6.5	6.0	6.0	5.8	
Alkalinity - Total (CaCO <sub>3</sub> )	S.M. 2320 B	1.0	6/20/98	55.0	79.0	47.0	36.0	
Hardness (CaCO <sub>3</sub> )	S.M. 2340 C	4.0	7/7/98	76.0	128.0	42.0	24.0	
Calcium (Ca)	S.M. 3500-Ca D	2.0	7/7/98	17.5	27.2	8.8	6.4	
Magnesium (Mg)	S.M. 3111B	0.01	7/8/98	7.13	12.6	2.83	1.58	
Aluminum (Al)	S.M. 3113B	0.005	7/6/98	NI	0.040	0.008	0.063	
Potassium (K)	S.M. 3111B	0.10	7/8/98	1.04	1.11	0.65	0.53	
Iron (Fe)	S.M. 3111B	0.02	7/8/98	7.75	0.84	5.50	7.80	
Manganese (Mn)	S.M. 3111B	0.01	7/8/98	0.83	0.91	0.69	1.25	
Sulfate (SO <sub>4</sub> )	S.M. 4110B	10.0	6/30/98	14.4	15.2	11.2	<10.0	



PWS ID #: 4266000

Town: Sharon

**SEC\_COI**  
page 2 of

	Analytical method	Detection Limit	Date Analyzed	Results (mg/L)				Lab Symbol
				A	B	C	D	
Chloride (Cl)	S.M. 4110 B	2.0	6/30/98	31.3	39.5	7.8	5.3	
Silver (Ag)	S.M. 3111B	0.01	7/6/98	ND	ND	ND	ND	
Copper (Cu)	S.M. 3111B	0.02	7/7/98	ND	ND	ND	ND	
Zinc (Zn)	S.M. 3111B	0.005	7/6/98	ND	0.010	0.007	0.005	

Laboratory Director Signature and Date  15 July 1998

Attention: Mail TWO copies of this report to your DEP Regional Office within 30 days of receipt of results and no later than 10 days after the end of the reporting period.

*For DEP/DWS use only: Please initial and date as completed.*

Accepted:	Disapproved:	Data entered into WQTS:
Comments:		

REPORT ON  
REDEVELOPMENT OF PUMPING  
STATION NO. 2 WELLFIELD

SHARON, MASSACHUSETTS  
JUNE 1992

AMORY ENGINEERS, P.C.  
DUXBURY, MASSACHUSETTS

AMORY ENGINEERS, P.C.

P.O. BOX 1768, 25 DEPOT STREET, DUXBURY, MASSACHUSETTS 02331-1768  
(617) 934-0178

WALTER AMORY  
DAVID A. JACOBSEN

RICHARD S. JOHNSON  
THOMAS C. SEXTON

WATER WORKS  
WATER RESOURCES  
CIVIL WORKS  
LAND USE  
WATER RATES

REPORTS  
DESIGN  
ADVICE  
CONSTRUCTION  
SERVICES

June 25, 1992

Mr. John A. Sulik, P.E.  
Superintendent  
Department of Public Works  
P. O. Box 517  
Sharon, MA 02067-0517

Re: Redevelopment of Pumping Station No. 2 Wellfield  
and Appurtenant Work, Contract 1991-W1

Dear Mr. Sulik:

This letter is to advise you of the results of redevelopment of Pumping Station No. 2 Wellfield. This project was recommended as part of the Phase 1 Construction Program in the Water Master Plan Update. Bids for Contract 1991-W1 were opened on December 18, 1991. The Contract was executed with F. G. Sullivan Drilling Company of Lancaster, MA on February 28, 1992. The work began on March 5, 1992 and was completed on April 7, 1992.

Well Redevelopment. The first phase of the work consisted of redevelopment of the nine 8-in. production wells by pumping and surging with and without chemicals. Well locations are shown on Appendix Figure A-1. Chemicals used for redevelopment included muriatic acid, hexametaphosphate and calcium hypochlorite.

Mr. John A. Sulik, P.E.  
June 24, 1992  
Page 2

Specific capacities of the wells were measured prior to, during and upon completion of well redevelopment. Specific capacities prior to and upon completion of redevelopment are summarized in Table 1 and presented in the driller's logs in Appendix A. Original specific capacities when the wells were new are also presented in Table 1 for comparison. Results show that specific capacities recovered to between 72 and 130 percent of original.

Upon completion of well redevelopment, the tops of the wells were fitted with 1-in. drop pipes and vacuum gauges for monitoring water levels. Protective steel caps were installed over the tops of the wells.

Water Quality. Water samples were taken from each of the wells after redevelopment and analyzed by Reitzel Laboratories, Clinton, MA. Results indicate that iron and manganese concentrations are acceptable in about half of the wells and excessive in the other half. For aesthetic purposes, the recommended limits for iron and manganese are 0.30 mg/l and 0.05 mg/l, respectively. Iron levels ranged from less than 0.05 mg/l (Wells 3 and 4) to 4.20 mg/l (Well 1). Manganese levels ranged from 0.02 mg/l (Wells 7) to 1.10 mg/l (Well 1). Combined iron and manganese levels were highest in Wells 1, 6 and 8 at 5.3, 2.6 and 2.5 mg/l,

**TABLE 1. RESULTS OF REDEVELOPMENT OF WELLFIELD No. 2**

WELL NUMBER	ORIGINAL WELL CAPACITY			BEFORE REDEVELOPMENT			AFTER REDEVELOPMENT				
	RATE (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY (GPM/FT)	RATE (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY (GPM/FT)	% OF ORIGINAL RATE	RATE (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY (GPM/FT)	% OF ORIGINAL RATE
1	200	13.8	14.49	50	22.7	2.20	25.0	180	15.6	11.54	90.0
2	150	11.4	13.16	18	19	0.95	12.0	190	15.6	12.18	126.7
3	150	13.9	10.79	100	19.1	5.24	66.7	160	15.7	10.19	106.7
4	130	14.1	9.22	40	15.25	2.62	30.8	97	14.35	6.76	74.6
5	200	9.2	21.74	23	22.1	1.04	11.5	240	12.8	18.75	120.0
6	160	15.5	10.32	50	23.6	2.12	31.3	190	18.6	10.22	118.8
7	200	9.3	21.51	50	22.8	2.19	25.0	260	13.1	19.85	130.0
8	160	15.8	10.13	50	22.2	2.25	31.3	115	11.2	10.27	71.9
9	170	16	10.63	50	20.4	2.45	29.4	136	12.5	10.88	80.0

**TABLE 2. RESULTS OF WATER QUALITY ANALYSES**

WELL NUMBER	pH (S.U.)	CONDUCTIVITY (micromhos/cm)	ODOR (T.O.N.)	TURBIDITY (NTU)	COLOR (C.U.)	NITRATE (Mg/l)	IRON (Mg/l)	MANGANESE (Mg/l)	TOTAL HARDNESS (Mg/l)	CHLORIDE (Mg/l)	SODIUM (Mg/l)
1	4.25	445	ND**	6.0	15	4.1	4.20	1.10	145	111	17
2	5.58	109	ND**	1.5	5	1.1	0.07	0.08	25	12	10
3	6.02	340	ND**	0.5	0	5.5	<.05	0.05	126	42	18
4	5.60	67	ND**	1.5	10	0.2	<.05	<.04	8	8	12
5	5.74	105	ND**	2.0	11	0.5	0.13	<.04	17	13	17.5
6	5.83	450	ND**	35.0	140	3.5	1.60	1.03	119	98	41
7	6.15	390	ND**	0.5	0	3.9	<.08	0.02	116	58	28
8	6.15	105	2*	4.0	30	0.4	2.30	0.15	23	23	9
9	5.70	96	ND**	2.0	15	0.1	0.60	0.24	21	17	8
COMPOSITE	6.81	25	ND**	7.3	25	2.3	1.79	0.30	76	40	14.4

\* - SULFIDE

\*\* - NONE DETECTED

Mr. John A. Sulik, P.E.  
June 24, 1992  
Page 4

respectively. A composite sample from all nine wells, analyzed by Oliveira Laboratories, West Bridgewater, MA, showed a iron level of 1.79 mg/l and manganese level of 0.30 mg/l, both in excess of recommended limits.

Turbidity was detected in all samples, ranging from 0.5 NTU (Well 3) to 35 NTU (Well 6) in the individual samples, and 7.2 NTU in the composite sample. While there is no MCL maximum contaminant levels for turbidity of groundwater, turbidity of 1.0 NTU or less is a desirable performance standard.

Nitrate levels were highest in Wells 1, 3, 6 and 7, ranging from 3.5 to 4.1 mg/l. Nitrate levels in other wells and in the composite sample were 2.3 mg/l or less. The MCL for nitrate is 10 mg/l.

Results of water quality analyses are summarized in Table 2 and presented in Appendix B.

Pump and Piping Tests. The second phase of the work included investigation of wellfield suction piping for leaks and wellfield pumping units for acceptable performance. During redevelopment, a leak was found in the piping connection to Well 8 and repaired by Water Division personnel. Subsequent to repair, the wellfield suction piping between individual well isolation valves and the

Mr. John A. Sulik, P.E.  
June 24, 1992  
Page 5

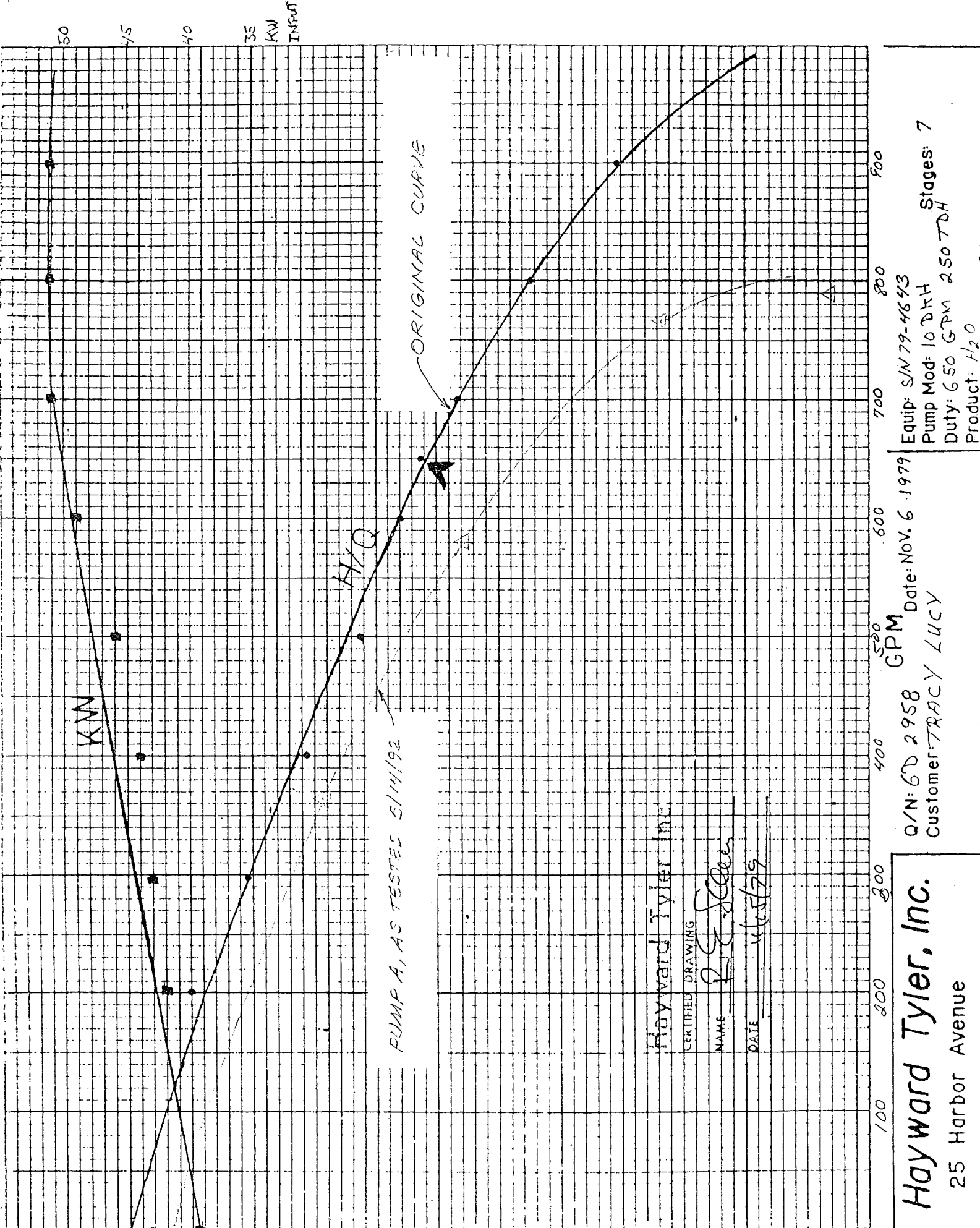
pumps was subjected to a vacuum test. Results showed no leakage.

On May 14, 1992, pump performance tests were performed on the station's two horizontal turbine pumps, the wellfield pumping units. The results, presented in Table 3 and in Figure 1 for Pump A and Table 4 and Figure 2 for Pump B, show that each pump is operating below original capacity. We believe the reduced performance is the result of normal pump wear for twelve-year-old pumps.

Conclusions and Recommendations. Wellfield water levels should be recorded monthly or more frequently, depending on use. Specific capacity of individual wells should be evaluated annually to determine their rates of decline and timing of future redevelopment.

Iron and manganese have been and continue to be problematic at Station 2. Water quality will continue to cause consumer complaints unless the supply is treated or operated selectively. Until treatment is provided, we recommend that the Water Division operate Station 2 in lag position after other better-water-quality wells, and only as water system demands require. To reduce composite iron and manganese concentrations, we recommend that one or more

FIGURE 1



Equip: S/N 79-4643  
 Pump Mod: 10 DKH  
 Duty: 650 GPM 250 TDH  
 Product: H<sub>2</sub>O

Q/N: 6D 2958  
 Customer: TRACY LUCY  
 Date: Nov. 6 1979

Hayward Tyler Inc.  
 CERTIFIED DRAWING  
 NAME: R.E. Steen  
 DATE: 11/17/79

**Hayward Tyler, Inc.**  
 25 Harbor Avenue

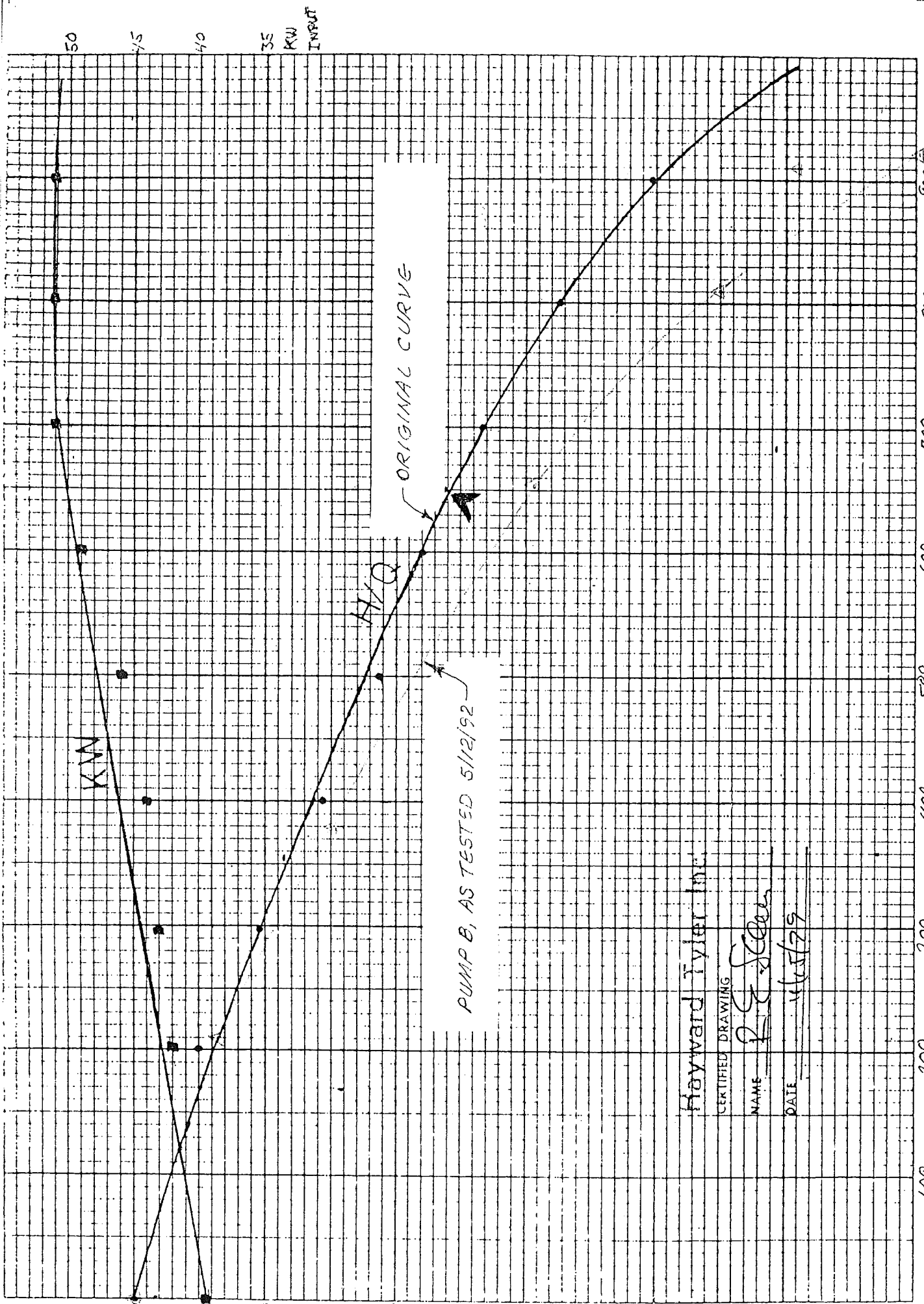


**TABLE 3**  
**SHARON DEPARTMENT OF PUBLIC WORKS**  
**WATER DIVISION**  
**PUMP TEST SUMMARY FORM**

FACILITY: Wellfield Pumping Station No. 2

<u>PUMP CERTIFIED CURVE DATA</u>																			
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">PUMP No.: A</td> <td style="width: 50%;">MFG: Hayward Tyler Inc.</td> </tr> <tr> <td>DESIGN CONDITION: 650 GPM</td> <td>275 TDH</td> </tr> <tr> <td>TEST BY: TCS</td> <td>DATE: 5/14/92</td> </tr> <tr> <td>SERIAL No.: 79-4643</td> <td>MODEL No.: 10 DKH</td> </tr> <tr> <td colspan="2">STAGES: 7</td> </tr> </table>										PUMP No.: A	MFG: Hayward Tyler Inc.	DESIGN CONDITION: 650 GPM	275 TDH	TEST BY: TCS	DATE: 5/14/92	SERIAL No.: 79-4643	MODEL No.: 10 DKH	STAGES: 7	
PUMP No.: A	MFG: Hayward Tyler Inc.																		
DESIGN CONDITION: 650 GPM	275 TDH																		
TEST BY: TCS	DATE: 5/14/92																		
SERIAL No.: 79-4643	MODEL No.: 10 DKH																		
STAGES: 7																			
<u>ELECTRIC METER</u>  DISK CONSTANT: 1.2  TRANSFORMER RATIO, M120					<u>MOTOR NAME PLATE DATA</u>  MOTOR MFG.: Hayward Tyler (Super Seven 10") HP.: 60      TYPE: MK7      DESIGN: 10/60/475A TEMP RISE:      RPM: 1750      AMPS: 60 VOLTS: 460      PHASE: 3      CYCLE: 60 SERIAL No.:      S.F.: 1.15														
1	2	3	4	5	6	7	8	9	10										
TEST No.	FLOW		SUCTION		DISCHARGE PRESSURE		GAGE CORR. (ft)	TDH (ft)	WATER HP										
	BY TIR (gpm)	BY PILOT GAGE (psi/gpm)	(in.Hg)	(ft)	(psi)	(ft)													
1	900	35 / 788	9	9.9	45	104.0		114	22.7										
2	650	19 / 580	6	6.6	111	256.4		263	38.5										
3	400	7.5 / 364	3	3.3	138	318.8		322	29.6										
4	800	33 / 765	8	8.8	75	173.3		182	35.2										
5	0	0	0	0	166	383.5		383											

FIGURE 2



Equip: S/N 79-4643  
 Pump Mod: 10 DRH  
 Duty: 650 GPM 250 TDH  
 Product: H<sub>2</sub>O  
 Stages: 7

Q/N: 6D 2958 Date: Nov. 6 1979  
 Customer: TRACY LUCY

Hayward Tyler, Inc.  
 CERTIFIED DRAWING  
 NAME: R. E. Steen  
 DATE: 11/17/79

Hayward Tyler, Inc.  
 25 Harbor Avenue  
 Normal, Conn 06850

**TABLE 4**  
**SHARON DEPARTMENT OF PUBLIC WORKS**  
**WATER DIVISION**  
**PUMP TEST SUMMARY FORM**

FACILITY: Wellfield Pumping Station No. 2

<u>PUMP CERTIFIED CURVE DATA</u>																			
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">PUMP No.: B</td> <td style="width: 50%;">MFG: Hayward Tyler Inc.</td> </tr> <tr> <td>DESIGN CONDITION: 650 GPM</td> <td>275 TDH</td> </tr> <tr> <td>TEST BY: TCS</td> <td>DATE: 5/14/92</td> </tr> <tr> <td>SERIAL No.: 79-4644</td> <td>MODEL No.: 10 DKH</td> </tr> <tr> <td colspan="2">STAGES: 7</td> </tr> </table>										PUMP No.: B	MFG: Hayward Tyler Inc.	DESIGN CONDITION: 650 GPM	275 TDH	TEST BY: TCS	DATE: 5/14/92	SERIAL No.: 79-4644	MODEL No.: 10 DKH	STAGES: 7	
PUMP No.: B	MFG: Hayward Tyler Inc.																		
DESIGN CONDITION: 650 GPM	275 TDH																		
TEST BY: TCS	DATE: 5/14/92																		
SERIAL No.: 79-4644	MODEL No.: 10 DKH																		
STAGES: 7																			
<u>ELECTRIC METER</u>  DISK CONSTANT: 1.2  TRANSFORMER RATIO, M120			<u>MOTOR NAME PLATE DATA</u>  MOTOR MFG.: Hayward Tyler (Super Seven 10") HF.: 60 TYPE: MK7 DESIGN: 10/60/475A TEMP RISE: RPM: 1750 AMPS: 60 VOLTS: 460 PHASE: 3 CYCLE: 60 SERIAL No.: S.F.: 1.15																
1	2	3	4	5	6	7	8	9	10										
TEST No.	FLOW		SUCTION		DISCHARGE PRESSURE		GAGE CORR. (ft)	TDH (ft)	WATER HP										
	BY TIR (gpm)	BY PILOT GAGE (psi/gpm)	(in.Hg)	(ft)	(psi)	(ft)													
1	1100	12 / 922	12.5	13.8	36.5	84.3		98	22.8										
2	1000	46.5 / 907	11	12.1	58	134.0		146	33.4										
3	900	37 / 810	10	11.0	73	168.6		180	36.8										
4	750	24 / 652	7.5	8.2	103	237.9		246	40.5										
5	450	8 / 376	4	4.4	139	321.1		325	30.9										
6	100	2.5 / 209	2	2.2	158	365.0		367	25.1										
7	0	0	0	0	172	397		397	0										

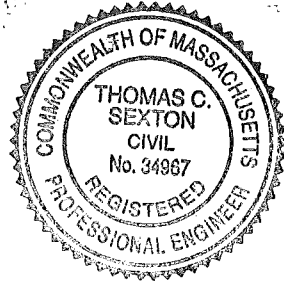
Mr. John A. Sulik, P.E.  
June 24, 1992  
Page 10

of the individual wells with poorer water quality (i.e., Wells No. 1, 6 and 8), be shut off. Composite sampling should be repeated after each well is shut off, to assess improvement in water quality.

Since pump performances have not declined excessively, we recommended against pump replacement at this time. Pump performance should be evaluated annually.

Very truly yours,

AMORY ENGINEERS, P.C.



By:

*Thomas C. Sexton*

Thomas C. Sexton, P.E.

TCS:vs  
enc

**APPENDIX A**

**Figure A-1**

**Well Redevelopment Logs**



LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523

Date Started: 4/17/92 Date Finished: 4/23/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #1

Well installed originally by: F.G. Sullivan Drilling Co., Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

Depth of well: 41.70 of pipe Length of screen: 5' Size of well: 8"

Original GPM 200 with 13.8 feet of drawdown from top of pipe

Static before treatment: 3.60 From top of pipe A.G. - 0.70

Depth of well before treatment: 41.70 from top of pipe

Capacity of well before treatment: 50 GPM Drawdown before treatment: 22.70

Kind of treatment used: Muratic acid & Rodine 308 - Hexametaphosphate-Calcium

Amount of treatment used: 55 Gals. & 1 Pt. - 100 lbs. Hypochlorite - 20 lbs.

Capacity of well after treatment: 180 GPM Drawdown after treatment: 15.60 (11.5 GPF)

Static water level after treatment: 3.60 From top of pipe

Type of condition of pump: -

Hours moving to and from job: 1 Hr.

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 34 Hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 34 Hrs. 1 Hr. Travel

Condition of well on completion of work: Good

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:



# F. G. SULLIVAN DRILLING CO., INC.

GRAVEL WELLS - TEST BORINGS - WELL RECONDITIONING • ANYWHERE IN NEW ENGLAND

PARKER ROAD • LANCASTER, MASS. 01523  
TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #1

4/17/92 - Set up the rig and installed 42' of 4" surge pipe, with an 8" surge set 1 ft. above the top of the screen and test pumped the well.

GPM - 50 with drawdown to 26.30' (2.2 GPF)  
Static from top of pipe - 3.60 A.G. - 0.70  
Depth from top of pipe - 41.70 Top of screen - 35.60 from top of pipe  
Screen length - 5'

The well was then pumped and surged for 7 hrs. The well then pumped 75 GPM with drawdown to 26.20 (3.3 GPF)  
Hrs - 8

4/21/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. of Rodine 308, by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it, chased by 25 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 5½ hrs. We then pumped and surged the well for 1 hr. the well then pumped 100 GPM with drawdown to 25.00 (4.7 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

A mixture of 100 lbs. of Hexametaphosphate with 300 gals of water was pumped into the well by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 50 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 20 lbs. of calcium hypochlorite and 250 gals. of water was pumped into the well, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. and left overnight.

Hrs. - 10

4/22/92 - Surged the well without pumping for 5 mins. every 15 mins. for 3 hrs. Then pumped and surged the well for 5 hrs. the well then pumped 172 GPM with drawdown to 19.70 (10.7 GPF).

Hrs. - 8



Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #1  
Page 2

4/23/92 - Surged and pumped the well for 7 hrs. the well then pumped 180 GPM with drawdown to 19.20 (11.5 GPF).

Depth after cleaning - 41.7 from top of pipe

The 4" surge pipe was pulled from the well. The rig was taken down and returned to Lancaster, MA

Hrs - 8      1 Hr. Travel

Total Hrs - 34      Travel - 1 hr.

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #1  
Page 2

4/23/92 - Surged and pumped the well for 7 hrs. the well then pumped 180 GPM with drawdown to 19.20 (11.5 GPF).

Depth after cleaning - 41.7 from top of pipe

The 4" surge pipe was pulled from the well. The rig was taken down and returned to Lancaster, MA

Hrs - 8      1 Hr. Travel

Total Hrs - 34      Travel - 1 hr.

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 4/13/92 Date Finished: 4/16/92

Name and Address of Job: Town of Sharon, MA at Pump Sta. #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #2

Well installed originally by: F.G. Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

Depth of well: 40.50 of pipe Length of screen: 5' Size of well: 8"

Original GPM 150 with 11.4 feet of drawdown from top of pipe

Static before treatment: 5.00 from top of pipe

Depth of well before treatment: 40.50 from top of pipe A.G. - 1.60

Capacity of well before treatment: 18 GPM Drawdown before treatment: 19.00 (0.9 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium Hypochlorite

Amount of treatment used: 55 Gals & 1 Pt. - 100 lbs. - 20 lbs.

Capacity of well after treatment: 190 GPM Drawdown after treatment: 15.6' (12.17 GPF)

Static water level after treatment: 5.00 from top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 34 hrs

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 34 Hrs.

Condition of well on completion of work: Good

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:



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Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #2

4/13/92 - Moved the rig from Well #3 and set it up. We then installed 42' of 4" surge pipe with an 8" surge set 1 ft above the top of the screen. We then test pumped the well.

GPM - 18 with drawdown to 24.00 (0.9 GPF)  
Static from top of pipe - 5.00      A.G. - 1.60  
Depth from top of pipe - 40.50  
Top of screen - 33.7 from top of pipe  
Screen length - 5'

The well was pumped and surged for 6 hrs. The well then pumped 26 GPM with drawdown to 25.00' (1.3 GPF)

Hrs. - 7

4/14/92 - Pumped into the well 55 gals of muratic acid with 1 pt. of Rodine 308, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 20 gals of water. The well was then surged without pumping for 5 mins every 15 mins for 5½ hrs. We then pumped and surged the well for 1 hrs. The well then pumped 115 GPM with drawdown to 24.00 (6.0 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. We then pumped into the well a mixture of 100 lbs. of hexametaphosphate and 300 gals. of water, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals of water. The well was then surged without pumping for 5 mins every 15 mins for 1½ hrs. A mixture of 20 lbs. of calcium hypochlorite and 200 gals of water was pumped into the well, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 mins every 15 mins for 1½ hrs and left overnight.

Hrs. - 9½

4/15/92 - Surged the well without pumping for 5 mins every 20 mins for 3 hrs. The well was then pumped and surged for 5½ hrs. The well then pumped 180 GPM with drawdown to 20.6' (11.5 GPF).

Hrs-8½

4/16/92 - Pumped and surged the well for 8 hrs. The well then pumped 190 GPM with drawdown to 20.60' (12.17 GPF)

Depth after cleaning - 40.50 from top of pipe

The 4" surge pipe was pulled from the well, the rig was taken down and moved to Well #1.

Hrs - 9

Total Hrs - 34 hrs.

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 4/7/92 Date Finished: 4/13/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #3

Well installed originally by: F.G. Sullivan Drilling Co. Inc.

Type of work to be done: Chemical treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

Depth of well: 41.30 Length of screen: 5' Size of well: 8"

Original GPM 150 with 13.9 feet of drawdown from top of pipe.

Static before treatment: 3.50' from top of pipe A.G. - 1.70

Depth of well before treatment: 41.30 from top of pipe

Capacity of well before treatment: 100 GPM Drawdown before treatment: 19.10' (5.2 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium Hypochlorite

Amount of treatment used: 55 Gals & 1 Pt. - 100 lbs. - 20 lbs.

Capacity of well after treatment: 160 GPM Drawdown after treatment: 15.7 (10.2 GPF)

Static water level after treatment: 3.50 from top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 34 Hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 34 Hrs.

Condition of well on completion of work: Good

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:



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Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #3

4/7/92 - Moved the rig from Well #4 and set it up. Then installed 42' of 4" surge pipe with an 8" surge set 1 ft. above the top of the screen. We then test pumped the well.

GPM - 100 with drawdown to 22.60' (5.2 GPF)  
Static from top of pipe - 3.50      A.G. - 1.70  
Depth from top of pipe - 41.30  
Top of screen - 34.6 from top of pipe  
Screen length - 5'

The well was pumped and surged for 5 hrs. The well then pumped 107 GPM with drawdown to 23.90 (5.2 GPF)

Hrs. - 7

4/8/92 - Pumped into the well 55 gals of muratic acid with 1 pt. Rodine 308, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute. Chased by 30 gallons of water. The well was then surged without pumping for 5½ hrs. We then pumped and surged the well for 1½ hrs. The well then pumped 11.5 GPM with drawdown to 19.30' (7.2 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Pumped into the well a mixture of 100 lbs. of Hexametaphosphate and 300 gals of water, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 50 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 20 lbs. of calcium hypochlorite and 275 gals of water was pumped into the well, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 50 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. - 10

4/9/92 - Surged the well without pumping for 5 mins. every 15 mins. for 3 hrs. Then pumped and surged the well for 5 hrs. The well then pumped 140 GPM with drawdown to 19.40' (8.80 GPF)

Hrs. - 8

4/10/92 - Pumped and surged the well for 8 hrs. The well then pumped 160 GPM with drawdown to 19.20 (10.2 GPF).

Hrs. - 8

Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #3  
Page 2

4/13/92 - Pulled the 4" surge pipe from the well and moved the rig to well #2.

Depth after cleaning - 41.30 from top of pipe

Hrs. - 1

Total Hrs. - 34

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 4/1/92 Date Finished: 4/7/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #4

Well installed originally by: F.G. Sullivan Drilling Co., Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

From top

Depth of well: 29.10 of pipe Length of screen: 3' Size of well: 8"

Original GPM 130 with 14.10 feet of drawdown from top of pipe

Static before treatment: 4.75 from top of pipe A.G. - 1.00

Depth of well before treatment: 28.70 from top of pipe

Capacity of well before treatment: 40 GPM Drawdown before treatment: 15.25 (2.6 GPF)

Kind of treatment used: Muratic Acid - Rodine 308 - Hexametaphosphate - Calcium Hypo-chlorit

Amount of treatment used: 30 Gals - 1/2 Pt. - 100 lbs. - 15 lbs.

Capacity of well after treatment: 97 GPM Drawdown after treatment: 14.35 (6.7 GPF)

Static water level after treatment: 4.75 from top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 31 Hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 50 lbs. of light soda ash.

Total hours to complete job: 31 Hrs.

Condition of well on completion of work: Good

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:





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Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #4

4/1/92 - Set the rig up on the well and installed 29' of 4" surge pipe with an 8" surge set 1 ft. above the top of the screen. We then test pumped the well-it pumped;

GPM - 40 with drawdown to 20.00 (2.6 GPF)  
Static from top of pipe - 4.75 A.G. - 1.00  
Depth from top of pipe - 28.70  
Top of screen - 24.30 from top of pipe  
Screen length - 3'

The well was pumped and surged for 5 hrs. It then pumped 65 GPM with drawdown to 18.00 (4.9 GPF).

Hrs - 8

4/2/92 - Pumped into the well 30 gals of muratic acid with  $\frac{1}{2}$  pt. of Rodine 308, by way of the 4" surge pipe raising and lowering it the length of the screen (3') so to evenly distribute it. Chased by 25 gals of water. We then surged the well without pumping for 5 mins. every 15 mins. for  $5\frac{1}{2}$  hrs. Then pumped and surged the well for 1 hr. The well then pumped 91 GPM with drawdown to 22.40' (5.1 GPF). The acid was pumped into a settling tank where it was neutralized with 50 lbs. of light soda ash. We then pumped into the well a mixture of 100 lbs. of hexameta-phosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (3') so to evenly distribute it. Chased by 50 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. We then pumped into the well a mixture of 15 lbs. of calcium hypochlorite with 200 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (3') so to evenly distribute it. Chased by 50 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. -  $9\frac{1}{2}$

4/3/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1 hr. The well was then surged and pumped for 7 hrs. The well then pumped 97 GPM with drawdown to 19.2' (6.7 GPF).

Hrs. - 8

4/6/92 - Surged and pumped the well for 3 hrs. The well then pumped 97 GPM with drawdown to 19.10' (6.7 GPF).

Hrs. - 3

Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #4  
Page 2

4/7/92 - Pumped and surged the well for 2 hrs. The well then pumped 97 GPM with drawdown to 19.10 (6.7 GPF).

Depth of well after cleaning - 29.10' from top of pipe

The 4" surge pipe was then pulled from the well. The rig was taken down and moved to Well #3.

Hrs. -  $2\frac{1}{2}$

Total Hrs. - 31 Hrs.

**LOG OF WELL REHABILITATION**  
**F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523**

Date Started: ..3/25/92..... Date Finished: ...4/1/92.....

Name and Address of Job: ...Town of Sharon, MA at Pump Station #2.....

Customer's representative in charge of this work: ...Tom Sexton - Amory Engineers.....

Well number and location: ...8" Gravel Well #5.....

Well installed originally by: ...F.G. Sullivan Drilling Co. Inc.....

Type of work to be done: ...Chemical Treatment and Redevelopment.....

Name of driller: ...Frank Sullivan Jr..... Helpers: .....Bob Bashaw.....  
From top

Depth of well: ..35.40 of pipe Length of screen: ...5'..... Size of well: ...8".....

Original GPM ....200..... with .....9.20'..... feet of drawdown from top of pipe.

Static before treatment: ...3.90 from top of pipe A.G. 1.20.....

Depth of well before treatment: ..35.40 from top of pipe.....

Capacity of well before treatment: ...23 GPM..... Drawdown before treatment: ...22.10'..(1.0 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium Hypochlorite

Amount of treatment used: 25 gals - 1/2 Pt. .... - 100 lbs..... - 25 lbs.

Capacity of well after treatment: ..240 GPM..... Drawdown after treatment: ...12.8..(18.7 GPF)...

Static water level after treatment: ....3.90 from top of pipe.....

Type of condition of pump: .....7.....

Hours moving to and from job: .....7.....

Hours removing and resetting pump: .....7.....

Hours surging and installing and removing surge pump: ...37 hrs.....

Remarks: ...The acid was pumped into a settling tank where it was.....  
.....neutralized with 50 lbs. of light soda ash.....

Total hours to complete job: ...37 Hrs.....

Condition of well on completion of work: Good.....

Was pump reconditioned before reinstalling: .....

Remarks: .....

Signature of driller: ..... Signature of customer: .....



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Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #5

3/25/92 - Moved the rig onto #5 and set it up. We removed the cap and sand pumped 2' of sand and rusty material out of the screen and installed 36' of 4" surge pipe with an 8" surge set 1 ft. above the screen.

Hrs. - 2

3/26/92 - We test pumped the well:

GPM - 23 with drawdown to 26.00' (1.0 GPF)  
Static from top of pipe - 3.90      A.G. - 1.20  
Depth from top of pipe - 35.40  
Top of screen - 28.90 from top of pipe  
Screen length - 5'

The well was pumped and surged for 7 hrs. The well then pumped 142 GPM with drawdown to 19.90 (8.8 GPF)

Hrs. - 8

3/27/92 - Pumped into the well 25 gals of Muratic Acid with  $\frac{1}{2}$  pt. Rodine 308, by way of the 4" surge pipe raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 6 hrs. The well was then pumped and surged for 3 hrs. The well then pumped 175 GPM with drawdown to 18.8' (11.7 GPF). The acid was pumped into a settling tank where it was neutralized with 50 lbs. of light soda ash.

Hrs. - 9

3/30/92 - Pumped and surged the well for 3 hrs. We then pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 75 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 2 hrs. We then pumped into the well a mixture of 25 lbs. of Calcium Hypochlorite with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 75 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 2 hrs. and left over-night.

Hrs. - 8

**LOG OF WELL REHABILITATION**  
**F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523**

Date Started: ..3/25/92..... Date Finished: ...4/1/92.....

Name and Address of Job: ...Town of Sharon, MA at Pump Station #2.....

Customer's representative in charge of this work: ...Tom Sexton - Amory Engineers.....

Well number and location: ...8" Gravel Well #5.....

Well installed originally by: ...F.G. Sullivan Drilling Co. Inc.....

Type of work to be done: ...Chemical Treatment and Redevelopment.....

Name of driller: ...Frank Sullivan Jr..... Helpers: .....Bob Bashaw.....

Depth of well: ..35.40 of pipe Length of screen: ...5'..... Size of well: ...8".....

Original GPM ....200..... with .....9.20'..... feet of drawdown from top of pipe

Static before treatment: ...3.90 from top of pipe A.G. 1.20.....

Depth of well before treatment: ..35.40 from top of pipe.....

Capacity of well before treatment: ...23 GPM..... Drawdown before treatment: ...22.10' (1.0 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium Hypochlorite

Amount of treatment used: 25 gals - 1/2 Pt. .... - 100 lbs. .... - 25 lbs.

Capacity of well after treatment: ..240 GPM..... Drawdown after treatment: ...12.8 (18.7 GPF)...

Static water level after treatment: ...3.90 from top of pipe.....

Type of condition of pump: .....7.....

Hours moving to and from job: .....7.....

Hours removing and resetting pump: .....7.....

Hours surging and installing and removing surge pump: ...37 hrs.....

Remarks: ...The acid was pumped into a settling tank where it was.....

.....neutralized with 50 lbs. of light soda ash.....

Total hours to complete job: ...37 Hrs.....

Condition of well on completion of work: Good.....

Was pump reconditioned before reinstalling: .....

Remarks: .....

Signature of driller: ..... Signature of customer: .....

**LOG OF WELL REHABILITATION**  
**F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523**

Date Started: .. 3/25/92 ..... Date Finished: ... 4/1/92 .....

Name and Address of Job: ... Town of Sharon, MA at Pump Station #2 .....

Customer's representative in charge of this work: ... Tom Sexton - Amory Engineers .....

Well number and location: ... 8" Gravel Well #5 .....

Well installed originally by: ... F.G. Sullivan Drilling Co. Inc. ....

Type of work to be done: ... Chemical Treatment and Redevelopment .....

Name of driller: ... Frank Sullivan Jr. .... Helpers: ... Bob Bashaw .....

Depth of well: .. 35.40 of pipe Length of screen: ... 5' ..... Size of well: ... 8" .....

Original GPM ... 200 ..... with ... 9.20' ..... feet of drawdown from top of pipe

Static before treatment: ... 3.90 from top of pipe A.G. 1.20 .....

Depth of well before treatment: .. 35.40 from top of pipe .....

Capacity of well before treatment: ... 23 GPM ..... Drawdown before treatment: ... 22.10' (1.0 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium Hypochlorite

Amount of treatment used: 25 gals - 1/2 Pt. .... - 100 lbs. .... - 25 lbs.

Capacity of well after treatment: .. 240 GPM ..... Drawdown after treatment: ... 12.8 (18.7 GPF)...

Static water level after treatment: ... 3.90 from top of pipe .....

Type of condition of pump: ... - .....

Hours moving to and from job: ... - .....

Hours removing and resetting pump: ... - .....

Hours surging and installing and removing surge pump: ... 37 hrs. ....

Remarks: ... The acid was pumped into a settling tank where it was  
... neutralized with 50 lbs. of light soda ash. ....

Total hours to complete job: ... 37 Hrs. ....

Condition of well on completion of work: Good .....

Was pump reconditioned before reinstalling: .....

Remarks: .....

Signature of driller: ..... Signature of customer: .....

**LOG OF WELL REHABILITATION**  
**F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523**

Date Started: .. 3/25/92 ..... Date Finished: ... 4/1/92 .....

Name and Address of Job: ... Town of Sharon, MA at Pump Station #2 .....

Customer's representative in charge of this work: ... Tom Sexton - Amory Engineers .....

Well number and location: ... 8" Gravel Well #5 .....

Well installed originally by: ... F.G. Sullivan Drilling Co. Inc. ....

Type of work to be done: ... Chemical Treatment and Redevelopment .....

Name of driller: ... Frank Sullivan Jr. .... Helpers: ... Bob Bashaw .....

Depth of well: .. 35.40 of pipe Length of screen: ... 5' ..... Size of well: ... 8" .....

Original GPM ... 200 ..... with ... 9.20' ..... feet of drawdown from top of pipe.

Static before treatment: ... 3.90 from top of pipe .. A.G. 1.20 .....

Depth of well before treatment: .. 35.40 from top of pipe .....

Capacity of well before treatment: ... 23 GPM ..... Drawdown before treatment: ... 22.10' .. (1.0 GPF)

Kind of treatment used: .. Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium

Amount of treatment used: .. 25 gals - 1/2 Pt. .... - 100 lbs. .... - 25 lbs. Hypochlorite

Capacity of well after treatment: .. 240 GPM ..... Drawdown after treatment: ... 12.8 .. (18.7 GPF)...

Static water level after treatment: ... 3.90 from top of pipe .....

Type of condition of pump: ... - .....

Hours moving to and from job: ... - .....

Hours removing and resetting pump: ... - .....

Hours surging and installing and removing surge pump: ... 37 hrs. ....

Remarks: ... The acid was pumped into a settling tank where it was .....

... neutralized with 50 lbs. of light soda ash. ....

Total hours to complete job: ... 37 Hrs. ....

Condition of well on completion of work: Good .....

Was pump reconditioned before reinstalling: .....

Remarks: .....

Signature of driller: ..... Signature of customer: .....

Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #5  
Page 2

3/31/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1 hr. We then pumped and surged the well for 7 hrs. The well then pumped 240 GPM with drawdown to 16.70' (18.7 GPF).

Depth of well after cleaning - 35.55 from top of pipe  
Field Test: Temp - 50°F Co<sub>2</sub> - 14 MG/L P.H. - 6.5

Hrs. - 8

4/1/92 - Pulled the 4" surge pipe from the well and moved to Well #4.

Hrs. - 2

Total Hrs. - 37 Hrs.



LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523

Date Started: 3/20/92 Date Finished: 3/25/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #6

Well installed originally by: F.G. Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment & Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

From top

Depth of well: 32.70 of pipe Length of screen: 5' Size of well: 8"

Original GPM 160 with 15.50' feet of drawdown from top of pipe

Static before treatment: 2.40 from top of pipe A.G. - 1.00

Depth of well before treatment: 32.70 from top of pipe

Capacity of well before treatment: 50 GPM Drawdown before treatment: 23.60 (2.1 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium

Hypoclorite

Amount of treatment used: 55 Gals. & 1 Pt - 100 lbs. - 25 lbs.

Capacity of well after treatment: 190 GPM Drawdown after treatment: 18.60 (10.2 GPF)

Static water level after treatment: 2.40 from top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 32 Hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 32 hrs.

Condition of well on completion of work: Good as original

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:



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Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #6

3/20/92 - Set up the rig on the well and installed 33' of 4" surge pipe with an 8" surge set 1 ft. above the top of the screen. The well was then test pumped.

GPM - 50 with drawdown to 26.0' (2.1 GPF)  
Static from top of pipe - 2.40 A.G. - 1.00  
Depth from top of pipe - 32.7  
Top of screen - 26.2 from top of pipe  
Screen length - 5'

The screen was full of rusty material and some sand that had to be sand pumped out.

The well was pumped and surged for 5 hrs. The well then pumped 80 GPM with drawdown to 21.6 (4.1 GPF).

Hrs. - 8

3/23/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 hrs. We then pumped and surged the well for 2 hrs. The well then pumped 120 GPM with drawdown to 22.00' (6.1 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of hexametaphosphate with 300 gals of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 75 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. We then pumped into the well a mixture of 25 lbs. of Calcium Hypochlorite with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins for 1 hr. and left overnight.

Hrs. - 9½

3/24/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1½ hrs. The well was then pumped and surged for 7 hrs. The well then pumped 190 GPM with drawdown to 21.00 (10.2 GPF).

Hrs. - 8½



# F. G. SULLIVAN DRILLING CO., INC.

GRAVEL WELLS - TEST BORINGS - WELL RECONDITIONING • ANYWHERE IN NEW ENGLAND

PARKER ROAD • LANCASTER, MASS. 01523  
TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #6

3/20/92 - Set up the rig on the well and installed 33' of 4" surge pipe with an 8" surge set 1 ft. above the top of the screen. The well was then test pumped.

GPM - 50 with drawdown to 26.0' (2.1 GPF)  
Static from top of pipe - 2.40 A.G. - 1.00  
Depth from top of pipe - 32.7  
Top of screen - 26.2 from top of pipe  
Screen length - 5'

The screen was full of rusty material and some sand that had to be sand pumped out.

The well was pumped and surged for 5 hrs. The well then pumped 80 GPM with drawdown to 21.6 (4.1 GPF).

Hrs. - 8

3/23/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 hrs. We then pumped and surged the well for 2 hrs. The well then pumped 120 GPM with drawdown to 22.00' (6.1 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of hexametaphosphate with 300 gals of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 75 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. We then pumped into the well a mixture of 25 lbs. of Calcium Hypochlorite with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins for 1 hr. and left overnight.

Hrs. - 9½

3/24/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1½ hrs. The well was then pumped and surged for 7 hrs. The well then pumped 190 GPM with drawdown to 21.00 (10.2 GPF).

Hrs. - 8½



# F. G. SULLIVAN DRILLING CO., INC.

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PARKER ROAD • LANCASTER, MASS. 01523  
TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #6

3/20/92 - Set up the rig on the well and installed 33' of 4" surge pipe with an 8" surge set 1 ft. above the top of the screen. The well was then test pumped.

GPM - 50 with drawdown to 26.0' (2.1 GPF)  
Static from top of pipe - 2.40      A.G. - 1.00  
Depth from top of pipe - 32.7  
Top of screen - 26.2 from top of pipe  
Screen length - 5'

The screen was full of rusty material and some sand that had to be sand pumped out.

The well was pumped and surged for 5 hrs. The well then pumped 80 GPM with drawdown to 21.6 (4.1 GPF).

Hrs. - 8

3/23/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 hrs. We then pumped and surged the well for 2 hrs. The well then pumped 120 GPM with drawdown to 22.00' (6.1 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of hexametaphosphate with 300 gals of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 75 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. We then pumped into the well a mixture of 25 lbs. of Calcium Hypochlorite with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins for 1 hr. and left overnight.

Hrs. - 9½

3/24/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1½ hrs. The well was then pumped and surged for 7 hrs. The well then pumped 190 GPM with drawdown to 21.00 (10.2 GPF).

Hrs. - 8½

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #6  
Page 2

3/25/92 - Surged and pumped the well for 4 hrs. The well pumped 190 GPM with drawdown to 21.00 (10.2 GPF). The surge pipe was then pulled from the well and the rig was taken down and moved to Well #5.

Depth after cleaning - 32.7 from top of pipe  
Field test: Iron - 2.0 PPM Temp - 50°F P.H. - 6.2

Hrs. - 6

Total Hrs. - 32

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 3/16/92 Date Finished: 3/20/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #7

Well installed originally by: F.G. Sullivan Drilling Co. Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw

Depth of well: 43.9 of pipe Length of screen: 5' Size of well: 8"

Original GPM 200 with 9.30 feet of drawdown from top of pipe

Static before treatment: 3.20 from top of pipe A.G. - 2.80

Depth of well before treatment: 43.80 from top of pipe

Capacity of well before treatment: 50 GPM Drawdown before treatment: 22.80 (2.1 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium

Amount of treatment used: 55 Gals & 1 Pt. - 100 lbs. - 20 lbs. Hypoclorite

Capacity of well after treatment: 260 GPM Drawdown after treatment: 13.10 (19.8 GPF)

Static water level after treatment: 3.20 from top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 31 hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 31 Hrs.

Condition of well on completion of work: Good as original

Was pump reconditioned before reinstalling:

Remarks:

Signature of driller: Signature of customer:



# F. G. SULLIVAN DRILLING CO., INC.

GRAVEL WELLS - TEST BORINGS - WELL RECONDITIONING • ANYWHERE IN NEW ENGLAND

PARKER ROAD • LANCASTER, MASS. 01523  
TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #7

3/16/92 - Set up the rig on the well and installed 44' of 4" surge with an 8" surge set 1 foot above the top of the screen.

Hrs. - 3

3/17/92 - The well was test pumped, it pumped 50 GPM with draw-down to 26.00' (2.1 GPF).

Static top of pipe - 3.2 A.G. - 2.80  
Depth top of pipe - 43.80  
Top of screen - 37.3 from top of pipe

The well was then pumped and surged for 8 hrs. It then pumped 130 GPM with drawdown to 25.70' (5.7 GPF).

Hrs. - 8

3/18/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 5 hrs. The well was then pumped and surged for 1½ hrs. The well then pumped 200 GPM with drawdown to 20.2' (11.7 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 20 lbs. of Calcium Hypochlorite and 300 gals. of water was then pumped into the well by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. - 9½

3/19/92 - Surged the well without pumping for 5 mins. every 15 mins. for ½ hr. then surged and pumped the well for 8 hrs. The well then pumped 260 GPM with drawdown to 16.3' (19.8 GPF).

Depth after cleaning - 43.9 from top of pipe  
Field test: Iron - 0 Temp. - 50 F P.H. - 6.2

Hrs. - 8½



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PARKER ROAD • LANCASTER, MASS. 01523  
TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #7

3/16/92 - Set up the rig on the well and installed 44' of 4" surge with an 8" surge set 1 foot above the top of the screen.

Hrs. - 3

3/17/92 - The well was test pumped, it pumped 50 GPM with draw-down to 26.00' (2.1 GPF).

Static top of pipe - 3.2 A.G. - 2.80  
Depth top of pipe - 43.80  
Top of screen - 37.3 from top of pipe

The well was then pumped and surged for 8 hrs. It then pumped 130 GPM with drawdown to 25.70' (5.7 GPF).

Hrs. - 8

3/18/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 5 hrs. The well was then pumped and surged for 1½ hrs. The well then pumped 200 GPM with drawdown to 20.2' (11.7 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 20 lbs. of Calcium Hypochlorite and 300 gals. of water was then pumped into the well by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. - 9½

3/19/92 - Surged the well without pumping for 5 mins. every 15 mins. for ½ hr. then surged and pumped the well for 8 hrs. The well then pumped 260 GPM with drawdown to 16.3' (19.8 GPF).

Depth after cleaning - 43.9 from top of pipe  
Field test: Iron - 0 Temp. - 50 F P.H. - 6.2

Hrs. - 8½





# F. G. SULLIVAN DRILLING CO., INC.

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TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #7

3/16/92 - Set up the rig on the well and installed 44' of 4" surge with an 8" surge set 1 foot above the top of the screen.

Hrs. - 3

3/17/92 - The well was test pumped, it pumped 50 GPM with draw-down to 26.00' (2.1 GPF).

Static top of pipe - 3.2    A.G. - 2.80  
Depth top of pipe - 43.80  
Top of screen - 37.3 from top of pipe

The well was then pumped and surged for 8 hrs. It then pumped 130 GPM with drawdown to 25.70' (5.7 GPF).

Hrs. - 8

3/18/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals of water. The well was then surged without pumping for 5 mins. every 15 mins. for 5 hrs. The well was then pumped and surged for 1½ hrs. The well then pumped 200 GPM with drawdown to 20.2' (11.7 GPF). The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Then we pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 20 lbs. of Calcium Hypochlorite and 300 gals. of water was then pumped into the well by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. - 9½

3/19/92 - Surged the well without pumping for 5 mins. every 15 mins. for ½ hr. then surged and pumped the well for 8 hrs. The well then pumped 260 GPM with drawdown to 16.3' (19.8 GPF).

Depth after cleaning - 43.9 from top of pipe  
Field test: Iron - 0    Temp. - 50° F    P.H. - 6.2

Hrs. - 8½

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #7  
Page 2

3/20/92 - Pulled the surge pipe from the well and moved the rig  
to Well #6.

Hrs. - 2

Total Hrs. - 31

LOG OF WELL REHABILITATION

F. G. SULLIVAN DRILLING CO., INC LANCASTER, MASS. 01523

Date Started: 3/11/92 Date Finished: 3/16/92

Name and Address of Job: Town of Sharon, MA at Pump Station #2

Customer's representative in charge of this work: Tom Sexton - Amory Engineers

Well number and location: 8" Gravel Well #8

Well installed originally by: F.G. Sullivan Drilling Co., Inc.

Type of work to be done: Chemical Treatment and Redevelopment

Name of driller: Frank Sullivan Jr. Helpers: Bob Bashaw
From top

Depth of well: 36.50 of pipe Length of screen: 5' Size of well: 8"

Original GPM 160 with 15.8' feet of drawdown from top of pipe.

Static before treatment: 3.80 from top of pipe A.G. - 2.30

Depth of well before treatment: 36.00 from top of pipe

Capacity of well before treatment: 50 GPM Drawdown before treatment: 22.20' (2.2 GPF)

Kind of treatment used: Muratic Acid & Rodine 308 - Hexametaphosphate - Calcium hypochlorite

Amount of treatment used: 55 Gals. & 1 Pt - 100 lbs. - 25 lbs.

Capacity of well after treatment: 115 GPM Drawdown after treatment: 11.2 (10.2 GPF)

Static water level after treatment: 3.80 From top of pipe

Type of condition of pump: -

Hours moving to and from job: -

Hours removing and resetting pump: -

Hours surging and installing and removing surge pump: 30 Hrs.

Remarks: The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash.

Total hours to complete job: 30 Hrs.

Condition of well on completion of work: Good as original

Was pump reconditioned before reinstalling: -

Remarks: A leak was detected at the saddle connection to the well.

Signature of driller: Signature of customer:



# F. G. SULLIVAN DRILLING CO., INC.

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TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #8

3/11/92 - Set the rig up on the well and installed 37' of 4" surge pipe and 8" surge set a foot from the top of the screen. We then test pumped the well.

GPM - 50 with drawdown to 26.0 (2.2 GPF)  
Static top of pipe - 3.80 A.G. - 2.30  
Depth top of pipe - 36.00'  
Top of screen top of pipe - 31.00

The well was then pumped and surged for 6 hrs. It then pumped 111 GPM with drawdown to 18.2' (7.7 GPF).

Hrs. - 8

3/12/92 - Pumped into the well 55 gals. of Muratic Acid with 1 pt. Rodine 308 by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 30 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 5½ hrs. We then pumped and surged the well for 1½ hrs. The well then pumped 115 GPM with drawdown to 16.6' (8.9 GPF.) The acid was pumped into a settling tank where it was neutralized with 100 lbs. of light soda ash. Pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1½ hrs. A mixture of 25 lbs. of Calcium Hypochlorite and 300 gals. of water was then pumped into the well by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. The well was then surged without pumping for 5 mins. every 15 mins. for 1 hr. and left overnight.

Hrs. - 9

3/13/92 - Surged the well without pumping for 5 mins. every 15 mins. for 1 hr. The well was then pumped and surged for 7 hrs. The well then pumped 115 GPM with drawdown to 15.00 (10.2 GPF).

Hrs. - 8

3/16/92 - Surged and pumped the well for 4 hrs. The well pumped 115 GPM with drawdown to 15.00 (10.2 GPF). The surge pipe was then pulled from the well. The rig was then taken down and moved to Well #7.

Hrs. - 5

Town of Sharon, MA  
Well Redevelopment Pump Sta #2  
8" Gravel Well #8  
Page 2

Depth of well after cleaning - 36.5 top of pipe  
Field test: Iron - 0.5 Temp - 50°F PH - 6.20

A leak was detected at the saddle connection to the well.

Total Hrs. - 30 Hrs.

**LOG OF WELL REHABILITATION**  
**F. G. SULLIVAN DRILLING CO., INC. LANCASTER, MASS. 01523**

Date Started: .. 3/4/92 ..... Date Finished: ... 3/10/92 .....

Name and Address of Job: Town of Sharon, MA at Pump Station #2 .....

Customer's representative in charge of this work: Tom Sexton - Amory Engineers .....

Well number and location: ... 8" Gravel Well #9 .....

Well installed originally by: F.G. Sullivan Drilling Co. Inc. ....

Type of work to be done: ... Chemical Treatment and Redevelopment .....

Name of driller: Frank Sullivan Jr. .... Helpers: Bob Bashaw .....

From top

Depth of well: 34.40 of pipe. Length of screen: 5' ..... Size of well: 8" .....

Original GPM ... 170 ..... with 16.00 ..... feet of drawdown from top of pipe.

Static before treatment: 4.10 from top of pipe ... A.G. - 1.50 .....

Depth of well before treatment: 34.40 From top of pipe .....

Capacity of well before treatment: 50 GPM ..... Drawdown before treatment: 20.4 (2.4 GPF) .....

Kind of treatment used: Muratic Acid & Rodina 308 - Hexametaphosphate - Calcium

Hypochlorite

Amount of treatment used: 55 Gals. & 1 pt ..... 100 lbs. .... 20 lbs. ....

Capacity of well after treatment: 136 GPM ..... Drawdown after treatment: 12.5 (10.8 GPF) ...

Static water level after treatment: 4.10 from top of pipe .....

Type of condition of pump: - .....

Hours moving to and from job: 1 Hr. ....

Hours removing and resetting pump: - .....

Hours surging and installing and removing surge pump: 33 Hrs. ....

Remarks: ... The acid was pumped into a settling tank where it was neutralized  
... with 100 lbs. of light soda ash. ....

Total hours to complete job: 33 Hrs. .... 1 Hr. Travel .....

Condition of well on completion of work: Good as original .....

Was pump reconditioned before reinstalling: .....

Remarks: .....

Signature of driller: ..... Signature of customer: .....



# F. G. SULLIVAN DRILLING CO., INC.

GRAVEL WELLS - TEST BORINGS - WELL RECONDITIONING • ANYWHERE IN NEW ENGLAND

PARKER ROAD • LANCASTER, MASS. 01523

TELEPHONE 617-365-2932

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #9

3/4/92 - Mobilized the rig from Lancaster, MA to Sharon Well #9 and set it up. Installed 35' of 4" surge pipe and 8" surge. Hay bails were laid out around well site.

Hrs. - 3      Travel - 1

3/5/92 - We test pumped the well. It pumped 50 GPM with drawdown to 24.50 (2.4 GPF). We pumped and surged the well for 5 hrs. The well then pumped 120 GPM with drawdown to 18.9' (8.1 GPF).

Static top of pipe - 4.10      A.G. 1.50  
Depth top of pipe - 34.4  
Top of screen top of pipe - 28.9  
GPM - 50 with drawdown to 24.50 (2.4 GPF)

Hrs. - 6

3/6/92 - Pumped into the well by way of the 4" surge pipe, 55 gals. of Muratic Acid and 1 pt. Rodine 308, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 25 gals. of water. The well was then surged without pumping for 6 hrs. The well was then pumped and surged for 2 hrs. The well then pumped 125 GPM with drawdown to 19.00 (8.3 GPF). The acid was pumped into a settling tank where it was neutralized with 200 lbs. of light sida ash.

Hrs. - 8

3/9/92 - Surged and pumped the well for 3½ hrs. We then pumped into the well a mixture of 100 lbs. of Hexametaphosphate with 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. We then surged the well without pumping for 5 mins. every 15 mins. for 2 hrs. Then we pumped into the well a mixture of 20 lbs. of Calcium Hypochlorite and 300 gals. of water by way of the 4" surge pipe, raising and lowering it the length of the screen (5') so to evenly distribute it. Chased by 100 gals. of water. We then surged the well without pumping for 5 mins. every 15 mins. for 2 hrs. and left overnight.

Hrs. - 8

Town of Sharon, MA  
Well Redevelopment Pump Sta. #2  
8" Gravel Well #9  
Page 2

3/10/92 - Pumped and surged the well for 8 hrs. The well then pumped 136 GPM with drawdown to 16.6' (10.8 GPF). We pulled the 4" surge pipe from the well and moved the rig to well #8.

Depth - top of pipe - 34.40 after cleaning

Hrs. - 8

Total Hrs. - 33      1Hr. Travel



**APPENDIX B**

**Water Quality Analyses**

MASSACHUSETTS DEP DIVISION OF WATER SUPPLY  
ANNUAL REGULAR CHEMISTRY FOR SOURCE WATERS \*

PWS ID 4266000 PWS Name Sharon Water Dept. Town Sharon

Sample Location A Station #2 Month/Year May 1992  
 Sample Location B \_\_\_\_\_  
 Sample Location C \_\_\_\_\_ Routine   
 Sample Location D \_\_\_\_\_ Special  explain below  
 Sample Location E \_\_\_\_\_

Lab Name Oliveira Labs. Lab Cert. # MA022 Collected by P. Desalliers  
 Analytical Methods Used \_\_\_\_\_  
 Notes \_\_\_\_\_

	Detection Limit mg/l	RESULTS MG/L				
		A	B	C	D	E
Lab Sample ID	//////////	#2557				
Date Collected	//////////	5/19/92				
Dates Analyzed		5/19-5/20				
Turbidity	0.10	7.25				
Sediment	----	slight				
Color	0.00	25.0				
Odor	----	none				
pH	----	6.81				
Alkalinity-Total (CaCO3)	0.50	22.0				
Hardness (CaCO3)	2.00	76.0				
Calcium (Ca)	0.80	16.0				
Magnesium (Mg)	0.00	8.78				
Sodium (Na)	1.00	14.4				
Potassium (K)	0.10	0.91				
Iron (Fe)	0.01	1.79				
Manganese (Mn)	0.01	0.30				
Sulfate (SO4)	1.00	14.0				
Chloride (Cl)	1.00	39.5				
Specific Cond. (micromhos/cm)	0.50	25.0				
Nitrogen (ammonia)	0.01	0.10				
Nitrogen (nitrate)	0.10	2.29				
Nitrogen (nitrite)	0.001	0.004				
Copper (Cu)	0.01	0.10				

ND = Not Detected

Laboratory Director Signature and Date

*P. Desalliers* 6/1/92

1/1/91

hf-a:\chemrpt

REITZEL ASSOCIATES

10 Kendall Place, Boylston, Ma. 01505  
617/869-2893

DRINKING WATER ANALYSIS

REPORT NO. 2927

Sample Taken by: F.G.S.

Date: 4-23-92 Time: 2pm

Analysis Requested By:  
Name: F.G. SULLIVAN DRILLING CO INC  
Address: 408 Parker Rd  
Lancaster, MA 01523  
Telephone:

Sample Location:  
Name: AT PUMP STA #2  
Address: 8" GRAVEL WELL #1  
TOWN OF SHARON, MA  
Telephone:

Bacteria Test Results

Total Coliform Bacteria \_\_\_\_\_ per 100 ML.

Chemical Test Results

In milligrams per liter unless otherwise noted.  
MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	4.25	Acidity	as CaCO <sub>3</sub>
Conductivity	umho/cm	445	Alkalinity	as CaCO <sub>3</sub>
Odor	T.O.N.	NO	Ammonia Nitrogen	
Turbidity	NTU	6.0	Arsenic	
Color	PT - Co. Units	15	Copper	
Nitrate Nitrogen		4.1	Ferrous Iron	
Iron		4.2	Fluoride	
Manganese		1.1	MBAS (Detergents)	
Total Hardness	as CaCO <sub>3</sub>	145	Nitrite Nitrogen	
Chloride		111	Residual Chlorine	
Sodium		17	Silica	
			Sulfate	
			Sulfide	

COMMENTS See enclosure: turbidity, iron, manganese

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
the results meet the \_\_\_\_\_ criteria for safe drinking water.

Approved \_\_\_\_\_ Supervisor

FEE: \$ Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

DRINKING WATER ANALYSIS REPORT NO. 2890

Sample Taken by: F. G. S. Date: 4-16-92 Time: 3PM

Analysis Requested By:  Name <u>F. G. SULLIVAN DRILLING</u> Address <u>408 Parker Rd</u> <u>Lancaster, MA 01523</u>  Telephone _____	Sample Location:  Name <u>TOWN OF SHARON</u> Address <u>PUMP STA #2</u> <u>8" GRAVEL WELL #2</u>  Telephone _____
--	---

Bacteria Test Results Total Coliform Bacteria \_\_\_\_\_ per 100 ml

✓ Chemical Test Results In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	5.58	Acidity	as CaCO <sub>3</sub>
Conductivity	umho/cm	109	Alkalinity	as CaCO <sub>3</sub>
Odor	T.O.N.	no	Ammonia Nitrogen	
Turbidity	NTU	1.5	Arsenic	
Color	PT - Co. Units	5	Copper	
Nitrate Nitrogen		1.1	Ferrous Iron	
Iron		0.07	Fluoride	
Manganese		0.08	MBAS (Detergents)	
Total Hardness	as CaCO <sub>3</sub>	25	Nitrite Nitrogen	
Chloride		12	Residual Chlorine	
Sodium		10	Silica	
			Sulfate	
			Sulfide	

COMMENTS See enclosure: manganese

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the \_\_\_\_\_ criteria for safe drinking water.

Approved \_\_\_\_\_ Supervisor

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

REITZEL ASSOCIATES

10 Kendall Place, Boylston, Ma. 01505  
617/869-2893

DRINKING WATER ANALYSIS

REPORT NO. 2928

Sample Taken by: F.G.S.

Date: 4-23-92 Time: 12noon

Analysis Requested By:		Sample Location:	
Name	F.G. SULLIVAN DRILLING CO INC	Name	AT Pump STA. #2
Address	408 Parker Rd Lancaster, MA 01523	Address	8" GRAVEL WELL #3 TOWN OF SHARON, MA.
Telephone		Telephone	

Bacteria Test Results

Total Coliform Bacteria \_\_\_\_\_ per 100 ML.

X Chemical Test Results

In milligrams per liter unless otherwise noted.  
MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	6.02	Acidity	as CaCO <sub>3</sub>
Conductivity	umho/cm	340	Alkalinity	as CaCO <sub>3</sub>
Odor	T.O.N.	NO	Ammonia Nitrogen	
Turbidity	NTU	0.5	Arsenic	
Color	PT - Co. Units	0	Copper	
Nitrate Nitrogen		5.5	Ferrous Iron	
Iron		<0.05	Fluoride	
Manganese		0.05	MBAS (Detergents)	
Total Hardness	as CaCO <sub>3</sub>	126	Nitrite Nitrogen	
Chloride		42	Residual Chlorine	
Sodium		18	Silica	
			Sulfate	
			Sulfide	

COMMENTS

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
the results meet the U.S.P.H.S. criteria for safe drinking water.

Approved Nancy Burnett Supervisor

FEE: \$      Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

**REITZEL ASSOCIATES**  
 ENVIRONMENTAL SAMPLING & ANALYSIS  
 63 PLAIN STREET CLINTON, MASSACHUSETTS 01510  
 PHONE (508) 366-7684  
 FAX (508) 366-7688

DRINKING WATER ANALYSIS REPORT NO. 2889

Sample Taken by: F.G.S. Date: 4-16-92 Time: 3 PM

Analysis Requested By: Name <u>F.G. Sullivan Drilling Co.</u> Address <u>408 Parker Rd</u> <u>Lancaster, Mass 01523</u> Telephone _____	Sample Location: Name <u>TOWN OF SHARON</u> Address <u>@ PUMP STA #2-8 GRAVEL WEL #4</u> Telephone _____
---	---

Bacteria Test Results Total Coliform Bacteria \_\_\_\_\_ per 100 ml

✓ Chemical Test Results In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	<u>5.60</u>	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	<u>67</u>	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	<u>no</u>	Ammonia Nitrogen		
Turbidity	NTU	<u>1.5</u>	Arsenic		
Color	PT - Co. Units	<u>10</u>	Copper		
Nitrate Nitrogen		<u>0.2</u>	Ferrous Iron		
Iron		<u>&lt;0.05</u>	Fluoride		
Manganese		<u>&lt;0.04</u>	MBAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	<u>8</u>	Nitrite Nitrogen		
Chloride		<u>8</u>	Residual Chlorine		
Sodium		<u>12</u>	Silica		
			Sulfate		
			Sulfide		

COMMENTS

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the U.S.P.H.S. criteria for safe drinking water.

Approved Nancy Burnett Supervisor

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

REITZEL ASSOCIATES  
 ENVIRONMENTAL SAMPLING & ANALYSIS  
 63 PLAIN STREET CLINTON, MASSACHUSETTS 01510  
 PHONE (508) 366-7884  
 FAX (508) 300-7606

DRINKING WATER ANALYSIS

REPORT NO. 2892

Sample Taken by: F.G.S.

Date: 4-16-92 Time: 1 PM

Analysis Requested By:

Sample Location:

Name E.G. SULLIVAN DRILLING  
 Address 408 Parker Rd  
Lancaster, MA 01523  
 Telephone

Name TOWN OF SHARON  
 Address PUMP STA. #2  
8" GRAVEL WELL #5  
 Telephone

Bacteria Test Results

Total Coliform Bacteria \_\_\_\_\_ per 100 ml

✓ Chemical Test Results

In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	<u>5.74</u>	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	<u>105</u>	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	<u>no</u>	Ammonia Nitrogen		
Turbidity	NTU	<u>2.0</u>	Arsenic		
Color	PT - Co. Units	<u>11</u>	Copper		
Nitrate Nitrogen		<u>0.5</u>	Ferrous Iron		
Iron		<u>0.13</u>	Fluoride		
Manganese		<u>&lt;0.04</u>	MBAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	<u>17</u>	Nitrite Nitrogen		
Chloride		<u>13</u>	Residual Chlorine		
Sodium		<u>17.5</u>	Silica		
			Sulfate		
			Sulfide		

COMMENTS

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the U.S.P.H.S. criteria for safe drinking water.

Approved Nancy Burnett Supervisor

FEE: \$      Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

DRINKING WATER ANALYSIS REPORT NO. 2891

Sample Taken by: F.G.S. Date: 4-16-92 Time: 11AM

Analysis Requested By:		Sample Location:	
Name <u>F.G. SULLIVAN DRILLING</u>	Name <u>TOWN OF SHARON</u>	Address <u>408 Parker Rd</u>	Address <u>PUMP STA. #2</u>
Address <u>Lancaster, MA 01523</u>	Address <u>8" GRAVEL WELL #6</u>	Telephone	Telephone

Bacteria Test Results Total Coliform Bacteria \_\_\_\_\_ per 100 ml

Chemical Test Results In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	<u>5.83</u>	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	<u>450</u>	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	<u>00</u>	Ammonia Nitrogen		
Turbidity	NTU	<u>35.0</u>	Arsenic		
Color	PT - Co. Units	<u>140</u>	Copper		
Nitrate Nitrogen		<u>3.5</u>	Ferrous Iron		
Iron		<u>1.6</u>	Fluoride		
Manganese		<u>1.03</u>	MBAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	<u>119</u>	Nitrite Nitrogen		
Chloride		<u>98</u>	Residual Chlorine		
Sodium		<u>41</u>	Silica		
			Sulfate		
			Sulfide		

COMMENTS See enclosure: color, turbidity, iron, manganese

Approved Nancy Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the \_\_\_\_\_ criteria for safe drinking water.

Approved \_\_\_\_\_ Supervisor

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS



**REITZEL ASSOCIATES**  
 ENVIRONMENTAL SAMPLING & ANALYSIS  
 63 PLAIN STREET CLINTON, MASSACHUSETTS 01618  
 PHONE (508) 368-7884  
 FAX (508) 360-7666

**DRINKING WATER ANALYSIS**

REPORT NO. 2878

Sample Taken by: F.G.S.

Date: 4-15-92 Time: 3 P.M.

Analysis Requested By:  
 Name F. G. Sullivan Drilling Co., Inc.  
 Address \_\_\_\_\_  
 Telephone \_\_\_\_\_

Sample Location:  
 Name Pump Sta #2  
 Address 8" GRAVEL Well #7  
TOWN OF SHARON, MA  
 Telephone \_\_\_\_\_

**Bacteria Test Results**

Total Coliform Bacteria \_\_\_\_\_ per 100 ml

**X Chemical Test Results**

In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	<u>6.15</u>	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	<u>390</u>	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	<u>no</u>	Ammonia Nitrogen		
Turbidity	NTU	<u>0.50</u>	Arsenic		
Color	PT - Co. Units	<u>0</u>	Copper		
Nitrate Nitrogen		<u>3.9</u>	Ferrous Iron		
Iron		<u>&lt;0.08</u>	Fluoride		
Manganese		<u>0.02</u>	MOAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	<u>116</u>	Nitrite Nitrogen		
Chloride		<u>58</u>	Residual Chlorine		
Sodium		<u>28</u>	Silica		
			Sulfate		
			Sulfide		

COMMENTS

Approved D Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the U.S.P.H.S. criteria for safe drinking water.

Approved D Burnett Supervisor

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

Fee payable upon sample receipt.

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

DRINKING WATER ANALYSIS

REPORT NO. 2879

Sample Taken by: F.G.S.

Date: 4-15-92 Time: 11 a.m.

Analysis Requested By:  
 Name: F.G. Sullivan Drilling Co., Inc.  
 Address:  
 Telephone:

Sample Location:  
 Name: Pump STA #2  
 Address: 8" Gravel Well #8  
 Town of Sharon, MA  
 Telephone:

Bacteria Test Results

Total Coliform Bacteria \_\_\_\_\_ per 100 ml

Chemical Test Results

In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	6.15	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	105	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	2 *	Ammonia Nitrogen		
Turbidity	NTU	4.0	Arsenic		
Color	PT - Co. Units	30	Copper		
Nitrate Nitrogen		0.4	Ferrous Iron		
Iron		2.3	Fluoride		
Manganese		0.15	MUAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	23	Nitrite Nitrogen		
Chloride		23	Residual Chlorine		
Sodium		9	Silica		
			Sulfate		
			Sulfide		

COMMENTS \* sulfide

Please see enclosure: color, iron, manganese

Approved: D Burnett Supervisor

With respect to the tests performed and reported here,  
 the results meet the \_\_\_\_\_ criteria for safe drinking water.

Approved: \_\_\_\_\_ Supervisor

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

Fee payable upon sample receipt

PLEASE SEE OTHER SIDE FOR INSTRUCTIONS

DRINKING WATER ANALYSIS

REPORT NO. 2880

Sample Taken by: F. G. Sullivan

Date: 4-15-92 Time: 11 A.M.

Analysis Requested By:  
 Name F. G. Sullivan Co., Inc.  
 Address \_\_\_\_\_  
 Telephone \_\_\_\_\_

Sample Location:  
 Name Pump STA #2  
 Address 8" GRAVEL Well #9  
TOWN OF SHARON, MA  
 Telephone \_\_\_\_\_

Bacteria Test Results

Total Coliform Bacteria \_\_\_\_\_ per 100

Chemical Test Results

In milligrams per liter unless otherwise noted.  
 MG/L = parts per million. Grains per gallon = MG/L 17.1

pH	S.U.	<u>5.70</u>	Acidity	as CaCO <sub>3</sub>	
Conductivity	umho/cm	<u>96</u>	Alkalinity	as CaCO <sub>3</sub>	
Odor	T.O.N.	<u>10</u>	Ammonia Nitrogen		
Turbidity	NTU	<u>2.0</u>	Arsenic		
Color	PT - Co. Units	<u>15</u>	Copper		
Nitrate Nitrogen		<u>0.1</u>	Ferrous Iron		
Iron		<u>0.60</u>	Fluoride		
Manganese		<u>0.24</u>	MUAS (Detergents)		
Total Hardness	as CaCO <sub>3</sub>	<u>21</u>	Nitrite Nitrogen		
Chloride		<u>17</u>	Residual Chlorine		
Sodium		<u>8</u>	Silica		
			Sulfate		
			Sulfide		

COMMENTS

*Please see enclosure: iron, manganese*

Approved D. Burnett Supervi:

With respect to the tests performed and reported here,  
 The results meet the \_\_\_\_\_ criteria for safe drinking water.

Approved \_\_\_\_\_ Supervi

FEE: \$ \_\_\_\_\_ Check ( ) Cash ( )

**F.G. Sullivan Drilling Co., Inc.**  
Log of Well Rehabilitation

Date Started: 9-27-22 Date Finished: 10-5-22

Name and Address of Job: Town of Sharon

Customer's representative in charge of this job: \_\_\_\_\_

Well number and Location: Well #3

Well originally installed by: Layne well co.

Type of work to be done: Chemical treatment and Redevelopment

Name of Driller: Kyle DiRico Helper: Trey Callahan

Depth of well: 45.8 ft Length of screen: 15 ft Size of well: 24" sleeved to 18"

Original GPM: 500GPM With \_\_\_\_\_ Feet of drawdown

Static before treatment: 2.50"

Depth of well before treatment: 45.10"

Capacity of the well before treatment: 200 GPM Drawdown before treatment: 18.5" (21 total)

Kind of treatment used: Hydrochloric acid NW-220 HTH

Amount of treatment used: 165 gallons 5 gallons 40 lbs

Capacity of well after treatment: 325 GPM Drawdown after treatment: 9.30"(11.80"total)

Static water level after treatment: 2.10

Pump test: Before: No After: No Sample Taken: No

Hours Removing and resetting the pump: 10 hours

Hours Surging and Brushing: 40 hours

Make of pump: American marsh Type: VT Model: 10 Msz-5 Serial #: 199686

Column pipe length: 30' Size: 6 inch Shaft: One inch

Pump Bowl Assembly: 4'.40"/5 stage Size: 10 inch GPM: \_\_\_\_\_ T.D.H.: \_\_\_\_\_

Make of Motor: Us motors HP: 30 PH: 3 Volts: 460 Amps: 116/58 RPM: 1780

Transducer Setting: 31 ft Pump Intake Setting: 34'.4"

Was pump reconditioned: The pump, column pipe and shafts were power washed and painted

Remarks: \_\_\_\_\_

Signature of Driller: \_\_\_\_\_ Video Inspection: No

## APPENDIX P

### Asbestos Regulations and Removal Forms





Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

---

# Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

## **ASBESTOS CEMENT PIPE GUIDANCE DOCUMENT**

**July 2019**

**Prepared by the Bureau of Air & Waste**

This information is available in alternate format. Contact Michelle Waters-Ekanem, Director of Diversity/Civil Rights at 617-292-5751.  
TTY# MassRelay Service 1-800-439-2370  
MassDEP Website: [www.mass.gov/dep](http://www.mass.gov/dep)

Printed on Recycled Paper

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## **I. Background**

The Massachusetts Department of Environmental Protection's (MassDEP's) asbestos regulation (310 CMR 7.15) protects public health and the environment by establishing safe handling practices for demolishing or renovating buildings and structures to prevent the release of asbestos fibers from asbestos-containing materials (ACM). MassDEP's regulations require notification as well as specific removal, handling, and disposal requirements for all ACM. These work practices include removing ACM prior to demolition or renovation activities, wetting the ACM before it is removed to prevent the release of asbestos dust, fully containing the work area (e.g., with plastic sheeting) and drawing air out of the containment through an air filtration unit equipped with a HEPA filter capable of capturing asbestos fibers, sealing the wetted Asbestos-Containing Waste Material (ACWM) in leak-tight containers with asbestos labeling, and properly disposing of the waste in a landfill permitted to accept ACM or ACWM.

Asbestos cement pipes often are found in underground utility conduits and municipal water, sewer and drainage systems. Asbestos cement pipes buried below ground are considered non-friable if they are in good condition. It should be noted that active asbestos cement pipe that is exposed and is not intended to be replaced or removed and is not disturbed by repair or replacement activities may remain in place and be backfilled.

## **II. Purpose**

This guidance document is based on the requirements in 310 CMR 7.15(12A) and explains how to safely remove, repair and dispose of asbestos cement pipes that are repaired or replaced in underground system networks owned by public and private utilities (e.g. water, sewer, electricity and gas). Its main purpose is to prevent the release of asbestos fibers into ambient air and to protect public health, safety, and the environment while removing, repairing and disposing of asbestos cement pipes.

This guidance document summarizes the requirements for underground asbestos-cement pipe that is owned by public and private utilities (e.g., pipes conveying drinking water, sanitary sewage, storm water, electricity, and gas).

This guidance document and 310 CMR 7.15(12A) only applies to asbestos-cement pipe. If at any time the owner or operator determines that the pipe they are repairing or replacing is not asbestos-cement pipe, they must comply with the applicable requirements of 310 CMR 7.15.

This document does not constitute "final agency action," and is not "regulation" as that term is used in M.G.L. c.30A. It may not be relied upon to create rights, duties, obligations or defenses, implied or otherwise, enforceable by any party in any administrative proceeding with the Commonwealth. In addition, this guidance does not exempt anyone from complying with any other applicable local, state or federal law,

including but not limited to: the United States Environmental Protection Agency (EPA) Asbestos National Emission Standards for Hazardous Air Pollutants (Asbestos NESHAP) regulation at 40 CFR part 61; the applicable United States Occupational Safety & Health Act (OSHA) standards at 29 CFR 1910 & 1926; and the Massachusetts Department of Labor Standards (DLS) regulation at 453 CMR 6.00.

### **III. Guidance Provisions**

#### ***a. Pre-Demolition/Renovation Survey***

MassDEP's asbestos regulation establishes that owners and operators (including contractors) are responsible for determining whether cement pipe in a particular utility conduit that will be repaired or replaced contains asbestos before starting demolition or renovation.

The methods described below can only be used at underground asbestos-cement pipe repair/replacement work conducted by public and privately-owned utilities or their contractors. Owners and operators who are not public or private utilities are subject to the survey requirements at 310 CMR 7.15(4) by employing or engaging an asbestos inspector to thoroughly inspect the pipe, including sampling and analysis for the presence of asbestos using approved EPA protocol.

An owner or operator (including utilities conducting pipe repair or replacement), must conduct a "thorough inspection" to determine the location and amount of any asbestos-containing pipe. A "thorough inspection" under 310 CMR 7.15(12A) shall be satisfied by one of the following three options:

- **Document Review:** The owner or operator shall review as-built plans or other documents identifying the content of particular cement pipes or pipe segments and any other material in the conduit that may be affected by a removal or repair project, provided that the documentation has been updated to reflect any repairs or alterations. "Other documents" may include analytical results from bulk sampling and asbestos analysis using an EPA-approved method, a manufacturer's Safety Data Sheet for the product as actually installed, or other irrefutable identifying information.
- **Visual Observation:** A person who has successfully completed a DLS-approved training course specific to asbestos cement pipe worker safety (e.g., the "8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety" course) or another course similar in length and content that has been reviewed and approved in writing by DLS shall conduct a visual identification through field observations of the pipe to be worked on (e.g., the manufacturer's brand-label markings indicating transite material or

the source of the pipe).

- **Presumption of Asbestos Containing Material:** The owner or operator may presume that a pipe or pipe segment contains asbestos and manage any repairs or removals in accordance with this guidance and 310 CMR 7.15(12A).

If the pipe or pipe segment is not identified as asbestos cement pipe by one of the options listed above, then the owner or operator shall comply with the requirements of 310 CMR 7.15(4) by performing a survey if the pipe contains suspect asbestos-containing material.

The owner/operator of the utility system at which the asbestos cement pipe was removed, repaired or replaced must keep documentation of the pre-demolition/renovation survey, signed and dated by the person who conducted the inspection, for a minimum of two (2) years in the project file. The documentation must indicate what information was relied upon to determine whether the pipe contained asbestos. (See Attachment A for a Pre-Demolition/Renovation Survey Documentation template.)

### ***b. Notification***

A notification must be submitted to MassDEP for each asbestos-cement pipe project on an Asbestos Notification Form ANF-001/BWP AQ-04 in accordance with 310 CMR 7.15(6). The notification must be submitted at least ten (10) working days before starting asbestos cement pipe removal. The ANF-001/BWP AQ-04 and answers to frequently asked questions about filing notifications are available at:

<https://www.mass.gov/how-to/aq-04-anf-001-asbestos-removal-notification>

The asbestos notification is filed online using MassDEP's online notification system, eDEP: <https://edep.dep.mass.gov/>

If you cannot wait the requisite 10 working-day notification period prior to starting work, you will need to request an emergency waiver from the MassDEP regional office that covers the town in which the project is located. (See the response to question number 4 in the "Frequently Asked Questions" section of this guidance document for more details on how to obtain an emergency waiver.) The MassDEP staff person who approves an emergency waiver will provide a project-specific waiver number that must be entered on the notification form in the relevant field.

A notification fee, currently \$100.00, is required when filing an ANF-001/BWP AQ-04. However, asbestos abatements at property owned by cities, towns, counties, districts of the Commonwealth, municipal housing authorities, federally recognized Indian tribe housing authorities, state agencies, the

Massachusetts Bay Transportation Authority, and owners of owner-occupied residential properties with four or fewer units are exempt from this fee.

Owners and operators who are planning to remove or repair several pipe segments over a specific period of time may apply to MassDEP for approval of a “blanket notification”, which would cover the entire project for a time period not to exceed one (1) year. While individual ANF-001/BW AQ-04 forms would still need to be submitted for each segment of the work, the blanket approval would eliminate the ten working day advance notification requirement for the individual filings. Information regarding asbestos blanket notifications may be found at:

<https://www.mass.gov/how-to/aq-05-asbestos-blanket-notification-approval>

An application fee of \$200 is required for each application for a blanket notification approval.

### ***c. Licensing and Training***

DLS’s regulation (453 CMR 6.00) establishes requirements for the use of contractors and other asbestos specialists who are licensed or certified by that Department. Please call DLS for all licensing and training questions. Contact information can be found in the response to Question 28 in the attached Frequently Asked Questions.

In lieu of hiring a DLS-licensed asbestos contractor, an owner or operator conducting asbestos abatement activity on underground asbestos cement piping may hire contractors or other entities who have completed the “8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety” course developed jointly by the MWWA and UCANE, or a course similar in length and content reviewed and approved in writing by DLS, provided that the owner, operator and contractor comply with the provisions and procedures described in this guidance document. To maintain one’s qualification, DLS requires that the contractor or other entity must complete 4-hour ACP Worker Safety Refresher Training at least every 5 years after the initial training.

### ***d. Specific Work Practice Requirements for Underground Asbestos-Cement Pipe.***

Owners/operators shall ensure the work practice standards listed below are followed:

1. Asbestos-cement pipe shall be handled in a manner that will minimize the risk of making it friable ACM or releasing asbestos dust into the environment.
2. At the start of work involving asbestos-cement pipe, owners/operators shall ensure that:
  - a. The asbestos-cement pipe shall be exposed with minimal disturbance.
  - b. Mechanical excavation shall not be used within six inches of the asbestos-cement pipe.

- c. The soil within six inches of the asbestos-cement pipe shall be uncovered by hand or with a shovel.
  - d. Once the pipe has been exposed, an assessment shall be made before proceeding to determine whether the asbestos-cement pipe is damaged, cracked or broken to determine whether the requirements of Section III.d.3. or 4. (below) apply to the asbestos abatement activity.
3. If the assessment shows that the asbestos-cement pipe is intact and not deteriorated:
  - a. Place 6 mil (0.006 inch) thick polyethylene sheeting under the asbestos cement pipe to prevent soil contamination.
  - b. Adequately wet the asbestos-cement pipe with amended water using surfactant or liquid soap before and during removal to avoid creating airborne dust.
  - c. Separate the asbestos cement pipe at the nearest coupling (bell or compression fitting).
  - d. Slide the asbestos-cement pipe apart at the joints (no saw cutting) or use other methods that do not cause the asbestos-cement pipe to break, become friable ACM or otherwise create the potential to release asbestos fibers.
  - e. Wrap wet asbestos cement pipe in two layers of 6 mil polyethylene sheeting, seal with duct tape and label (This may be done either in the trench or adjacent to the trench). Package any other asbestos-containing debris from the abatement in accordance with 310 CMR 7.15(7)(f)(3) – e.g., while wet, place debris in two plastic bags (six-mil minimum thickness each bag, one inside the other) or in leak-proof metal, plastic or plastic lined drums with locking lids.
  - f. If the trench is filled with water, the placement of polyethylene sheeting is not required.
4. If the asbestos-cement pipe is deteriorated or is not intact, or when the use of mechanical breakage with saws, snap or blade cutting, and/or tapping is necessary:
  - a. Place 6 mil (0.006 inch) thick polyethylene sheeting under the asbestos-cement pipe to prevent soil contamination.
  - b. Adequately wet asbestos-cement pipe with amended water where cutting or breaking will occur.
  - c. Saw cutting of asbestos-cement pipe shall only be conducted with a HEPA-shrouded vacuum attachment or wet cutting equipment, unless it is conducted within a small enclosure that isolates the area in which the saw cutting is being conducted to prevent the release of asbestos fibers to ambient air.
  - d. Wrap wet asbestos cement pipe in two layers of 6 mil polyethylene sheeting, seal with duct tape and label (This may be done either in the trench or adjacent to the trench). Package any other asbestos-containing debris from the abatement in accordance with 310 CMR 7.15(7)(f)(3) – e.g., while wet, place debris in two plastic bags (six-mil minimum thickness each bag, one inside the other) or in leak-proof metal, plastic or plastic lined drums with locking lids.

5. For activities that disturb friable ACM, no visible emissions shall be discharged to the outside air during the collection, processing, packaging or transporting of any ACM or ACWM.
6. Refer to Section “III.e.” of this guidance document for packaging, labeling, disposal, and record retention requirements.

### ***e. Packaging, Labeling, Disposal and Record Retention***

All ACWM must be packaged, labeled, transported, stored and disposed of in accordance with requirements specified at 310 CMR 7.15(15): Asbestos-containing Waste Material Packaging Requirements, 310 CMR 7.15(16): Asbestos-containing Waste Material Transport Requirements, 310 CMR 7.15(17): Asbestos-containing Waste Material Storage and Disposal Requirements, 310 CMR 7.15(18): Waste Shipment Records and Reports, and 310 CMR 19.061: Special Waste, including but not limited to the following:

- i. Place properly wrapped and labeled ACWM pipe as well as all other packaged ACWM and debris in a roll-off container(s), or covered trucks, trailers or vans that are lined with 2 layers of 6 mil polyethylene sheeting.
  - a. The container shall be an enclosed and sealed leak-tight container having proper labels and U.S. Department of Transportation placards as required.
  - b. If open-top roll-off containers are used, they must be properly sealed, labeled and secured inside a locked fenced area when they are not being loaded to prevent access by unauthorized personnel, and covered to prevent water accumulation.
- ii. Package, transport and dispose of ACWM in accordance with local, state, and federal regulations.
- iii. Complete waste shipment records must be retained for 2 years by the owner/operator of the facility that generated the ACWM.
- iv. Dispose of ACWM at a landfill permitted to accept ACWM.

**Please note:** “Bulk Loading”<sup>1</sup> of ACWM is not permitted without written approval from MassDEP - via approval of a Non-Traditional Asbestos Abatement Work Practice Application. (See BWP AQ-36 “Application for Non-Traditional Asbestos Abatement Work Practice Approval” <https://www.mass.gov/how-to/aq-36-non-traditional-asbestos-abatement-work-practice-approval> for information about how to apply for this permit.) Loading operations involving waste generated from asbestos cement pipe removal that is handled, packaged, labeled, containerized and stored/disposed of in accordance with Sections III.d. and III.e. of this guidance are not considered bulk loading

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<sup>1</sup> “Bulk Loading” means the placement of unconfined ACWM in a vehicle or container, such as a roll-off, dumpster or truck *in lieu* of packaging the ACWM in individual leak tight containers.[310 CMR 7.15(1) Definitions

and do not require a Non-Traditional Asbestos Abatement Work Practice Approval.

### ***f. Visual Inspection Requirement***

When asbestos cement pipe removal is repaired or replaced, the final visual inspection shall be performed by a person who has completed a DLS-approved training course specific to asbestos cement pipe worker safety (e.g., the “8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety” course), or another course similar in length and content that has been reviewed and approved in writing by DLS).

The person conducting the final visual inspection shall:

- a. Inspect the work area to ensure there was no visible debris remaining:
  - i. In the excavation trench;
  - ii. In soil excavated from the trench;
  - iii. In the surrounding area adjacent to the trench after the removal of the asbestos cement pipe, and
  - iv. On any tools used during the removal/repair/replacement activities.
- b. Ensure that all ACWM has been removed for proper storage/disposal.

The person who conducted the final visual inspection shall sign and date the documentation of the final inspection, in a format provided by the Department, as evidence that the inspection was performed and that the condition of “no remaining visible debris” was met. Owners/operators shall keep such documentation at their regular place of business for two (2) years from the date of final visual inspection and provide it to the Department upon request. (See Attachment B for an example of a Post-Abatement Visual Inspection template.)

## **Frequently Asked Questions About Asbestos Cement Pipe Removal**

### **1. What is Asbestos? Is it hazardous to your health?**

Asbestos is a naturally occurring fibrous mineral consisting of any one of a number of silicates. Asbestos has been and is still used in a variety of products because of its physical properties, which make it resistant to heat, fire, and many caustic chemicals. Asbestos has been used extensively as fireproofing, an insulating agent, and for decorative purposes, among many other uses.

The physical properties that give asbestos its resistance to heat and decay are linked with several adverse human effects. Asbestos tends to break into a dust of

microscopic fibers. Because of their size and shape, these tiny fibers can remain suspended in the air for long periods of time and can easily penetrate bodily tissue when inhaled or ingested. Because of their durability, these fibers can remain in the body for many years.

Asbestos is known to cause asbestosis and various forms of cancer. **Asbestosis** is a chronic disease of the lungs that makes breathing progressively more difficult, and can lead to death. Cancer can result from breathing asbestos fibers and **lung cancer** is the most frequent. **Mesothelioma**, an incurable cancer of the chest and abdominal membranes, almost never occurs without exposure to asbestos. Asbestos-related diseases have a long latency period and may not show up until 10 to 40 years after exposure. Each exposure increases the likelihood of developing an asbestos-related disease.

## **2. How do I know whether cement pipes contain asbestos?**

Cement pipes used for public drinking water, waste water, roof drains or underground conduits may contain asbestos and should be handled in accordance with MassDEP's asbestos regulation (310 CMR 7.15) and the specific "Requirements for Underground Asbestos-Cement Pipe" (310 CMR 7.15(12A)) unless the owner possesses documentation based on sampling and analysis, in accordance with approved EPA test methods, that has shown that they do not contain asbestos. It is the obligation of anyone removing or repairing materials that contain asbestos to handle them in accordance with applicable laws and regulations. Ignorance or avoidance of this responsibility does not remove this obligation.

Up-to-date as-built plans, reviewed by the owner/operator, that accurately identify the material that pipes or pipe segments are made of can be relied on to confirm that the pipe contains asbestos.. Another acceptable method for determining whether a pipe or pipe segment contains asbestos is through visual identification in the field at the time of excavation, when the pipe material is readily identifiable by observing the manufacturer's brand-label (e.g. Johns-Manville Transite) or other markings on the pipe (e.g., indicating its source). This identification must be done by a person who has completed a DLS-approved training course specific to asbestos cement pipe worker safety (e.g. the "8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety" course) or another course similar in length and content that has been reviewed and approved in writing by DLS). If up-to-date as-built plans are not available and a definitive visual identification cannot be made, the owner/operator can presume the cement pipe contains asbestos and handle it in accordance with this guidance.

## **3. Does MassDEP have to be notified prior to beginning an asbestos cement pipe removal or repair project?**

Yes, the owner/operator of a facility containing asbestos cement pipes must notify MassDEP ten working days before removing or repairing asbestos cement pipes. Notification is required no matter who is doing the removal/repair or how much



asbestos cement pipe is being removed or repaired. Please note that notification is required for repairs of asbestos cement pipe using tools that are considered “non-destructive” or “fail-safe” such as metal compression patches, wet tapping, etc. (See response to Question number 4 below for how to satisfy the notification requirement in the case of an emergency situation.)

#### **4. We have an emergency and the pipe(s) need to be repaired immediately. Can we make the necessary repairs prior to submitting notification to MassDEP?**

Yes, if MassDEP grants you an “emergency waiver.” Work can be performed right away by calling the appropriate regional MassDEP office and obtaining an emergency waiver of the ten (10) working day waiting period. To identify the regional office for the town in which your project is located, please go to the MassDEP website at the following URL: <https://www.mass.gov/service-details/massdep-regional-offices-by-community>. Simply call the service center and ask for the asbestos program staff, or call the asbestos program staff member listed in response to FAQ number 27 below. The MassDEP staff person who approves an emergency waiver will provide a project-specific waiver number that must be entered on the notification form in the relevant field.

If the emergency occurs after business hours or on a weekend, leave a detailed message including your contact information on voice mail for the MassDEP asbestos inspector’s voice mail and proceed with the repairs as detailed in this document. You should then follow up with MassDEP on the following business day. You will still be required to submit an asbestos notification form ANF-001/BWP AQ-04 within 24 hours of the removal.

In addition, you can conduct the work without the required ten working day notification period if you have a MassDEP approved asbestos blanket notification. Information regarding asbestos blanket notifications may be found under the heading “BWP AQ 05 - Application for Asbestos Blanket - Form and Guidance” at the following link: <http://www.mass.gov/eea/agencies/massdep/service/approvals/bwp-aq-05.html>.

#### **5. Is there a notification form I should use?**

Notification for asbestos cement pipe removal must be made by completing and submitting to MassDEP the MassDEP-approved Asbestos Notification Form ANF-001 (also known as BWP AQ-04). The Asbestos Notification Form is available on MassDEP’s web site at <http://www.mass.gov/eea/agencies/massdep/service/approvals/bwp-aq-04-anf-001.html> . The asbestos notification can be filed online via MassDEP’s website. See question number 10 below.

## **6. When must the notification be submitted?**

The regulations require that the notification must be submitted at least ten working days in advance of the start of the asbestos cement pipe removal project. “Working days” do not include Saturdays, Sundays, or any day that MassDEP offices are closed for business, such as legal holidays.

## **7. When does the ten working day waiting period begin and end?**

Your 10 working day waiting period will start when you submit your form, and you will receive an automatic notification that the submittal was received.

Please note that you must start work on the “start date” and end on the “end date” you indicate on the ANF-001. If you change the start date, you must revise your notification prior to the original start date indicated and allow for a full ten-day waiting period prior to the revised start date. If you need to start work sooner than ten days before the revised start date, call the MassDEP regional office to request an emergency waiver of the ten-day waiting period. (See Emergency Waiver information found at FAQ no. 4.) If you start and end work on the dates indicated in the original notification, but work intermittently within that period, that does not require a revision - simply notify the MassDEP regional office which days will not be performing work.

## **8. Will I be notified when I can begin the work?**

No. Unless MassDEP contacts you with a statement of deficiencies about your notification, you can begin work on the "project start date" you entered on the Asbestos Notification Form ANF-001. When completing the ANF-001, be sure that the "project start date" falls on or after the 10 working day wait period.

## **9. Is a fee required for filing an asbestos notification?**

The notification fee required by MassDEP regulations (310 CMR 4.00: Timely Action Schedule and Fee Provisions) for asbestos removal is \$100 per notification. A notification revision requires re-filing the notification and payment of a \$35 fee.

Please note: owners of owner-occupied residential properties with four or fewer units, cities, towns, counties, districts of the Commonwealth, municipal housing authorities, federally recognized Indian tribe housing authorities, state agencies and the MBTA are not subject to the asbestos notification fee. However, state agencies are subject to fees greater than \$100 (e.g., the \$200 Blanket Notification Approval application fee).

## **10. How do I submit the ANF-001 to the MassDEP?**

Notification must be made on a current version of the MassDEP Asbestos Notification Form (ANF-001), which satisfies the requirements of both MassDEP and

DLS regulations (See: <https://www.mass.gov/how-to/aq-04-anf-001-asbestos-removal-notification>.) Follow these steps:

1. If you have not already done so, register online with <https://edep.dep.mass.gov/edep/>. Select “New User” and complete the required steps. It should take no more than five minutes to complete the registration process, and you can begin online filing of your notifications right away.
2. The eDEP Asbestos Notification Form and Instructions are available at: <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>
3. When filing via eDEP, you will pay the fee online using a credit card. Please note that “fee decals” are no longer sold and cannot be used to file online.
4. When filing electronically through eDEP, your 10-working day waiting period will start when you submit your form, and you will receive an automatic notification that the submittal has been recorded.

#### *Troubleshooting*

If you get an error message after you click “Error Check & Next” at the end of the form that says “License # is not recognized,” please check to make sure you typed the DLS License and Certification Numbers for the asbestos contractor, on-site supervisor/foreman, project monitor, and asbestos analytical lab number correctly. (Please note: Only fill in the fields for the DLS license/certification #'s for questions 6-9 in Section A of the form. The fields with the corresponding names and addresses will be pre-populated when you click “Error Check & Next.”)

If the project does not require the use of a DLS-licensed asbestos contractor, then simply check off the appropriate boxes on the BWP AQ04 (ANF-001) PreForm and when you click “Error Check & Next,” it will automatically pre-populate the asbestos contractor and asbestos supervisor fields (i.e. questions 6 and 7) to reflect work by a “Non Licensed Removal.” For the project monitor and analytical lab information (i.e. questions 8 and 9) for this type of “Non Licensed Removal” situation, you can enter the DLS certification number in the appropriate data field if one of those disciplines will be used on the project. Or if those disciplines will not be used, then you can simply enter “N/A” in the DLS Certification data fields and leave the “Name” data fields blank.

If you still get an error message pop-up box, please contact the MassDEP data systems group: [BAW.eDEP@state.ma.us](mailto:BAW.eDEP@state.ma.us)

### *eDEP Features*

Use of the eDEP online notification system ensures that you are using the most current form, and that you have provided all required information. Filing your ANF-001 Notification online via eDEP helps avoid common mistakes. Furthermore, electronic filers can see all of the Construction/Demolition Notification Forms they have submitted on-line by clicking on the “My eDEP” tab in the upper left corner of your log-in screen. In the event that either the project start date or end date changes, triggering the requirement to file a notification revision, the simplest way to do this is by filing a notification revision online via eDEP. (See Question 10 for more information on filing notification revisions.)

If you are unable to use the eDEP online notification system to file your ANF-001, you may file an alternate format (e.g. a paper version of the ANF-001) by emailing a request to [BAW.eDEP@state.ma.us](mailto:BAW.eDEP@state.ma.us). Please include a phone number where you can be reached so that MassDEP can help you in your request. If you have any questions or desire further information about filing electronically through eDEP, please email your inquiry to [BAW.eDEP@state.ma.us](mailto:BAW.eDEP@state.ma.us).

### **11. Do I need to notify other government agencies in addition to the MassDEP?**

You may be required to notify the local Building Department, Fire Department, or Board of Health in the city or town where the asbestos is being removed. Always contact local officials to ask what notification or permits are required. Submittal of a complete ANF-001 to MassDEP satisfies **state** (both MassDEP and DLS) and **federal** notification requirements (e.g., EPA Asbestos NESHAP) for projects that will remove or disturb asbestos-containing material.

### **12. Do I need to hire an asbestos contractor to repair and/or remove asbestos cement pipe?**

DLS’s regulation (453 CMR 6.00) establishes requirements for the use of contractors and other asbestos specialists who are licensed or certified by DLS. Please call DLS for all licensing and training questions. Contact information can be found in the response to Question 28 in the attached Frequently Asked Questions.

In lieu of hiring a DLS-licensed asbestos contractor, an owner or operator conducting asbestos abatement activity on underground asbestos cement piping may hire Contractors or other entities who have completed the “8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety” course or a course similar in length and content reviewed and approved in writing by DLS, provided that the owner, operator and contractor comply with the provisions and procedures that are described in this guidance document.

**13. Can I crush the asbestos cement pipe in the trench and place new pipe over it?**

No, crushing an asbestos cement pipe and leaving it in the trench is prohibited under 310 CMR 7.15. Further, the EPA has determined that backfilling and burial of the crushed asbestos cement pipe would cause these locations to be considered active disposal sites and therefore subject to the “Standard for Active Waste Disposal Sites” (40 CFR 61.154).

**14. Can I “ream” or “pipe burst” new water supply pipe through existing asbestos cement pipe?**

No, this is not allowed because reaming or pipe bursting through an existing asbestos cement pipe would cause the existing asbestos cement pipe to become crushed and “friable” (see response to question number 13 above).

**15. What if the trench is filled with water which prevents the placement of polyethylene sheeting below the asbestos cement pipe (as required in Section IV.d. – Handling Practices)?**

If the trench is filled with water, the placement of polyethylene sheeting is not required, as stated in Section III.d – Specific Work Practice Requirements. However, any visible debris must be managed in accordance with the requirements of Section III.e. – Packaging, Labeling, Disposal and Record Retention and III.f. – Visual Inspection Requirement.

**16. What should I do with the water in the trench?**

For work on the intact asbestos cement pipe(s), first try to pump the water out to a storm drain prior to any work. If there is substantial damage to the asbestos cement pipe and there are numerous pieces immersed in standing water, then the contaminated water should be pumped out and filtered through a 5 micron filter before the water is discharged.

**17. Am I required to remove asbestos cement pipe that will not be disturbed by repair or replacement activities?**

MassDEP only requires the removal of asbestos cement pipe that is exposed and will be disturbed during repair or replacement activities.

When a section of asbestos cement pipe is being repaired or replaced, the remaining portions of that pipeline are not required to be removed, provided that they are not exposed by excavation activity.

Additionally, if a section of asbestos cement pipe that is being actively used (e.g., a utility conduit) is exposed by excavation but will not be impacted by the repair or replacement work, it may be left in place and backfilled.

**18. Where can I obtain the packaging and labeling materials?**

The MassDEP-required asbestos warning labels and asbestos waste bags may be obtained from industrial supply houses, insulation supply houses, or may be purchased directly from licensed asbestos contractors. Polyethylene sheeting and duct tape are widely available from hardware, home supply and other stores.

**19. Can I store waste asbestos cement pipe?**

Asbestos cement pipe waste material that has been properly wetted, packaged in sealed, leak-tight containers, and labeled can be temporarily stored for up to thirty (30) days at a secure location on property owned or controlled by the owner or operator of the public/private utility system or at the place of business of the company/contractor removing asbestos-cement pipe from its site of origin. The storage location must be secured (e.g., storage in a locked fenced-in area) and maintained in accordance with all federal, state and local requirements. Contact local officials to determine if temporary storage of asbestos cement pipes is allowed in your municipality.

**20. Can I store unused “virgin” asbestos cement pipe?**

Unused (i.e. “virgin”) asbestos cement pipe that is still suitable for use is not considered an ACWM, and is therefore not subject to the ACWM storage limitations. Measures should be taken to ensure that stored virgin asbestos cement pipe does not become deteriorated by constant exposure to the elements. If virgin asbestos cement pipe deteriorates so that it is no longer suitable for use, then it would be considered ACWM and subject to all the applicable packaging, labeling, storage and disposal requirements at 310 CMR 7.15(15) – (18).

**21. Can I dispose of the asbestos cement pipes with my other solid waste?**

No. The asbestos cement pipes must be managed as a “Special Waste” (requiring proper packaging, labeling, and disposal) and in Massachusetts may only be disposed of at a facility that is permitted to accept ACWM under 310 CMR 19.061 (“Special Waste” regulation).

**22. How can I find a place to dispose of the asbestos cement pipes?**

The best option is to hire a waste hauler or asbestos contractor to transport the asbestos cement pipes to a disposal facility. Many waste haulers and asbestos contractors are familiar with various disposal facilities and frequently transport wastes to facilities permitted to accept ACWM.

You also can contact a landfill directly and arrange to transport the waste to the landfill yourself. ACWM can only be disposed at a solid waste landfill permitted to accept “Special Waste”, which in Massachusetts must be operated in accordance with regulatory requirements specified at 310 CMR 19.061, or in another state, in

accordance with the relevant “Special Waste” permit requirements. You should contact the facility in advance of transporting ACWM for disposal.

ACWM may not be sent to an incinerator or to a construction and demolition (C&D) debris processing facility in Massachusetts. Likewise, no Massachusetts transfer stations are permitted to accept ACWM.

### **23. How do I find an asbestos waste hauler?**

Asbestos waste haulers may be located by using any available internet search engine or by looking this topic up in the Yellow Pages. Try entering/looking under topics such as "rubbish," "waste" or "asbestos." Any firm hauling ACWM must be registered with the Federal Highway Administration’s Motor Carrier Division. Call the nearest regional MassDEP office for additional help.

### **24. Can I transport the waste asbestos cement pipes myself?**

Waste asbestos cement pipe that has been packaged and labeled in accordance with Section III.e. – Packaging, Labeling, Disposal and Record Retention, may be transported in a covered truck, trailer or van to a secured, temporary storage location at property owned or controlled by the pipe owner or operator or at the place of business of the company/contractor that removed the asbestos-cement pipe from the excavation, as outlined in question 19. If a van is used, the waste asbestos cement pipe should be transported in a compartment separate from the driver or passenger seats. A pickup truck bed should be covered with an impermeable tarpaulin cover and secured so that it does not allow the accumulation of rain water. The waste containers should not be loaded above the side rails in any truck or trailer.

### **25. Is there any paperwork required for transporting the waste asbestos cement pipes?**

Yes. 310 CMR 7.15(18): Waste Shipment Records and Reports requires that an asbestos Waste Shipment Record (WSR) document accompanies each shipment of ACWM. Waste hauling companies and/or asbestos removal companies can supply WSR forms. (A template for the WSR form is available at: <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>). The WSR must be signed by each company or person involved with removal, transportation and disposal of the ACWM, including the facility owner or “generator” of the asbestos. The asbestos removal contractor may sign on behalf of the owner.

Pursuant to 310 CMR 7.15(18), if a completed copy of the WSR, signed by the disposal facility to acknowledge receipt of the waste shipment, is not received back by the generator within 35 days of the initial shipment, the generator must contact the transporter or disposal facility to determine the status of the waste shipment. This section of the regulation also requires the generator to notify the MassDEP regional office in writing if the generator does not receive a signed copy of the WSR from the disposal facility within 45 days of the date of shipment. The generator, the transporter, and the disposal facility must each retain a copy of the WSR signed by all

the parties for at least two years. You do not need to send a completed copy of the WSR to any regulatory agency, but MassDEP may request a copy of the WSR from any of the parties in the event of an inspection.

Additionally, transportation of asbestos (which is designated as a hazardous material for transportation) is regulated by the U.S. Department of Transportation (US DOT), which has established requirements for shipping documents, packaging, labeling, and vehicle placarding (49 CFR 173.1090): asbestos must be loaded, handled and unloaded in a manner that will minimize occupational exposure to airborne asbestos fibers released during transit. US DOT also requires that transporters carry identification papers for all quantities of asbestos greater than 1 pound. The Massachusetts state police enforce this requirement.

## **26. Does MassDEP have a document containing general information about asbestos?**

Yes. The “Asbestos Information and Resource Guide” is available <https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>. The guide includes contact information for various government agencies responsible for asbestos, a list of regulations governing asbestos, and general information about asbestos and asbestos removal.

## **27. How do I contact MassDEP for more information?**

For more information on asbestos or other environmental issues, please visit MassDEP’s website at [www.mass.gov/dep/about/contacts.htm](http://www.mass.gov/dep/about/contacts.htm) or contact the following MassDEP officials:

**Boston:** (For general information about asbestos policy/regulation and notification/fees) Mike Elliott at 617-292-5575 or [michael.elliott@mass.gov](mailto:michael.elliott@mass.gov)

**Central Region:** Gregg Levins at 508-767-2768 or [gregory.levins@mass.gov](mailto:gregory.levins@mass.gov)

**Northeast Region:** John MacAuley at 978-694-3262 or [john.macauley@mass.gov](mailto:john.macauley@mass.gov)

**Southeast Region:** Cynthia Baran at 508-946-2887 or [cynthia.baran@mass.gov](mailto:cynthia.baran@mass.gov)  
Emergency Waiver Hotline: 508-946-2882

**Western Region:** Marc Simpson at 413-755-2115 or [marc.simpson@mass.gov](mailto:marc.simpson@mass.gov)

## **28. How do I contact Massachusetts DLS?**

For information about DLS asbestos training, certification and/or licensing, contact:

Massachusetts Department of Labor Standards/Asbestos Program  
Charles Hurley Building  
19 Staniford Street, 2nd Floor  
Boston, MA 02114  
Phone: 617-626-6960, Fax: 617-626-6965, Web: [www.mass.gov/dols](http://www.mass.gov/dols)



## Template A: Pre-Demolition/Renovation Survey Documentation

### 1. Project Location:

\_\_\_\_\_  
(Street address, GPS coordinates or other location identification)

City/Town: \_\_\_\_\_, MA

### 2. Pre-Demolition/Renovation Survey

Survey Date: \_\_\_\_\_

MassDEP's asbestos regulation requires owners and operators (including contractors) to determine whether cement pipe in the utility conduit that will be disturbed contains asbestos. Please identify the information that was used to determine whether the pipe at this location contains asbestos by checking all applicable boxes:

Accurate, up-to-date as-built plans or other utility network documents. Specify title and revision date of the as-built drawing or other documentation:

\_\_\_\_\_  
 Visual identification/ field observations of exposed pipe. Specify manufacturer's brand-label marking (e.g. "Johns-Manville Transite") or other features used to identify composition/source of pipe:

\_\_\_\_\_  
 I was physically present at the location described above and personally observed the pipe or pipe segment when it was exposed and before it was removed, replaced and/or repaired.

Presumed that pipe contained asbestos.

Relied on representative samples that were analyzed at a certified laboratory.

Identify Laboratory and DLS certification number: \_\_\_\_\_

Date samples were collected: \_\_\_\_\_ Date of lab report: \_\_\_\_\_

Result of the analysis (% asbestos): \_\_\_\_\_

**Does the pipe (or pipe segment) that will be disturbed contain asbestos?**  Yes  No

**If "Yes", what is the MassDEP Asbestos Notification Number (ANF-001 Form)?** \_\_\_\_\_

### 3. Qualifications. Please check the applicable box:

I have successfully completed the "8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety" course approved by the Massachusetts Department of Labor Standards (DLS), or a course similar in length and content reviewed and approved in writing by DLS; or

I am a DLS-certified Asbestos Inspector.

Name (please print): \_\_\_\_\_

Title/Company: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Template B: Post-Abatement Visual Inspection Documentation

### 1. Project Location/Identification:

\_\_\_\_\_  
(Street address, GPS coordinates or other location identification)

City/Town: \_\_\_\_\_ MA

MassDEP Asbestos Notification Number (ANF-001 Form): \_\_\_\_\_

### 2. Post-Abatement Visual Inspection

Date of Visual Inspection: \_\_\_\_\_

When any repair/removal of an asbestos cement pipe or pipe segment is complete, a visual inspection must be done before the trench is backfilled to confirm that ALL of the following conditions have been met. Please check each condition below to document that the visual inspection confirmed:

- No visible debris was present in trench.
- No visible debris was present outside of the trench (e.g. in excavated soils and the immediately surrounding area).
- No visible contamination was seen on tools.
- All Asbestos Containing Waste Material has been removed from the area for proper disposal.
- I was physically present at the location described above and personally conducted this inspection while the pipe or pipe segment was exposed and before the trench was backfilled.

### 3. **Qualifications.** Please check the applicable box:

- I have successfully completed the "8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety" approved by the Massachusetts Department of Labor Standards (DLS), or a course similar in length and content reviewed and approved in writing by DLS; or
- I am a DLS-certified Asbestos Project Monitor.

Name (please print): \_\_\_\_\_

Signature: \_\_\_\_\_

Title/Company: \_\_\_\_\_

Date: \_\_\_\_\_

## APPENDIX Q

Massachusetts Historical Commission Project Notification Form



950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A

MASSACHUSETTS HISTORICAL COMMISSION  
220 MORRISSEY BOULEVARD  
BOSTON, MASS. 02125  
617-727-8470, FAX: 617-727-5128

RECEIVED

MAR 31 2023

MASS. HIST. COMM

RC 73030

PROJECT NOTIFICATION FORM

After review of MHC files and the materials you submitted, it has been determined that this project is unlikely to affect significant historic or archaeological resources.

Project Name: Wells 2, 3, and 4 Water Treatment Plant

Location / Address: 15 Tree Lane

City / Town: Town of Sharon, Massachusetts

Project Proponent

Name: Eric Hooper, Department of Public Works Superintendent

Address: 217R South Main Street, BOX 517

City/Town/Zip/Telephone: Town of Sharon, Massachusetts 02067

Edward L. Bell  
Deputy State Historic Preservation Officer  
Massachusetts Historical Commission

(781) 784-1525 ext. 2311

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name

Type of License or funding (specify)

Refer to the Attached License/Funding List

Project Description (narrative):

The project consists of the construction of a water treatment plant at the 15 Tree Lane site, the existing site of Well 4. Site improvements include the construction of an access road, a building (7,500 square feet), infiltration basins to attenuate stormwater, and new water main piping to connect the well sites to the new treatment facility.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

This project includes the possible demolition of the existing chemical building located south of the proposed WTP, as the building will no longer be needed following construction of the proposed facility.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

Yes, the project includes rehabilitation of existing water treatment equipment and support systems. The existing chemical equipment will be removed at all well sites. Hazardous material assessments will also be conducted to determine whether additional rehabilitation is needed.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Yes, the project includes the construction of a new water treatment plant. Refer to Figure 3 for a preliminary design plan.

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify.

No.

What is the total acreage of the project area?

Woodland	<u>±3.1</u>	acres	Productive Resources:	
Wetland	<u>+0.9</u>	acres	Agriculture	_____ acres
Floodplain	<u>+1.6</u>	acres	Forestry	_____ acres
Open space	<u>0</u>	acres	Mining/Extraction	_____ acres
Developed	<u>±0.7</u>	acres	Total Project Acreage	<u>6.3</u> acres

What is the acreage of the proposed new construction? 0.17 acres (building only)


What is the present land use of the project area?

The project area is adjacent to an existing paved right-of-way and is currently undeveloped (wooded).

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

Please refer to the attached Figure 1 and Figure 2.

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form:  Date: 3/29/2023

Name: Sarah Price, P.E.

Address: Environmental Partners  
1900 Crown Colony Drive, Suite 402

City/Town/Zip: Quincy, MA

Telephone: (617) 657-0287

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

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MAR 31 2023

MASS. HIST. COMM  
PC. 73030

*Federal and State License and Funding List  
Wells 2, 3, and 4 Water Treatment Plant – Well 3 Site  
Sharon, Massachusetts*

<b>Agency Name</b>	<b>Type of License of Funding</b>
DWSRF	Grant/loan funding
ARPA	Funding
MassDEP Drinking Water	Approval
MEPA	Approval
Conservation Commission	Approval
Zoning Board	Approval





**APPENDIX R**  
MEPA Certificate





*The Commonwealth of Massachusetts*  
*Executive Office of Energy and Environmental Affairs*  
 100 Cambridge Street, Suite 900  
 Boston, MA 02114

Maura T. Healey  
 GOVERNOR

Kimberley Driscoll  
 LIEUTENANT GOVERNOR

Rebecca L. Tepper  
 SECRETARY

Tel: (617) 626-1000  
 Fax: (617) 626-1081  
<http://www.mass.gov/eea>

November 29, 2023

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS  
 ON THE  
 SINGLE ENVIRONMENTAL IMPACT REPORT

PROJECT NAME : Wells 2, 3, and 4 Water Treatment Plant  
 PROJECT MUNICIPALITY : Sharon  
 PROJECT WATERSHED : Boston Harbor  
 EEA NUMBER : 16725  
 PROJECT PROPONENT : Town of Sharon  
 DATE NOTICED IN MONITOR : October 23, 2023

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62L) and Section 11.08 of the MEPA regulations (301 CMR 11.00), I have reviewed the Single Environmental Impact Report (Single EIR) and hereby determine that it **adequately and properly complies** with MEPA and its implementing regulations.

Project Description

As described in the Single EIR, the project consists of the construction of a new 7,500-square foot (sf) water treatment plant (WTP) with a capacity of 1.85 million gallons per day (mgd), approximately 1.1 miles of new water mains to connect three existing (Wells 2, 3 and 4) to the WTP, and upgrades to three existing well stations. The proposed WTP will be constructed at the Well 4 site to treat water from Wells 2, 3 and 4, using chemical and filtration treatment systems, including potassium hydroxide for pH adjustment; sodium hypochlorite for disinfection and oxidation; three vertical pressure filters for the removal of iron and manganese; sodium bisulfite for dechlorination; bag filtration for solids removal; an adsorptive media vessel-based treatment for removal of PFAS; and standard finishing processes such as the addition of fluoride to water. The WTP will be designed as a “zero discharge” facility; process waste streams will be directed into the backwash waste tank then recycled to the head of

the WTP. Settled solids in the backwash tank will be periodically pumped to a tanker truck for off-site disposal. The WTP will also include a new driveway off Tree Lane near the existing driveway to the Well 4 site that parallels Tree Lane and ends in a parking area at the northern end of the site and a new stormwater management system.

Water from Wells 2, 3 and 4 will be pumped to the new WTP. A new 8-inch raw water main will be constructed using horizontal directional drilling (HDD) under Beaver Brook and associated wetlands to convey water from Well 3 to the existing Well 2 10-inch discharge water main. The 10-inch water main, in turn, will convey raw water from Wells 2 and 3 to a proposed 8-inch raw water main at the end of the Well 2 access drive that will transmit raw water to the proposed WTP. The proposed 8-inch water main will be installed between the Well 2 access drive and the proposed WTP at the Well 4 site following a route along Moose Hill Parkway, Depot Street and Tree Lane. A new 8-inch water main will be installed to convey raw water from Well 4 to the proposed WTP. The existing well stations at Wells 2, 3, and 4 will be upgraded with new pumps and electrical systems within the existing well station buildings.

The Town's water supply consists of six groundwater wells. Wells 2, 3 and 4 have a maximum daily withdrawal rate of 1.85 mgd; however, the Town is authorized to withdraw only 1.28 mgd from these sources. Water samples collected from Wells 2 and 3 over the last two years detected levels of iron and manganese in Well 2 that exceeded the SMCL and levels exceeding the SMCLs for manganese in Well 3. The Town began testing for PFAS in its wells after MassDEP established a PFAS MCL of 20 parts per trillion (ppt) in 2020. Water samples collected from Wells 2, 3 and 4 were found to contain PFAS at levels above the MCL. The Town installed a temporary PFAS treatment system at Well 4, where PFAS levels were nearly 5 times the MCL, and removed Well 2 from service. The Town is not proposing any change to the permitted withdrawal rate from the wells. The purpose of the project is to ensure that the Town can continue to use Wells 2, 3, and 4, which provide water to most of the Town's residents.

### Project Site

The site of the proposed WTP consists of two Town-owned parcels in central Sharon with a combined area of approximately 6.3 acres. The site is bordered to the east by railroad tracks used by the Massachusetts Bay Transportation Authority (MBTA) Providence/Stoughton commuter rail and Amtrak; to the south by Upland Road and Depot Street; to the west and northwest by residences along Tree Lane and Pine Grove Avenue; and to the north by undeveloped forested land. The site slopes steeply from elevation 205 feet (ft) NAVD 88 adjacent to wetlands associated with Beaver Brook in the eastern part of the site to an elevation approximately 240 ft NAVD 88 at Tree Lane. The existing Well 4 facility is located in the central part of the site at elevation 215 ft NAVD 88 and is accessed by an unpaved driveway off Tree Lane. Most of the site is forested, except for Beaver Brook and associated wetland resource areas in the eastern and southern parts of the site. According to the Federal Emergency Management Agency National Flood Hazard Layer, a 100-year floodplain (Zone AE) with a Base Flood Elevation (BFE) of 204 ft NAVD 88 is located in the low-lying part of the site adjacent to Beaver Brook; the southernmost section of the floodplain is designated as a regulatory floodway. The 100-year floodplain is regulated as Bordering Land Subject to Flooding (BLSF) under the Wetlands Regulations (310 CMR 10.00).

Well 2 is located in a wooded, undeveloped area approximately 0.6 miles southwest of Well 4 and the proposed site of the WTP. It is accessed by a driveway off Moose Hill Parkway. Well 2 is bordered to the east by a large wetland associated with Beaver Brook, to the south and west by undeveloped land owned by MassAudubon and to the north by undeveloped land and Moose Hill Parkway. The site is located within the 100-year floodplain (Zone A) with a BFE of 216 ft NAVD 88. Well 3 is located approximately 0.4 miles south of Well 2 and the northern end of Farnham Road. It is bordered to the north and west by the large wetland system associated with Beaver Brook, to the east by the Town's composting site and to the south by undeveloped land and a residential neighborhood along Sandy Ridge Circle.

Wells 2 and 3 are located within one mile of an Environmental Justice (EJ) population<sup>1</sup> (Block Group 3, Census Tract 4141) designated as Minority located in southwest Sharon. The location of the proposed WTP at the Well 4 site is not located within one mile of an EJ population. The project areas are within five miles of 32 additional EJ populations in Stoughton, Canton, Norwood, Walpole and Foxborough designated as Minority and Minority and English Isolation.

### Environmental Impacts and Mitigation

Potential environmental impacts associated with the project include alteration of 46,480 sf (1.07 acres) acres of land, including removal of trees and site regrading; creation of 19,450 sf (0.45 acres) of impervious area; and alteration of approximately 63,595 sf (1.46 acres) of Riverfront Area. The project will also temporarily impact BLSF in connection with installation of new water mains; however, this impact was not quantified because no regrading or construction of new permanent structures are proposed in BLSF.

The purpose of the project is to provide safe drinking water by reducing levels of PFAS, manganese and iron from three of the Town's drinking water wells. Measures to avoid, minimize, and mitigate environmental impacts include construction of a new stormwater management system, the use of erosion and sedimentation controls during project construction, use of HDD to avoid impacts to wetland resource areas due to construction of the raw water main under Beaver Brook, the restoration of temporarily disturbed areas following construction, and measures to increase the resiliency of proposed structures.

### Jurisdiction and Permitting

This project is subject to MEPA review because it requires an Agency Action and meets/exceeds the thresholds at 301 CMR 11.03(4)(b)(4) (construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd) and 301 CMR 11.03(3)(b)(1)(f) (alteration of ½ or more acres of any other wetlands (Riverfront Area)). The project requires the preparation of an EIR pursuant to 301 CMR 11.06(7)(b) because it is located within a DGA (1 mile) around one or more EJ Populations. The project will require a BRP-WS 24 (Approval to Construct a Water Treatment Facility) permit from MassDEP.

The project requires an Order of Conditions from the Sharon Conservation Commission (or in

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<sup>1</sup> "Environmental Justice Population" is defined in M.G.L. c. 30, § 62 under four categories: Minority, Income, English Isolation, and a combined category of Minority and Income.

the case of an appeal, a Superseding Order of Conditions from MassDEP) and a National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) from the U.S. Environmental Protection Agency (EPA).

The project is seeking Financial Assistance from the State Revolving Fund (SRF) Drinking Water Program, administered by MassDEP. Therefore, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

#### Changes Since the Filing of the Expanded Environmental Notification Form (EENF)/Proposed EIR

The Single EIR identified the following changes to the project since the filing of the EENF/Proposed EIR:

- The WTP has been redesigned with a residential façade rather than a barn-like façade;
- The orientation of the WTP has been adjusted to provide a larger buffer between the facility and Tree Lane; and,
- To minimize impacts to wetlands, the proposed water main between Well 2 and Well 3 will be constructed entirely using horizontal directional drilling (HDD) rather than by a combination of trenching and HDD.

#### Review of the Single EIR

The Single EIR was generally responsive to the limited Scope included in the Certificate on the EENF/Proposed EIR. It reviewed the Town's public engagement efforts since the EENF/Proposed EIR was filed, provided updated plans showing wetland resource area boundaries in relation to project components and impact estimates, provided the results of a Sound Analysis, and reviewed resiliency measures incorporated into the design of the project. It provided responses to comments received on the EENF/Proposed EIR and included draft Section 61 Findings.

The Single EIR included a Sound Analysis which summarized the results of an evaluation of secondary noise impacts associated with the proposed WTP. The analysis modeled the impacts of the facility at the proposed location at the Well 4 site on Tree Lane and at the Well 3 site off Farnham Road, which is one of the alternative locations for the WTP evaluated in the EENF. The analysis was conducted by the Town in response to concerns from residents north and west of the Well 4 site; the residents indicated that the site, which consists of a wooded hillside under existing conditions, would no longer provide a noise buffer between the residential area and trains passing along tracks south and east of the Well 4 site. The analysis was based on background sound levels recorded at the proposed WTP site and the alternative WTP site at Well 3, and modeled changes in sound levels due to both the removal of trees and the reflection of sound waves off the proposed building at each site. The analysis concluded that the proposed would cause a change in sound levels ranging from a decrease of 3 decibels (dB) to an increase of 3 dB at nearby residences at both locations. According to the Single EIR, a change of 3 dB would not be expected to be noticeable. The analysis did not evaluate the noise generated by operation of the proposed WTP; according to the Town, all operations will be confined to the interior of the building and will not be audible at adjacent residences. I encourage the Town to conduct a more comprehensive noise study prepared consistent with MassDEP's Noise Policy and to incorporate

measures to sound impacts from construction and operation of the WTP to the maximum extent practicable.

### *Alternatives Analysis*

The Single EIR provided supplemental information for the three alternative WTP sites reviewed in the EENF/Proposed EIR, including revised estimates of the environmental impacts associated with each alternative.<sup>2</sup>

Build Alternative A1 would construct the WTP at a site near Well 2 and its access road, and installation of approximately 6,000 ft of new water main between the site and Well 4. The WTP would be constructed in a level area that has been mostly cleared of trees located at the base of a steep hill. The site is in a remote area with no nearby residences or other uses. However, the site is entirely located within Riverfront Area and within the 100-year floodplain of Beaver Brook with a BFE of 216 ft NAVD 88 and would have the greatest impacts to these resource areas than any of the other alternatives. The ground level at the site is at elevation 208 ft. According to the Town, MassDEP typically requires that new water treatment facilities and their access roads be located at least two feet above the 100-year floodplain, which in this case would require construction of the building 10 feet above existing grade and elevating the access road by a similar amount. The Single EIR also indicated that, because the project is seeking federal funding, it would have to comply with the requirement that the first-floor elevation of the WTP be three feet above the 100-year flood elevation, or 11 feet above the existing grade. In addition, the cleared area is too small to accommodate the footprint of the WTP, which would require additional site clearing and regrading. According to the Single EIR, the addition of 11 feet of fill to raise the site of the WTP, and a comparable amount of fill to elevate the roadway, would make this alternative infeasible; therefore, no cost estimate was developed.

Build Alternative A2 would construct the WTP near the top of the hill at the Well 2 site (rather than at the base of the hill as proposed in Build Alternative A1) and approximately 6,000 ft of new water main. The Build Alternative A2 site is also in a remote area without nearby residential or commercial uses. However, the site is entirely wooded and has a steep topography, which would require a significant amount of regrading and clearing to establish a level construction site. In addition, a new, 300-ft long driveway would have to be constructed down the hill to meet the existing access drive. The potential routes for the new driveway are limited by steep grades and ledge on the hillside and wetlands adjacent to the existing access drive. Although the WTP would be located well above the 100-year flood elevation, the new driveway would be partially located in the floodplain; as a result, this alternative would have temporary impacts to 23,990 sf of BLSF. In addition, construction of the new driveway would require relocation of an existing hiking trail from the adjacent MassAudubon property to the existing access drive. According to the Single EIR, Build Alternative A2 is not a practicable site for the WTP due to the challenging construction conditions, which result in an estimated cost of \$42.95 million; this is higher than any other alternative.

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<sup>2</sup> After the close of the comment period on the Single EIR, I received comments recommending that the Town evaluate a No Build Alternative involving a connection to the MWRA system rather than construction of the proposed WTP and water mains. According to the Town, this alternative was discussed by the Selectboard but rejected for several reasons, including its costs. I note that a connection to the MWRA system would have impacts of its own, including an interbasin transfer of water. Accordingly, I do not find it necessary to require further consideration of this No Build Alternative as part of this MEPA review.

Build Alternative B would construct the WTP on the Well 3 site at the end of Farnham Road. The site has several suitable characteristics for construction of a WTP, including a generally flat topography that is located outside of wetland resource areas and the floodplain and compatibility with the Town's use of a nearby site as its composting facility. The site is located within 500 feet of up to six homes on Sandy Ridge Circle, which is located to the south/southwest. Construction of water mains would have no permanent impacts to Riverfront Area and temporarily alter approximately 24,225 sf of Riverfront Area, which is significantly less than the wetlands impacts of the other alternatives. In addition, Build Alternative B would require approximately 12,000 ft of new water mains, including approximately 3,000 ft main to convey water from Well 2; a separate 6,600-ft water main to convey water from Well 4; and 6,600 ft of new main to convey finished water from the WTP to the distribution system. All three new water mains would require a crossing of Beaver Brook, which would increase the cost of this alternative, which is estimated to be approximately \$42.04 million. Finally, Build Alternative B is the only alternative which would require a main carrying finished water to be installed deep under Beaver Brook using HDD; if the finished water main under Beaver Brook were to break or require repair, it would remove all three wells from operation and limit the Town's ability to meet the Town's demand for water.

The Preferred Alternative includes the construction of a new WTP at the Well 4 site. According to the Single EIR, the advantages of the Well 4 site include sufficient land area available to avoid impacts to BLSF and to minimize impacts to Riverfront Area; it requires less earthwork than the Well 2 site; and it minimizes the length of new water mains (5,300 ft) that would need to be installed. However, the preferred site is located within a residential neighborhood with four direct abutters and six or more residences within 500 feet. According to residents of the surrounding neighborhood, the amount of earthwork proposed at the site and the facility, including the retaining wall and fence proposed along the site's Tree Lane frontage, would impact the scenic nature of the neighborhood and generate noise and lighting impacts. The Single EIR described a revised orientation of the WTP which, compared to the design originally described in the EENF/Proposed EIR, shifts the northern end of the facility to the east, away from the neighborhood, and allows for additional plantings between the facility and the neighborhood. Compared to the orientation included in the EENF/Proposed EIR, which was designed to minimize Riverfront Area impacts, the revised orientation of the building increases permanent impacts to the Riverfront Area from 14,735 sf to 23,205 sf and temporary Riverfront Area impacts from 17,660 sf to 40,390 sf. However, the revised orientation was selected as the Preferred Alternative due to the increased buffer provided from residences. According to the Single EIR, the Preferred Alternative would cost \$36.34 million, which is significantly less than any of the other alternatives.

### *Environmental Justice*

The project area is located within one mile of one EJ population in Sharon designated as Minority. Within the census tract containing the above EJ population, no languages are identified as those spoken by 5% or more of residents who also identify as not speaking English very well. In the EENF/Proposed EIR, the Town provided a baseline assessment of any existing "unfair or inequitable Environmental Burden and related public health consequences" impacting the identified EJ population in accordance with 301 CMR 11.07(6)(n)(1) and the MEPA Interim Protocol for Analysis of EJ Impacts. The baseline assessment included a review of the data provided by the Department of Public Health (DPH) EJ Tool applicable to the DGA regarding "vulnerable health EJ criteria"; this term is defined in



the DPH EJ Tool to include any one of four environmentally related health indicators (Childhood Lead Exposure, Childhood Asthma Emergency Department Visits, Low Birth Weight and Heart Attack Hospitalizations) that are measured to be 110% above statewide rates based on a five-year rolling average. As documented in both the EENF/Proposed EIR and Single EIR, neither the Town of Sharon nor Block Group 3, Census Tract 4141, in which the EJ population is located, exceed 110% of the statewide rates of any of the four vulnerable health EJ criteria. According to the Single EIR, the project will not have disproportionate adverse effects on EJ populations because no project activities are proposed within EJ populations, there are minimal air emissions associated with the project, the project will have minimal traffic impacts during the operations and construction periods and stormwater runoff will be managed on-site. The purpose of the project is to protect the public health of all residents served by the drinking water system, which includes residents in EJ populations, by constructing a treatment facility that will ensure that the drinking water from Wells 2, 3 and 4 meets drinking water standards.

Prior to the publication of the EENF/Proposed EIR, the Town sent advance notification of the project in the form of an EJ Screening Form to a “EJ Reference List” provided by the MEPA Office and consisting of Community Based Organizations (CBOs) and tribes/indigenous organizations. Organizations on the EJ Reference List were provided with notice of the MEPA remote and in-person site visits conducted during the EENF/Proposed EIR review period. In addition, the Town posted notices of public meetings at Town Hall, the Sharon Public Library and the Sharon Post Office. Since the Certificate on the EENF/Proposed EIR was issued on July 31, 2023, the project was presented and discussed at public meetings held by Town of Sharon Water Management Advisory Committee and the Select Board, and the project will be the topic of upcoming public hearings to be held by the Sharon Conservation Commission, Sharon Planning Board, and Sharon Board of Zoning Appeals. According to the Single EIR, notices of the meetings were distributed to residents of the neighborhood adjacent to the proposed WTP and organizations on the EJ Reference List, and were posted at Town Hall, the Sharon Public Library and the Sharon Post Office. The Town will continue to use these notification methods to encourage public participation in future meetings during the design, permitting, and construction phases of the project.

#### *Wetlands and Stormwater*

The Single EIR provided a revised design of the section of water main to be installed between Well 3 and Well 2. In the EENF/Proposed EIR, the Town proposed to install most of the water main in a trench and to use HDD to install only the section under Beaver Brook. According to the Single EIR, the entire raw water main will be constructed below wetlands and Beaver Brook using HDD; this change will reduce temporary impacts to Riverfront Area by 6,863 sf and to BLSF by 7,545 sf. The project will comply with all requirements of the Order of Conditions to be issued by the Sharon Conservation Commission minimizing and mitigating impacts to Riverfront Area and BLSF.

The project will add 0.45 acres of impervious area at the proposed WTP site. According to the Single EIR, a new stormwater management system be constructed at the WTP site that will be designed in accordance with the MassDEP Stormwater Management Standards (SMS), including requirements for pollutant removal and peak flow attenuation through the use of Best Management Practices (BMPs) such as deep-sump hooded catch basins, sediment forebays and two infiltration basins with emergency overflow spillways and riprap aprons. As detailed below, the stormwater management system will be designed to accommodate storm events under projected future climate conditions.

### *Climate Change*

The Single EIR reviewed the output report, previously included in the EENF/Proposed EIR, from the MA Resilience Design Tool which assessed the climate risks of the project. Based on the output report, the project has a “High” exposure rating based on the project’s location for extreme heat and riverine and urban flooding due to extreme precipitation. Based on the 30-year useful life and the self-assessed criticality identified for the WTP, the MA Resilience Design Tool recommends a planning horizon of 2050 and a return period associated with a 50-year (2% chance) storm event when designing the WTP. It also recommends planning for the 90th percentile for applicable extreme heat parameters. According to the Single EIR, the WTP is unlikely to experience riverine flooding because its first-floor elevation will be 226 ft NAVD 88, which is over 20 ft higher than the 100-year flood elevation of Beaver Brook. The stormwater management system at the WTP will be designed with the capacity handle the current 100-year storm event having a 24-hour precipitation depth of 9.07 inches, which exceeds the 8.9 inches of precipitation projected for the 2050 50-year storm event. Given the critical nature of the WTP, I encourage the Town to evaluate a stormwater management system design with the capacity to handle an even higher level of increased precipitation associated with more intense storm events anticipated under future climate conditions. According to the Single EIR, the Well Stations will be upgraded with new high-efficiency variable frequency drive pumps and will install electrical equipment within water-tight panels and conduits to provide protection from flooding.

### Mitigation and Draft Section 61 Findings

The Single EIR included an updated chapter that summarized proposed mitigation measures and provided individual draft Section 61 Findings for each Agency that will issue permits for the Project. The draft Section 61 Findings will be revised and finalized during permitting.

### *Environmental Justice*

- The Town will continue to provide notification to residents of public meetings during the design, permitting, and construction phases of the project.

### *Wetlands and Waterways*

- Work within wetland resource areas will be conducted in accordance with the Order of Conditions issued by the Sharon Conservation Commission.
- A stormwater management system, designed consistent with the Massachusetts Stormwater Management Standards, will be constructed at the WTP.
- Minimize impacts to wetland resource areas by constructing water mains within roadways and previously-disturbed areas and by using HDD to install the raw water main from Well 3 under Beaver Brook.
- Restore disturbed Riverfront Area and BLSF to original site grades, and by revegetating disturbed areas.
- Minimize impacts to wetlands and water quality by using sedimentation and erosion controls around work areas and other stormwater management measures required by the Order of Conditions and Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance

with the NPDES General Permit.

### *Adaptation and Resiliency*

- A landscaped buffer will be planted between the WTP and Tree Lane.
- The WTP will be located at an elevation approximately 20 ft higher than the Beaver Brook BFE (204 ft NAVD 88) near the site, which minimizes the potential for riverine flooding of the site under future storm conditions.
- The WTP will be designed to be energy efficient, including a high-efficiency building envelope, an electric air source heat pump (ASHP) to heat and cool the control room/laboratory, reduced light power density and outdoor LED lighting.
- The stormwater management system at the WTP will be designed with the capacity handle the current 100-year storm event with a 24-hour precipitation depth of 9.07 inches, which exceeds the 8.9 inches of precipitation projected for the 2050 50-year storm event.
- Well station upgrades include installation of new pumps with high-efficiency variable frequency drives.
- The Well Stations will be designed to protect electrical equipment by using water-tight panels and conduits and will be constructed with backup generators located in weatherproof enclosures.

### *Construction Period*

- Install and maintain sedimentation and erosion controls around work areas and implement other stormwater management measures in accordance with the SWPPP.
- Minimize dust by implementing dust control measures, such as sweeping streets in work areas, covering dump trucks and sprinkling water or calcium chloride on disturbed areas.
- Minimize air emissions by using an emission control device such as a diesel oxidation catalyst or diesel particulate filter on each piece of diesel construction equipment, using ultra-low sulfur diesel (ULSD) fuel, prohibiting motor vehicle engines from idling more than five minutes, and require that diesel equipment meet EPA's Tier 4 Emissions Standards.
- Develop a traffic management plan to maintain safe roadway conditions for pedestrians, bicyclists and motorists.
- Notify MassDEP if any contaminated soil and groundwater is encountered during construction.
- Manage any contaminated soil and groundwater encountered during construction in accordance with applicable Massachusetts Contingency Plan (MCP) requirements and under the supervision of a Licensed Site Professional (LSP).
- Manage any asbestos cement water mains encountered during construction by storing and disposing of the material in accordance with the Solid Waste Management Regulations (310 CMR 19.00) and Air Quality Regulations (310 CMR 7.00) including requirements for handling and disposal of asbestos.

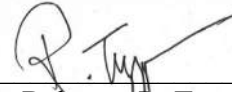
### Conclusion

Based on a review of the Single EIR and consultation with Agencies, I find that the Single EIR adequately and properly complies with MEPA and its implementing regulations. The project may

proceed to permitting. Participating Agencies should forward copies of the final Section 61 Findings to the MEPA Office for publication in accordance with 301 CMR 11.12.

November 29, 2023

Date

  
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Rebecca L. Tepper

Comments received:

10/30/2023 Meredith Avery  
11/22/2023 Massachusetts Department of Environmental Protection (MassDEP)/Southeast  
Regional Office (SERO)  
11/27/2023 Debbie Tatro  
11/27/2023 Paul Lauenstein  
11/28/2023 Neponset River Watershed Association

RLT/AJS/ajs

October 30, 2023

Alex Strysky  
MEPA Unit  
100 Cambridge Street  
Boston MA (via email)

Re: Sharon Wells 2, 3 and 4 Treatment – SEIR comments MEPA #16725

Dear Mr Strysky,

After reviewing the Town of Sharon's Single EIR I am disappointed that the town has produced another document that fails to accurately depict the environmental consequences of each Alternative. I find the document misleading in several ways and feel that clarifying this analysis is important to federal, state, and local boards and agencies in their decision-making process.

I would like to submit the following additional comments on the project MEPA documentation.

1. 1. The Noise Study is incomplete
  - o The sound study required by the MEPA Certificate on the EENF and conducted by the town appears to be incomplete. The study at Well 4 does not model the loss of the earthen hillside that currently buffers the Pine Grove and Tree Lane Neighborhoods from the train noise and vibration nearby. This study should include the impact of loss of hillside as requested (not just the loss of vegetation). Further, it does not model noise from the new treatment plant itself on the abutting homes and, the sound modeling was conducted at the proposed well site, not at the receptors in the neighborhood. Abutters to Well 4 have been told that the facility cannot be turned, as the downslope side creates "too much noise" to turn it toward the neighborhood. It's not clear why this new noise would have been omitted from the study, or why the study did not take noise measurements at the receptor locations.
2. The Cost Analysis is Incomplete
  - o Once the sound study is updated, any costs or additional disturbance that may be needed to mitigate noise impacts to the neighborhood must be part of the alternatives analysis.
  - o Beyond any needed noise mitigation, the \$36 million cited in the document does not include other mitigation costs already committed to by the Select Board during their hearing process. These costs need to be added to the Well 4 project costs as line item and not lumped into the contingency that will inevitably be eroded by other unforeseen costs that inevitably come up during construction.
  - o Without this additional information, the cost comparison in the document is incomplete.
3. The Wetlands impacts discussion and Riverfront Alternative Analysis is incomplete and misleading

- We note that 310 CMR 10.58 requires an alternatives analysis to minimize impacts to Riverfront. We note that Well 3 represents a total avoidance alternative for all jurisdictional wetlands, including Riverfront. The town has indicated that Well 3 is feasible operationally and is constructable (and will in fact have far less site earthwork than other options) Since this site represents an avoidance alternative that meets the purpose and need of the project, 310 CMR 10.58 would require that it be selected as the preferred. The costs that have been left out of Well 4 accounting create a misleading cost comparison between these two alternatives that is relevant to this regulatory process.
  - The description of Well 2 hillside on page 15 describes the permitting as a “significant” regulatory challenge. When in fact this Alternative is less impactful to regulated wetlands than Well 4, which the document describes as “more favorable”. This assessment is factually wrong since Well 4 has the greatest impact of any alternative. This statement is silent on permitting at Well 3 which would be even easier to permit than the other two given it avoids all impacts to buffers, and Riverfront.
  - Well 3 is described as having “regulatory challenges” to crossing Beaver Brook, when in fact an HDD crossing is required of all alternatives, not just Well 3. In fact, the document states elsewhere that HDD was selected because it avoid impacts on the wetlands. So how can the HDD crossing of Beaver Brook “avoid impacts” for Well 4 but create “permitting challenges” for Well 3?
  - The description of each well site and its proximity to homes continues to be misleading as well. Rather than state the *closest* distance to a nearby homes the analysis lumps all homes into two categories: 250 and 500 feet. Conveniently avoiding the actual distance to homes at (which at Well 4 is 70 feet, significantly below the 250-foot arbitrary threshold and three times closer than any other alternative.) This type of analysis obfuscates the actual details that downplay the community impacts. Since proximity to homes was selected by the town as a criterion for the alternatives analysis, it should be more accurately represented and mitigated appropriately with detailed commitments and financial accounting.
4. Statements throughout compare only one alternative to another rather than comparing all three. Comparing Well 4 to Well 2 rather than to both Well 2 and 3 is misleading and factually incorrect – for example:
- “Consequently, obtaining approvals from the Sharon Conservation Commission and DEP would be comparatively less challenging than the Well 2 site.” It appears this is incorrect as the impacts at Well 4 are *greater* than both Well 2 hillside and Well 3 and raises the question as to why this analysis avoids comparing it to Well 3 where permitting would be easiest.

In reviewing the proposed alternative layouts, the preferred alternative as presented would have the greatest environmental harm – placing a chemical treatment plant in a neighborhood with no undisturbed buffer as would be afforded at every other site, creating pathways for additional noise and air pollution from nearby trains due to the loss of the earthen hillslope, placing construction traffic and activity at a high crash site in the center of town, creating greater impacts to riverfront than either of the other alternatives, and resulting in greater impacts to the 100 foot buffer than either of the other sites. This is not clearly stated anywhere in the document. Mitigating the impacts to the Well 4 neighborhood as

promised by the town will undoubtedly add to the cost. Leaving these costs out of the document leads to a misleading conclusion that this site is far less expensive than other alternatives, which is not the case.

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Meredith Avery', with a long, sweeping horizontal line extending to the right.

Meredith Avery

36 Pine Grove Ave

Sharon, MA 02067

Cc: Sharon Conservation Commission

DEP SERO



## Department of Environmental Protection

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

Maura T. Healey  
Governor

Kimberley Driscoll  
Lieutenant Governor

Rebecca L. Tepper  
Secretary

Bonnie Heiple  
Commissioner

November 22, 2023

Rebecca L. Tepper,  
Secretary of Energy and Environment  
Executive Office of Energy and  
Environmental Affairs  
100 Cambridge Street, Suite 900  
ATTN: MEPA Office  
Boston, MA 02114

RE: SEIR Review. EOEEA # 16725  
SHARON. Wells 2, 3, 4 Water Treatment at  
15 Tree Lane

Dear Secretary Tepper,

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Single Environmental Impact Report (SEIR) for the Wells 2, 3, 4 Water Treatment at 15 Tree Lane, Sharon, Massachusetts (EOEEA #16725). The Project Proponent provides the following information for the Project:

**The Project proposes to construct a permanent treatment facility for the removal of iron, manganese, and per- and polyfluoroalkyl Substances (PFAS) from the raw water at Wells 2, 3, and 4. The project includes a new water treatment plant (WTP) located at the existing Well Station 4 site at 15 Tree Lane in Sharon, MA as well as water main work to connect Wells 2, 3, and 4 to the new WTP. The proposed WTP site includes the following:**

- An approximate 7,500 square foot building with a residential façade and slab on grade to house the treatment facility;
- Below grade pipe gallery, finished water wet well, and backwash waste tank;
- Access road and parking;
- Screening from neighboring residences in accordance with the Sharon Zoning Bylaw;
- Plantings and associated landscaping improvements;
- Stormwater infiltration basins, catch basins, and drainage manholes; and,
- Retaining walls to reconcile grade differentials across the site.

Additionally, the project includes approximately 5,800 feet of new water main to connect Wells 2, 3, and 4 to the new WTP facility.

**Since the filing of the Proposed EIR, the following project updates have been made and incorporated into this Single EIR:**



- **WTP Building façade** – The architectural design of the building façade changed from a barn-like façade to a residential façade.
- **WTP Building Site Orientation** – The site layout at the Preferred Well 4 site was updated to include a vegetated buffer between the building and Tree Lane and closed draining system.
- **Well 2 to Well 3 Water Main** - The alignment of the proposed cross country water main changed to be a direct horizontal directional drill from Well 2 to Well 3.
- **Alternatives Analysis** – The Alternatives Analysis has been expanded based on comments submitted on the Proposed EIR as follows:
  - a. The Proponent developed concept level site development plans for two additional sites: the Well 2 and Well 3 sites.
  - b. The concept level site plans helped develop an opinion of probable project cost (OPPC) to supplement the alternatives analysis.
- **Noise Analysis** – The Proponent completed a noise analysis based on comments submitted on the Proposed EIR.
- **Public Outreach** – The Proponent held multiple Town meetings to review and evaluate the project. Public notice of meetings included notification to abutters of all alternative sites under evaluation.

### *Bureau of Water Resources (BWR) Comments*

**Wetlands.** The Proponent is reminded that the Wetlands Notice of Intent, including the stormwater report, shall be submitted to both the Sharon Conservation Commission and MassDEP. The Stormwater

**Drinking Water.** As designed, the new WTP appears to provide drinking water in compliance with the Secondary Maximum Contaminant Levels (MCL) for iron and manganese, the Massachusetts Primary MCL for PFAS6 and the probable new Federal Primary MC for PFAS compounds.

**Underground Injection Control (UIC).** Because at the time of submittal of the SEIR Stormwater Control design plans have not been finalized, the Proponent is reminded that underground infiltration structures may be subject to the jurisdiction of the MassDEP *Underground Injection Control (UIC)* program. These structures must be registered with MassDEP UIC program through the submittal of a BRP WS-06 UIC Registration application through MassDEP’s electronic filing system, eDEP. The statewide UIC program contact is Joe Cerutti, who can be reached at [joseph.cerutti@state.ma.us](mailto:joseph.cerutti@state.ma.us). All information regarding on-line (eDEP) UIC registration applications may be obtained at the following web page under the category “Applications & Forms”: <https://www.mass.gov/underground-injection-control-uic>.

Additional information can be found at: <https://www.mass.gov/how-to/ws-06-registration-of-a-class-v-uic-well-and-modification-of-an-existing-registration>.

### *Bureau of Air and Waste (BAW) Comments*

#### **Air Quality.**

##### *Noise.*

As discussed in the SEIR, “the Proponent is working to retain a natural tree buffer between the proposed WTP and Tree Lane properties to help mitigate potential noise impacts.”

The Project Proponent is advised that the MassDEP noise policy (<https://www.mass.gov/doc/massdep-noise-policy/download>) that applies to the Project establishes a 10 dB(A) increase in sound as the maximum sound impact which cannot be exceeded at the property line or the nearest receptor. Sound increases are evaluated in accordance with the MassDEP Noise

Pollution Policy Interpretation. The Proponent is reminded that the 10 dB(A) is not a design standard but a performance standard. Sound impacts should be mitigated to extent practicable during and after the WTP's construction.

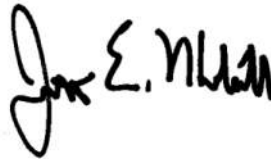
**Solid Waste Management** The Proponent did not commit to source separation at the construction site in the SEIR. MassDEP recommends the Proponent reconsider source separation or separating different recyclable materials at the job site. Source separation may lead to higher recycling rates and lower recycling costs. Further guidance can be found at: <https://recyclingworksma.com/construction-demolitionmaterials-guidance/>

For more information on how to prevent banned materials from entering the waste stream the Proponent should contact the RecyclingWorks in Massachusetts program at (888) 254- 5525 or via email at [info@recyclingworksma.com](mailto:info@recyclingworksma.com) RecyclingWorks in Massachusetts also provides a website that includes a searchable database of recycling service providers, available at <http://www.recyclingworksma.com>.

***Other Comments/Guidance***

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this SEIR. If you have any questions regarding these comments, please contact George Zoto at [George.Zoto@mass.gov](mailto:George.Zoto@mass.gov) or [Jonathan.Hobill@mass.gov](mailto:Jonathan.Hobill@mass.gov).

Very truly yours,



Jonathan E. Hobill,  
Regional Engineer,  
Bureau of Water Resources

JH/GZ

Cc: DEP/SERO

ATTN: Millie Garcia-Serrano, Regional Director  
Gerard Martin, Deputy Regional Director, BWR  
John Handrahan, Deputy Regional Director, BWSC  
Seth Pickering, Deputy Regional Director, BAW  
Jennifer Viveiros, Deputy Regional Director, ADMIN  
Maissoun Reda, Chief, Wetlands and Waterways, BWR  
Andrew Poyant, Wetlands and Waterways, BWR  
James McLaughlin, Chief, Drinking Water, BWR  
Giliane Tardieu, Drinking Water, BWR  
Michelle Regon, Drinking Water, BWR  
Duane LeVangie, Chief, Water Management Act, BWR/Boston  
Jen DURso, Water Management Act, BWR/Boston  
Mark Dakers, Chief, Solid Waste, BAW  
Elza Bystrom, Solid Waste, BAW  
Angela Gallagher, Chief, Site Management, BWSC

Jennifer Wharff, Site Management, BWSC  
Amanda Cantara, Site Management, BWSC

**From:** [Paul Lauenstein](#)  
**To:** [Strycky, Alexander \(EEA\)](#)  
**Subject:** comments on Sharon's MEPA application for a PFAS filtration facility  
**Date:** Monday, November 27, 2023 6:32:03 PM  
**Attachments:** [Filtration v MWRA.pdf](#)

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CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Attached are comments concerning the Town of Sharon's MEPA application to build a PFAS filtration plant.

They include comments about the environmental impact of Sharon's wells, which will continue to impact Sharon's local environment until Sharon switches to MWRA water.

Paul Lauenstein  
4 Gavins Pond Rd.  
Sharon, MA 02067  
781-784-2986

**Sharon's Drinking Water Source:  
Local Wells or MWRA Reservoirs?**

**Four factors to consider:**

- 1. Contamination of drinking water**
- 2. Water hardness**
- 3. Environmental impacts**
- 4. Cost**

My name is Paul Lauenstein. I live at 4 Gavins Pond Rd. By way of disclosure, I served for nine years on Sharon's Water Management Advisory Committee, and I am currently a volunteer member of MWRA's Water Supply Citizens Advisory Committee.

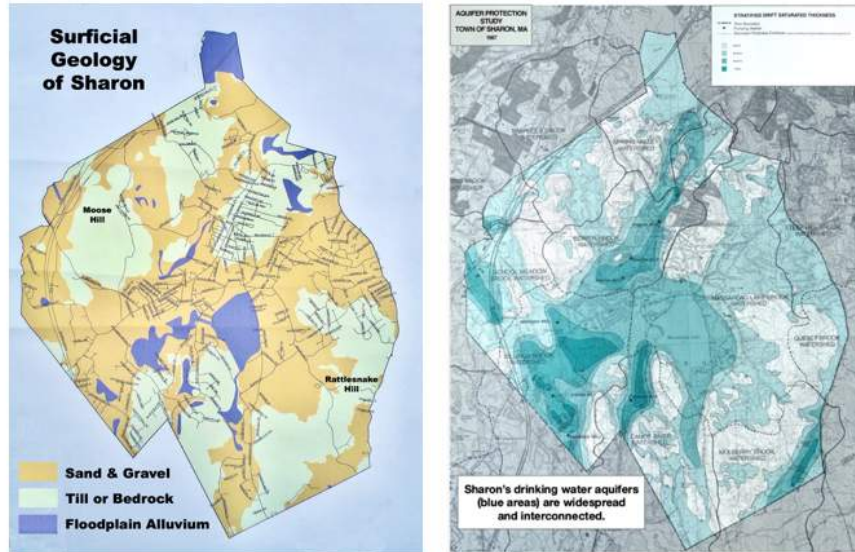
Sharon is facing a choice between building a PFAS filtration plant, or building a pipeline to connect to the MWRA water supply system.

Either option will cost tens of millions of dollars. We cannot afford to do both.

Four factors should be weighed in making this choice:

1. Contamination of drinking water,
2. Hard water vs. soft water,
3. Environmental impacts, and
4. Cost

## 1. Contamination



**Permeable sand & gravel overlies most of Sharon's aquifers.**

First, let's take a look at contamination.

Sharon's municipal drinking water wells tap permeable sand and gravel aquifers. These aquifers get re-charged by rain that percolates down to the aquifers through sand and gravel. Contaminants on the surface dissolve in the rain water, and end up in the aquifers.



**Septic Systems**



**Herbicides & Pesticides  
applied to lawns**

Effluent from approximately 6,000 septic systems constantly adds pharmaceuticals and personal care products to the groundwater.

Homeowners and businesses apply a wide variety of herbicides and pesticides to their lawns, which washes into the ground when it rains.



**Pesticide application at a soccer field near Well #7**

Pesticides were applied to a soccer field in a groundwater protection district near Well #7. When town officials found out, they told those responsible never to do that again, but enforcement is problematic.





**Facility installed behind Shaw's Plaza to remove trichloroethylene (TCE) from the groundwater**

Years ago, trichloroethylene (TCE) from a dry cleaning business at Shaw's Plaza contaminated the groundwater near Well #5. A facility had to be constructed to prevent the TCE from contaminating Well #5, which is only about a quarter mile away. TCE in the groundwater behind Shaw's Plaza continues to be monitored to this day.



Road salt elevates the level of sodium in Sharon's well water, which has approximately double the concentration of sodium found in MWRA water.



**Automotive chemicals stained this garage floor.**

If road salt is getting into Sharon's well water, what other automotive chemicals from Sharon's 100 miles of roadways might be finding their way into our drinking water aquifers?

**WATER QUALITY SUMMARY** Listed below are 19 contaminants detected in Sharon's drinking water in 2021. Not listed are over 100 other contaminants for which we tested but did not detect. The complete list of contaminants that we test for is available at the Department of Public Works office and at the Sharon Public Library.

**SAMPLES COLLECTED FROM OUR WATER SUPPLY**

Substance (Contaminant)	Units	Highest Annual Average	Range of Detection	Maximum Contaminant Level Goal (MCLG)	Maximum Contaminant Level (MCL)	Other State or Federal Action Level	Source of Contaminant
<b>PRIMARY CHEMICALS</b>							
Acetone	ppb	17.9	ND - 17.9	6300	N/A		Discharge from industrial production and use, in automobile exhaust, from landfills and natural sources
Alpha Emitters	pCi/L	10.8	0.1-10.6	15	0		Erosion of natural deposits
Chloroform	ppb	2.1	ND-2.1	70	N/A		By-product of drinking water chlorination
Combined Radium	pCi/L	2.39	0.29-2.39	5	0		Erosion of natural deposits
Fluoride	ppm	0.82	0.63-0.82	4	4		Water additive which promotes strong teeth
Nitrate	ppm	6.30	0.75-6.30	10	10		Runoff from fertilizer use; Leaching from septic tanks
Perchlorate <sup>1</sup>	ppb	0.34	0.07-0.34	2.0	N/A		Oxygen additive in solid fuel propellant for rockets, missiles, and fireworks
PFAS <sup>2</sup>							
Well # - violation (Avg)	ppb	88.8	ND-88.8	20.0	N/A		Discharges and emissions from industrial and manufacturing sources associated with the production or use of these PFAS, including production of moisture and oil-resistant coatings on fabrics and other materials. Additional sources include the use and disposal of products containing these PFAS, such as fire-fighting foams.
All other sources (Avg)	ppb	19.5	ND-19.5	20.0	N/A		
<b>SECONDARY CHEMICAL</b>							
Manganese <sup>3</sup>	ppb	64 (Avg)	9 - 230	NR	NR		Erosion of natural deposits
<b>UNREGULATED CHEMICALS<sup>4</sup></b>							
Bromodichloromethane	ppb	0.8	ND-0.8	NR	NR		By-product of drinking water chlorination
Chlorodibromomethane	ppb	0.7	ND-0.7	NR	NR		By-product of drinking water chlorination
Perfluorobutane sulfonic acid (PFBS)	ppb	0.9	ND-0.3	NR	NR		N/A
Perfluorohexanoic acid (PFHxI)	ppb	1.3	ND-6.1	NR	NR		N/A
Sodium <sup>5</sup>	ppm	82.2	20.1-113	NR	NR		Discharge from the use and improper storage of sodium-containing de-icing compounds or in water softening agents

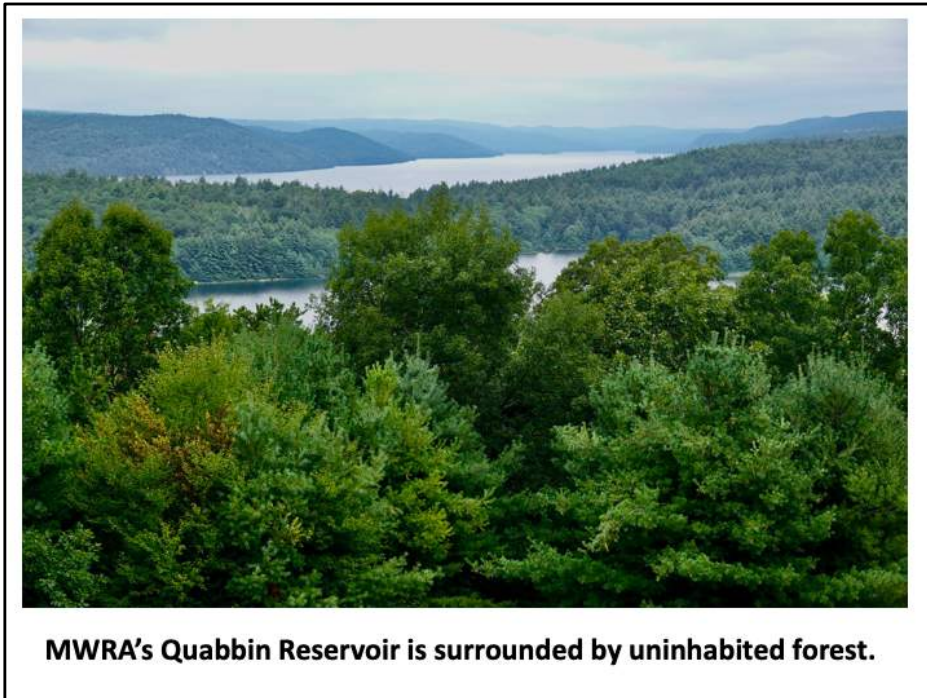
**Water suppliers are only required to test for a few of the thousands of possible contaminants in drinking water.**

**SAMPLES COLLECTED FROM YOUR FAUCETS**

Substance (Contaminant)	Units	Maximum Contaminant Level Goal (MCLG)	Range of Detection	Maximum Contaminant Level (MCL)	Other State or Federal Action Level	Source of Contaminant
<b>PRIMARY CHEMICALS</b>						
Total Trihalomethanes	ppb	23.9 (DTE 4)	3.3-37.4	80	N/A	By-product of drinking water chlorination
Halacetic Acids (HAA5)	ppb	4.9 (DTE 4)	ND-11	80	N/A	By-product of drinking water chlorination
Chlorine	ppm	0.45	0.07-1.52	ADMCL	ADMCL	Water additive used to control microbes
<b>OTHER</b>						
Copper <sup>6</sup> (if samples exceeded the action level)	ppm	0.16	0 - 0.21	1.3	1.3	Corrosion of household plumbing systems
Lead <sup>7</sup> (if samples exceeded the action level)	ppb	7	0 - 9	15	0	Corrosion of household plumbing systems

Public water suppliers are required to test for a few dozen potential contaminants. The results are posted on the town web site. However, there are thousands of chemicals in the products we use daily. It is simply not feasible to test the drinking water for all of them.

For example, there are more than 5,000 different kinds of PFAS and new ones are being developed all the time, but public water suppliers are only required to test for six of them. Prior to 2021, no PFAS testing was required at all. As a result, Sharon residents including infants and pregnant women were exposed to PFAS.



The Quabbin Reservoir, which provides most of MWRA's water, is surrounded by mostly uninhabited forest, which naturally filters and purifies the water. The MWRA is one of the few major water supplies in the United States where filtration is not required by the EPA.

## 2. Water Hardness



**Mineral deposits in toilet bowls are evidence of Sharon's hard water.**


Second, let's take a look at water hardness.

Groundwater from Sharon's wells is "hard" meaning it is high in dissolved minerals.

Hard water reduces the effectiveness of detergents, so clothes and dishes do not get as clean.

Hard water is not good for skin and hair.

Hard water leads to more frequent replacement of water heaters and washing machines.

Estimate #11283 

<b>Billing Address</b>	<b>Service Address</b>	<b>Send Payment To</b>	<b>Sent On</b>
Sharon MA 02067 United States	Sharon MA 02067 United States	Water Filtration Of New England Inc PO Box 2070 Sandwich MA 02563 3508888947 ksdemeub@culligan.com	08/04/23
			<b>Total</b> \$8,471.10
			<b>Payments</b> 80.00
			<b>Balance</b> \$8,471.10

**Charges**

Item	Description	Unit Cost	Tax	Quantity	Line Total
1" HE Softener	Culligan 1" High Efficiency Softener	\$2,714.43	✓	1.0	\$2,714.43
1" HE Carbon	Culligan 1" High Efficiency Carbon	\$2,579.02	✓	1.0	\$2,579.02
Subpiping	Installation labor and 1/2" copper plumbing supplies	\$3,850.00	✗	1.0	\$3,850.00
AC 30	Culligan AC30 Good Water Drinking Reverse	\$1,227.41	✓	1.0	\$1,227.41
				Subtotal	\$8,069.86
				Tax (ST)	\$401.24
				<b>Total</b>	<b>\$8,471.10</b>

**Notes**

We recommend the water softener in your home due to the level of hardness detected in your water. Water that is hard will leave a residue on fixtures, sinks, tubs, appliances, etc. This residue over time will cause premature failure of appliances and fixtures, leading to costly repairs. In some cases hard water can cause skin to be dry and irritated as well as drying out hair. This unit will eliminate those issues you are experiencing by dramatically reducing hardness causing minerals in your water. It will also reduce iron therefore preventing iron staining and damage. The maintenance on this unit is keeping salt in the brine tank. Typically, brines will fill up the brine tank every 9-12 months. The cost of each fill up is around \$100.

We recommend the Carbon filter to remove contaminants from the town water. The carbon filter would help improve the taste, smell, and clarity of the water. The maintenance on the carbon unit is every 5 years. It requires a resin re-bed. We remove the old media and replace it with new media. The cost of this service is about \$550.

The AC30 Reverse Osmosis system, is a point of use unit used for drinking water purposes. This unit will dramatically reduce impurities in your drinking water such as sodium, fluoride, chlorine, copper, etc. These filters are changed every year for a cost of approximately \$295. There is a membrane on the unit that gets changed about every 4-6 years, based off our water test, and that is an additional \$195.

**Terms**

The whole system, top to bottom, comes with a one-year warranty. If anything needs to be fixed or replaced on the units in the first year it will be at no charge to you. The HE circuit boards, control valve bodies and brine tank have a 10-year warranty. The Quadra-hull softener tank and carbon tank have a lifetime warranty.

For the AC30, the faucet, tank, and manifold have a lifetime warranty. The filters, O-rings and tubing have a one-year leak guarantee from when they are changed by a Culligan technician.

Along with the warranty you have a 100% satisfaction guarantee on this system for the first 30 days. If you are not satisfied within the first 30 days, we will remove the system and give you a full equipment refund.

Upon completion of the work payment is due. We accept cash, check, and credit cards. For projects over \$10,000, a 25% deposit is required.

All quotes are good for 30 days.

Signatures

**Water softening systems are expensive.**

**This one cost \$8,500, not including ongoing operating and maintenance costs.**

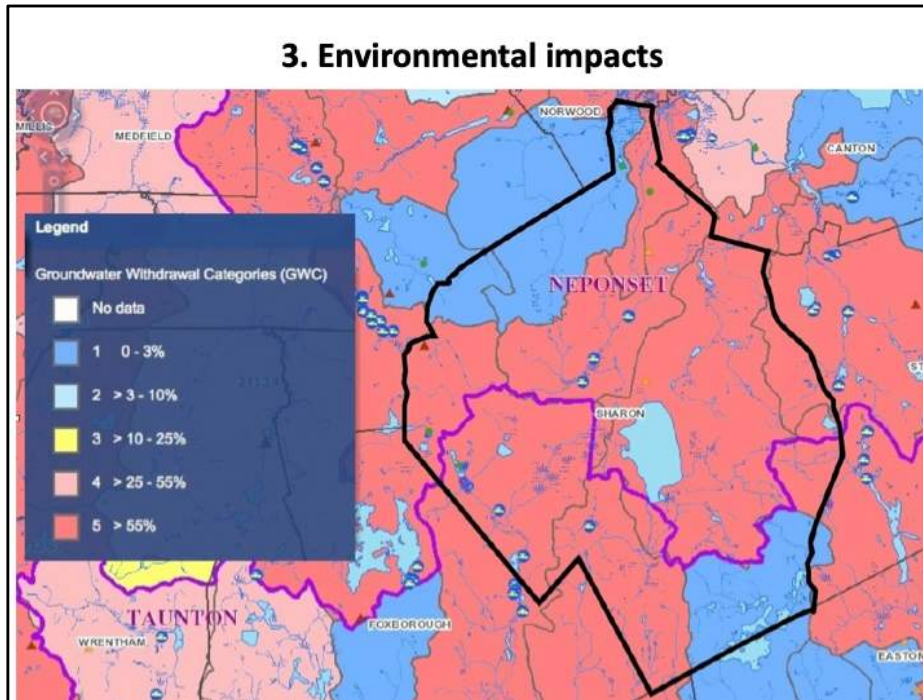
Water softening systems are expensive.

This one, installed recently in a Sharon home, cost almost \$8,500, not including operating and maintenance costs.

It would cost \$50 million dollars to install water softening systems like this one in every home in Sharon.

Surface water from MWRA's reservoirs is naturally "soft," meaning it is low in dissolved minerals.

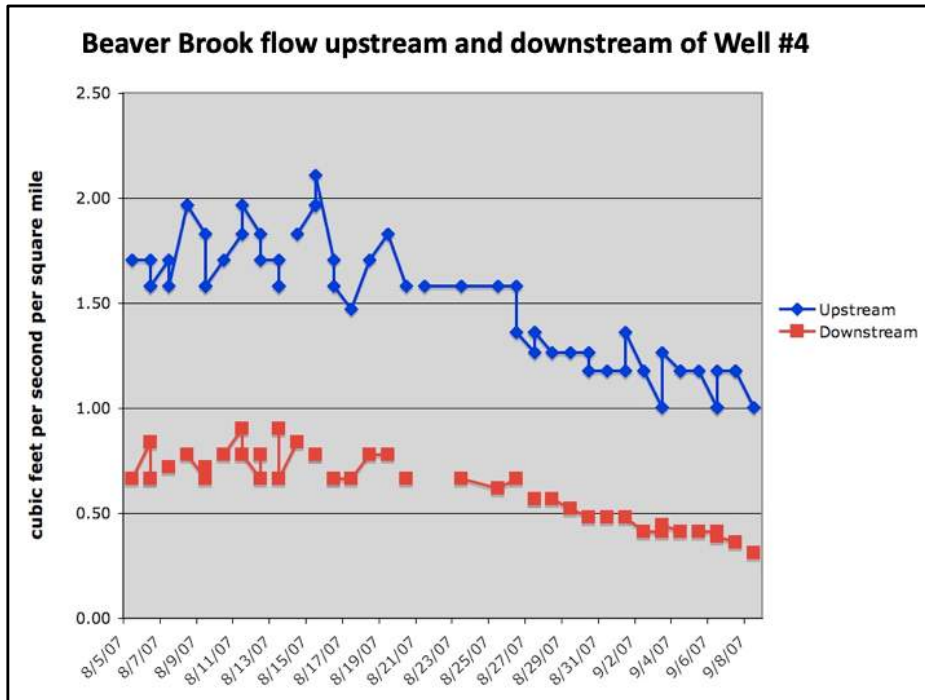
### 3. Environmental impacts



Third, let's take a look at environmental impacts.

Areas shown in red on this map of Sharon are classified by the state as Groundwater Withdrawal Level 5, meaning most of Sharon's environment is maximally impacted by pumping of municipal wells, which appear as blue dots on the map.

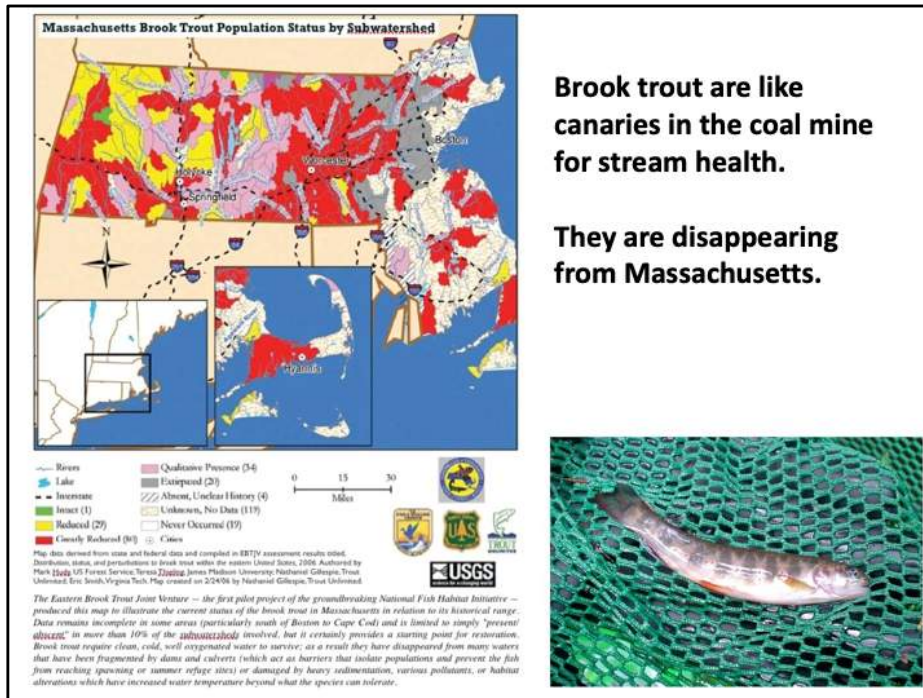




Well #4, located beside Beaver Brook, pumps up to a million gallons per day.

Streams and rivers normally gain flow as they flow downstream. However, the flow in Beaver Brook downstream of Well #4, shown in red, can be lower than flow upstream of the well, shown in blue, due to amount of water withdrawn by the well.

The impact of well pumping is most acute during hot, dry summer weather when aquatic ecosystems are most stressed.



**Brook trout are like canaries in the coal mine for stream health.**

**They are disappearing from Massachusetts.**



Brook trout are like canaries in the coal mine for stream health.

They have disappeared from the areas shown in gray on the map, and they are greatly reduced in the areas shown in red.

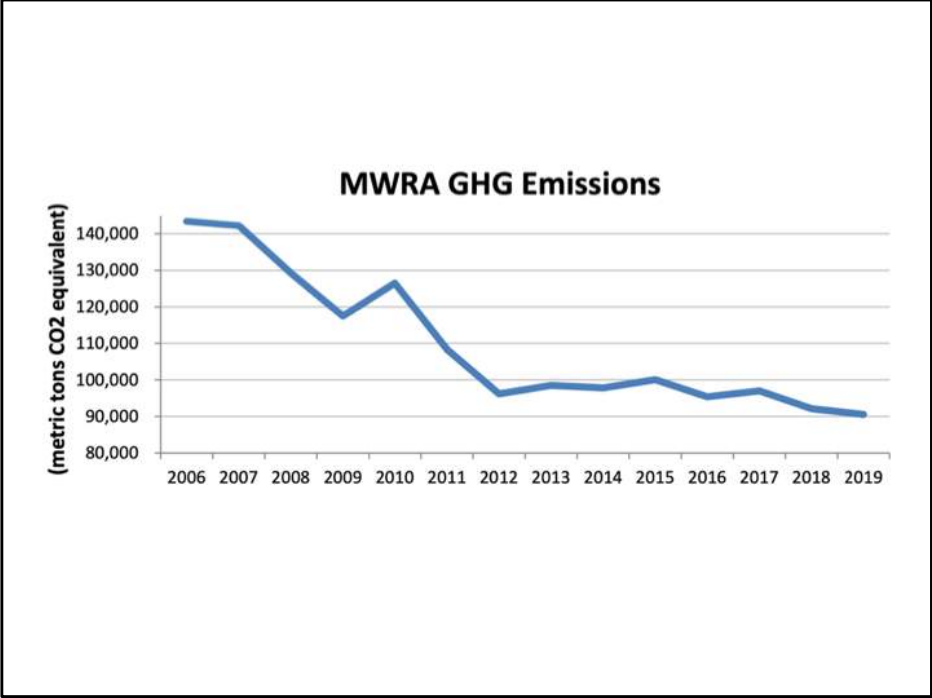
When the Massachusetts Division of Fisheries and Wildlife sampled fish populations in Beaver Brook they only found brook trout upstream of the wells.

**Town Meeting resolution passed in 2019**

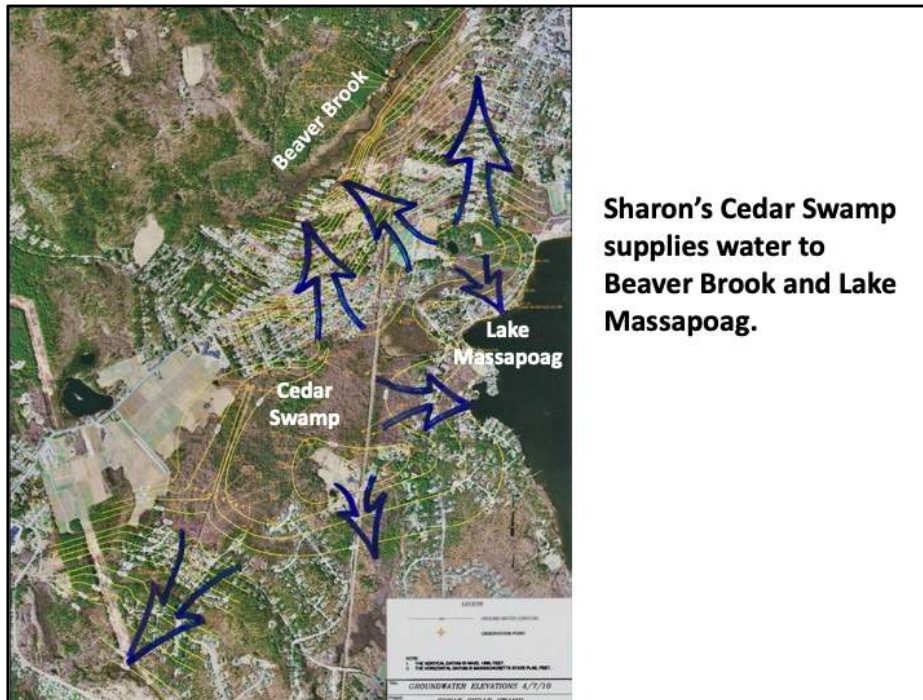
**BE IT FURTHER RESOLVED that the Town of Sharon adopt a goal of reducing greenhouse gas emissions to zero by 2050, and move as quickly as possible to achieve that goal.**

In 2019, Sharon Town Meeting adopted a goal of zero emissions by 2050. As part of that resolution, town officials and staff were asked to consider greenhouse gas emissions as part of the municipal decision-making process.

A filtration plant requires energy to operate, and would increase Sharon's greenhouse gas emissions.



MWRA has reduced its greenhouse gas emissions by approximately 40% since 2006.



Organic peat up to 12 feet deep has been accumulating in Sharon's 250-acre Atlantic White Cedar Swamp for thousands of years. The peat absorbs rain water like a gigantic sponge and gradually releases it to feed Beaver Brook and the underwater springs that feed Lake Massapoag.

When properly hydrated, wetlands like the Cedar Swamp can sequester carbon four times faster than upland forest.



When the water table drops, the carbon sequestration process is reversed. Bacteria oxidize the organic matter, which is released to the atmosphere as carbon dioxide.

By lowering the water table, municipal well pumping has contributed to the loss of up to three feet of organic peat from Cedar Swamp, exposing the roots of this cedar tree, toppling others, and releasing carbon dioxide.

#### **4. Cost**

**The Finance Committee's analysis shows MWRA water would be more expensive, but:**

- **Hidden costs of hard water were not considered.**
- **The treatment plant would only treat 3 of our 6 wells.**
- **Our wells are old, and will require renovation.**
- **Ongoing costs can be controlled through conservation.**

Finally, let's take a look at cost.

The Finance Committee's analysis shows MWRA water would be more expensive, but:

- The hidden costs of hard water were not considered.
- The proposed \$37 million dollar treatment plant would only treat three of our six wells.
- Our wells average 52 years of age. They will eventually have to be renovated at considerable expense.
- Ongoing costs can be controlled through water conservation.

**Only the three wells shown in green are included.**

Date	PFAS6 Concentration (nanograms per liter)					
	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7
4/6/21	19.5	6.2	Not Used	0.0	2.2	8.6
5/4/21	19.8	5.9	Not Used		9.2	4.3
6/7/21	34		Not Used			0
6/21/21	Not Used		ND			
6/23/21	Not Used		ND			0
7/14/21	Not Used	13.1	ND	NS	10.0	5.7
8/12/21	Not Used	10.2	ND	0.0	9.1	5.4
9/16/21	Not Used	13.1	ND	0.0	15.1	7.1
10/13/21	Not Used	Not Used	ND	NS	17.2	6.8
11/18/21	Not Used	Not Used	ND	NS	Not Used	6.0
12/16/21	Not Used	Not Used	ND	NS	Not Used	6.0

ND – None Detected

NS – No Sample Required due to prior 0.0 nanograms per liter results

When Well #4 had to be shut down due to PFAS, all five of the other wells were used to keep Sharon supplied with water.

The proposed filtration plant would only treat the three municipal wells along Beaver Brook, shown in green.

Of the other three municipal wells, two tested positive for PFAS at higher levels than new EPA rules would allow.

The cost to provide PFAS treatment facilities at the two contaminated wells shown in red is not included in the \$37 million in the warrant article, and the cost to operate and maintain these additional facilities was not included in the Finance Committee’s cost analysis.

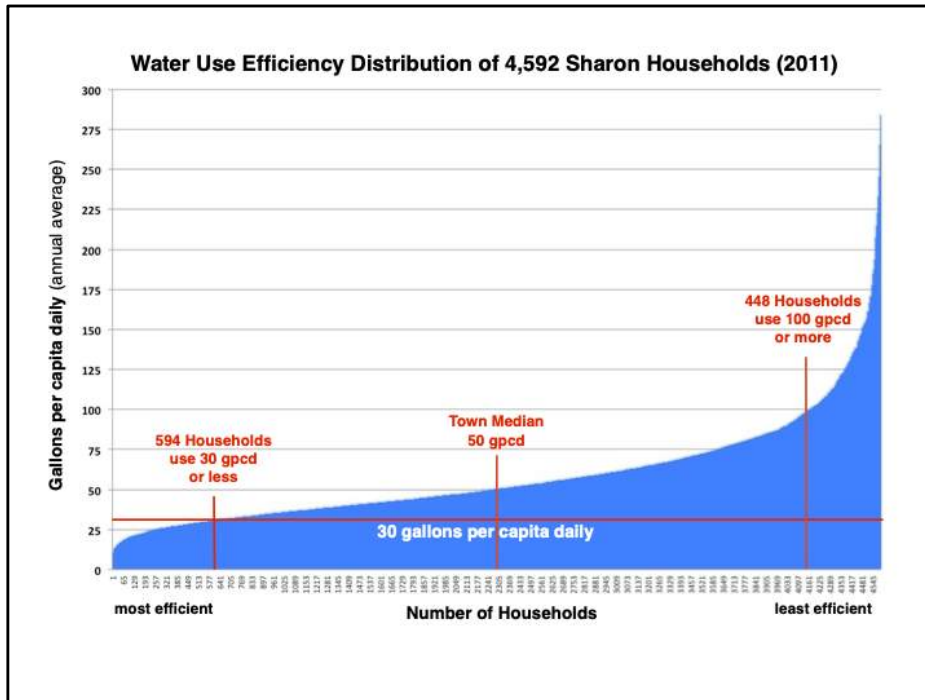


### Sharon's aging wells

Well No.	#2	#3	#4	#5	#6	#7
Year built	1979	1954	1959	1972	1976	1989
Age	44	69	64	51	47	34

**The average age of Sharon's six wells is 52 years.**

Sharon's wells are aging. They will eventually have to be renovated at considerable expense unless we switch to MWRA.



The amount of water used by households in Sharon varies from less than 30 gallons per person per day to more than 100 gallons per person per day.

If every Sharon household were to use water as efficiently as the most water-efficient 600 homes in Sharon, town-wide water use could be cut almost in half. That would greatly reduce the cost of importing MWRA water.

Every homeowner can control their own water bills by controlling their household water use. The Sharon Water Department helps by providing rebates for water-efficient toilets and washing machines.

### **Conclusion**

**The peace of mind of reliably safe, naturally soft MWRA water is worth the cost, especially considering the ability of every household to control their own cost of water through conservation.**

**We should have an opportunity to vote for MWRA water at a future Town Meeting.**

**Please vote NO on Article 1.**

The peace of mind of reliably safe, naturally soft MWRA water is worth the cost, especially considering the ability of every household to control their own cost of water through conservation.

So if you would like an opportunity to vote for MWRA water at a future Town Meeting, please vote NO on Article 1 tonight.

November 27, 2023

Massachusetts Environmental Policy Act Office  
100 Cambridge Street  
Suite 900  
Boston MA

RE MEPA file # 16725 Wells 2, 3 and 4 Treatment in Sharon MA

Dear Mr. Strysky,

I am a resident of Sharon, and just learned about the MEPA process today.

While our Town's water department has been considering solutions for the new EPA PFAS guidelines for years, they have proceeded, to my knowledge, without seriously considering the MWRA option. They also have not informed residents about the MWRA option. At an earlier meeting of the Water Management Advisory Committee where this topic was under discussion, I and other residents were not allowed to comment or ask questions. And my subsequent question to the DPW about the MWRA option went unanswered.

Just recently, in the 11<sup>th</sup> hour, I learned about the planned location for a local water treatment facility, and the MEPA process.

In the MEPA filing they describe the No-Build Alternative (Section 4.1.1): "is not considered a viable option for the Project Site". That statement is non-sensical. The No Build option is clearly an alternative if we consider switching to MWRA water as an option to the issue at hand i.e. the new EPA PFAS guidelines and protecting the health of residents.

I am requesting, and will request through the town, that the residents of Sharon be provided with an environmental impact analysis that compares the MWRA vs. local PFAS treatment facility options.

I am also requesting that the residents of Sharon learn the true cost of joining the MWRA as our water provider. While the Town has hired professional consults to provide the cost estimates of several locations for a local PFAS treatment facility, they are comparing those numbers to in-house DPW-generated estimates of the cost of joining the MWRA. We need non-biased professionals to learn the estimated cost of joining the MWRA, an environmentally friendly option, which can then be compared to the cost of a local PFAS treatment plant with environmental impacts.

Thank you for taking the time to hear my concerns.

Sincerely,

Debbie Tatro, PhD  
10 Sturges Rd.  
Sharon, MA. 02067

781-835-8258



**From:** [Ian Cooke](#)  
**To:** [Strycky, Alexander \(EEA\)](#)  
**Subject:** Comment on 16725 Sharon water treatment plant  
**Date:** Tuesday, November 28, 2023 10:21:38 PM

---

**CAUTION:** This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Hello Alexander,

I am writing to comment on the above referenced project. Recognizing that this comment is arriving late I will keep it brief.

We would urge the Secretary to require that the applicant submit a Supplemental EIR to incorporate an additional alternative that has been conspicuously omitted from the analysis, specifically a year round or seasonal connection to the MWRA water system.

Although this alternative has been omitted from the analysis, it has been actively discussed within the town and the town has gone so far as to develop a cost estimate for this alternative. The town already has a physical connection to the MWRA system which is presently only authorized for emergency use. Further it appears that the cost of the MWRA alternative is similar to the cost of the preferred alternative or perhaps less expensive when external subsidies are excluded. The MWRA alternative also comes with significantly fewer environmental impacts as summarized below.

All the alternatives described in the EIR involve permanent and temporary construction impacts to wetlands, many if not all of which could be avoided with the MWRA alternative.

Perhaps more importantly, the existing local water withdrawals associated with wells 2, 3 and 4 have a very significant negative impact on streamflow, aquatic life and wetlands in an extensive watershed area downstream.

Beaver Brook where the water withdrawals are located is classified by MassDEP as a groundwater category 5 stream, MassDEP's most severely impacted category which indicates that healthy native aquatic life communities can not be sustained.

In fact MassDEP finds that Beaver Brook has an August groundwater depletion level of 200%+ and a net groundwater depletion level of 178%. These depletion levels are among the highest, if not the highest, found anywhere in the Neponset River Watershed.

Site specific studies of the Beaver Brook Watershed conducted by MassDEP and MA DFG confirm that native fluvial fish species including cold water species are present in a small section of brook upstream of the wells, but absent downstream of the wells in spite of the availability of high quality riparian habitat in the downstream area. A finding which is fully consistent with the MassDEP groundwater category classification.

The Town of Sharon should be lauded for its effective efforts at conserving water which have slightly reduced the magnitude of these withdrawal impacts, but in order to restore Beaver Brook to a healthy state, it will still be necessary to further reduce withdrawals far beyond the savings that could be achieved through even the most aggressive water conservation efforts.

The only feasible means to achieve such a reduction would be to import water from the MWRA on at least a seasonal basis. In practice the preferred alternative will make impacts to Beaver Brook worse, because none of Sharon's water sources outside the Beaver Brook sub watershed will be furnished with needed treatment plants, thus making the Town even more dependent on the already overstressed Beaver Brook.

The MWRA option would also come with a number of other environmental, reliability, climate resilience, drought resilience, and water quality / public health benefits to the town, at what appears to be a similar overall cost and potentially with lower greenhouse gas emissions.

Given the the substantial benefits and reasonable cost associated with the MWRA alternative, and the fact that this alternative has been evaluated in other fora but has been actively and entirely omitted from the list of alternatives evaluated through the MEPA process, we urge the Secretary to require a supplemental EIR that incorporates this alternative in its analysis.

Thank you for your consideration.

Ian Cooke  
Executive Director  
Neponset River Watershed Association  
2173 Washington Street  
Canton, MA 02021  
781-575-0354 x 305





## APPENDIX S

### Draft Stormwater Pollution Prevention Plan



# DRAFT STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

WELLS 2, 3 AND 4 WATER TREATMENT PLANT

Sharon, Massachusetts  
Norfolk County

October 2023

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- Appendix A – Project Design Drawings (provided under separate cover)
- Appendix B – Copy of 2022 CGP (provided under separate cover)
- Appendix C – NOI and EPA Authorization Email
- Appendix D – Site Inspection Form and Dewatering Inspection Form
- Appendix E – Corrective Action Log
- Appendix F – SWPPP Amendment Log
- Appendix G – Subcontractor Certifications/Agreements
- Appendix H – Grading and Stabilization Activities Log
- Appendix I – Training Documentation
- Appendix J – Delegation of Authority
- Appendix K – Endangered Species Documentation
- Appendix L – Historic Preservation Documentation
- Appendix M – Rainfall Gauge Recording
- Appendix N – Turbidity Meter Manual and Manufacturer's Instructions

# SECTION 1 CONTACT INFORMATION/RESPONSIBLE PARTIES

## Section 1.1 OPERATOR(S)/SUBCONTRACTOR(S)

Names of Operator(s)/Subcontractor(s) to be included when construction contract is awarded.

### Operator(s):

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

### Subcontractor(s):

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

### 24-Hour Emergency Contact:

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

## Section 1.2 STORMWATER TEAM

Stormwater Team to be included when construction contract is awarded.

### DRAFT SWPPP Preparer:

Company:	Environmental Partners				
Name:	Adam Kran				
Address:	1900 Crown Colony Dr Unit 402				
City:	Quincy	State:	MA	Zip Code:	02169
Telephone:	617-657-0200		Email:	ask@envpartners.com	

### Final SWPPP Preparer:

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

### Inspection Personnel:

Inspection Personnel to be included when construction contract is awarded.

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		

### Corrective Actions Personnel:

Corrective Actions Personnel shall be the Contractor after the contract is awarded.

Company:					
Name:					
Address:					
City:		State:	MA	Zip Code:	
Telephone:			Email:		



# SECTION 2 SITE EVALUATION, ASSESSMENT, AND PLANNING

## Section 2.1 PROJECT/SITE INFORMATION

### Project Name and Address

Project/Site Name: Wells 2, 3 and 4 Water Treatment Plant

Street/Location: 15 Tree Lane

City: Sharon

State: Massachusetts

ZIP Code: 02067

County or Similar Government Division: Norfolk

### Project Latitude/Longitude

Latitude: 42.073635 ° N

(decimal degrees)

Longitude: 71.110492 ° W

(decimal degrees)

Latitude/longitude data source:  Map  GPS  Other (please specify): Google Earth

Horizontal Reference Datum:  NAD 27  NAD 83  WGS 84

### Additional Site Information

Is your site located on Indian country lands, or on a property of religious or cultural significance to an Indian Tribe?  Yes  No

## Section 2.2 DISCHARGE INFORMATION

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)?

Yes  No

Are there any waters of the U.S. within 50 feet of your project's earth disturbances?

Yes  No

**Table 1: Discharge Receiving Waters**

Point of Discharge ID	Name of receiving water that receives stormwater discharge:	Is the receiving water impaired (on the CWA 303(d) list)?	If yes, list the pollutants that are causing the impairment:	Has a TMDL been completed for this receiving waterbody?	If yes, list TMDL Name and ID:	Pollutant(s) for which there is a TMDL:	Is this receiving water designated as a Tier 2, Tier 2.5, or Tier 3 water?	If yes, specify which Tier (2, 2.5, or 3)?
[001]	Beaver Brook	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	NA	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	NA	NA	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	NA

## Section 2.3 NATURE OF CONSTRUCTION ACTIVITIES

### General Description of Project

The proposed project includes constructing a new water treatment plant building with associated landscape, access road, parking, utility, and stormwater improvements.

Business days and hours for the project: Monday – Friday

### Size of Construction Site

Size of Property	7.6 acres
Total Area Expected to be Disturbed by Construction Activities	1.07 acres
Maximum Area Expected to be Disturbed at Any One Time, Including On-site and Off-site Construction Support Areas	1.07 acres

### Type of Construction Site *(check all that apply):*

Single-Family Residential   
  Multi-Family Residential   
  Commercial   
  Industrial  
 Institutional   
  Highway or Road   
 Utility   
 Other \_\_\_\_\_

Will you be discharging dewatering water from your site?                       Yes     No

If yes, will you be discharging dewatering water from a current or former Federal or State remediation site?                       Yes     No

### Pollutant-Generating Activities

List and describe all pollutant-generating activities and indicate for each activity the associated pollutants or pollutant constituents that could be discharged in stormwater from your construction site. Take into account where potential spills and leaks could occur that contribute pollutants to stormwater discharges, and any known hazardous or toxic substances, such as PCBs and asbestos, that will be disturbed during construction.

Pollutant generating activities will be consistent with general land development projects. This includes the demolition of an existing buildings on site, disturbance of wooded areas, installation of utilities and stormwater management systems, construction of a 7,500 sf Water Treatment Plant building, construction of new parking areas and site driveways, and general landscaping.

<b>Pollutant-Generating Activity</b> (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations)	<b>Pollutants or Pollutant Constituents</b> (e.g., sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels)
Paving Operations	Fuels, paints

<b>Pollutant-Generating Activity</b> (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations)	<b>Pollutants or Pollutant Constituents</b> (e.g., sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels)
Construction Sediment	Sediment
Construction Debris	Sediment, fuels

**Construction Support Activities**

Describe any construction support activities for the project (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas):

There will be very limited storage of construction supplies and materials on-site.

**Contact Information for Construction Support Activities**

Contact information for construction support activities will be identified after project is bid for construction.

## Section 2.4 SEQUENCE OF ESTIMATED DATES OF CONSTRUCTION ACTIVITIES

Estimated Schedule

Estimated Start Date of Construction Activities for this Phase	Summer 2024
Estimated End Date of Construction Activities for this Phase	Fall 2026
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Summer 2024
Estimated Date(s) when Stormwater Controls will be Removed	Fall 2026

## Section 2.5 AUTHORIZED NON-STORMWATER DISCHARGES

### List of Authorized Non-Stormwater Discharges Present at the Site

Authorized Non-Stormwater Discharge	Will or May Occur at Your Site?
Discharges from emergency fire-fighting activities	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fire hydrant flushing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Landscape irrigation	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Water used to wash vehicles and equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Water used to control dust	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Potable water including uncontaminated water line flushing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
External building washdown (soaps/solvents are not used and external surfaces do not contain hazardous substances)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Pavement wash waters	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Uncontaminated air conditioning or compressor condensate	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Uncontaminated, non-turbid discharges of ground water or spring water	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Foundation or footing drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Uncontaminated construction dewatering water	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

## Section 2.6 SITE MAPS

Project Design Drawings are included in Appendix A of this report.

# SECTION 3 DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

## Section 3.1 ENDANGERED SPECIES PROTECTION

This project is eligible for coverage under Criterion C under this permit.

- Criterion C:** Discharges not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designates critical habitats. ESA-listed species and/or designated critical habitat(s) under the jurisdiction of the USFWS and/or NMFS are likely to occur in or near your site's "action area," and you certify to EPA that your site's discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed threatened or endangered species and/or designated critical habitat. This certification may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat. To certify your eligibility under this criterion, indicate 1) the ESA-listed species and/or designated habitat located in your "action area" using the process outlined in Appendix D of this permit; 2) the distance between the site and the listed species and/or designated critical habitat in the action area (in miles); and 3) a rationale describing specifically how short- or long-term adverse effects to ESA-listed species will be avoided from the discharges and discharge-related activities. (Note: You must include a copy of your site map from your SWPPP showing the upland and in-water extent of your "action area" with your NOI.)
- Check to confirm you have provided documentation in your SWPPP as required by CGP Appendix D.

Refer to the US Fish and Wildlife Service report and justification for the Criterion C classification in the attached Appendix K.

## Section 3.2 HISTORIC PROPERTY SCREENING PROCESS

**Instructions (see CGP Part 1.1.6, 7.2.9.b, Appendix E, and the "Historic Preservation" section of the Appendix H – NOI Form and Instructions):**

Follow the screening process in Appendix E of the permit to determine whether your installation of subsurface earth-disturbing stormwater controls will have an effect on historic properties.

- Include documentation supporting your determination of eligibility.
- To contact your applicable State historic preservation office, information is available at <https://ncshpo.org/directory/>
- To contact your applicable Tribal historic preservation office, information is available at [https://grantsdev.cr.nps.gov/THPO\\_Review/index.cfm](https://grantsdev.cr.nps.gov/THPO_Review/index.cfm)

### Appendix E, Step 1

- Do you plan on installing any stormwater controls that require subsurface earth disturbance, including, but not limited to, any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.
- Dike
- Berm
- Catch Basin
- Pond
- Constructed Site Drainage Feature (e.g., ditch, trench, perimeter drain, swale, etc.)
- Culvert
- Channel
- Other type of ground-disturbing stormwater control: Infiltration Basins, Drain manhole, Proprietary stormwater treatment units

### Appendix E, Step 2

- If you answered yes in Step 1, have prior professional cultural resource surveys or other evaluations determined that historic properties do not exist, or have prior disturbances at the site have precluded the existence of historic properties?  YES  NO

The project has received negative determination from the Massachusetts Historical Commission (MHC) stating that the project is unlikely to affect significant historic or archaeological resources. The notification has been included in the attached Appendix L.

## Section 3.3 SAFE DRINKING WATER ACT UNDERGROUND INJECTION CONTROL REQUIREMENTS

### Instructions (see CGP Part 7.2.9.c):

- If you will use any of the identified controls in this section, document any contact you have had with the applicable State agency or EPA Regional Office responsible for implementing the requirements for underground injection wells in the Safe Drinking Water Act and EPA's implementing regulations at 40 CFR Parts 144-147.
- For State UIC program contacts, refer to the following EPA website:  
<https://www.epa.gov/uic>.

Do you plan to install any of the following controls? Check all that apply below.

- Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)
- Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow

- Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)



# SECTION 4 EROSION AND SEDIMENT CONTROLS AND DEWATERING PRACTICES

**General Instructions (See CGP Parts 2.2 and 7.2.6):**

- Describe the erosion and sediment controls that will be implemented at your site to meet the requirements of CGP Part 2.2.
- Describe any applicable stormwater control design specifications (including references to any manufacturer specifications and/or erosion and sediment control manuals/ordinances relied upon).
- Describe any routine stormwater control maintenance specifications.
- Describe the projected schedule for stormwater control installation/implementation.

Erosion and sediment controls that will be implemented at the site include stabilized construction exit, perimeter siltation control with filter sock, additional siltation control with silt fence, loaming and seeding, inlet control placed in catch basins, and the other features as mentioned below. Please refer to the project's Operation and Maintenance manual for maintenance protocols relative to the proprietary stormwater devices on-site.

## Section 4.1 NATURAL BUFFERS OR EQUIVALENT SEDIMENT CONTROLS

**Buffer Compliance Alternatives**

Are there any receiving waters within 50 feet of your project's earth disturbances?  YES  NO

(Note: If no, no further documentation is required for Section 4.1 in the SWPPP Template. Continue to Section 4.2.)

Check the compliance alternative that you have chosen:

- No natural buffer exists due to preexisting development disturbances (e.g., structures, impervious surfaces) that occurred prior to the initiation of planning for this project.

Project Design Drawings are included in Appendix A of this report which demonstrates compliance with this alternative.

## Section 4.2 PERIMETER CONTROLS

Sediment controls that will be installed downhill of this project site during construction include filter socks and silt fence along with the silt sacks at the catch basins on Tree Lane.

The contractor will install sediment control barriers along the perimeter of the site prior to land disturbance as shown on the Project Design Drawings included in Appendix A. Additional control barriers shall be installed as required to control runoff from the site. If intense rainfall is predicted before all tributary areas are stabilized, erosion control measures will be reinforced for the duration of the storm. All trenches will be backfilled as soon as possible.

**Specific Perimeter Controls**

<b>Sediment Control Barrier</b>	
<b>Description:</b> Sediment control barriers will be siltation fencing in addition to filter sock	
<b>Installation</b>	Sediment control barriers will be installed prior to the start of land clearing in the locations shown on the Project Drawings. These barriers will remain in place until all tributary surfaces have been fully stabilized. Refer to the Erosion Control Detail Sheet CD-1 in Appendix A for the perimeter controls construction details—sediment control barriers shall be anchored adequately into the ground surface and barriers shall overlap sufficiently (not placed side-by-side) to block passage of sediment.
<b>Maintenance Requirements</b>	<ul style="list-style-type: none"> <li>• Sediment captured by perimeter controls shall be checked twice each month and after each heavy rain. Silt shall be removed prior to accumulation to one half of the above-ground height of the barrier (minimum of 6 in).</li> <li>• Condition of sediment control device shall be checked twice each month or more frequently as required. Damaged and/or deteriorated items shall be replaced. Sediment control devices shall be maintained in place and in effective condition.</li> </ul>

Section 4.3 SEDIMENT TRACK-OUT

<p><b>Instructions (see CGP Parts 2.2.4 and 7.2.6.b.iii):</b></p> <ul style="list-style-type: none"> <li>– Describe stormwater controls that will be used to minimize sediment track-out.</li> <li>– Describe location(s) of vehicle exit(s), procedures to remove accumulated sediment off-site (e.g., vehicle tracking), and stabilization practices (e.g., stone pads or wash racks or both) to minimize off-site vehicle tracking of sediment. Also include the design, installation, and maintenance specifications for each control.</li> </ul>
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The contractor will install, inspect and maintain a stabilized construction exit for the duration of the project to minimize sediment tracking onto impervious surfaces and public ways. Sweeping shall be completed at the end of each working day to minimize sediment track out. The contractor shall inspect the public roadways adjacent to the construction entrance at least twice a day to ensure sediment track out is controlled, and undertake efforts consistent with this SWPPP and local regulations to ensure that any accumulated sediment on public roadways is removed.

**Specific Track-Out Controls**

<b>Stabilized Construction Exit(s)</b>	
<b>Description:</b> The stabilized construction exit will be constructed of coarse stone aggregate on top of a fabric layer.	
<b>Installation</b>	The construction exit will be installed at the beginning of the project in the location indicated on the Site Plans and will remain in place for the duration of the project.
<b>Maintenance Requirements</b>	<ul style="list-style-type: none"> <li>• Conditions at the exit from the site shall be inspected, at a minimum of, at the start and finish of each workday. Any sediment tracks or accumulation shall be cleaned by means of sweeping, vacuuming, or brushing/shoveling. Hosing or sweeping of sediment into stormwater conveyance infrastructure not intended for sediment control is prohibited.</li> <li>• Entrance shall be top dressed with new stone as required to maintain effectiveness. Additional locations may also be considered if sediment tracking becomes an issue.</li> </ul>
<b>Design Specifications</b>	See Construction Detail CD-1 Plans.

**Section 4.4 STOCKPILES OR LAND CLEARING DEBRIS PILES COMPRISED OF SEDIMENT OR SOIL**

The contractor shall store materials and equipment off-site and away from the close proximity of the wetland resource areas. Inclusion of any additional perimeter protection shall be considered if need arises for the additional sediment control measures due to stock piles.

<b>Perimeter Protection</b>	
<b>Description:</b> Sediment control barriers will be a filter sock barrier. Control barriers shall be installed at the base of all stockpiles. All stockpiles shall be within the limit of work. In advance of significant rainstorms, considerations for additional protection, including covering the piles, shall be made. Material stockpiles shall be located to minimize potential for runoff impacts, generally away from the surface waters and drainage inlets.	
<b>Installation</b>	Sediment control barriers for stockpiles will be installed once stockpiling of materials begins.
<b>Maintenance Requirements</b>	<ul style="list-style-type: none"> <li>• Watch for erosion along the pile and regrade/compact to prevent further erosion; cleanup any sediment that travels down the pile.</li> <li>• Any piles that will be unused for 14 or more days will be covered or an appropriate temporary stabilization will be provided.</li> <li>• The contractor is prohibited from hosing down or sweeping soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the U.S.</li> </ul>

## Section 4.5 MINIMIZE DUST

The contractor shall take steps to minimize the amount of dust created by construction activities. Dust control should be undertaken on an as-needed basis, especially when unstabilized surfaces are present. The contractor shall expect dust conditions to be worse during summer months or periods of extended dry weather.

### **Specific Dust Controls**

<b>Water Controls</b>	
<b>Description:</b> Contractor shall use on-site water or water trucks to control dust on-site.	
<b>Installation</b>	As necessary.
<b>Maintenance Requirements</b>	N/A

## Section 4.6 MINIMIZE STEEP SLOPE DISTURBANCES

The contractor shall minimize the amount of time any disturbed steep slopes are left un-stabilized and should be aware of any weather conditions that may increase the chances of slope wash-out and take necessary precautions to prevent this condition.

### **Specific Steep Slope Controls**

<b>Hydroseed</b>	
<b>Description:</b> Contractor shall hydroseed slopes with general seed mix to stabilize the slopes.	
<b>Installation</b>	Hydroseeding shall be completed within 7 days of final topsoil placement.
<b>Maintenance Requirements</b>	Watch for erosion of soils below and compact and re-hydroseed as needed to continue towards full stabilization and establishment of vegetative materials.

## Section 4.7 TOPSOIL

The project includes the conversion of existing wooded areas into impervious area via building construction and construction of asphalt throughout the site. In these areas, the topsoil must be removed to its full depth to allow for the import of the base materials for the finished surfaces. In the areas of proposed infiltrative stormwater features, any topsoil must be removed to a depth sufficient to remove all unsuitable fill material and replaced with appropriate soil media. The intent is to keep as much topsoil on-site; however, it is likely that excess topsoil will be generated and will have to be removed from site. Soils and sediment removed from the site will be legally disposed of to comply with local, state, and federal regulations.

## Section 4.8 SOIL COMPACTION

The contractor shall restrict vehicle and equipment use in locations where vegetative stabilization will occur or where infiltration practices will be installed. The contractor shall utilize areas of proposed compacted or impervious surfaces to the greatest extent possible for vehicle or equipment maneuvering. The contractor will manage construction as well as placement of sand

below infiltrative stormwater management facilities. The design requires the removal of all fill in the areas of the infiltrative stormwater management facilities and replacement of the fill with sandy material to promote infiltration. The removal of fill and placement of sand in these areas will occur after the building is substantially constructed and heavy machinery is no longer necessary to travel on these areas.

## Section 4.9 STORM DRAIN INLETS

Silt sacks shall be installed at all drainage inlets in the general vicinity of the project site.

### Specific Storm Drain Inlet Controls

<b><u>Drain System Protection (Existing and New)</u></b>	
<b>Description:</b> Silt sacks will be installed at drainage structures and maintained and cleaned until all areas flowing to these structures are adequately stabilized with vegetation and/or final surface treatment.	
<b>Installation</b>	<ul style="list-style-type: none"> <li>Inlet protection will be installed prior to the start of construction. These protections will remain in place until all tributary surfaces have been fully stabilized.</li> </ul>
<b>Maintenance Requirements</b>	<ul style="list-style-type: none"> <li>Sediment within the drain system protection shall be checked twice each month and after each heavy rain. Silt shall be removed if greater than 6 in. deep or is impacting the function of the device.</li> <li>Clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.</li> </ul>
<b>Design Specifications</b>	See Construction Detail Plans.

## Section 4.10 CONSTRUCTED SITE DRAINAGE FEATURE

### Specific Site Drainage Controls

<b><u>Diversions Swales</u></b>	
<b>Description:</b> The site drainage features to be installed are included in the site plans in Appendix A. These plans outline the various control practices that will be implemented during the construction of the site drainage features to manage erosion and control water velocity.	
<b>Installation</b>	As indicated in the Plans in Appendix A
<b>Maintenance Requirements</b>	Remove sediment accumulated before it reaches one-half of the above ground height of the proposed drainage features.

## Section 4.11 SEDIMENT BASINS OR SIMILAR IMPOUNDMENTS

Temporary sediment basins are depressions constructed downslope of construction activity and located such that stormwater runoff from upland areas and any construction diversion swales flow into the basin. After a contractor is selected, the contractor shall be responsible for installing sediment basin(s) to detain the 2-year, 24-hour storm, if needed. The basin(s) shall be kept in effective operating condition and sediment shall be removed when sediment accumulates to one-half of the design capacity of the basin, or sooner.

## Section 4.12 CHEMICAL TREATMENT

The use of chemical treatments is not proposed at this time. Should the Operator choose to use polymers, flocculants, or other treatment chemicals at the site, the operator must update the SWPPP to include the following:

- **Soil Types**
  - List all the soil types including soil types expected to be exposed during construction in areas of the project that will drain to chemical treatment systems and those expected to be found in fill material.
- **Treatment Chemicals**
  - List all treatment chemicals that will be used at the site and explain why these chemicals are suited to the soil characteristics.
  - Describe the dosage of all treatment chemicals you will use at the site or the methodology you will use to determine dosage.
  - Provide information from any applicable Safety Data Sheets (SDS).
  - Describe how each of the chemicals will be stored consistent with CGP Part 2.2.13c.
  - Include references to applicable State or local requirements affecting the use of treatment chemicals, and copies of applicable manufacturer's specifications regarding the use of your specific treatment chemicals and/or chemical treatment systems.
- **Special Controls for Cationic Treatment Chemicals** (if applicable)
  - If the applicable EPA Regional Office authorized you to use cationic treatment chemicals, include the official EPA authorization letter or other communication, and identify the specific controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a discharge that does not meet water quality standards.
- **Schematic Drawings of Stormwater Controls/Chemical Treatment Systems**
  - Provide schematic drawings of any chemically-enhanced stormwater controls or chemical treatment systems to be used for application of treatment chemicals.
- **Training**
  - Describe the training that personnel who handle and apply chemicals have received prior to permit coverage, or will receive prior to the use of treatment chemicals.

## Section 4.13 DEWATERING PRACTICE

When dewatering is required, the following practices shall be followed:

1. The contractor shall coordinate dewatering with all Local, State, and Federal agencies and obtain all required permits.
2. The contractor shall treat dewatering discharges with controls to minimize discharges of pollutants.
3. The contractor shall not discharge visible floating solids or foam.
4. The contractor shall use an oil-water separator or suitable filtration device (such as a cartridge filter) that is designed to remove oil, grease, or other products if dewatering water is found to contain these materials.
5. To the extent feasible, the contractor shall use vegetated, upland areas of the site to infiltrate dewatering water before discharge. Use of waters of the U.S. as part of the treatment area is prohibited.
6. At all points where dewatering water is discharged, the contractor shall comply with the velocity dissipation requirements of Part 2.2.11 of the CGP.
7. The contractor shall either haul backwash water away for disposal or return it to the beginning of the treatment process.
8. The contractor shall replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.

The project requires the use dewatering bags as shown in the Detail Plans.

## Section 4.14 OTHER STORMWATER CONTROLS

Contractor shall update this SWPPP if any additional stormwater control measures have been adapted.

## Section 4.15 SITE STABILIZATION

### Total Amount of Land Disturbance Occurring at Any One Time

- Five Acres or less*  
 *More than Five Acres*

<b>Loam and Seed</b>
<input checked="" type="checkbox"/> <i>Vegetative</i> <input type="checkbox"/> <i>Non-Vegetative</i> <input type="checkbox"/> <i>Temporary</i> <input type="checkbox"/> <i>Permanent</i>
<b>Description:</b> <ul style="list-style-type: none"><li>• Areas of disturbed soils that do not receive a final surface treatment as part of the project will be loamed and seeded. Depending on the final vegetation type (maintained versus naturalized) different seed mixes shall be used accordingly. Initiation of the installation of stabilization measures will begin immediately in any areas of exposed soil where construction activities has permanently ceased or will be temporarily inactive for 14 or more days. Completion of the installation of stabilization measures will be completed as soon as practicable, but not later than seven days after stabilization has been initiated.</li></ul>

<b>Loam and Seed</b>	
<b>Installation</b>	Schedule for seed mix timing is to be determined after the contract project is awarded
<b>Completion</b>	Immediately in any areas of exposed soil where construction activities has permanently ceased or will be temporarily inactive for 14 or more days.
<b>Maintenance Requirements</b>	Irrigate as needed. Care shall be taken by contractor to maintain the loamed and seeded area for the proper growth of vegetation.



# SECTION 5 POLLUTION PREVENTION CONTROLS

## Section 5.1 POTENTIAL SOURCES OF POLLUTION

Construction Site Pollutants include the following:

<b>Pollutant-Generating Activity</b>	<b>Pollutants or Pollutant Constituents</b> (That could be discharged if exposed to stormwater)	<b>Location on Site</b> (Or reference SWPPP site map where this is shown)
Clearing/Grubbing/Earthwork	Sediment	Refer to Project Drawings
Paving Operations	Sediment, trash, oils	Refer to Project Drawings
Material Delivery/Storage	Sediment, oils, solids, chemicals	Site Entrance
Solid Waste	Solids	N/A
Spills	Sediment, Nutrients, oils, hazardous chemicals, other chemicals	N/A
Vehicle Storage	Sediment, oils, chemicals	N/A
Landscape Operations	Sediment, nutrients, bacteria	Refer to Project Drawings
Sanitary Facilities	Sediment, nutrients, bacteria	N/A

## Section 5.2 SPILL PREVENTION AND RESPONSE

The contractor will train all personnel in the proper handling and cleanup of spilled materials. No spilled hazardous materials or hazardous wastes will be allowed to come in contact with stormwater discharges. If such contact occurs, the stormwater discharge will be contained on-site until appropriate measures in compliance with State and Federal regulations are taken to dispose of such contaminated stormwater. It shall be the responsibility of the job site superintendent to properly train all personnel in spill prevention and cleanup procedures.

All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete curing compounds and additives, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

1. During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater shall not be stored or handled in areas of the site draining to an infiltration area. An 'infiltration area' is any area of the site that by design or as a result of soils, topography and other relevant factors accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other Stormwater Pollution Prevention (SWPPP)

forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purpose of storage and handling of these materials.

2. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing power, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the site.

Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and supplies.

In the event of a spill the following procedures should be followed:

1. All spills will be cleaned up immediately after discovery.
2. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with the hazardous substances.
3. The project manager and the Engineer of Record will be notified immediately.
4. Spills of toxic or hazardous materials will be reported to the appropriate Federal, State, and/or Local government agency, regardless of the size of the spill.
5. The Sharon Fire Department will be contacted: Call 911 or (781) 784-2121.
6. If the spill exceeds a Reportable Quantity, the SWPPP must be modified within seven (7) calendar days of knowledge of the discharge to provide a description of the release, the circumstances leading to the release, and the date of the release, The plans must identify measures to prevent the recurrence of such release and to respond to such releases.

The job site superintendent will be the spill prevention and response coordinator. He/she will designate the individuals who will receive spill prevention and response training. These individuals will each become responsible for a particular phase of prevention and response. The names of these personnel will be posted on site.

## Section 5.3 FUELING AND MAINTENANCE OF EQUIPMENT AND VEHICLES

The Contractor shall minimize fueling and equipment maintenance on site as this is an active drinking water supply property. The Contractor shall take extreme care if fueling and maintenance is performed on site.

Inspect construction vehicles daily and repair any leaks immediately. Dispose of all used oil, antifreeze, solvents, and other automotive-related chemicals according to manufacturer instructions off-site. These wastes require special handling and disposal. Used oil, antifreeze, and some solvents can be recycled at designated facilities, but other chemicals must be disposed of at a hazardous waste disposal site.

Vehicle maintenance operations produce substantial amounts of hazardous and other wastes that require regular disposal. Cleanup spills and dispose of cleanup materials off-site immediately. Inspect equipment and storage containers regularly to identify leaks or signs of deterioration.

## Section 5.4 WASHING OF EQUIPMENT AND VEHICLES

Contractor shall minimize washing of equipment and vehicles on site. If the Contractor must, the Contractor shall designate a special paved area for the washing of vehicles and area shall be designated with a sign.

### Specific Pollution Prevention Practices

<b>Washing of Equipment / Vehicles</b>	
<b>Description:</b> Contractor shall locate a special paved area for the washing of equipment or vehicles. Area shall have a sign that designates it as a washout area. To direct wash water to treatment facilities, ensure that vehicle washing areas are impervious and are equipped with a berm. Use blowers or vacuums instead of water to remove dry materials from vehicles if possible. Because water alone can remove most dirt adequately, use high-pressure water spray without detergents at vehicle washing areas. If contractor must use detergents, they shall avoid phosphate- or organic-based cleansers to reduce nutrient enrichment and biological oxygen demand in wastewater. Use only biodegradable products that are free of halogenated solvents. Clearly mark all washing areas, and inform workers that all washing must occur in this area. Do not perform other activities, such as vehicle repairs, in the wash area.	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	TBD
<b>Design Specifications</b>	N/A

## Section 5.5 STORAGE, HANDLING, AND DISPOSAL OF BUILDING PRODUCTS, MATERIALS, AND WASTES

### Section 5.5.1 Building Materials and Building Products

The project will result in construction and domestic debris and waste. Contractor shall supply the means to minimize the exposure of construction products, materials, and waste to precipitation and stormwater. The contractor shall provide facilities to properly handle and dispose of waste with considerations for health and safety of the employees.

### Specific Pollution Prevention Practices

<b>Storage, Containment, Handling of Materials</b>	
<p><b>Description:</b> Contractor shall designate a waste collection area on site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.</p> <ul style="list-style-type: none"> <li>• Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.</li> <li>• Schedule waste collection to prevent the containers from overflowing.</li> <li>• Clean spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.</li> <li>• During the demolition phase of construction, provide extra containers and schedule more frequent pickups.</li> <li>• Collect, remove and dispose of all construction site wastes at authorized disposal areas.</li> <li>• Contact a local environmental agency to identify these disposal sites.</li> </ul>	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	N/A
<b>Design Specifications</b>	N/A

## Section 5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials (CGP 2.3.3.b) General

Fertilizers are not planned to be used on the landscape areas throughout the project site at the time of this SWPPP preparation. If fertilizers are used, the contractor shall follow all regulations that apply to the use, handling, or disposal of pesticides and fertilizers. Contractor shall store fertilizers and pesticides in a dry, covered area and will take precautions to minimize the exposure of these chemicals to precipitation and to stormwater.

### Specific Pollution Prevention Practice

<b>Proper Handling and Application of Materials</b>	
<p><b>Description:</b></p> <ul style="list-style-type: none"> <li>• Contractor shall follow all Federal, State, and Local regulations that apply to the use, handling, or disposal of pesticides and fertilizers.</li> <li>• Contractor shall not handle the materials any more than necessary.</li> <li>• Contractor shall store pesticides and fertilizers in a dry, covered area.</li> <li>• Contractor shall construct berms or dikes to contain stored pesticides and fertilizers in case of spillage.</li> <li>• Contractor shall follow the recommended application rates and methods for the products.</li> <li>• Contractor shall have equipment and absorbent materials available in storage and application areas to contain and cleanup any spills that occur.</li> </ul>	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	N/A
<b>Design Specifications</b>	N/A

### Section 5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals (CGP 2.3.3.c)

Any on-site fueling shall be limited to vehicles that are to remain onsite. Other fluids shall not be stored on-site with all maintenance on vehicles being completed at off-site locations. Should storage of materials on site be required, Contractor shall store materials in water-tight containers and provide cover to minimize the exposure of these products to precipitation and stormwater.

#### Specific Pollution Prevention Practices

<b>Material Handling</b>	
<b>Description:</b>	
<ul style="list-style-type: none"> <li>• Contractor shall store new and used petroleum products for vehicles in covered areas with berms or dikes in place to contain any spills.</li> <li>• Immediately contain and cleanup any spills with absorbent materials.</li> <li>• Have equipment available in fuel storage areas and in vehicles to contain and cleanup any spills that occur.</li> </ul>	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	Contractor shall clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. Contractor is prohibited from hosing down areas to clean surfaces or spills. Contractor shall eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.
<b>Design Specifications</b>	N/A

### Section 5.5.4 Hazardous or Toxic Waste (CGP 2.3.3.d)

Should the project result in the generation of toxic or hazardous wastes, the Contractor shall store materials in containers which are constructed to prevent leakage and corrosion.

#### Specific Pollution Prevention Practices

<b>Material Handling</b>	
<p><b>Description:</b></p> <ul style="list-style-type: none"> <li>• Contractor shall consult with local waste management authorities about the requirements for disposing of hazardous materials.</li> <li>• To prevent leaks, empty and clean hazardous waste containers before disposing of them.</li> <li>• Never remove the original product label from the container because it contains important safety information. Follow the manufacturer’s recommended method of disposal, which should be printed on the label.</li> <li>• Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.</li> <li>• Contractor shall separate hazardous or toxic waste from construction and domestic waste.</li> <li>• Waste shall be stored in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable Federal, State, or Local requirements.</li> <li>• All outside containers shall be stored within appropriately-sized secondary containment (spill berms, decks, spill containment pallets) to prevent spills from being discharged.</li> <li>• Contractor shall clean up spills immediately, using dry clean-up methods, and dispose of used materials properly. Contractor is prohibited from hosing the area down to clean surfaces or spills. Contractor shall eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.</li> </ul> <p>To ensure the proper disposal of any contaminated soils that have been exposed to and still contain hazardous substances, the contractor shall consult with State or Local solid waste regulatory agencies or private firms. Some landfills might accept contaminated soils, but they require laboratory tests first. Any disposal of contaminated soils shall be coordinated with the Project Engineer and shall conform to all State and Local regulations.</p>	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	Review daily.
<b>Design Specifications</b>	N/A

## Section 5.5.5 Construction and Domestic Waste (CGP 2.3.3.e)

The project will result in construction and domestic debris and waste. The Contractor shall provide facilities to properly handle and dispose of waste with considerations for health and safety of employees.

### Specific Pollution Prevention Practices

<b>Waste Containers</b>	
<b>Description:</b>	
<ul style="list-style-type: none"> <li>• Contractor shall designate a waste collection area on site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.</li> <li>• Contractor shall provide waste containers of sufficient size and number to contain construction and domestic wastes.</li> <li>• Contractor shall ensure that containers have lids so they can be covered before periods of rain, and shall keep containers in a covered area whenever possible.</li> <li>• Contractor shall schedule waste collection to prevent the containers from overflowing.</li> <li>• Contractor shall cleanup spills immediately.</li> <li>• Contractor shall collect, remove and dispose of all construction site wastes at authorized disposal areas. Contact a local environmental agency to identify these disposal sites.</li> </ul>	
<b>Installation</b>	TBD
<b>Maintenance Requirements</b>	Review daily.
<b>Design Specifications</b>	N/A

## Section 5.5.6 Sanitary Waste (CGP 2.3.3.f)

Temporary facilities shall be provided by the contractor for on-site use by employees. This section shall be updated by the contractor once the project is awarded and temporary facilities has been included on-site.

### Specific Pollution Prevention Practices

<b>Temporary Facilities</b>	
<b>Description:</b> Temporary facilities shall be provided by the contractor.	
<b>Installation</b>	Temporary facilities will be installed at the beginning of the project. Facilities shall be positioned so that they are secure and will not be tipped or knocked over. Temporary facilities shall be located away from the waters of the U.S. and stormwater inlets and conveyances.
<b>Maintenance Requirements</b>	Temporary facilities shall have routine inspections and shall be scheduled for waste collection as needed.
<b>Design Specifications</b>	N/A

## Section 5.6 WASHING OF APPLICATORS AND CONTAINERS USED FOR STUCCO, PAINT, CONCRETE, FORM RELEASE OILS, CUTTING COMPOUNDS, OR OTHER MATERIALS

Should washout of paint of other materials be required, Contractor shall direct wash water into leak-proof containers or lined pit designed so that no overflows can occur due to inadequate sizing or precipitation.

**Specific Pollution Prevention Practices**

<b>Washout Container</b>	
<p><b>Description:</b> Contractor shall direct wash water into a leak-proof container or leak-proof and lined pit designed so that no overflows can occur due to inadequate sizing or precipitation. If the washout of paint or other materials are required, Contractor shall handle washout or cleanout wastes as follows:</p> <ul style="list-style-type: none"> <li>• Contractor shall not dump liquid wastes in storm sewers or waters of the U.S.</li> <li>• Contractor shall dispose of liquid wastes in accordance with applicable requirements in Part 2.3.3 of the 2017 CGP.</li> <li>• Contractor shall remove and dispose of hardened concrete waste consistent with the handling of other construction wastes.</li> </ul>	
<b>Installation</b>	Washout container will be installed as required for the project. Any washout or cleanout activities will be located as far away as possible from the waters of the U.S. and stormwater inlets or conveyances, and, to the extent feasible, the contractor shall designate the washout areas to be used for washout or cleanout only.
<b>Maintenance Requirements</b>	Maintenance of the washout is to include removal of hardened concrete. The facility shall have sufficient volume to contain all the concrete waste resulting from washout and a minimum freeboard of 1 foot. Facility shall not be filled beyond 95% capacity and shall be cleaned out once 75% full unless a new facility is constructed.
<b>Design Specifications</b>	N/A

## Section 5.7 APPLICATION OF FERTILIZERS

At the time of the preparation of this SWPPP, fertilizers are not planned to be used on the landscape areas throughout the project site. If the contractor deems fertilizers necessary, and approved by the Engineer and Owner, the Contractor shall follow all regulations that apply to the use, handling, or disposal of fertilizers. Contractor shall store fertilizers in a dry, covered area and will take precautions to minimize the exposure of these chemicals to precipitation and to stormwater.

**Specific Pollution Prevention Practices**

<b>Appropriate Use</b>	
<ul style="list-style-type: none"> <li>• <b>Description:</b> Type and amount of fertilizer is to be determined by the final plantings determined for the site.</li> </ul>	



<b>Appropriate Use</b>	
<b>Installation</b>	Fertilizer shall be applied at the appropriate time of year to coincide as closely as possible to the period of maximum vegetation uptake and growth. Contractor shall apply fertilizer at a rate in amounts consistent with manufacturer's specifications. Contractor shall avoid applying fertilizers before heavy rains that could cause excess nutrients to be discharged. Contractor shall never apply fertilizers to frozen ground. Contractor shall never apply fertilizers to stormwater conveyance channels. Contractor shall follow all Federal, State, and Local requirements regarding fertilizer application.
<b>Maintenance Requirements</b>	N/A
<b>Design Specifications</b>	N/A

## Section 5.8 OTHER POLLUTION PREVENTION PRACTICES

Contractor shall provide information below about any other pollution prevention practices that are implemented during construction that are not described above.

# SECTION 6 INSPECTION, MAINTENANCE, AND CORRECTIVE ACTION

## Section 6.1 INSPECTION PERSONNEL AND PROCEDURES

### **Instructions (see CGP Parts 4, 5, and 7.2.7):**

Describe the procedures you will follow for maintaining your stormwater controls, conducting inspections, and, where necessary, taking corrective actions in accordance with CGP Parts 4, 5, and 7.2.7.

Inspection Personnel shall be designated by the Contractor after the construction contract is awarded.

### **Site Inspection Schedule**

#### **Standard Frequency:**

- Every 7 calendar days
- Every 14 calendar days and within 24 hours of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period (including when there are multiple, smaller storms that alone produce less than 0.25 inches but together produce 0.25 inches or more in 24 hours), or
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period on the first day of a storm and continues to produce 0.25 inches or more of rain on subsequent days (you conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the last day of the storm that produces 0.25 inches or more of rain (i.e., only two inspections would be required for such a storm event)), or
  - A discharge caused by snowmelt from a storm event that produces 3.25 inches or more of snow within a 24-hour period.

#### **Reduced Frequency (if applicable)**

##### **For stabilized areas**

- Twice during first month, no more than 14 calendar days apart; then once per month after first month until permit coverage is terminated consistent with Part 9 in any area of your site where the stabilization steps in 2.2.14.a have been completed.
  - Specify locations where stabilization steps have been completed
  - Insert date that they were completed(Note: It is likely that you will not be able to include this in your initial SWPPP. If you qualify for this reduction (see CGP Part 4.4.1), you will need to modify your SWPPP to include this information. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.2 and 4.3, as applicable.)

**For stabilized areas on “linear construction sites” (as defined in Appendix A)**

- Twice during first month, no more than 14 calendar days apart; then once more within 24 hours of a storm event that produces 0.25 inches or more of rain within a 24-hour period, or within 24 hours of a snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period
  - Specify locations where stabilization steps have been completed
  - Insert date that they were completed(Note: It is likely that you will not be able to include this in your initial SWPPP. If you qualify for this reduction (see CGP Part 4.4.1), you will need to modify your SWPPP to include this information.)

**For arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought**

- Once per month and within 24 hours of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
  - A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period.

Insert beginning and ending month identified as the seasonally dry period for your area or the valid period of drought:

- Beginning month of the seasonally dry period: Insert approximate date
- Ending month of the seasonally dry period: Insert approximate date

**For frozen conditions where construction activities are being conducted**

- Once per month

Insert beginning and ending dates of frozen conditions on your site:

- Beginning date of frozen conditions: Insert approximate date
- Ending date of frozen conditions: Insert approximate date

**For frozen conditions where construction activities are suspended**

- Inspections are temporarily suspended

Insert beginning and ending dates of frozen conditions on your site:

- Beginning date of frozen conditions: Insert approximate date
- Ending date of frozen conditions: Insert approximate date

**Dewatering Inspection Schedule**

Select the inspection frequency that applies based on CGP Part 4.3.2

**Dewatering Inspection**

- Once per day on which the discharge of dewatering water occurs.

**Site Inspection Report Forms**

See Appendix D for inspection report form.

## Section 6.2 CORRECTIVE ACTION

**Instructions (CGP Parts 5 and 7.2.7):**

- Describe the procedures for taking corrective action in compliance with CGP Part 5.

**Personnel Responsible for Corrective Actions**

The Contractor shall be responsible for corrective actions. The Contractor will be selected following public bidding.

**Corrective Action Forms**

See Appendix E for Corrective Action Form.

## Section 6.3 DELEGATION OF AUTHORITY

**Instructions:**

- Identify the individual(s) or positions within the company who have been delegated authority to sign inspection reports.
- Attach a copy of the signed delegation of authority (see example in Appendix J of this SWPPP Template.)
- For more on this topic, see Appendix G, Subsection 11 of EPA's CGP.

**Duly Authorized Representative(s) or Position(s):**

This section of the SWPPP will be updated after the project contract is awarded.

See Appendix J for Delegation of Authority documentation.

# SECTION 7 CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## APPENDIX A

### Site Plans

*(Provided under separate cover)*

APPENDIX B

2022 CGP

*(Provided under separate cover)*

APPENDIX C  
NOI and EPA Authorization Email



This appendix will be updated after the NOI has been submitted by the Contractor.

APPENDIX D  
Site Inspection Form and Dewatering Inspection Form

<b>Section A – General Information</b> (If necessary, complete additional inspection reports for each separate inspection location.)	
<b>Inspector Information</b>	
<b>Inspector Name:</b>	<b>Title:</b>
<b>Company Name:</b>	<b>Email:</b>
<b>Address:</b>	<b>Phone Number:</b>
<b>Inspection Details</b>	
<b>Inspection Date:</b>	<b>Inspection Location:</b>
<b>Inspection Start Time:</b>	<b>Inspection End Time:</b>
<b>Current Phase of Construction:</b>	<b>Weather Conditions During Inspection:</b>
<b>Did you determine that any portion of your site was unsafe for inspection per CGP Part 4.5?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If “Yes,” provide the following information:</b> Location of unsafe conditions: The conditions that prevented you inspecting this location:	
<b>Indicate the required inspection frequency:</b> (Check all that apply. You may be subject to different inspection frequencies in different areas of the site.)	
<b>Standard Frequency (CGP Part 4.2):</b> <input type="checkbox"/> At least once every 7 calendar days; <b>OR</b> <input type="checkbox"/> Once every 14 calendar days <i>and</i> within 24 hours of the occurrence of either: <ul style="list-style-type: none"> <li>• A storm event that produces 0.25 inches or more of rain within a 24-hour period, or</li> <li>• A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period</li> </ul>	
<b>Increased Frequency (CGP Part 4.3.1)</b> (If site discharges to sediment or nutrient-impaired waters or to waters designated as Tier 2, Tier 2.5, or Tier 3): <input type="checkbox"/> Once every 7 calendar days <i>and</i> within 24 hours of the occurrence of either: <ul style="list-style-type: none"> <li>• A storm event that produces 0.25 inches or more of rain within a 24-hour period, or</li> <li>• A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period</li> </ul>	

**Reduced Frequency (CGP Part 4.4):**

- For stabilized areas: Twice during first month, no more than 14 calendar days apart; then once per month after first month until permit coverage is terminated
- For stabilized areas on "linear construction sites": Twice during first month, no more than 14 calendar days apart; then once more within 24 hours of the occurrence of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
  - A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period
- For arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought: Once per month and within 24 hours of the occurrence of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
  - A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period
- For frozen conditions where construction activities are being conducted: Once per month

**Was this inspection triggered by a storm event producing 0.25 inches or more of rain within a 24-hour period?**  Yes  No

**If "Yes," how did you determine whether the storm produced 0.25 inches or more of rain?**

- On-site rain gauge
- Weather station representative of site.  
Weather station location:

**Total rainfall amount that triggered the inspection (inches):**

**Was this inspection triggered by a snowmelt discharge from a storm event producing 3.25 inches or more of snow within a 24-hour period?**  Yes  No

**If "Yes," how did you determine whether the storm produced 3.25 inches or more of snow?**

- On-site rain gauge
- Weather station representative of site.  
Weather station location:

**Total snowfall amount that triggered the inspection (inches):**

Section B – Condition and Effectiveness of Erosion and Sediment (E&S) Controls (CGP Part 2.2) (Insert additional rows if needed)					
Type and Location of E&S Control	Conditions Requiring Routine Maintenance? <sup>1</sup>	If “Yes,” How Many Times (Including This Occurrence) Has This Condition Been Identified?	Conditions Requiring Corrective Action? <sup>2, 3</sup>	Date on Which Condition First Observed (If Applicable)?	Description of Conditions Observed
1.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
2.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
3.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
4.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
5.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
<p><b>If the same routine maintenance was found to be necessary three or more times for the same control at the same location (including this occurrence), follow the corrective action requirements and record the required information in your corrective action log, or describe here why you believe the specific condition should still be addressed as routine maintenance:</b></p>					

<sup>1</sup> Routine maintenance includes minor repairs or other upkeep performed to ensure that the site’s stormwater controls remain in effective operating condition, not including significant repairs or the need to install a new or replacement control. Routine maintenance is also required for specific conditions: (1) for perimeter controls, whenever sediment has accumulated to half or more the above-ground height of the control (CGP Part 2.2.3.c.i); (2) where sediment has been tracked-out from the site onto paved roads, sidewalks, or other paved areas (CGP Part 2.2.4.d); (3) for inlet protection measures, when sediment accumulates, the filter becomes clogged, and/or performance is compromised (CGP Part 2.2.10.b); and (4) for sediment basins, as necessary to maintain at least half of the design capacity of the basin (CGP Part 2.2.12.f)

<sup>2</sup> Corrective actions are triggered only for specific conditions (CGP Part 5.1):

1. A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part 2.1.4.c, you find it necessary to repeatedly (i.e., three (3) or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part 4.7.1.c that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under 2.1.4); or
2. A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly; or
3. Your discharges are not meeting applicable water quality standards; or
4. A prohibited discharge has occurred (see CGP Part 1.3); or
5. During the discharge from site dewatering activities:
  - a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part 3.3.2.b); or
  - b. You observe or you are informed by EPA, State, or local authorities of the presence of the conditions specified in Part 4.6.3.e.

<sup>3</sup> If a condition on your site requires a corrective action, you must also fill out a corrective action log found at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>. See CGP Part 5.4 for more information.

Section C – Condition and Effectiveness of Pollution Prevention (P2) Practices and Controls (CGP Part 2.3)					
(Insert additional rows if needed)					
Type and Location of P2 Practices and Controls	Conditions Requiring Routine Maintenance? <sup>1</sup>	If “Yes,” How Many Times (Including This Occurrence) Has This Condition Been Identified?	Conditions Requiring Corrective Action? <sup>2, 3</sup>	Date on Which Condition First Observed (If Applicable)?	Description of Conditions Observed
1.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
2.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
3.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
4.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
5.	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No		
<p>If the same routine maintenance was found to be necessary three or more times for the same control at the same location (including this occurrence), follow the corrective action requirements and record the required information in your corrective action log, or describe here why you believe the specific condition should still be addressed as routine maintenance:</p>					

Section D – Stabilization of Exposed Soil (CGP Part 2.2.14) (Insert additional rows if needed)					
Specific Location That Has Been or Will Be Stabilized	Stabilization Method and Applicable Deadline	Stabilization Initiated?	Final Stabilization Criteria Met?	Final Stabilization Photos Taken?	Notes
1.		<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date initiated:	<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date criteria met:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2.		<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date initiated:	<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date criteria met:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3.		<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date initiated:	<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date criteria met:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4.		<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date initiated:	<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date criteria met:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5.		<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date initiated:	<input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes," date criteria met:	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Section E – Description of Discharges (CGP Part 4.6.2) <i>(Insert additional rows if needed)</i>	
<p><b>Was a discharge (not including dewatering) occurring from any part of your site at the time of the inspection?<sup>4</sup></b>    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p> <p><b>If “Yes,” for each point of discharge, document the following:</b></p> <ul style="list-style-type: none"> <li>• The visual quality of the discharge.</li> <li>• The characteristics of the discharge, including color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants.</li> <li>• Signs of the above pollutant characteristics that are visible from your site and attributable to your discharge in receiving waters or in other constructed or natural site drainage features.</li> </ul>	
Discharge Location	Observations
1.	
2.	
3.	
4.	
5.	

<sup>4</sup> If a dewatering discharge was occurring, you must conduct a dewatering inspection pursuant to CGP Part 4.3.2 and complete a separate dewatering inspection report.



**Section F – Signature and Certification (CGP Part 4.7.2)**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**MANDATORY: Signature of Operator or "Duly Authorized Representative:"**

<b>Signature:</b>	<b>Date:</b>
<b>Printed Name:</b>	<b>Affiliation:</b>

**OPTIONAL: Signature of Contractor or Subcontractor**

<b>Signature:</b>	<b>Date:</b>
<b>Printed Name:</b>	<b>Affiliation:</b>

## **General Tips for Using This Template**

This Site Inspection Report Template is provided to assist you in preparing site inspection reports for EPA's 2022 Construction General Permit (CGP). If you are covered under the 2022 CGP, you can use this template to create a site inspection report form that is customized to the specific circumstances of your site and that complies with the minimum reporting requirements of Part 4.7 of the permit. Note that the use of this form is optional; you may use your own site inspection report form provided it includes the minimum information required in Part 4.7 of the CGP.

This template does not address the CGP's inspection reporting requirements related to dewatering activities. A separate inspection template has been developed specifically for dewatering activities and is available at <https://www.epa.gov/npdcs/construction-general-permit-resources-tools-and-templates>.

Keep in mind that this document is a template and not an "off-the-shelf" inspection report that is ready to use without some modification. You must first customize this form to include the specifics of your project in order for it to be useable for your inspection reports. Once you have entered all of your site-specific information into the blank fields, you may use this form to complete inspection reports.

The following tips for using this template will help you ensure that the minimum permit requirements are met:

- **Review the inspection requirements.** Before you start developing your inspection report form, read the CGP's Part 4 inspection requirements. This will ensure that you have a working understanding of the permit's underlying inspection requirements.
- **Complete all required blank fields.** Fill out all blank fields. Only by filling out all fields will the template be compliant with the requirements of the permit. (Note: Where you do not need the number of rows provided in the template form for your inspection, you may delete these or cross them off as you see fit. Or, if you need more space to document your findings, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)
- **Use your site map to document inspection findings.** In several places in the template, you are directed to specify the location of certain features of your site, including where stormwater controls are installed and where you will be stabilizing exposed soil. You are also asked to fill in location information for unsafe conditions and the locations of any discharges occurring during your inspections. Where you are asked for location information, EPA encourages you to reference the point on your SWPPP site map that corresponds to the requested location on the inspection form. Using the site map as a tool in this way will help you conduct efficient inspections, will assist you in evaluating problems found, and will ensure proper documentation.
- **Complete the inspection report within 24 hours of completing a site inspection.** You must complete an inspection report in accordance with Part 4.7.1 of the CGP.
- **Include the inspection form with your SWPPP.** Once your form is complete, make sure to include a copy of the inspection form in your SWPPP in accordance with Part 7.2.7.e of the CGP.
- **Retain copies of all inspection reports with your records.** You must also retain in your records copies of all inspection reports in accordance with the requirements in Part 4.7.3 of the CGP. These reports must be retained for at least 3 years from the date your permit coverage expires or is terminated in accordance with the requirements in Part 4.7.4 of the CGP.

## **Instructions for Section A**

### **Inspector Name**

Enter the name of the person that conducted the inspection. Include the person's contact information (title, affiliated company name, address, email, and phone number).

### **Inspection Date and Time**

Enter the date you performed the inspection and the time you started and ended the inspection.

### **Weather Conditions During Inspection**

Enter the weather conditions occurring during the inspection, e.g., sunny, overcast, light rain, heavy rain, snowing, icy, windy.

### **Current Phase of Construction**

If this project is being completed in more than one phase, indicate which phase it is currently in.

### **Inspection Location**

If your project has multiple locations where you conduct separate inspections, specify the location where this inspection is being conducted. If only one inspection is conducted for your entire project, enter "Entire Site." If necessary, complete additional inspection report forms for each separate inspection location.

### **Unsafe Conditions for Inspection (CGP Part 4.5.7)**

Inspections are not required where a portion of the site or the entire site is subject to unsafe conditions. These conditions should not regularly occur and should not be consistently present on a site. Generally, unsafe conditions are those that render the site (or a portion of it) inaccessible or that would pose a significant probability of injury to applicable personnel. Examples could include severe storm or flood conditions, high winds, and downed electrical wires.

If your site, or a portion of it, is affected by unsafe conditions during the time of your inspection, provide a description of the conditions that prevented you from conducting the inspection and what parts of the site were affected. If the entire site was considered unsafe, specify the location as "Entire Site."

### **Inspection Frequency**

Check all the inspection frequencies that apply to your project. Note that you may be subject to different inspection frequencies in different areas of your site.

### **Inspection Triggered by a Storm Event**

If you were required to conduct this inspection because of a storm event that produced 0.25 inches or more of rain within a 24-hour period, indicate whether you relied on an on-site rain gauge or a nearby weather station (and where the weather station is located). Also, specify the total amount of rainfall for this specific storm event.

If you were required to conduct this inspection because of a snowmelt discharge from a storm event that produced 3.25 inches or more of snow within a 24-hour period, then indicate whether you relied on an on-site measurement or a nearby weather station (and where the weather station is located). Also, specify the total amount of snowfall for this specific storm event.

## **Instructions for Section B**

### **Type and Location of Erosion and Sediment (E&S) Controls**

Provide a list of all erosion and sediment (E&S) controls that your SWPPP indicates will be installed and implemented at your site. This list must include at a minimum all E&S controls required by CGP Part 2.2. Include also any natural buffers established under CGP Part 2.2.1. Buffer requirements apply if your project's earth-disturbing activities will occur within 50 feet of a discharge to receiving water. You may group your E&S controls on your form if you have several of the same type of controls (e.g., you may group "Inlet Protection Measures," "Perimeter Controls," and "Stockpile Controls" together on one line), but if there are any problems with a specific control, you must separately identify the location of the control, whether routine maintenance or corrective action is necessary, and in the notes section you must describe the specifics about the problem you observed.

### **Conditions Requiring Routine Maintenance?**

Answer "Yes" if the E&S control requires routine maintenance as defined in footnote 1 of this template. Note that in many cases, "Yes" answers are expected and indicate a project with an active operation and maintenance program. You should also answer "Yes" if work to fix the problem is still ongoing from the previous inspection, though necessary work must be initiated immediately and completed by the end of the next business day or within seven calendar days if documented in accordance with CGP Part 2.1.4.b.

### **If "Yes," How Many Times (Including this Occurrence) Has this Condition Been Identified?**

Indicate how many times the routine maintenance has been required for the same control at the same location.

### **Conditions Requiring Corrective Action?**

Answer "Yes" if you found any of the conditions listed in footnote 2 in this template to be present during your inspection (CGP Part 5.1). If you answer "Yes," you must take corrective action and complete a corrective action log, found at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>. You should also answer "Yes" if work to fix the problem from a previous inspection is still ongoing, though the operator must comply with the corrective action deadlines in CGP Part 5.2.

### **Date on Which Condition First Observed (If Applicable)?**

Provide the date on which the condition that triggered the need for routine maintenance or corrective action was first identified. If the condition was just discovered during this inspection, enter the inspection date. If the condition is a carryover from a previous inspection, enter the original date of the condition's discovery.

### **Description of Conditions Observed**

For each E&S control and the area immediately surrounding it, describe whether the control is properly installed and whether it appears to be working to minimize sediment discharge. Indicate also whether a new or modified control is necessary to comply with the permit. Describe any problem condition(s) you observed such as the following:

1. Failure to install or to properly install a required E&S control
2. Damage or destruction to an E&S control caused by vehicles, equipment, or personnel, a storm event, or other event
3. Mud or sediment deposits found downslope from E&S controls, including in receiving waters, or on nearby streets, curbs, or open conveyance channels
4. Sediment tracked out onto paved areas by vehicles leaving construction site
5. Noticeable erosion or sedimentation at discharge outlets or at adjacent streambanks or channels
6. Erosion of the site's sloped areas (e.g., formation of rills or gullies)
7. E&S control is no longer working due to lack of maintenance
8. Other incidents of noncompliance

Describe also why you think the problem condition(s) occurred as well as actions (e.g., routine maintenance or corrective action) you will take or have taken to fix the problem.

For buffer areas, make note of whether they are marked off as required, whether there are signs of construction disturbance within the buffer, which is prohibited under the CGP, and whether there are visible signs of erosion resulting from discharges through the area.

If routine maintenance or corrective action is required, briefly note the reason. If routine maintenance or corrective action has been completed, make a note of the date it was completed and what was done. *If corrective action is required, note that you will need to complete a separate corrective action log describing the condition and your work to fix the problem.*

### **Routine Maintenance Need Has Been Found to be Necessary Three (3) or More Times for the Same Control at the Same Location (Including this Occurrence)**

If routine maintenance has been required three (3) or more times for the same control at the same location, the permit requires (CGP Part 2.1.4.c) you to fix the problem using the corrective action procedures in CGP Part 5 or to document why you believe the reoccurring problem can be addressed as a routine maintenance fix. If you believe the problem can continue to be fixed as routine maintenance, describe why you believe the specific condition should still be addressed as routine maintenance.

### **Instructions for Section C**

#### **Type and Location of Pollution Prevention (P2) Practices and Controls**

Provide a list of all pollution prevention (P2) practices and controls that are implemented at your site. This list must include all P2 practices and controls required by CGP Part 2.3 and those that are described in your SWPPP.

### **Conditions Requiring Routine Maintenance?**

Answer "Yes" if the P2 practice or control requires routine maintenance as defined in footnote 1 of this template. Note that in many cases, "Yes" answers are expected and indicate a project with an active operation and maintenance program. You should also answer "Yes" if work to fix the problem is still ongoing.

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from the previous inspection, though necessary work must be initiated immediately and completed by the end of the next business day or within seven calendar days if documented in accordance with CGP Part 2.1.4.b.

**If “Yes,” How Many Times (Including this Occurrence) Has this Condition Been Identified?**

Indicate how many times the routine maintenance has been required for the same practice or control at the same location.

**Conditions Requiring Corrective Action?**

Answer “Yes” if you found any of the conditions listed in footnote 2 in this template to be present during your inspection (CGP Part 5.1). If you answer “Yes,” you must take corrective action and complete a corrective action log, found at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>. You should also answer “Yes” if work to fix the problem from a previous inspection is still ongoing, though the operator must comply with the corrective action deadlines in CGP Part 5.2.

**Date on Which Condition First Observed (If Applicable)?**

Provide the date on which the condition that triggered the need for maintenance or corrective action was first identified. If the condition was just discovered during this inspection, enter the inspection date. If the condition is a carryover from a previous inspection, enter the original date of the condition’s discovery.

**Description of Conditions Observed**

For each P2 control and the area immediately surrounding it, describe whether the control is properly installed, and whether it appears to be working to minimize or eliminate pollutant discharges. Indicate also whether a new or modified control is necessary to comply with the permit. Describe any problem condition(s) you observed such as the following:

1. Failure to install or to properly install a required P2 control
2. Damage or destruction to a P2 control caused by vehicles, equipment, or personnel, or a storm event
3. Evidence of a spill, leak, or other type of pollutant discharge, or failure to have properly cleaned up a previous spill, leak, or other type of pollutant discharge
4. Spill response supplies are absent, insufficient, or not where they are supposed to be located
5. Improper storage, handling, or disposal of chemicals, building materials or products, fuels, or wastes
6. P2 control is no longer working due to lack of maintenance
7. Other incidents of noncompliance

Describe also why you think the problem condition(s) occurred as well as actions (e.g., routine maintenance or corrective action) you will take or have taken to fix the problem.

If routine maintenance or corrective action is required, briefly note the reason. If routine maintenance or corrective action has been completed, make a note of the date it was completed and what was done. *If corrective action is required, note that you will need to complete a separate corrective action log describing the condition and your work to fix the problem.*

**Routine Maintenance Need Was Found to be Necessary Three (3) or More Times for the Same Control at the Same Location (Including this Occurrence)**

If routine maintenance has been required three (3) or more times for the same control at the same location, the permit requires (CGP Part 2.1.4.c) you to fix the problem using the corrective action procedures in CGP Part 5 or to document why you believe the reoccurring problem can be addressed as a routine maintenance fix. If you believe the problem can continue to be fixed as routine maintenance, describe why you believe the specific condition should still be addressed as routine maintenance.

**Instructions for Section D**

**Specific Location That Has Been or Will Be Stabilized**

List all areas where soil stabilization is required to begin because construction work in that area has permanently stopped or temporarily stopped (i.e., work will stop for 14 or more days), and all areas where stabilization has been implemented (CGP Part 2.2.14).

**Stabilization Method and Applicable Deadline**

For each area, specify the method of stabilization (e.g., hydroseed, sod, planted vegetation, erosion control blanket, mulch, rock).

Specify also which of the following stabilization deadlines apply to this location:

1. 5 acres or less of land disturbance occurring at any one time at site: Complete no later than 14 calendar days after stabilization initiated.
2. More than 5 acres of land disturbance occurring at any one time at site: Complete no later than 7 calendar days after stabilization initiated.
3. Arid, semi-arid, and drought-stricken areas: See CGP Part 2.2.14.b.i.
4. Unforeseen circumstances: See CGP Part 2.2.14.b.ii.
5. Discharges to a sediment- or nutrient-impaired water or to a water identified as Tier 2, 2.5, or 3 for antidegradation purposes: Complete no later than 7 days after stabilization initiated.

**Stabilization Initiated?**

For each area, indicate whether stabilization has been initiated. If "Yes," then enter the date stabilization was initiated.

**Final Stabilization Criteria Met?**

For each area, indicate whether the final stabilization criteria in CGP Part 2.2.14.c have been met. If "Yes," then enter the date final stabilization criteria were met.

**Final Stabilization Photos Taken?**

Answer "Yes" if you have taken photos before and after meeting the stabilization criteria as required in CGP Part 8.2.1.a.

**Notes**

For each area where stabilization has been initiated, describe the progress that has been made and what additional actions are necessary to complete stabilization. Note the effectiveness of stabilization in preventing erosion. If stabilization has been initiated but not completed, make a note of the date it is to be completed. If stabilization has been completed, make a note of the date it was completed. If stabilization has not yet been initiated, make a note of the date it is to be initiated and the date it is to be completed.

**Instructions for Section E**

You are only required to complete this section if a discharge is occurring at the time of the inspection (CGP Part 4.6.2).

**Was a discharge (not including dewatering) occurring from any part of your site at the time of the inspection?**

During your inspection, examine all points of discharge from your site, and determine whether a discharge is occurring. If a dewatering discharge was occurring, you must conduct a dewatering inspection pursuant to CGP Part 4.3.2. If there is a discharge, answer "Yes" and complete the questions below regarding the specific discharge. If there is not a discharge, answer "No" and skip to the next page.

**Discharge Location** (Repeat as necessary if there are multiple points of discharge.)

Specify the location on your site where the discharge is occurring. The location may be an outlet from a stormwater control or constructed stormwater channel, a discharge into a storm sewer inlet, or a specific point on the site. Be as specific as possible; it is recommended that you refer to a precise point on your site map.

**Observations**

Document the visual quality of the discharge and take note of the characteristics of the stormwater discharge, including color; odor; floating, settled, or suspended solids; foam; oily sheen; and other indicators of stormwater pollutants. Also, document signs of these same pollutant characteristics that are visible from your site and attributable to your discharge in receiving waters or in other constructed or natural site drainage features.

## **Instructions for Section F**

Each inspection report must be signed and certified to be considered complete (CGP Part 4.7.2).

### **Operator or “Duly Authorized Representative” – MANDATORY** (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)

At a minimum, the site inspection report must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation:* By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship:* By a general partner or the proprietor, respectively.
- *For a municipality, State, Federal, or other public agency:* By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

### **Contractor or Subcontractor - OPTIONAL**

Where you rely on a contractor or subcontractor to complete the site inspection report, you should consider requiring the individual(s) to sign and certify each report. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the site inspection report as well. If applicable, sign, date, and print your name and affiliation.

### **Note**

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Site Inspection Report Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at [cgp@epa.gov](mailto:cgp@epa.gov)

<b>Section A – Dewatering Discharges (CGP Part 4.6.3)</b> Complete this section within 24 hours of completing the inspection. (If necessary, complete additional inspection reports for each separate inspection location.)	
Inspector Information	
Inspector Name:	Title:
Company Name:	Email:
Address:	Phone Number:
Inspection Details	
Inspection Date:	Inspection Location:
Discharge Start Time:	Discharge End Time:
Rate of Discharge (gallons per day):	Corrective Action Required? <sup>1</sup> <input type="checkbox"/> Yes <input type="checkbox"/> No
Describe Indicators of Pollutant Discharge at Point of Dewatering Discharge: <sup>1</sup>	
<b>Attach Photographs of:</b> <ol style="list-style-type: none"> <li>1. Dewatering water prior to treatment by a dewatering control(s) and the final discharge after treatment; and</li> <li>2. Dewatering control(s); and</li> <li>3. Point of discharge to any receiving waters flowing through or immediately adjacent to the site and/or to constructed or natural site drainage features, storm drain inlets, and other conveyances to receiving waters.</li> </ol>	

<sup>1</sup> If you observe any of the following indicators of pollutant discharge, you are required to take corrective action under Part 5.1.5.b:

- a sediment plume, suspended solids, unusual color, presence of odor, decreased clarity, or presence of foam; or
- a visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water.



**Section B – Signature and Certification (CGP Part 4.7.2)**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**MANDATORY: Signature of Operator or "Duly Authorized Representative:"**

<b>Signature:</b>	<b>Date:</b>
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<b>Printed Name:</b>	<b>Affiliation:</b>
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**OPTIONAL: Signature of Contractor or Subcontractor**

<b>Signature:</b>	<b>Date:</b>
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<b>Printed Name:</b>	<b>Affiliation:</b>
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## **General Tips for Using This Template**

This Dewatering Inspection Report Template is provided to assist you in preparing dewatering inspection reports for EPA's 2022 Construction General Permit (CGP). If you are covered under the 2022 CGP, you can use this template to create a dewatering inspection report form that complies with the minimum reporting requirements of Part 4.6.3 of the permit. Note that the use of this form is optional; you may use your own inspection report form provided it includes the minimum information required in Part 4.6.3 of the CGP.

This template is for dewatering inspections only. A separate site inspection report template that does not include dewatering inspections and complies with the minimum reporting requirements of Part 4.7 of the permit is available at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>.

If you are covered under a State CGP, this template may be helpful in developing a report that can be used for that permit; however, it will need to be modified to meet the specific requirements of that permit. If your permitting authority requires you to use a specific inspection report form, you should not use this form.

The following tips for using this template will help you ensure that the minimum permit requirements are met:

- **Review the inspection requirements.** Before you start developing your inspection report form, read the CGP's Part 4 inspection requirements. This will ensure that you have a working understanding of the permit's underlying inspection requirements.
- **Complete all required blank fields.** Fill out all blank fields. Only by filling out all fields will the template be compliant with the requirements of the permit. (Note: Where you do not need the number of rows provided in the template form for your inspection, you may delete these as you see fit. Or, if you need more space to document your findings, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)
- **Use your site map to document inspection findings.** In several places in the template, you are directed to specify the location of certain features of your site, including where stormwater controls are installed and where you will be stabilizing exposed soil. You are also asked to fill in location information for unsafe conditions and the locations of any discharges occurring during your inspections. Where you are asked for location information, EPA encourages you to reference the point on your SWPPP site map that corresponds to the requested location on the inspection form. Using the site map as a tool in this way will help you conduct efficient inspections, will assist you in evaluating problems found, and will ensure proper documentation.
- **Include the inspection form with your SWPPP.** Once your form is complete, make sure to include a copy of the inspection form in your SWPPP in accordance with Part 7.2.7.e of the CGP.
- **Retain copies of all inspection reports with your records.** You must also retain copies of all inspection reports in your records in accordance with the requirements in Part 4.7.3 of the CGP. These reports must be retained for at least 3 years from the date your permit coverage expires or is terminated in accordance with the requirements in Part 4.7.4 of the CGP.

## **Instructions for Section A**

### **Inspector Name**

Enter the name of the person that conducted the inspection. Include the person's contact information (title, affiliated company name, address, email, and phone number).

### **Inspection Date**

Enter the date you performed the inspection.

### **Inspection Location**

If your project has multiple locations where you conduct separate dewatering inspections, specify the location where this inspection is being conducted. Otherwise, you can enter "dewatering operation."

### **Discharge Start and End Times**

Enter the approximate time the dewatering discharge started and ended on the day of the inspection.

DRAFT

### **Rate of Discharge**

Enter the rate of discharge in gallons per day on the day of inspection.

To estimate the approximate discharge rate on the day of dewatering inspection, one approach is to use the manufacturer's design pump rating for the pump model in use. For example, a pump rated at 164 gpm (gallons per minute) by the manufacturer can be assumed to be discharging at 164 gpm in most cases. To convert to gallons per day, multiply the rate in gpm by the ratio of minutes in one-day (1,440 minutes per day), resulting in a discharge rate of 236,160 gallons per day.

In cases where the dewatering discharge is being pumped over long distances or a substantial distance uphill, which will result in a reduced pump rate relative to manufacturer's specification, the operator may improve the accuracy of the estimate by estimating the time required to fill a container of a known volume. For example, if it takes 60 seconds to fill an empty 55-gallon barrel, the estimated discharge rate is 55 gpm, or 79,200 gallons per day.

### **Indicators of Pollutant Discharge**

For the point of discharge, describe any observed sediment plume, suspended solids, unusual color, presence of odor, decreased clarity, or presence of foam; and/or a visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water.

### **Corrective Action Required?**

Answer "Yes" if during your inspection you found any of the conditions listed above in the instructions for the Indicators of Pollutant Discharge section. If you answer "Yes," you must take corrective action and complete a corrective action log, found at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>. Answer "No" if you did not observe any of the listed pollutant indicators.

### **Photographs**

As required in CGP Part 8.2.1.a, attach photos of: (1) dewatering water prior to treatment by a dewatering control(s) and the final discharge after treatment; (2) the dewatering control(s); and (3) the point of discharge to any receiving waters flowing through or immediately adjacent to the site and/or to constructed or natural site drainage features, storm drain inlets, and other conveyances to receiving waters.

### **Instructions for Section B**

Each inspection report must be signed and certified to be considered complete (CGP Part 4.7.2).

### **Operator or "Duly Authorized Representative" – MANDATORY (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)**

At a minimum, the dewatering inspection report must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation:* By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship:* By a general partner or the proprietor, respectively.

- *For a municipality, State, Federal, or other public agency:* By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

#### **Contractor or Subcontractor - OPTIONAL**

Where you rely on a contractor or subcontractor to complete the dewatering inspection report, you should consider requiring the individual(s) to sign and certify each report. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the dewatering inspection report as well. If applicable, sign, date, and print your name and affiliation.

#### **Note**

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Dewatering Inspection Report Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at [cgp@epa.gov](mailto:cgp@epa.gov)

APPENDIX E  
Corrective Action Log

# 2022 CGP Corrective Action Log

Project Name: \_\_\_\_\_

NPDES ID Number: \_\_\_\_\_

Section A – Individual Completing this Log	
Name:	Title:
Company Name:	Email:
Address:	Phone Number:
Section B – Details of the Problem (CGP Part 5.4.1.a)	
Complete this section <u>within 24 hours</u> of discovering the condition that triggered corrective action.	
Date problem was first identified:	Time problem was first identified:
What site conditions triggered this corrective action? <i>(Check the box that applies. See instructions for a description of each triggering condition (1 thru 6).)</i>	
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5a <input type="checkbox"/> 5b <input type="checkbox"/> 6	
Specific location where problem identified:	
Provide a description of the specific condition that triggered the need for corrective action and the cause (if identifiable):	
Section C – Corrective Action Completion (CGP Part 5.4.1.b)	
Complete this section <u>within 24 hours</u> after completing the corrective action.	
For site condition # 1, 2, 3, 4, or 6 (those not related to a dewatering discharge) confirm that you met the following deadlines (CGP Part 5.2.1):	
<input type="checkbox"/> Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events. <b>AND</b>	
<input type="checkbox"/> Completed corrective action by the close of the next business day, unless a new or replacement control, or significant repair, was required. <b>OR</b>	
<input type="checkbox"/> Completed corrective action within seven (7) calendar days from the time of discovery because a new or replacement control, or significant repair, was necessary to complete the installation of the new or modified control or complete the repair. <b>OR</b>	
<input type="checkbox"/> It was infeasible to complete the installation or repair within 7 calendar days from the time of discovery. Provide the following additional information:  Explain why 7 calendar days was infeasible to complete the installation or repair:	

Provide your schedule for installing the stormwater control and making it operational as soon as feasible after the 7 calendar days:

**For site condition # 5a, 5b, or 6 (those related to a dewatering discharge), confirm that you met the following deadlines:**

- Immediately took all reasonable steps to minimize or prevent the discharge of pollutants until a solution could be implemented, including shutting off the dewatering discharge as soon as possible depending on the severity of the condition taking safety considerations into account.
- Determined whether the dewatering controls were operating effectively and whether they were causing the conditions.
- Made any necessary adjustments, repairs, or replacements to the dewatering controls to lower the turbidity levels below the benchmark or remove the visible plume or sheen.

Describe any modification(s) made as part of corrective action: (Insert additional rows below if applicable)	Date of completion:	SWPPP update necessary?	If yes, date SWPPP was updated:
1.		<input type="checkbox"/> Yes <input type="checkbox"/> No	
2.		<input type="checkbox"/> Yes <input type="checkbox"/> No	

**Section D - Signature and Certification (CGP Part 5.4.2)**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**MANDATORY: Signature of Operator or "Duly Authorized Representative:"**

<b>Signature:</b>	<b>Date:</b>
<b>Printed Name:</b>	<b>Affiliation:</b>

**OPTIONAL: Signature of Contractor or Subcontractor**

<b>Signature:</b>	<b>Date:</b>
<b>Printed Name:</b>	<b>Affiliation:</b>

## **General Instructions**

This Corrective Action Log Template is provided to assist you creating a corrective action log that complies with the minimum reporting requirements of Part 5.4 of the EPA's Construction General Permit (CGP). For each triggering condition on your site, you will need to fill out a separate corrective action log.

The entire form must be completed to be compliant with the requirements of the permit. (Note: In Section C, if you do not need the number of rows provided in the corrective action log, you may delete these or cross them off. Alternatively, if you need more space to describe any modifications, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)

If you are covered under a State CGP, this template may be helpful in developing a log that can be used for that permit; however, you will likely need to modify this form to meet the specific requirements of any State-issued permit. If your permitting authority requires you to use a specific corrective action log, you should not use this template.

## **Instructions for Section A**

**Individual completing this form** Enter the name of the person completing this log. Include the person's contact information (title, affiliated company name, address, email, and phone number).

## **Instructions for Section B**

You must complete Section B within 24 hours of discovering the condition that triggered corrective action. (CGP Part 5.4)

### **When was the problem first discovered?**

Specify the date and time when the triggering condition was first discovered.

### **What site conditions triggered this corrective action? (CGP Parts 5.1 and 5.3)**

Check the box corresponding to the numbered triggering condition below that applies to your site.

1. A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part **Error! Reference source not found.**, you find it necessary to repeatedly (i.e., 3 or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part **Error! Reference source not found.** that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under Part **Error! Reference source not found.**);
2. A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly;
3. Your discharges are not meeting applicable water quality standards;
4. A prohibited discharge has occurred (see Part 1.3);
5. During discharge from site dewatering activities:
  - a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part **Error! Reference source not found.**); or
  - b. You observe or you are informed by EPA, State, or local authorities of the presence of any of the following at the point of discharge to a receiving water flowing through or immediately adjacent to your site and/or to constructed or natural site drainage features or storm drain inlets:
    - sediment plume
    - suspended solids
    - unusual color
    - presence of odor
    - decreased clarity
    - presence of foam
    - visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water
6. EPA requires corrective action as a result of permit violations found during an inspection carried out under Part 4.8.



**Provide a description of the problem** (CGP Part 5.4.1.a)

Provide a summary description of the condition you found that triggered corrective action, the cause of the problem (if identifiable), and the specific location where it was found. Be as specific as possible about the location; it is recommended that you refer to a precise point on your site map.

**Instructions for Section C**

You must complete Section C within 24 hours after completing the correction action. (CGP Part 5.4)

**Deadlines for completing corrective action for condition # 1, 2, 3, 4, or 6 (if not relating to a dewatering discharge)** (CGP Part 5.2.1)

Check the box to confirm that you met the deadlines that apply to each triggering condition. You are always required to check the first box (i.e., Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.). Only one of the next three boxes should be checked depending on the situation that applies to this corrective action.

Check the second box if the corrective action for this particular triggering condition does not require a new or replacement control, or a significant repair. These actions must be completed by the close of the next business day from the time of discovery of the condition.

Check the third box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair. These actions must be completed by no later than seven calendar days from the time of discover of the condition.

Check the fourth box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair, and if it is infeasible to complete the work within seven calendar days. Additionally, you will need to fill out the table below the checkbox that requires:

1. An explanation as to why it was infeasible to complete the installation or repair within seven calendar days of discovering the condition.
2. Provide the schedule you will adhere to for installing the stormwater control and making it operational as soon as feasible after the seventh day following discovery.

Note: Per Part 5.2.1.c, where these actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within seven calendar days of completing this work.

**Deadlines for completing corrective action for condition # 5a, 5b, or 6 related to a dewatering discharge** (CGP Part 5.2.2)

These deadlines apply to conditions relating to construction dewatering activities. Check the box to confirm that you met the deadlines that apply to each triggering condition. You are required to check all of the boxes in this section to indicate your compliance with the corrective action deadlines.

**List of modification(s) to correct problem**

Provide a list of modifications you completed to correct the problem.

**Date of completion**

Enter the date you completed the modification. The work must be completed by the deadline you indicated above.

**SWPPP update necessary?**

Check "Yes" or "No" to indicate if a SWPPP update is necessary consistent with Part 7.4.1.a in order to reflect changes implemented at your site. If "Yes," then enter the date you updated your SWPPP. The SWPPP updates must be made within seven calendar days of completing a corrective action. (CGP Part 5.2.1.c)

**Instructions for Section D**

Each corrective action log entry must be signed and certified following completion of Section D to be considered complete. (CGP Part 5.4.2)

**Operator or "Duly Authorized Representative" – MANDATORY** (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)

At a minimum, the corrective action log must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation:* By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship:* By a general partner or the proprietor, respectively.
- *For a municipality, State, Federal, or other public agency:* By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

#### **Contractor or Subcontractor - OPTIONAL**

Where you rely on a contractor or subcontractor to complete this log and the associated corrective action, you should consider requiring the individual(s) to sign and certify each log entry. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the log as well. If applicable, sign, date, and print your name and affiliation.

#### **Recordkeeping**

Logs must be retained for at least 3 years from the date your permit coverage expires or is terminated. (CGP Part 5.4.4)

Keep copies of your signed corrective action log entries at the site or at an easily accessible location so that it can be made immediately available at the time of an on-site inspection or upon request by EPA. (CGP Part 5.4.3) Include a copy of the corrective action log in your SWPPP. (CGP Part 7.2.7.e)

#### **Note**

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Corrective Action Log Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at [cgp@epa.gov](mailto:cgp@epa.gov)

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APPENDIX F  
SWPPP Amendment Log

**Appendix F –SWPPP Amendment Log**

**Instructions (see CGP Part 7.4):**

- Create a log here of changes and updates to the SWPPP. You may use the table below to track these modifications.
- SWPPP modifications are required pursuant to CGP Part 7.4.1 in the following circumstances:
  - ✓ Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater controls, or other activities at your site that are no longer accurately reflected in your SWPPP (this includes changes made in response to corrective actions triggered under CGP Part 5);
  - ✓ To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;
  - ✓ If inspections or investigations determine that SWPPP modifications are necessary for compliance with this permit;
  - ✓ Where EPA determines it is necessary to install and/or implement additional controls at your site in order to meet requirements of the permit;
  - ✓ To reflect any revisions to applicable Federal, State, Tribal, or local requirements that affect the stormwater control measures implemented at the site; and
  - ✓ If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	

APPENDIX G  
Subcontractor Certifications/Agreements

**Appendix G – Subcontractor Certifications/Agreements**

SUBCONTRACTOR CERTIFICATION  
STORMWATER POLLUTION PREVENTION PLAN

Project Number: \_\_\_\_\_

Project Title: Wells 2, 3 And 4 Water Treatment Plant

Operator(s): \_\_\_\_\_

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

**I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.**

This certification is hereby signed in reference to the above named project:

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Type of construction service to be provided: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_

Date:

APPENDIX H  
Grading and Stabilization Activities Log

**Appendix H – Grading and Stabilization Activities Log**

Date Grading Activity Initiated	Description of Grading Activity	Description of Stabilization Measure and Location	Date Grading Activity Ceased (Indicate Temporary or Permanent)	Date When Stabilization Measures Initiated
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE
INSERT DATE			INSERT DATE <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	INSERT DATE



## APPENDIX I

### Training Documentation

*(Include documentation showing completion of trainings in accordance with Section 1.2 of the SWPPP and section 7.2.2 of the CGP)*

APPENDIX J  
Delegation of Authority

**Appendix J –Delegation of Authority Form**

Delegation of Authority

I, \_\_\_\_\_ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the EPA's Construction General Permit (CGP), at the \_\_\_\_\_ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

\_\_\_\_\_ (name of person or position)  
\_\_\_\_\_ (company)  
\_\_\_\_\_ (address)  
\_\_\_\_\_ (city, State, zip)  
\_\_\_\_\_ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix G of EPA's CGP, and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix G.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

**Name:** \_\_\_\_\_

**Company:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

APPENDIX K  
Endangered Species Documentation

Note to reviewer: Please refer to the end of this Appendix for documentation supporting the Criterion C eligibility of this project per Section 3.1 of the SWPPP narrative.



## United States Department of the Interior



FISH AND WILDLIFE SERVICE  
New England Ecological Services Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5094  
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To:  
Project Code: 2023-0044951  
Project Name: Sharon Well 4 Treatment System

February 13, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

*Updated 12/27/2022 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.*

### **About Official Species Lists**

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

### **Endangered Species Act Project Review**

Please visit the “**New England Field Office Endangered Species Project Review and Consultation**” website for step-by-step instructions on how to consider effects on listed

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species and prepare and submit a project review package if necessary:

<https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review>

**\*NOTE\*** Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

**Northern Long-eared Bat - (Updated 12/27/2022)** Please visit our New England Field Office Project Review webpage at the link above for updated northern long-eared bat consultation guidance. The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule will go into effect on **January 30, 2023**. After that date, the current 4(d) rule for NLEB will no longer be in effect, and the 4(d) determination key will no longer be available. New compliance tools will be available by mid- to late-January, and information will be posted on our New England Field Office Project Review webpage in January, so please check this site often for updates.

Depending on the type of effects a project has on NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project may result in incidental take of NLEB after the new listing goes into effect, this will need to be addressed in an updated consultation that includes an Incidental Take Statement. Many of these situations will be addressed through the new compliance tools. If your project may require re-initiation of consultation, please wait for information on the new tools to appear on our website or contact our office at **newengland@fws.gov** for additional guidance.

#### *Additional Info About Section 7 of the Act*

Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<https://www.fws.gov/service/section-7-consultations>

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

**Candidate species** that appear on the enclosed species list have no current protections under the

ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

### **Migratory Birds**

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

<https://www.fws.gov/program/migratory-bird-permit>

<https://www.fws.gov/library/collections/bald-and-golden-eagle-management>

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

## **Official Species List**

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**New England Ecological Services Field Office**

70 Commercial Street, Suite 300

Concord, NH 03301-5094

(603) 223-2541



## Project Summary

Project Code: 2023-0044951

Project Name: Sharon Well 4 Treatment System

Project Type: Water Supply Facility - New Constr

Project Description: The project includes the construction of a new water treatment facility for PFAS removal at an existing municipal well site in Sharon, MA. The project also includes a water main extension approximately 1-mile in length from a nearby well-site to the proposed treatment facility.

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@42.1238397,-71.18842996193376,14z>



Counties: Norfolk County, Massachusetts

## Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

- 
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

### Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Threatened

### Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9743">https://ecos.fws.gov/ecp/species/9743</a>	Candidate

### Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

## **IPaC User Contact Information**

Agency: Environmental Partners  
Name: Mollie Scott  
Address: 1900 Crown Colony Drive  
Address Line 2: Unit 402  
City: Quincy  
State: MA  
Zip: 02169  
Email: mms@envpartners.com  
Phone: 6176570950

## **Lead Agency Contact Information**

Lead Agency: Environmental Protection Agency



# United States Department of the Interior



FISH AND WILDLIFE SERVICE  
New England Ecological Services Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5094  
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To:  
Project Code: 2024-0001575  
Project Name: Wells 2, 3 and 4 Water Treatment Plant

October 04, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

*Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.*

## **About Official Species Lists**

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

## **Endangered Species Act Project Review**

Please visit the “**New England Field Office Endangered Species Project Review and Consultation**” website for step-by-step instructions on how to consider effects on listed

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species and prepare and submit a project review package if necessary:

<https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review>

**\*NOTE\*** Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

**Northern Long-eared Bat - (Updated 4/12/2023)** The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

<https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis>

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at [newengland@fws.gov](mailto:newengland@fws.gov) to see if reinitiation is necessary.

#### *Additional Info About Section 7 of the Act*

Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<https://www.fws.gov/service/section-7-consultations>

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

**Candidate species** that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to

consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

### **Migratory Birds**

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

<https://www.fws.gov/program/migratory-bird-permit>

<https://www.fws.gov/library/collections/bald-and-golden-eagle-management>

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

## **OFFICIAL SPECIES LIST**

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

### **New England Ecological Services Field Office**

70 Commercial Street, Suite 300

Concord, NH 03301-5094

(603) 223-2541

## PROJECT SUMMARY

Project Code: 2024-0001575

Project Name: Wells 2, 3 and 4 Water Treatment Plant

Project Type: Water Supply Facility - New Constr

Project Description: The project includes the construction of a new water treatment facility for PFAS removal at an existing municipal well site in Sharon, MA. The project also includes a water main extension approximately 1-mile in length from a nearby well-site to the proposed treatment facility.

Project Location:

The approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@42.11666080000005,-71.19350374999999,14z>



Counties: Norfolk County, Massachusetts

## ENDANGERED SPECIES ACT SPECIES

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

- 
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## MAMMALS

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Endangered

## INSECTS

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9743">https://ecos.fws.gov/ecp/species/9743</a>	Candidate

## CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.



## **IPAC USER CONTACT INFORMATION**

Agency: Environmental Partners Group, LLC  
Name: Srushti Shah  
Address: 1900 Crown Colony Drive, Suite 402  
City: Quincy  
State: MA  
Zip: 02169  
Email: sbs@envpartners.com  
Phone: 8577535140

**Criterion C Eligibility Requirements**

**C** **Discharges not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat.** ESA-listed species and/or designated critical habitat(s) under the jurisdiction of the USFWS and/or NMFS are likely to occur in or near your site's "action area," and you certify to EPA that your site's discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed threatened or endangered species and/or designated critical habitat. This certification may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat. To certify your eligibility under this criterion, you must indicate below 1) the ESA-listed species and/or designated habitat located in your "action area" using the process outlined in this Appendix; 2) the distance between the site and the listed species and/or designated critical habitat in the action area (in miles); and 3) a rationale describing specifically how short- or long-term adverse effects to ESA-listed species will be avoided from the discharges and discharge-related activities. You must also include a copy of your site map from your SWPPP showing the upland and in-water extent of your "action area" with your NOI.

**C1.** I confirm that both ESA-listed species and designated critical habitat under the jurisdiction of the USFWS and/or NMFS were considered in my evaluation. Yes

**C2.** Provide the USFWS information resources and expertise used to arrive at this criterion selection:

**C3.** Provide the NMFS information resources and expertise used to arrive at this criterion selection:

**C4.** What ESA-listed species and/or designated critical habitat are located in your “action area?” (or attach a printout of the species’ list(s))


**C5.** What is the distance between your site and the ESA-listed species and/or designated critical habitat within the action area (in miles, state “on site” if the ESA-listed species and/or designated critical habitat is within the area to be disturbed)? \_\_\_\_\_

**C6.** Provide the rationale describing specifically how any short- or long-term adverse effects to ESA-listed species will be avoided from the discharge and discharge-related activities.

**C7.** I confirm that a site map from my SWPPP showing the upland and in-water extent of my “action area” is attached. Yes

**C8.** Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion C. Yes

**Instructions**

- > **If you selected Criterion C above and answered questions C1-C8, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.**
- > If not, please proceed to step 4. 



APPENDIX L  
Historic Preservation Documentation

APPENDIX A

MASSACHUSETTS HISTORICAL COMMISSION  
220 MORRISSEY BOULEVARD  
BOSTON, MASS. 02125  
617-727-8470, FAX: 617-727-5128

RECEIVED

MAR 31 2023

MASS. HIST. COMM

RC 73030

PROJECT NOTIFICATION FORM

After review of MHC files and the materials you submitted, it has been determined that this project is unlikely to affect significant historic or archaeological resources.

Project Name: Wells 2, 3, and 4 Water Treatment Plant

Location / Address: 15 Tree Lane

City / Town: Town of Sharon, Massachusetts

Project Proponent

Name: Eric Hooper, Department of Public Works Superintendent

Address: 217R South Main Street, BOX 517

City/Town/Zip/Telephone: Town of Sharon, Massachusetts 02067

*[Signature]*  
Edward L. Bell  
Deputy State Historic Preservation Officer  
Massachusetts Historical Commission

(781) 784-1525 ext. 2311

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

*XC: MAJOR PROJECT, DEP. STATE HISTORICAL COMMISSION, ENVIRONMENTAL PARTNERS*

Agency Name

Type of License or funding (specify)

Refer to the Attached License/Funding List

Project Description (narrative):

The project consists of the construction of a water treatment plant at the 15 Tree Lane site, the existing site of Well 4. Site improvements include the construction of an access road, a building (7,500 square feet), infiltration basins to attenuate stormwater, and new water main piping to connect the well sites to the new treatment facility.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

This project includes the possible demolition of the existing chemical building located south of the proposed WTP, as the building will no longer be needed following construction of the proposed facility.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

Yes, the project includes rehabilitation of existing water treatment equipment and support systems. The existing chemical equipment will be removed at all well sites. Hazardous material assessments will also be conducted to determine whether additional rehabilitation is needed.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Yes, the project includes the construction of a new water treatment plant. Refer to Figure 3 for a preliminary design plan.

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify.

No.

What is the total acreage of the project area?

Woodland ±3.1 acres  
Wetland ±0.9 acres  
Floodplain ±1.6 acres  
Open space 0 acres  
Developed ±0.7 acres

Productive Resources:  
Agriculture \_\_\_\_\_ acres  
Forestry \_\_\_\_\_ acres  
Mining/Extraction \_\_\_\_\_ acres  
Total Project Acreage 6.3 acres

What is the acreage of the proposed new construction? 0.17 acres (building only)

What is the present land use of the project area?

The project area is adjacent to an existing paved right-of-way and is currently undeveloped (wooded).

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

Please refer to the attached Figure 1 and Figure 2.

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form:  Date: 3/29/2023

Name: Sarah Price, P.E.

Address: Environmental Partners  
1900 Crown Colony Drive, Suite 402

City/Town/Zip: Quincy, MA

Telephone: (617) 657-0287

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

RECEIVED

MAR 31 2023

MASS. HIST. COMM  
PC. 73030

*Federal and State License and Funding List  
Wells 2, 3, and 4 Water Treatment Plant – Well 3 Site  
Sharon, Massachusetts*

<b>Agency Name</b>	<b>Type of License of Funding</b>
DWSRF	Grant/loan funding
ARPA	Funding
MassDEP Drinking Water	Approval
MEPA	Approval
Conservation Commission	Approval
Zoning Board	Approval

DRAFT





APPENDIX M  
Rainfall Gauge Recording

## Appendix M – Rainfall Gauge Recording

Use the table below to record the rainfall gauge readings at the beginning and end of each work day. An example table follows.

Month/Year			Month/Year			Month/Year		
Day	Start time	End time	Day	Start time	End time	Day	Start time	End time
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
18			18			18		
19			19			19		
20			20			20		
21			21			21		
22			22			22		
23			23			23		
24			24			24		
25			25			25		
26			26			26		
27			27			27		
28			28			28		
29			29			29		
30			30			30		
31			31			31		

APPENDIX N  
Turbidity Meter Manual and Manufacturer's Instructions

This SWPPP does not list the Beaver Brook as “sensitive waters” (which are (1) receiving waters listed as impaired for sediment or a sediment-related parameter per Appendix A of the CGP and (2) receiving waters designated as a Tier 2, 2.5, or 3).

The EPA’s Stormwater Discharge Mapping Tools found at <https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools> have been used to confirm the point of discharge and designation of the sediment receiving water.

## APPENDIX T

Water Main Contract #2024-10 W-Sheets (Informational Purposes Only)



# WATER MAIN CONTRACT #2024-10

## DEPARTMENT OF PUBLIC WORKS TOWN OF SHARON, MA

DWSRF #12443

APRIL 2024

### INDEX

- G-1 GENERAL NOTES AND LEGEND
- W-1 WATER MAIN PLAN I - STA 0+00 TO STA 14+00
- W-2 WATER MAIN PLAN II AND DIRECTIONAL DRILL PLAN AND PROFILE I - STA 14+00 TO STA 25+70
- W-3 WATER MAIN PLAN III - STA 25+70 TO 29+00
- W-4 DIRECTIONAL DRILL PLAN AND PROFILE II - STA 0+00 TO STA 9+00
- W-5 DIRECTIONAL DRILL PLAN AND PROFILE III - STA 9+00 TO STA 17+00
- WD-1 CONSTRUCTION DETAILS I
- WD-2 CONSTRUCTION DETAILS II
- WD-3 CONSTRUCTION DETAILS III
- TMP-1 TRAFFIC MANAGEMENT PLAN I
- TMP-2 TRAFFIC MANAGEMENT PLAN II

PUBLIC WORKS SUPERINTENDENT  
ERIC HOOPER, P.E.

TOWN ENGINEER  
PETER O'CAIN, P.E.

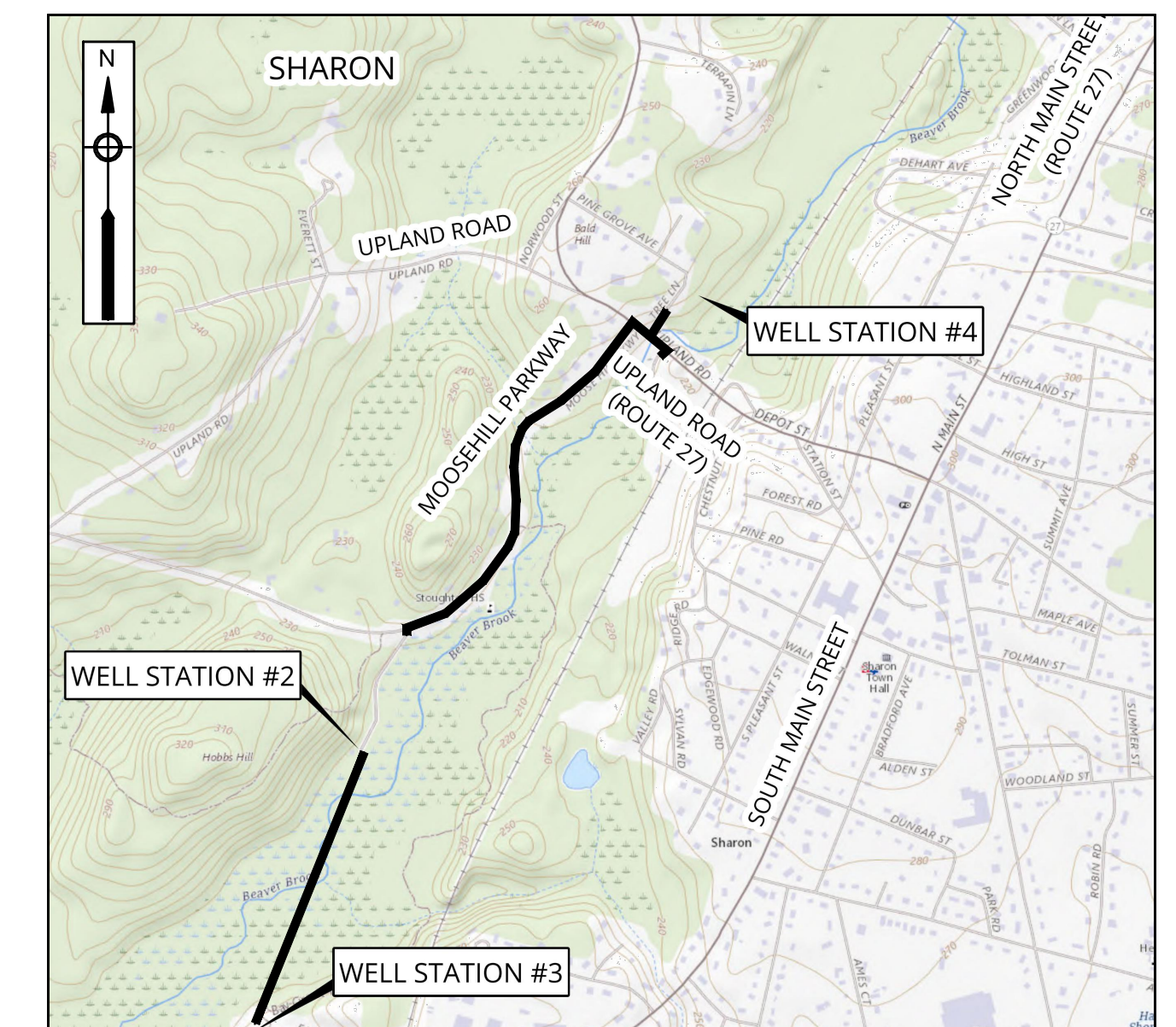
WATER DIVISION SUPERVISOR  
ROBERT TERPSTRA

PUMP STATION MANAGER  
BOB FISHER



APRIL 2024

**ENVIRONMENTAL  
PARTNERS**  
— An Apex Company —



VICINITY MAP  
1"= 1,000'

FOR CONSTRUCTION

# GENERAL NOTES

- BASEMAP INFORMATION PROVIDED IS FROM A SURVEY PERFORMED BY ZENITH LAND SURVEYORS, LLC IN 2022 AND 2023 SUPPLEMENTED BY RECORD INFORMATION PROVIDED BY THE TOWN OF SHARON DEPARTMENT OF PUBLIC WORKS. THE BASIS OF BEARING FOR ALL SURVEYS IS AN APPROXIMATED NORTH AMERICAN VERTICAL DATUM OF 1988 (NAV88) AND THE HORIZONTAL DATUM USED IS THE NORTH AMERICAN DATUM OF 1983 (NAD83).
- BASEMAP INFORMATION ON SHEETS W-4 AND W-5 ARE FROM MASSGIS AND LIDAR AND NOT FIELD SURVEYED. WETLAND DELINEATION IS FROM MASSGIS.
- EXISTING GAS, ELECTRIC, TELEPHONE, AND CABLE/TELEVISION UTILITY INFORMATION SHOWN ON ALL SHEETS IS TAKEN FROM RECORD INFORMATION SUPPLIED BY THE UTILITY PROVIDER. IT IS NOTED THAT ADDITIONAL UTILITY PIPES, WIRES, AND STRUCTURES MAY EXIST.
- WETLAND RESOURCE AREA DELINEATION FLAGGED BY ENVIRONMENTAL CONSULTING & RESTORATION, LLC ON APRIL 27, 2022 AND FIELD LOCATED BY ZENITH LAND SURVEYORS, LLC AS PART OF THE SITE SURVEY.
- IN AREAS WHERE CONSTRUCTION ACTIVITIES ARE ANTICIPATED TO OCCUR ADJACENT TO PRIVATE PROPERTY, PROPERTY LINE LOCATIONS ARE TO BE REVIEWED WITH THE TOWN OF SHARON PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES.
- THE CONTRACTOR SHALL NOT STORE ANY APPARATUS, MATERIALS, SUPPLIES, OR EQUIPMENT ON DRAINAGE STRUCTURES, PRIVATE PROPERTY OR WITHIN 100 FEET OF WETLANDS OR 200 FEET OF MEAN HIGH WATER, UNLESS DIRECTED TO DO SO BY THE CONTRACT DOCUMENTS.
- NORTH DIRECTION SHOWN IS APPROXIMATE.
- THE CONTRACTOR SHALL RESTORE ALL PUBLIC AND PRIVATE PROPERTY TO ITS PRE-CONSTRUCTION CONDITION AT NO ADDITIONAL COST TO THE OWNER.
- THE CONTRACTOR SHALL PROVIDE ALL MATERIAL, LABOR, EQUIPMENT, AND APPURTENANCES NECESSARY TO COMPLETE ALL THE WORK OF THIS CONTRACT. AS OUTLINED ON THESE PLANS, AND FURNISH A COMPLETE JOB, IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL GOVERNING AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK. ADEQUATE PROTECTION OF PERSONS AND PROPERTY SHALL BE PROVIDED AT ALL TIMES AND THE WORK SHALL BE EXECUTED IN SUCH A WAY AS TO AVOID HAZARD TO PERSONS AND PROPERTY.
- ALL STRUCTURES AND PIPELINES LOCATED ADJACENT TO THE TRENCH EXCAVATION SHALL BE PROTECTED AND FIRMLY SUPPORTED BY THE CONTRACTOR UNTIL THE TRENCH IS BACKFILLED. INJURY TO ANY SUCH STRUCTURE CAUSED BY, OR RESULTING FROM, THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. ALL UTILITIES REQUIRING REPAIR, RELOCATION, OR ADJUSTMENT AS A RESULT OF THE PROJECT SHALL BE COORDINATED THROUGH THE RESPECTIVE UTILITY AND THE TOWN.
- ALL DEMOLISHED MATERIALS SHALL BE REMOVED FROM THE SITE AND LEGALLY DISPOSED.
- THE CONTRACTOR IS TO TAKE SPECIAL CARE NOT TO DAMAGE TREES, BUSHES, PLANTS, FLOWERS, STONEWALLS, FENCES, ETC. WITHIN THE CONSTRUCTION AREA UNLESS THEY ARE NOTED TO BE REMOVED. CONTRACTOR SHALL REPLACE ALL DAMAGED ITEMS AT NO COST TO OWNER.
- THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL CONSTRUCTION AND DEMOLITION MATERIALS, EQUIPMENT, AND OTHER DEBRIS AS A RESULT OF CONSTRUCTION WORK, AND SHALL RESTORE THE SITE TO A NEAT AND ORDERLY CONDITION.
- THE CONTRACTOR SHALL INSTALL AND MAINTAIN TRAFFIC CONTROL DEVICES AS NECESSARY AND IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES. CONTRACTOR SHALL REMOVE AND REPLACE, OR REPAIR, ALL CURBS, SIDEWALKS, PAVEMENT AND OTHER ITEMS DAMAGED BY HIS CONSTRUCTION ACTIVITIES TO AT LEAST THEIR ORIGINAL CONDITION, AND TO THE SATISFACTION OF THE TOWN OF SHARON AND ENGINEER.
- ANY TRAFFIC SIGNAL EQUIPMENT (LIGHTS, CONDUITS, LOOP DETECTORS) DISTURBED SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AS DIRECTED BY THE TOWN AT THE CONTRACTOR'S EXPENSE.
- THE CONTRACTOR IS RESPONSIBLE FOR SECURING SITE STORAGE AND LAYDOWN AREAS FOR PIPES, SUPPLIES, MATERIALS, AND EQUIPMENTS. THE LOCATION AND LIMITS OF ALL ON-SITE WORK AND STORAGE AREAS SHALL BE REVIEWED/COORDINATED WITH, AND ACCEPTABLE TO, THE TOWN OF SHARON. THE CONTRACTOR SHALL LIMIT THEIR ACTIVITIES TO THESE AREAS.
- AT THE WELL STATION 4 AND WATER TREATMENT PLANT SITE, INGRESS AND EGRESS SHALL BE LIMITED TO TREE LANE; NO INGRESS OR EGRESS FROM PINE GROVE AVENUE SHALL BE ALLOWED.
- ELEVATIONS OF EXISTING STRUCTURES ARE BASED ON INFORMATION OBTAINED FROM AVAILABLE DRAWINGS AND RECORDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL ELEVATIONS, DIMENSIONS, ANGLES AND EXISTING CONDITIONS AT THE WORK SITE PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
- THE CONTRACTOR SHALL HANDLE GROUNDWATER, WHERE ENCOUNTERED, IN AN APPROVED MANNER. DURING ANY DEWATERING, THE CONTRACTOR SHALL USE STONE AROUND THE SUCTION END TO MINIMIZE DISCHARGE OF TRENCH MATERIALS. THE DISCHARGED WATER SHALL PASS THROUGH A DEWATERING BAG.
- ALL EXISTING UTILITIES SHOWN ARE APPROXIMATE, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO THE START OF WORK. CONTRACTOR SHALL NOTIFY DIG SAFE AT LEAST 72 HOURS IN ADVANCE, EXCLUDING WEEKENDS AND HOLIDAYS, PRIOR TO ANY EXCAVATION. TEST PITS TO LOCATE EXISTING UTILITIES MAY BE ORDERED BY THE ENGINEER.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUPPORT OF ALL UTILITIES AND STRUCTURES DURING CONSTRUCTION.

- THE CONTRACTOR IS ADVISED TO TAKE ALL PRECAUTIONS AND MAKE ALL INVESTIGATIONS NECESSARY TO PERFORM THE WORK. THE OWNER WILL NOT CONSIDER CONTRACTOR'S UNFAMILIARITY WITH THE PROJECT OR SITE CONDITIONS AT THE TIME OF BID AS A BASIS FOR ADDITIONAL COMPENSATION.
- IN THOSE INSTANCES WHERE POWER OR TELEPHONE POLE SUPPORT IS REQUIRED, THE CONTRACTOR SHALL PROVIDE A MINIMUM 48-HOUR NOTIFICATION TO THE RESPECTIVE UTILITY COMPANY. NO ADDITIONAL PAYMENT WILL BE PROVIDED FOR TEMPORARY BRACING OF UTILITIES.
- THE CONTRACTOR SHALL MAKE ALL REQUIRED FIELD MEASUREMENTS TO VERIFY EXISTING AND CONTRACT INTERFACE DIMENSIONS, LOCATIONS, AND OTHER CONDITIONS.
- ALL DIMENSIONS AND QUANTITIES SHALL BE DETERMINED OR VERIFIED BY THE CONTRACTOR.
- DO NOT SCALE DRAWINGS UNLESS OTHERWISE NOTED. WRITTEN DIMENSION AND STATIONING SHALL PREVAIL. REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.
- THE TOWN OF SHARON REQUIRES ONE WEEK ADVANCED NOTICE TO PROVIDE UTILITY LOCATION SERVICES.
- ALL OPEN TRENCHES MUST BE BACK FILLED AT THE END OF THE WORKDAY OR COVERED AND SECURED WITH STEEL PLATES, RAMPED AS APPROVED BY THE ENGINEER AND TOWN. STEEL PLATES MAY ONLY BE USED FOR 24-HOUR INCREMENTS AT THE SAME LOCATION. STEEL PLATES SHALL NOT BE USED DURING WEEKENDS OR HOLIDAYS. NO EXCEPTIONS SHALL BE PERMITTED.
- ALL AREAS DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED IN KIND AT NO COST TO THE OWNER, TO THE SATISFACTION OF THE OWNER/ENGINEER.
- THE CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY THE CONTRACTOR'S WORK, INCLUDING ON PRIVATE PROPERTY, TO ITS PRE-CONSTRUCTION CONDITION.
- THE CONTRACTOR SHALL BE REQUIRED TO FURNISH AND MAINTAIN A TELEPHONE NUMBER WHERE THE CONTRACTOR CAN BE REACHED 24 HOURS A DAY, 7 DAYS A WEEK, UNTIL THE PROJECT HAS REACHED SUBSTANTIAL COMPLETION.
- THE CONTRACTOR SHALL PROVIDE ALL MATERIAL, LABOR AND EQUIPMENT NECESSARY TO COMPLETE WORK ON THIS CONTRACT AS OUTLINED IN THE CONTRACT DOCUMENTS (PLANS AND SPECIFICATIONS) AND FURNISH A COMPLETE JOB.
- THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS AND INSPECTIONS REQUIRED FOR THE EXECUTION OF THIS WORK AND SHALL OBTAIN NECESSARY APPROVAL FROM THE AUTHORITIES THAT HAVE JURISDICTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLETE ADHERENCE TO ALL PROVISIONS AND REQUIREMENTS OF THE CONTRACT DOCUMENTS INCLUDING, BUT NOT LIMITED TO, THE CONTRACT DRAWINGS, THE CONTRACT GENERAL REQUIREMENTS, SPECIAL CONDITIONS AND TECHNICAL SPECIFICATIONS, AND TO ALL PERMITS APPENDED THERETO.
- THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE REGULATIONS OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
- ANY ALTERATIONS REQUIRED ON THESE DRAWINGS DURING CONSTRUCTION SHALL BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION AND RECORDED ON THE AS-BUILT DRAWINGS.
- ANY REQUIRED HAZARDOUS WASTE ABATEMENT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL MAKE ARRANGEMENTS FOR LEGAL DISPOSAL OF ALL HAZARDOUS WASTE.
- ALL EQUIPMENT SHALL BE REMOVED FROM THE PROJECT AREA AT THE COMPLETION OF EACH WORK DAY AND STORED IN THE DESIGNATED STAGING AREA OR OTHER APPROVED AREA NEAR BY.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING, SETTING UP, AND REMOVING ALL SIGNAGE, CONES, BARRICADES, BARRELS, AND OTHER TRAFFIC CONTROL DEVICES ON A DAILY BASIS.
- CONTRACTOR SHALL HANDLE, STORE, REMOVE, TRANSPORT AND LEGALLY DISPOSE OF ANY ASBESTOS-CEMENT PIPE AS SHOWN ON THE PLANS IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS. ASBESTOS NOTIFICATION FORMS SHALL BE COMPLETED AND SUBMITTED TO THE APPROPRIATE AGENCY/AGENCIES AND COPIES SHALL BE PROVIDED TO THE ENGINEER.
- ALL LEAD SERVICE LINES REQUIRING REPLACEMENT AS PART OF THE CONTRACT MAY NOT BE SHOWN ON THE PLANS. THE WORK WILL BE PAYABLE THROUGH THE APPLICABLE CONTRACT ITEM(S). ANY ENCOUNTERED LEAD SERVICE LINES ON MOOSE HILL PARKWAY MUST BE REPLACED. A LIST OF THE KNOWN LEAD SERVICE LINES TO BE REPLACED IN THE VICINITY OF THE PROJECT AREA ARE AS FOLLOWS:

#16 MOOSE HILL PARKWAY	#41 PINE GROVE AVE
#63 MOOSE HILL PARKWAY	#24 UPLAND ROAD
#67 MOOSE HILL PARKWAY	#42 UPLAND ROAD
#85 MOOSE HILL PARKWAY	#43 UPLAND ROAD
#32 PINE GROVE AVE	#49 UPLAND ROAD
#36 PINE GROVE AVE	#52 UPLAND ROAD
#37 PINE GROVE AVE	

# WATER MAIN NOTES:

- MINIMUM COVER OVER THE PROPOSED WATER MAIN, SERVICES, AND APPURTENANCES SHALL BE 5'-0" UNLESS OTHERWISE NOTED OR DIRECTED BY ENGINEER. WHERE NECESSARY, NEW WATER MAINS SHALL BE INSTALLED AT A GREATER DEPTH TO CLEAR OBSTACLES SHOWN ON THE DRAWINGS AT NO ADDITIONAL COST TO THE OWNER. MINIMUM CLEARANCES TO UTILITIES, AS SHOWN ON THE DRAWINGS, SHALL BE MAINTAINED.
- EXCEPT WHERE OTHERWISE DIRECTED, 12" MINIMUM CLEARANCE SHALL BE PROVIDED BETWEEN THE NEW WATER UTILITY AND OTHER EXISTING UTILITIES WHERE THEY CROSS. WHERE NEW WATER UTILITY PASSES UNDER EXISTING UTILITIES, IT SHALL CROSS WITHOUT THE USE OF BENDS UNLESS OTHERWISE NOTED ON THE PLANS. TYPICAL EXISTING UTILITIES INCLUDE GAS, TELECOM, WATER, STORM DRAIN, ELECTRIC, AND FIBER-OPTIC.
- WATER AND SANITARY SEWER LINES SHALL HAVE A MINIMUM HORIZONTAL SEPARATION OF THEN (10) FEET, A TEN (10) FOOT SEPARATION IS NOT POSSIBLE TO BE PROVIDED THERE MUST BE AT LEAST EIGHTEEN (18) INCHES OF VERTICAL SEPARATION, IT IS PREFERRED THAT WATER MAINS CROSS ABOVE SEWER LINES.
- ALL HYDRANT BRANCHES SHALL HAVE VALVES AS SHOWN ON THE HYDRANT DETAIL.
- THE CONTRACTOR SHALL STAKE OUT ALL HYDRANT LOCATIONS AT LEAST 3 DAYS IN ADVANCE OF INSTALLATION. LOCATION OF ALL HYDRANTS SHALL BE VERIFIED BY THE SHARON FIRE DEPARTMENT, ENGINEER, AND OWNER PRIOR TO DIGGING FOR INSTALLATION.
- TEST PITS TO LOCATE EXISTING UTILITIES MAY BE ORDERED BY THE ENGINEER TO DETERMINE WHETHER TO RAISE OR LOWER THE PROPOSED WATER MAIN TO CLEAR EXISTING UTILITIES OR MEET EXISTING WATER MAINS.
- EXISTING WATER MAINS OR SERVICES SHALL NOT BE ABANDONED WITHOUT THE APPROVAL OF THE OWNER.
- WATER SERVICE SHALL NOT BE INTERRUPTED MORE THAN 4 HOURS WITHOUT PRIOR APPROVAL OF THE OWNER.
- ANY HYDRANT WHICH IS NOT IN SERVICE SHALL BE COVERED WITH A SECURELY FASTENED BURLAP BAG (OR EQUAL).
- THE CONTRACTOR SHALL NOT OPEN OR CLOSE ANY VALVES OR HYDRANTS WHICH HOLD WATER IN THE SYSTEM. THE OWNER WILL, ON 24 HOURS NOTICE FROM THE CONTRACTOR, OPEN AND/OR CLOSE ANY VALVES OR HYDRANTS REQUIRED FOR DRAINING OR ADMITTING WATER TO THE VARIOUS SECTIONS OF THE WATER MAINS.
- SOME WATER SERVICE CONNECTIONS MAY NOT BE SHOWN ON THE DRAWINGS. THE OWNER WILL MARK THE LOCATION OF SUCH CONNECTIONS, PROVIDED THE CONTRACTOR GIVES THE OWNER AT LEAST ONE WEEK ADVANCE NOTICE.
- THE CONTRACTOR IS REQUIRED TO NOTIFY AND COORDINATE WITH THE RESIDENTS ALL WATER MAIN SHUT DOWNS 24 HOURS IN ADVANCE.
- CONCRETE THRUST BLOCKS AND "MEGA-LUG" (OR APPROVED EQUAL) MECHANICAL RESTRAINTS ARE REQUIRED AT FITTINGS, PLUGS, AND HYDRANTS.
- WATER SERVICES SHALL BE INSULATED IN AREAS WHERE CONNECTION TO EXISTING WATER SERVICE IS LESS THAN 4 FEET DEEP.
- VALVE DECOMMISSIONING - CLOSE VALVE, REMOVE AND LEGALLY DISPOSE OF GATE BOX, FILL HOLE, AND PAVE ACCORDING TO TYPICAL TRENCH DETAIL.
- SLEEVES, NIPPLES, AND ACCESSORIES NECESSARY FOR CONNECTIONS BETWEEN EXISTING AND NEW PIPES MAY NOT BE SHOWN IN DETAIL. FURNISH AND INSTALL ITEMS NECESSARY FOR CONNECTING TO EXISTING MAINS AND AS INDICATED ON THE CONTRACT DOCUMENTS.
- HYDRANT DECOMMISSIONING - CUT AND CAP HYDRANT LATERAL, REMOVE EXISTING HYDRANT ASSEMBLY AND DELIVER TO THE SHARON WATER DEPARTMENT. FILL HOLE AND PAVE ACCORDING TO TYPICAL TRENCH DETAIL OR RESTORE LANDSCAPING TO MATCH ADJACENT AREAS AT NO EXPENSE TO THE OWNER.
- CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL MATERIAL REMOVED FROM TRENCH DURING CUTTING AND CAPPING OF EXISTING WATER MAINS.
- ALL HYDRANT LATERALS SHALL CROSS UNDER EXISTING UTILITIES AND WATER MAINS. HYDRANT EXTENSIONS SHALL BE INSTALLED, AS NECESSARY, AT NO ADDITIONAL COST TO THE OWNER.
- PRIOR TO DEMOBILIZATION THE CONTRACTOR SHALL OPERATE EVERY VALVE, HYDRANT, WITH THE RESIDENT PROJECT REPRESENTATIVE PRESENT TO ENSURE PROPER OPERATION.
- ALL WATER MAINS, HYDRANT LATERALS AND SERVICES SHALL BE COVERED WITH PRINTED, DETECTABLE WARNING TAPE INSTALLED AS SHOWN ON THE TRENCH DETAIL AND HYDRANT DETAIL.
- TRENCHES MAY BE SAW CUT OR ZIPPED.
- THE WORK AREA SHALL BE LEFT CLEAN AT THE END OF EACH WORK DAY, INCLUDING BUT NOT LIMITED TO MOTORIZED SWEEPING TO REMOVE LOOSE SOIL, MATERIALS AND ALL OTHER DEBRIS ACCUMULATED ON PAVED SURFACES FROM CONSTRUCTION ACTIVITIES.
- DUST CONTROL SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

- TRENCH PAVING SHALL OCCUR EACH FRIDAY AT A MINIMUM, OR PRIOR TO EACH WEEKEND. PAVEMENT SHALL BE PLACED IN ADVANCE OF INCLEMENT CONDITIONS.
- ALL WATER MAIN SHALL BE POLYETHYLENE V-BIO ENCASED.

# CONSERVATION NOTES

- PRIOR TO START OF WORK, AND IF THE PROJECT INVOLVES WORK ADJACENT TO BORDERING VEGETATED WETLAND, THE BOUNDARY OF THE WETLAND IN THE VICINITY OF THE PROPOSED WORK AREA SHALL BE MARKED BY WOODEN STAKES OR FLAGGING. ONCE IN PLACE, THE WETLAND BOUNDARY MARKERS SHALL BE MAINTAINED UNTIL A CERTIFICATE OF COMPLIANCE HAS BEEN ISSUED BY CONSERVATION COMMISSION.
- EROSION CONTROL MEASURES SHALL BE INSTALLED AND INSPECTED BY THE CONSERVATION ADMINISTRATOR PRIOR TO THE START OF WORK.
- THE CONSERVATION OFFICE SHALL BE NOTIFIED AT LEAST TWO BUSINESS DAYS PRIOR TO THE START OF THE HORIZONTAL DIRECTIONAL DRILLING.
- ALL SEDIMENTATION BARRIERS SHALL BE MAINTAINED IN GOOD REPAIR UNTIL ALL DISTURBED AREAS HAVE BEEN FULLY STABILIZED AS APPROVED BY THE ENGINEER/OWNER. THE GENERAL CONTRACTOR SHALL INSPECT EROSION CONTROLS ON A DAILY BASIS AND REMOVE ACCUMULATED SEDIMENTS AS NEEDED. THE ENGINEER/OWNER RESERVES THE RIGHT TO REQUIRE ADDITIONAL EROSION CONTROLS AND/OR DAMAGE PREVENTION CONTROLS AT NO ADDITIONAL COST TO THE OWNER.
- CONTRACTOR SHALL IMMEDIATELY CONTROL ANY EROSION PROBLEMS THAT OCCUR AT THE SITE AND SHALL ALSO IMMEDIATELY NOTIFY THE CONSERVATION COMMISSION, WHICH RESERVES RIGHT TO REQUIRE ADDITIONAL EROSION AND/OR DAMAGE PREVENTION CONTROLS IT MAY DEEM NECESSARY.
- A MASSDEP SIGN NOT LESS THAN TWO SQUARE FEET OR MORE THAN THREE SQUARE FEET IN SIZE SHALL BE POSTED ON SITE IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS. THE SIGN SHALL BEAR THE WORDS "MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION" [OR, "MASSDEP"] "FILE NUMBER: SE280-0653". NO WORK IS TO COMMENCE UNTIL A DEP NUMBER SIGN IS DISPLAYED AT THE SITE.
- THE CONTRACTOR SHALL FURNISH AND INSTALL SILT SACKS IN ALL CATCH BASINS ASSOCIATED WITH THE WORK AREA AND AS DIRECTED BY THE ENGINEER.
- SILT SACKS AND OTHER EROSION AND SEDIMENT CONTROL MEASURES/DEVICES SHALL BE INSPECTED, CLEANED, REPLACED AND/OR REPAIRED AS NECESSARY, AND AFTER EACH SIGNIFICANT RAINFALL.
- THE CONTRACTOR SHALL STOCKPILE SUFFICIENT SOIL EROSION AND SEDIMENT CONTROL MATERIALS ONSITE TO REPAIR ANY DAMAGED SOIL EROSION AND SEDIMENT CONTROLS.
- THE CONTRACTOR SHALL NOT DISCHARGE WATER FROM DEWATERING OPERATIONS DIRECTLY INTO A WETLAND, SURFACE WATER, OR ANY STORM SEWER.
- GROUNDWATER FROM DEWATERING OPERATIONS SHALL BE TREATED TO REDUCE THE AMOUNT OF SEDIMENT CONTAINED IN THE WATER TO ALLOWABLE LEVELS.
- ALL DEWATERING DISCHARGES SHALL ALSO INCLUDE ENERGY DISSIPATION TO PREVENT SCOURING.
- REFER TO ORDER OF CONDITIONS IN APPENDIX F OF SPECIFICATIONS FOR REQUIREMENTS. CONTRACTOR IS REQUIRED TO COMPLY WITH ALL CONDITIONS.
- ANY FILL USED IN THE CONNECTION WITH THIS PROJECT SHALL BE CLEAN FILL. ANY FILL SHALL CONTAIN NO TRASH, REFUSE, RUBBISH, OR DEBRIS, INCLUDING BUT NOT LIMITED TO LUMBER, BRICKS, PLASTER, WIRE, LATH, PAPER, CARDBOARD, PIPE, TIRES, ASHES, REFRIGERATORS, MOTOR VEHICLES, OR PARTS OF ANY OF THE FOREGOING.

# LEGEND

EXISTING		PROPOSED
	HYDRANT	POLYETHYLENE "V-BIO" ENCASED FINISHED WATER MAIN
	CATCH BASIN (CB)	POLYETHYLENE "V-BIO" ENCASED RAW WATER MAIN
	DRAIN MANHOLE (DMH)	
	TELECOM MANHOLE (TMH)	
	MANHOLE	
	WATER VALVE/GAS GATE	
	WATER SHUTOFF	
	MONITORING WELL	
	WATER METER PIT	
	SOLID SLEEVE	
	CAPE COD BERM (CCB)	
	BITUMINOUS CONCRETE CURB (BCC), CONCRETE BERM (CB), GRANITE CURB (GC)	
	EDGE OF PAVEMENT	
	1' MINOR CONTOUR	
	5' MAJOR CONTOUR	
	PROPERTY LINES	
	LIMIT OF WPA ZONE I	
	LIMIT OF FLOOD ZONE	
	LIMIT OF WETLAND	
	DRAIN LINE	
	GAS MAIN	
	ELECTRIC OVERHEAD WIRES	
	ELECTRIC UNDERGROUND	
	UNDERGROUND TELEPHONE LINE	
	WATER MAIN	
	STONE WALL	
	METAL GUARD RAIL	
	CONCRETE GUARD RAIL	
	FENCE	
	VEGETATION	
	LANDSCAPED AREA	
	UTILITY POLE (UP#)	
	GUY WIRE ANCHOR	
	GUY WIRE	
	ELECTRICAL BOX	
	CONIFEROUS TREE	
	DECIDUOUS TREE	
	BUSH/SHRUB	
	BOULDER/ROCK	
	MAILBOX (MB)	
	SIGN	
	CONCRETE BOLLARD	
	LIGHT POLE	
	HAND HOLE	
	BOUND	
	POST/PILLAR	
	IRON ROD	
	FLAGPOLE	
	BORING LOCATION	
	BENCHMARK	
	WETLAND FLAG	
	GAS SERVICE	

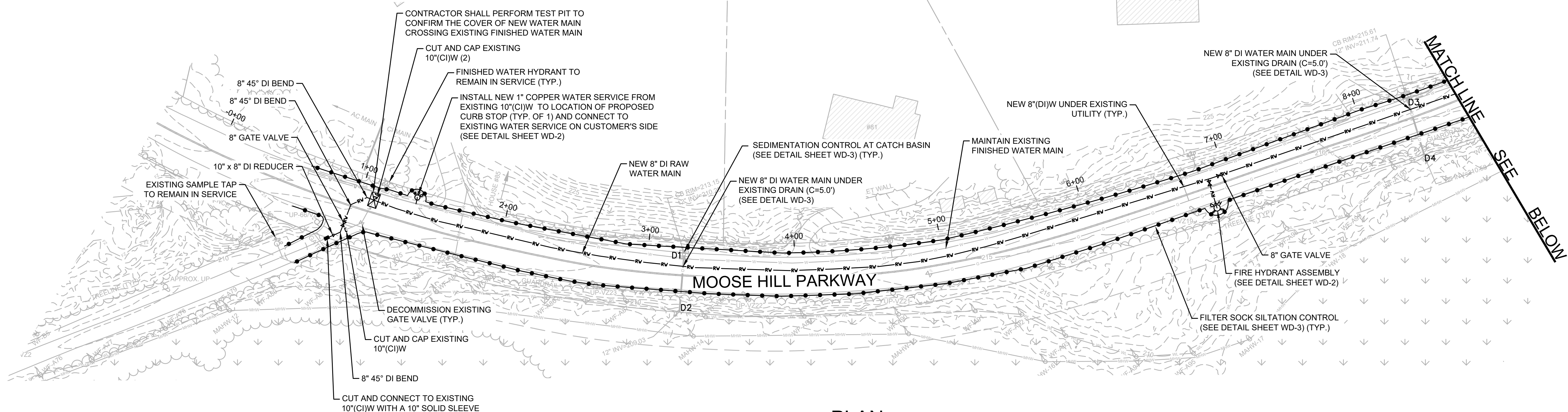
# ABBREVIATIONS

AC	ASBESTOS CEMENT
CI	CAST IRON
CM	CORRUGATED METAL
CP	CORRUGATED PLASTIC
CS	COATED STEEL
Cu	COPPER
DI	DUCTILE IRON
GAL	GALVANIZED IRON
HDPE	HIGH DENSITY POLYETHYLENE
PL	PLASTIC
PVC	POLYVINYL CHLORIDE
RC	REINFORCED CONCRETE
STL	STEEL
D	DRAIN
G	GAS
W	WATER
T	TELEPHONE
UNK.	UNKNOWN
C	COVER

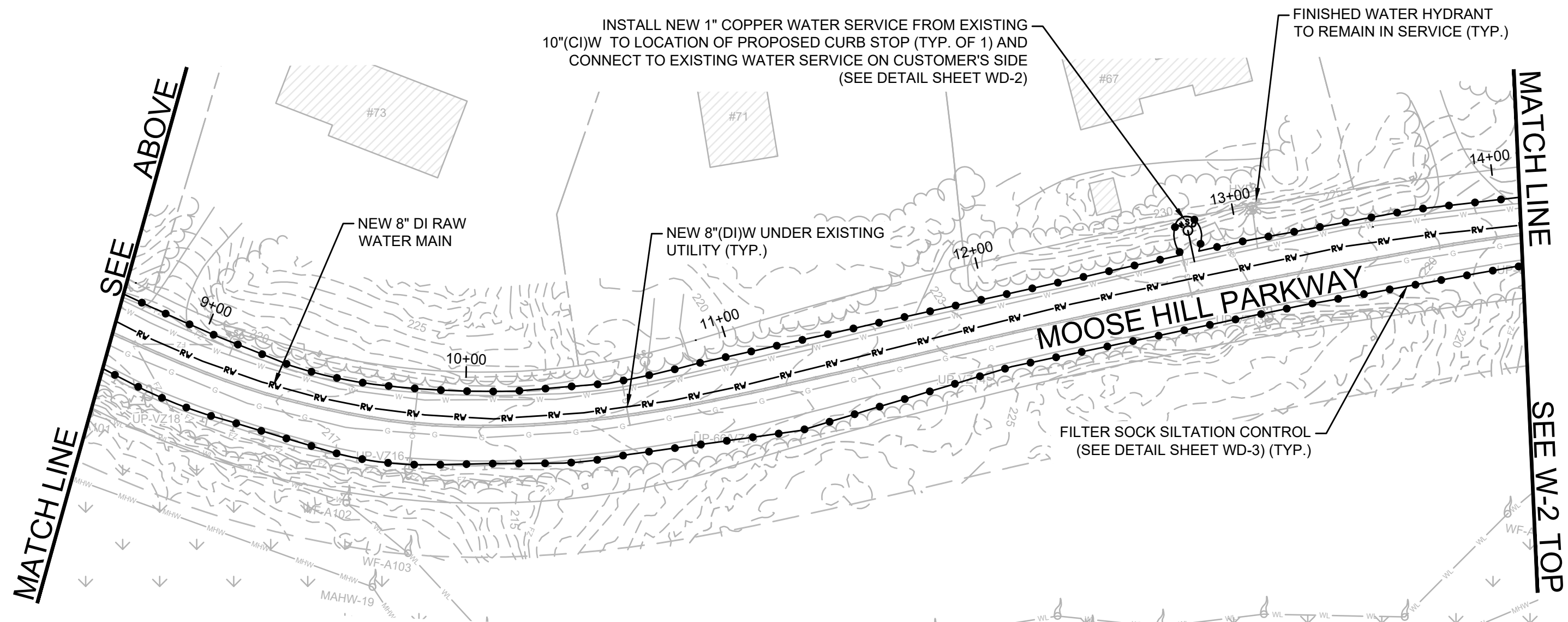
			MARK	DATE	DESCRIPTION	Scale	N.T.S.		WATER MAIN CONTRACT NO. 2024-10 TOWN OF SHARON, MA	FOR CONSTRUCTION
						Date	APRIL 2024			Job No.
						Designed by	SBS		GENERAL NOTES AND LEGEND	
						Drawn by	SBS			
						Checked by	LEU			
						Approved by	LEU			

Drawing file: I:\Sharon\_Ma\_245\245-2103\_Wat 4\_PFAAS\_Treatment\_System\06\_Final\_Design\Drawings\CAD\01\_General\_Sheets\_WM.dwg Plot Date: Apr 11, 2024-10:33am





**PLAN**  
SCALE: 1"=40'



**PLAN**  
SCALE: 1"=40'

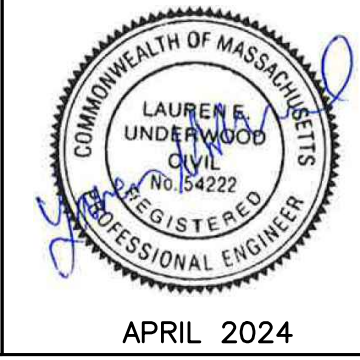
- NOTE:**
1. CONTRACTOR SHALL FIELD VERIFY ALL INVERT INFORMATION AND UTILITY CROSSINGS BEFORE COMMENCING EXCAVATION WORK FOR THE PROPOSED WATER MAIN.
  2. FOR UTILITY CROSSINGS, PROVIDE 1-FT MINIMUM VERTICAL SEPARATION BETWEEN THE NEW WATER MAIN AND THE EXISTING UTILITY UNLESS OTHERWISE NOTED.
  3. ALL NEWLY INSTALLED WATER MAIN SHALL BE POLYETHYLENE V-BIO ENCASED.

**MOOSE HILL PARKWAY  
DRAINAGE DEPTH TO INVERT**

D1 = INV. 2.8' 12"(UNK.)D
D2 = INV. 4.0' 12"(UNK.)D
D3 = INV. 3.9' 12"(UNK.)D
D4 = INV. 5.0' 12"(UNK.)D



**ENVIRONMENTAL PARTNERS**  
— An Apex Company —



MARK	DATE	DESCRIPTION

Scale	1" = 40'
Date	APRIL 2024
Job No.	245-2103
Designed by	SBS
Drawn by	SBS
Checked by	LEU
Approved by	LEU

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

**WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA**

**WATER MAIN PLAN I - STA 0+00 TO STA 14+00**

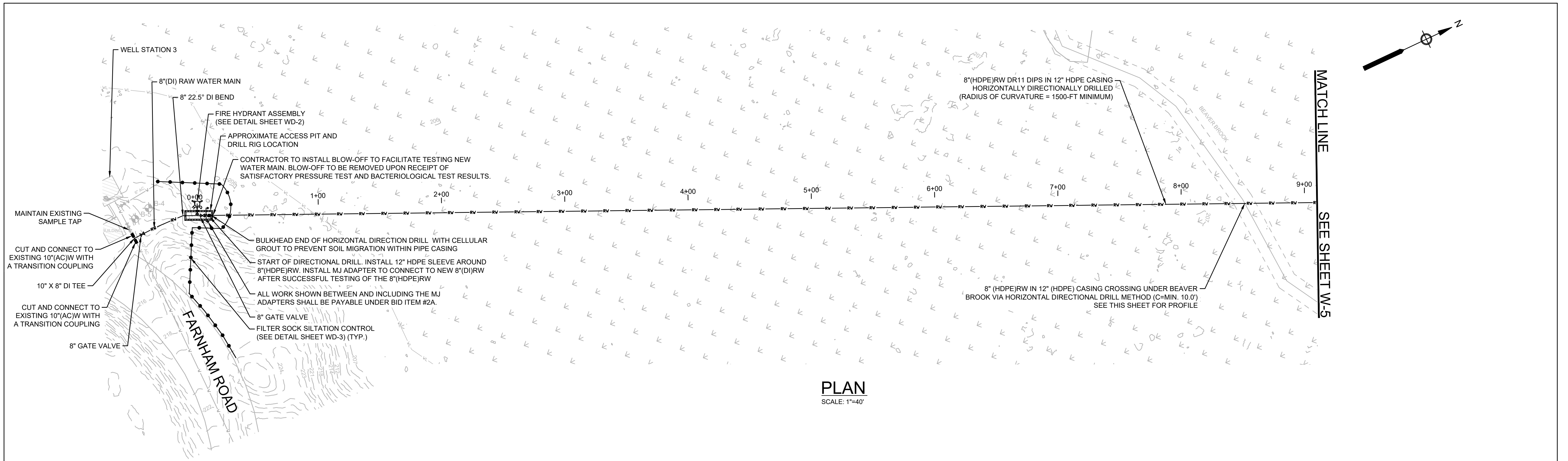
FOR CONSTRUCTION

Sheet No.

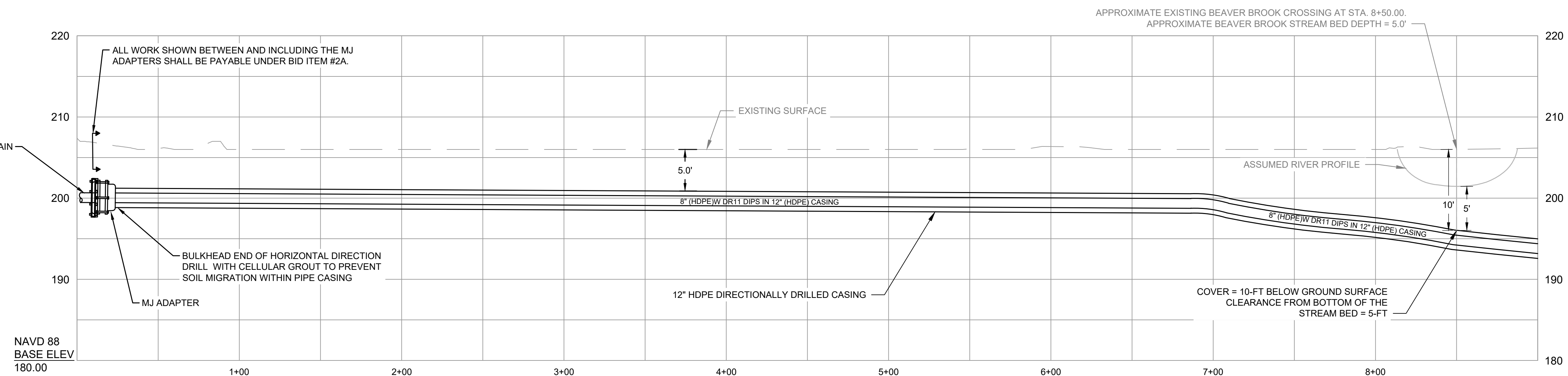
**W-1**











**PLAN**  
SCALE: 1"=40'

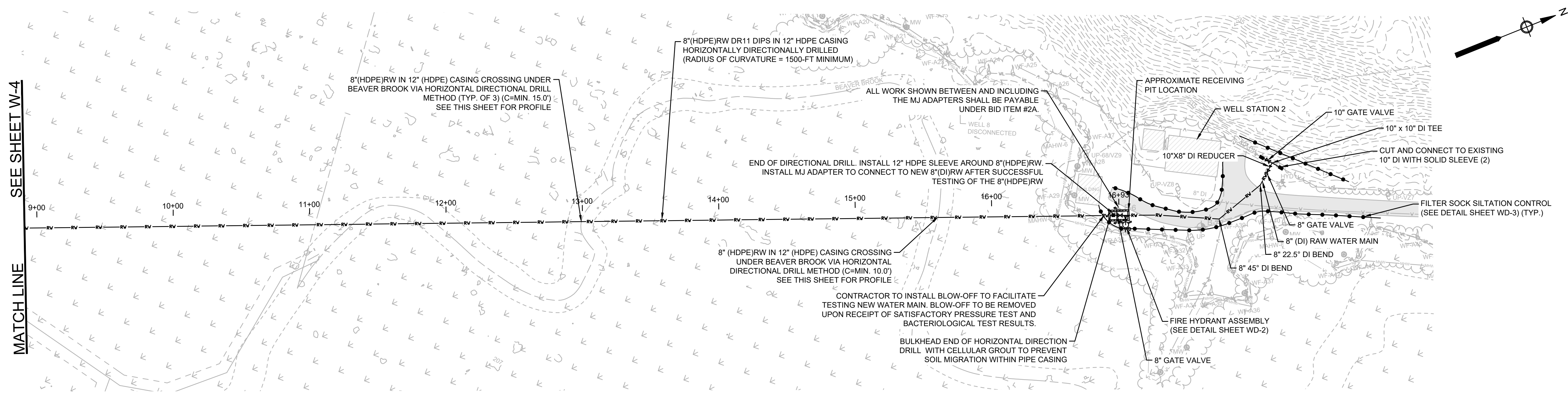


**BEAVER BROOK CROSSING - STA 0+00 TO STA 9+00  
DIRECTIONAL DRILLING PROFILE**

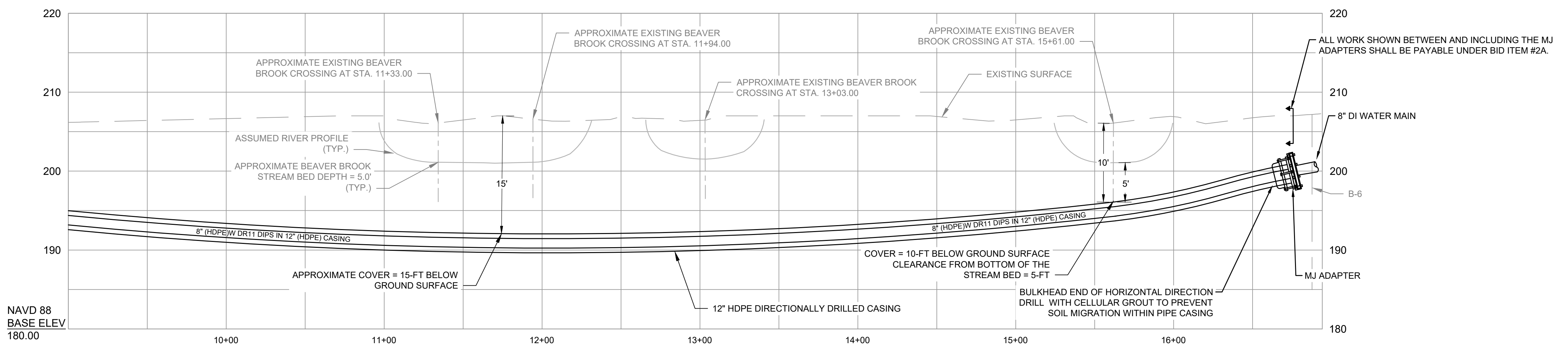
HORIZONTAL SCALE: 1" = 40'  
VERTICAL SCALE: 1" = 8'

- NOTES:**
1. CONTRACTOR SHALL FIELD VERIFY ALL INVERT INFORMATION AND UTILITY CROSSINGS BEFORE COMMENCING EXCAVATION WORK FOR THE PROPOSED WATER MAIN.
  2. FOR UTILITY CROSSINGS, PROVIDE 1-FT MINIMUM VERTICAL SEPARATION BETWEEN THE NEW WATER MAIN AND THE EXISTING UTILITY UNLESS OTHERWISE NOTED.
  3. ALL NEWLY INSTALLED WATER MAIN SHALL BE POLYETHYLENE V-BIO ENCASED
  4. CONTRACTOR IS REQUIRED TO SUBMIT INADVERTENT FLUID RETURN PLAN WITH THE INADVERTENT RETURNS PROCEDURES IN DETAIL.
  5. BEAVER BROOK BED DEPTH ASSUMED TO BE 5 FT. BELOW GROUND SURFACE BASED ON FEMA BEAVER BROOK (TOWN OF SHARON) FLOOD PROFILES IN PANEL 0080.

			Scale	AS SHOWN		<b>WATER MAIN CONTRACT NO. 2024-10 TOWN OF SHARON, MA</b>	FOR CONSTRUCTION
			Date	APRIL 2024			Sheet No.
			Job No.	245-2103	THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING	<b>DIRECTIONAL DRILL PLAN AND PROFILE II - STA 0+00 TO STA 9+00</b>	<b>W-4</b>
			Designed by	SBS			
			Drawn by	SBS			
			Checked by	LEU			
			Approved by	LEU			
APRIL 2024 MARK DATE DESCRIPTION							



**PLAN**  
SCALE: 1" = 40'



**BEAVER BROOK CROSSING - STA 9+00 TO STA 16+93**  
**DIRECTIONAL DRILLING PROFILE**  
HORIZONTAL SCALE: 1" = 40'  
VERTICAL SCALE: 1" = 8'

- NOTES:**
1. CONTRACTOR SHALL FIELD VERIFY ALL INVERT INFORMATION AND UTILITY CROSSINGS BEFORE COMMENCING EXCAVATION WORK FOR THE PROPOSED WATER MAIN.
  2. FOR UTILITY CROSSINGS, PROVIDE 1-FT MINIMUM VERTICAL SEPARATION BETWEEN THE NEW WATER MAIN AND THE EXISTING UTILITY UNLESS OTHERWISE NOTED.
  3. ALL NEWLY INSTALLED WATER MAIN SHALL BE POLYETHYLENE V-BIO ENCASED.
  4. CONTRACTOR IS REQUIRED TO SUBMIT INADVERTENT FLUID RETURN PLAN WITH THE INADVERTENT RETURNS PROCEDURES IN DETAIL.
  5. BEAVER BROOK BED DEPTH ASSUMED TO BE 5 FT. BELOW GROUND SURFACE BASED ON FEMA BEAVER BROOK (TOWN OF SHARON) FLOOD PROFILES IN PANEL 0080.



MARK	DATE	DESCRIPTION

Scale	AS SHOWN
Date	APRIL 2024
Job No.	245-2103
Designed by	SBS
Drawn by	SBS
Checked by	LEU
Approved by	LEU

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

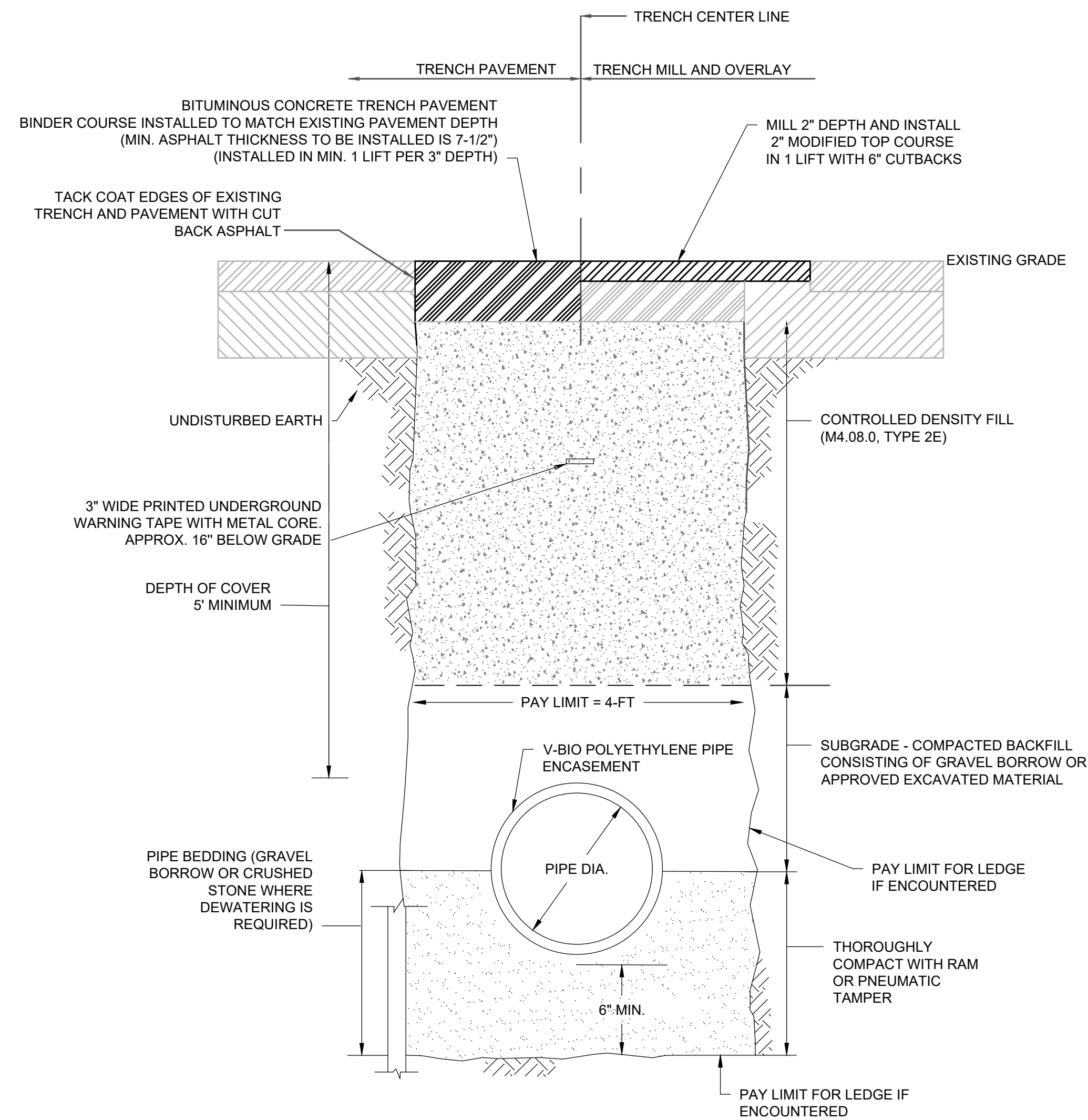
WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA

**DIRECTIONAL DRILL PLAN AND PROFILE III - STA 9+00 TO STA 17+00**

FOR CONSTRUCTION

Sheet No.

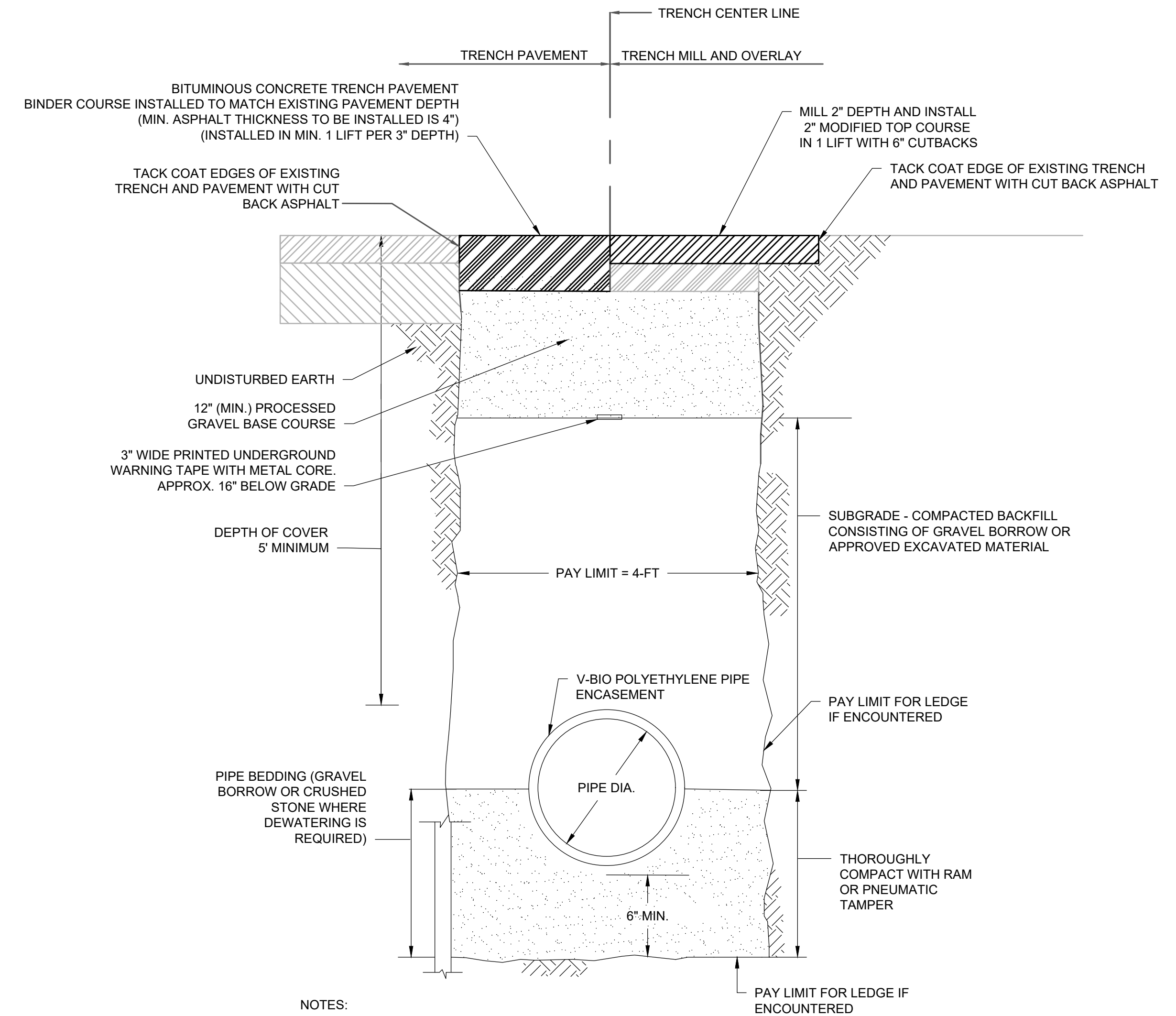
**W-5**



NOTES:

- PAVEMENT INSTALLED BEYOND PAYMENT LINE MUST BE PRE-APPROVED BY THE ENGINEER.
- THE FINISHED SURFACE OF THE TRENCH PAVEMENT, AFTER COMPACTION, SHALL BE TRUE TO THE ESTABLISHED LINE AND GRADE OF THE EXISTING PAVEMENT.
- TRENCH PAVEMENT SHALL BE MACHINE LAID UTILIZING A SIDEWALK BOX SPREADER OR EQUAL; NO HAND WORK IS ALLOWED.
- ANY GRASS AREA DISTURBED SHALL BE GRADED, LOAMED TO A DEPTH OF 6" AND SEEDED. WHERE NO GRASS OCCURS, USE 6" DEEP PROCESSED GRAVEL.

**UPLAND ROAD/DEPOT STREET  
TRENCH DETAIL**  
SCALE: N.T.S.



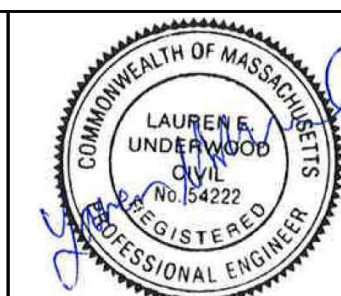
NOTES:

- PAVEMENT INSTALLED BEYOND PAYMENT LINE MUST BE PRE-APPROVED BY THE ENGINEER.
- THE FINISHED SURFACE OF THE MIXTURE, AFTER COMPACTION, SHALL BE TRUE TO THE ESTABLISHED LINE AND GRADE OF THE EXISTING PAVEMENT.
- TRENCH PAVEMENT SHALL BE MACHINE LAID UTILIZING A SIDEWALK BOX SPREADER OR EQUAL; NO HAND WORK IS ALLOWED.
- ANY GRASS AREA DISTURBED SHALL BE GRADED, LOAMED TO A DEPTH OF 6" AND SEEDED. WHERE NO GRASS OCCURS, USE 6" DEEP PROCESSED GRAVEL.

**TYPICAL TRENCH DETAIL**  
SCALE: N.T.S.



**ENVIRONMENTAL  
PARTNERS**  
— An Apex Company —



APRIL 2024

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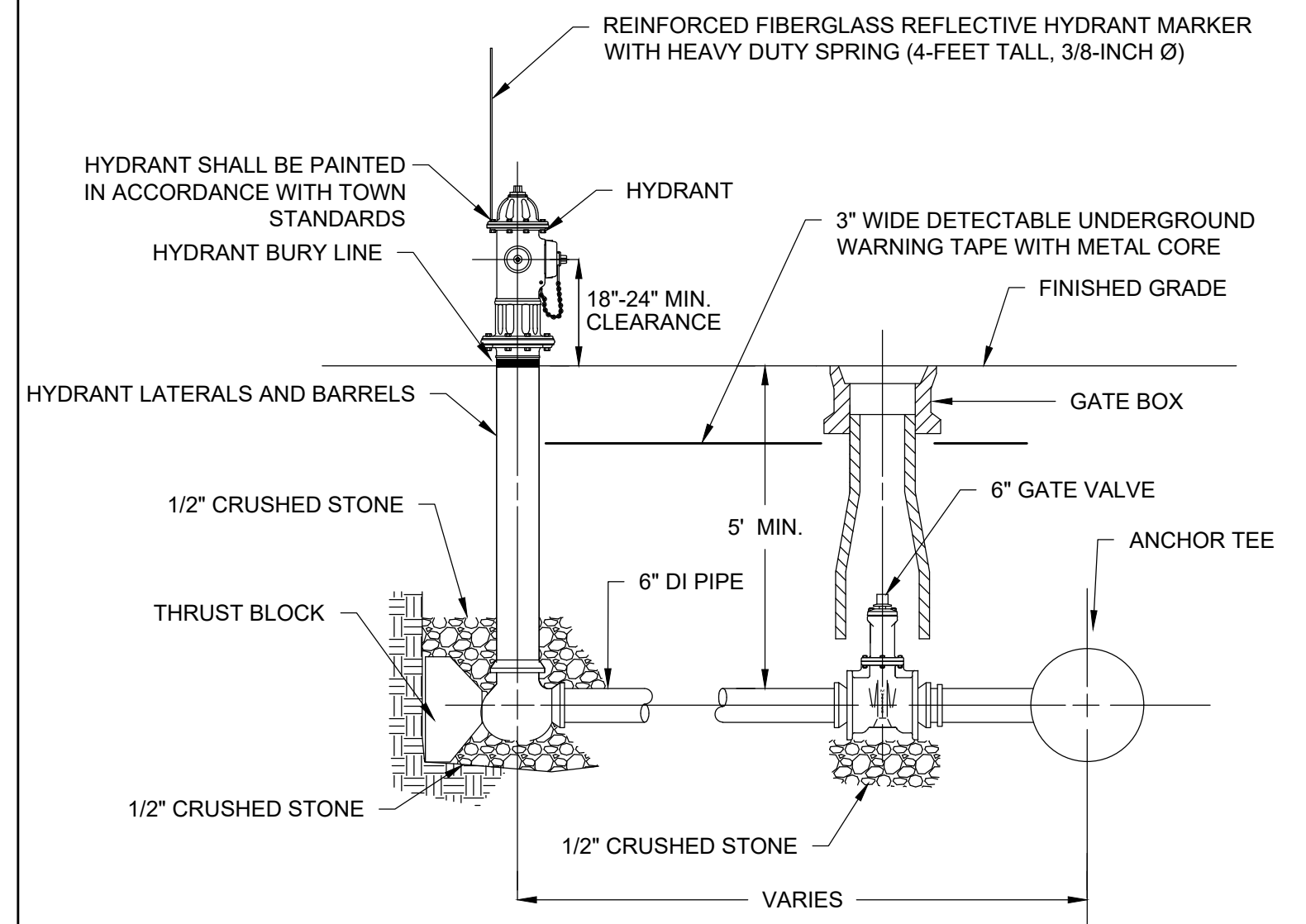
**WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA**

**CONSTRUCTION DETAILS I**

FOR CONSTRUCTION

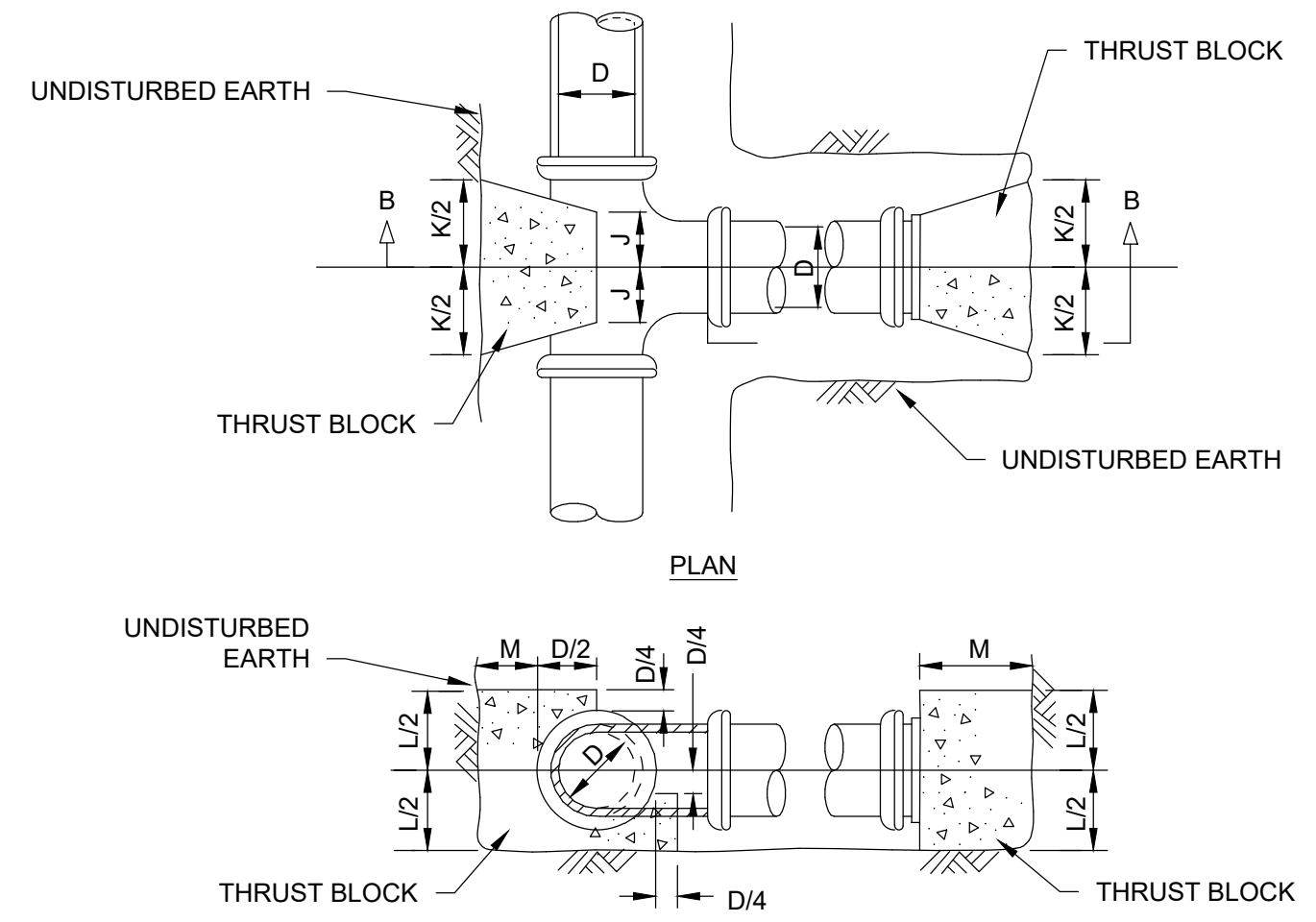
Sheet No.

**WD-1**



- NOTES:**
- CONFIRM HYDRANT LOCATION WITH OWNER PRIOR TO EXCAVATION.
  - ALL HYDRANT, VALVE, AND TEE JOINTS SHALL HAVE RESTRAINED MECHANICAL JOINTS.
  - DEPTH OF HYDRANT BURY SHALL SUIT INSTALLED DEPTH OF COVER OVER WATER MAIN. INSTALL RISERS AS NECESSARY AT NO ADDITIONAL COST TO THE OWNER.
  - HYDRANTS SHALL OPEN RIGHT (CLOCKWISE TO OPEN).

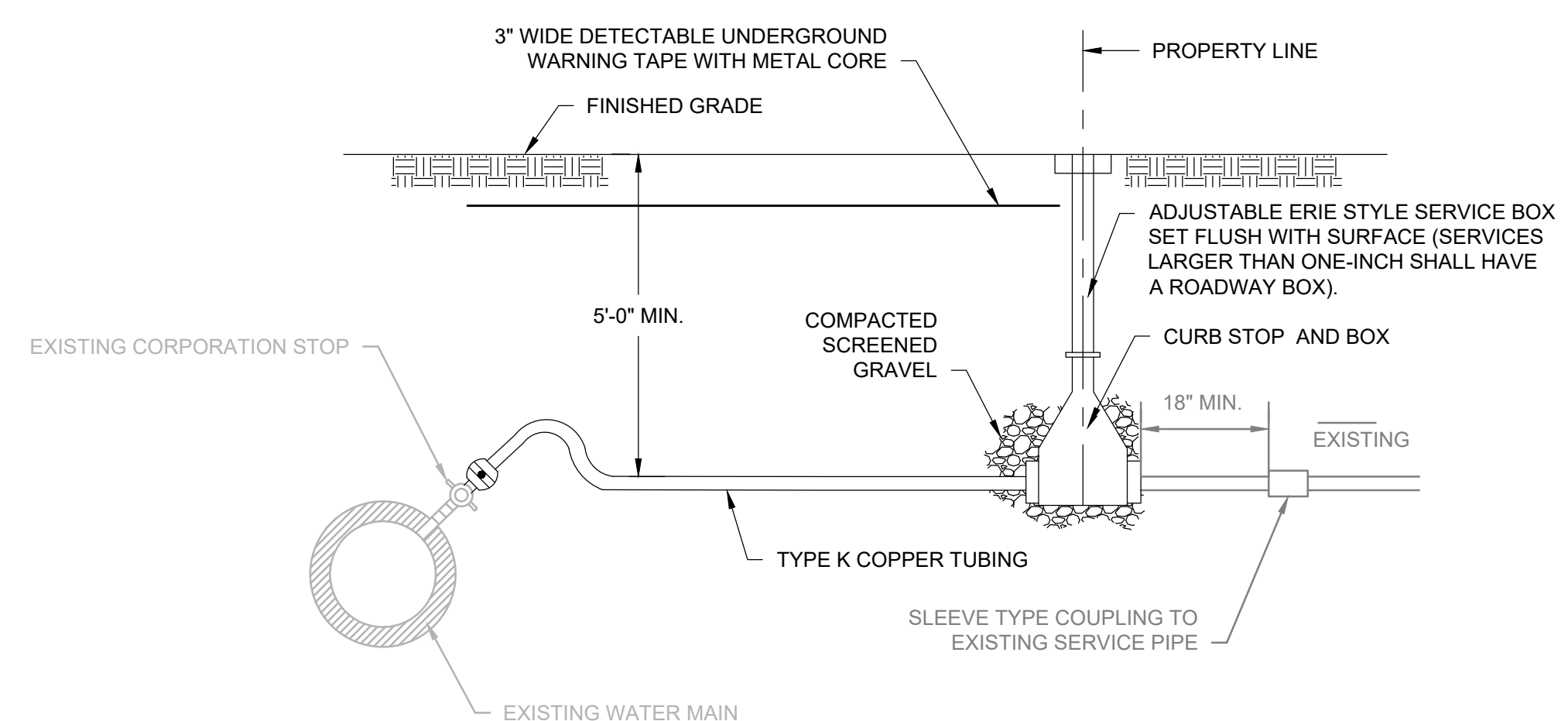
**HYDRANT ASSEMBLY DETAIL**  
SCALE: N.T.S.



- NOTES:**
- ALL CONCRETE SHALL BE 3000 PSI @ 28 DAYS (CLASS 'A' CONCRETE).
  - DIMENSIONS SHOWN ARE MINIMUM AND ARE BASED UPON SOIL PRESSURE OF 1500 PSF AND TOTAL PRESSURE OF 250 PSI. TOTAL PRESSURE IS WORKING PRESSURE PLUS SURGE PRESSURE.
  - THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH.

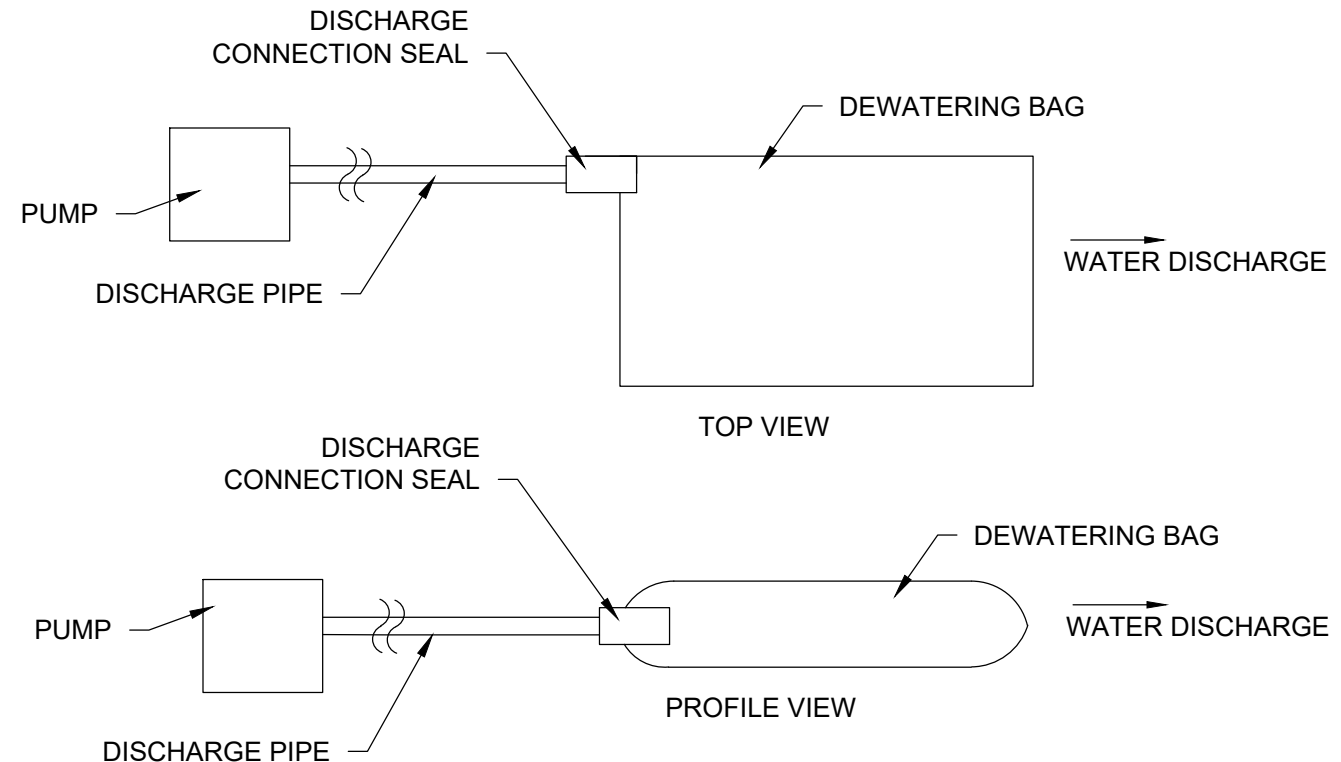
TABLE OF DIMENSIONS						
D (in.)	4	6	8	10	12	14
J (in.)	6	6	7	9	10	12
K (in.)	16	16	20	26	32	36
L (in.)	16	16	21	24	29	34
M (in.)	11	11	14	16	19	22

**CONCRETE THRUST BLOCK DETAIL AT TEE / PLUG/CAP**  
SCALE: N.T.S.



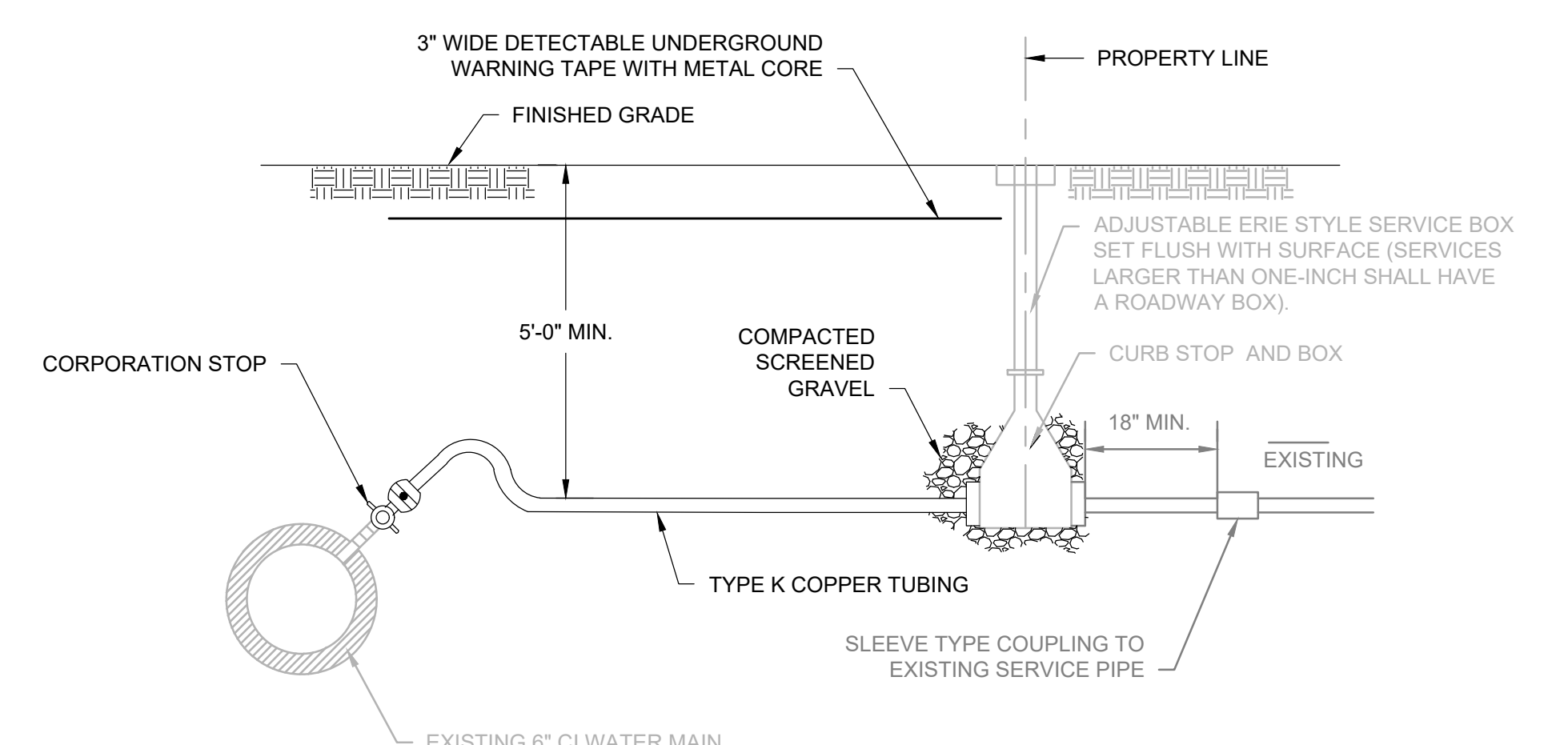
- NOTES:**
- ALL SERVICE TUBING SHALL BE TYPE K COPPER.
  - ALL JOINTS SHALL BE COMPRESSION TYPE.
  - COPPER WIRE SERVICE LINE SHALL BE BACKFILLED WITH SAND BY HAND TO 12" ABOVE TUBING AND SHALL HAVE A SAND BEDDING OF 6".
  - WATER SERVICES SHALL BE INSULATED IN AREAS WHERE CONNECTION TO EXISTING WATER SERVICE IS LESS THAN 4 FEET.
  - ALL WATER SERVICE PLUMBING MATERIALS SHALL BE "LEAD FREE" IN ACCORDANCE WITH SECTION 1417 OF THE SAFE DRINKING WATER ACT AND SECTION 9 OF NSF STANDARD 61.

**TYPICAL SERVICE TRANSFER EXISTING WATER MAINS**  
SCALE: N.T.S.



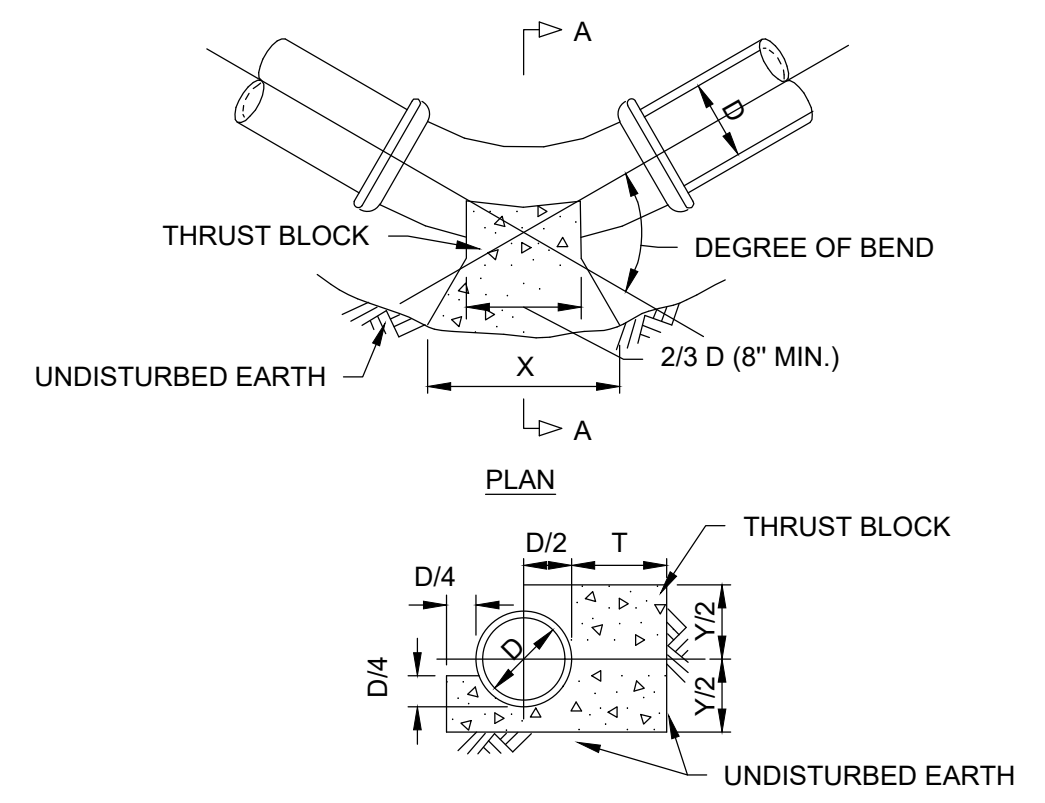
- NOTES:**
- DEWATERING BAG SIZE AND QUANTITY SHALL BE AS NEEDED TO ADEQUATELY FILTER ALL PUMP EFFLUENT FROM DEWATERING ACTIVITIES. CONTRACTOR SHALL PROVIDE A REDUNDANT BAG ON SITE AT ALL TIMES.
  - EACH BAG SHALL HANDLE A 2", 3", OR 4" DISCHARGE HOSE.
  - DISCHARGE HOSES CAN BE PLACED ALONG ANY EDGE BY MAKING A SMALL INCISION INTO THE FABRIC, INSERTING THE HOSE, AND THEN CLAMPING THE FABRIC TO THE HOSE VIA WIRE, TIES, CLAMP, ROPE OR SIMILAR TO CREATE A GOOD SEAL.
  - CONTRACTOR SHALL AVOID DISCHARGING MULTIPLE PIPES INTO ONE BAG.

**DEWATERING BAGS**  
SCALE: N.T.S.



- NOTES:**
- ALL SERVICE TUBING SHALL BE TYPE K COPPER.
  - ALL JOINTS SHALL BE COMPRESSION TYPE.
  - COPPER WIRE SERVICE LINE SHALL BE BACKFILLED WITH SAND BY HAND TO 12" ABOVE TUBING AND SHALL HAVE A SAND BEDDING OF 6".
  - WATER SERVICES SHALL BE INSULATED IN AREAS WHERE CONNECTION TO EXISTING WATER SERVICE IS LESS THAN 4 FEET.
  - ALL WATER SERVICE PLUMBING MATERIALS SHALL BE "LEAD FREE" IN ACCORDANCE WITH SECTION 1417 OF THE SAFE DRINKING WATER ACT AND SECTION 9 OF NSF STANDARD 61.

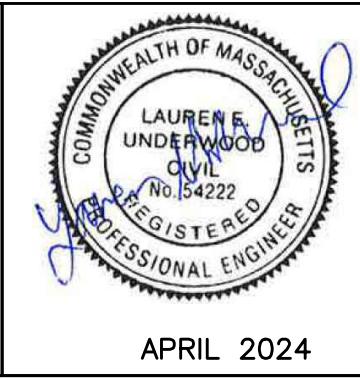
**TYPICAL SERVICE TRANSFER TREE LANE**  
SCALE: N.T.S.



- NOTES:**
- ALL CONCRETE SHALL BE 3000 P.S.I. @ 28 DAYS (CLASS "A" CONCRETE).
  - DIMENSIONS SHOWN ARE MINIMUM AND ARE BASED UPON SOIL PRESSURE OF 1500 P.S.F. AND TOTAL PRESSURE OF 250 P.S.I. TOTAL PRESSURE IS WORKING PRESSURE PLUS SURGE PRESSURE.
  - THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH.

TABLE OF DIMENSIONS																			
DIMENSION	90° BEND				45° BEND				22 1/2° BEND				11 1/4° BEND						
D (in.)	4	6	8	10	4	6	8	10	4	6	8	10	4	6	8	10			
X (in.)	35	35	50	56	72	80	24	24	35	45	51	60	28	28	30	32			
Y (in.)	20	20	24	32	35	40	16	16	19	21	27	33	13	13	16	19			
T (in.)	11	11	14	16	19	22	11	11	14	16	19	22	11	11	13	16			

**CONCRETE THRUST BLOCK DETAIL AT BEND**  
SCALE: N.T.S.



MARK	DATE	DESCRIPTION

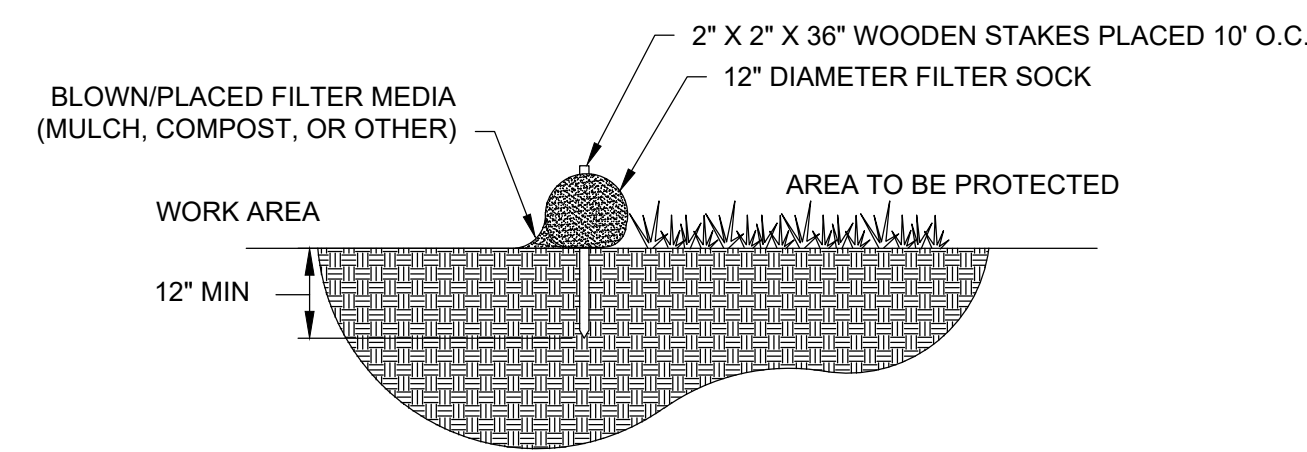
Scale	N.T.S.
Date	APRIL 2024
Job No.	245-2103
Designed by	SBS
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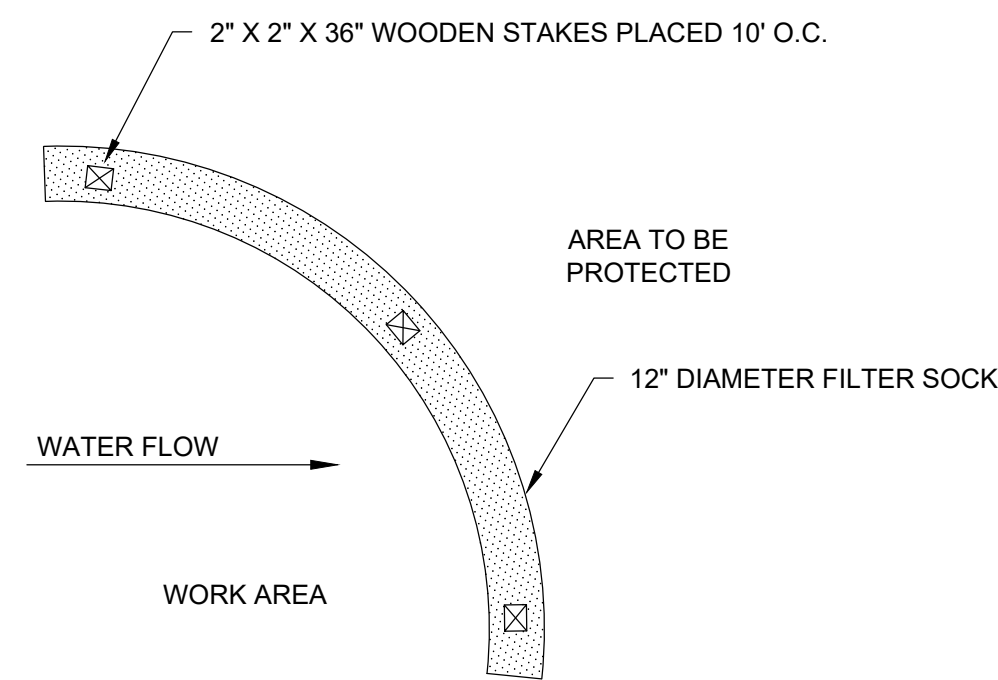
WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA

CONSTRUCTION DETAILS II

FOR CONSTRUCTION  
Sheet No.  
**WD-2**

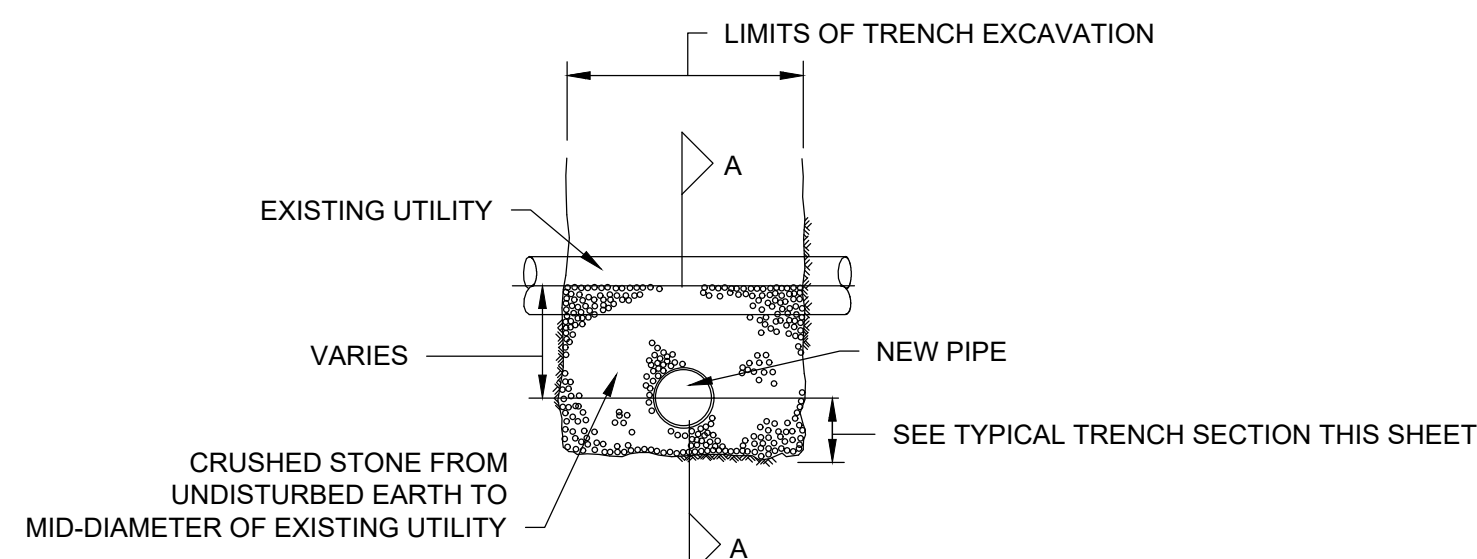


SECTION

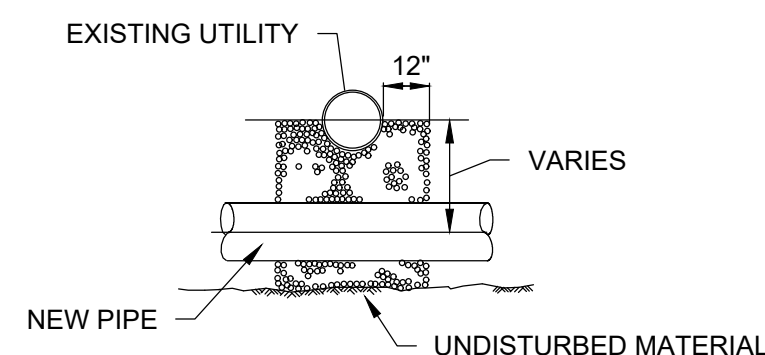


PLAN

**12" DIAMETER FILTER SOCK**  
SCALE: N.T.S.

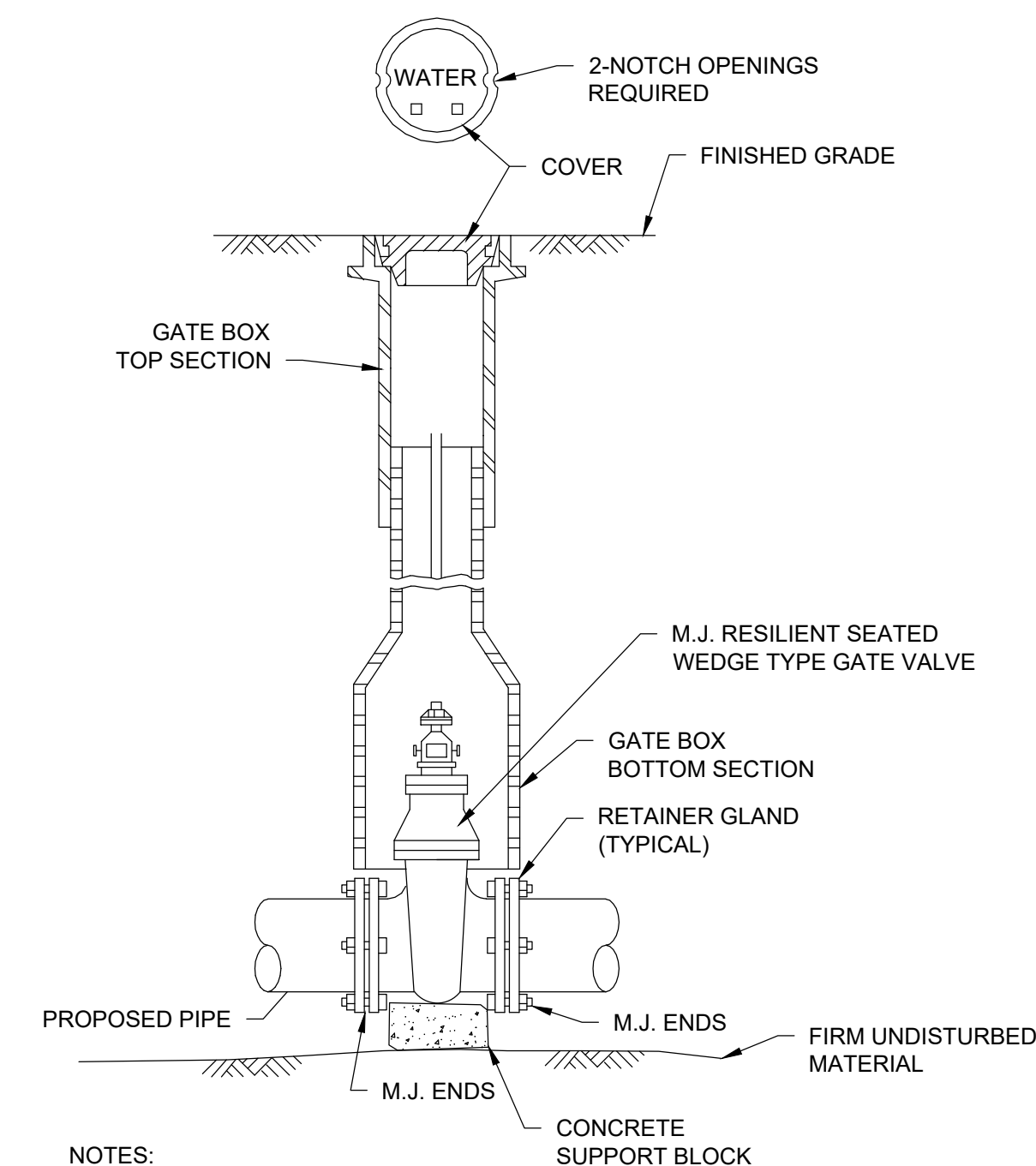


TYPICAL SECTION



SECTION A-A

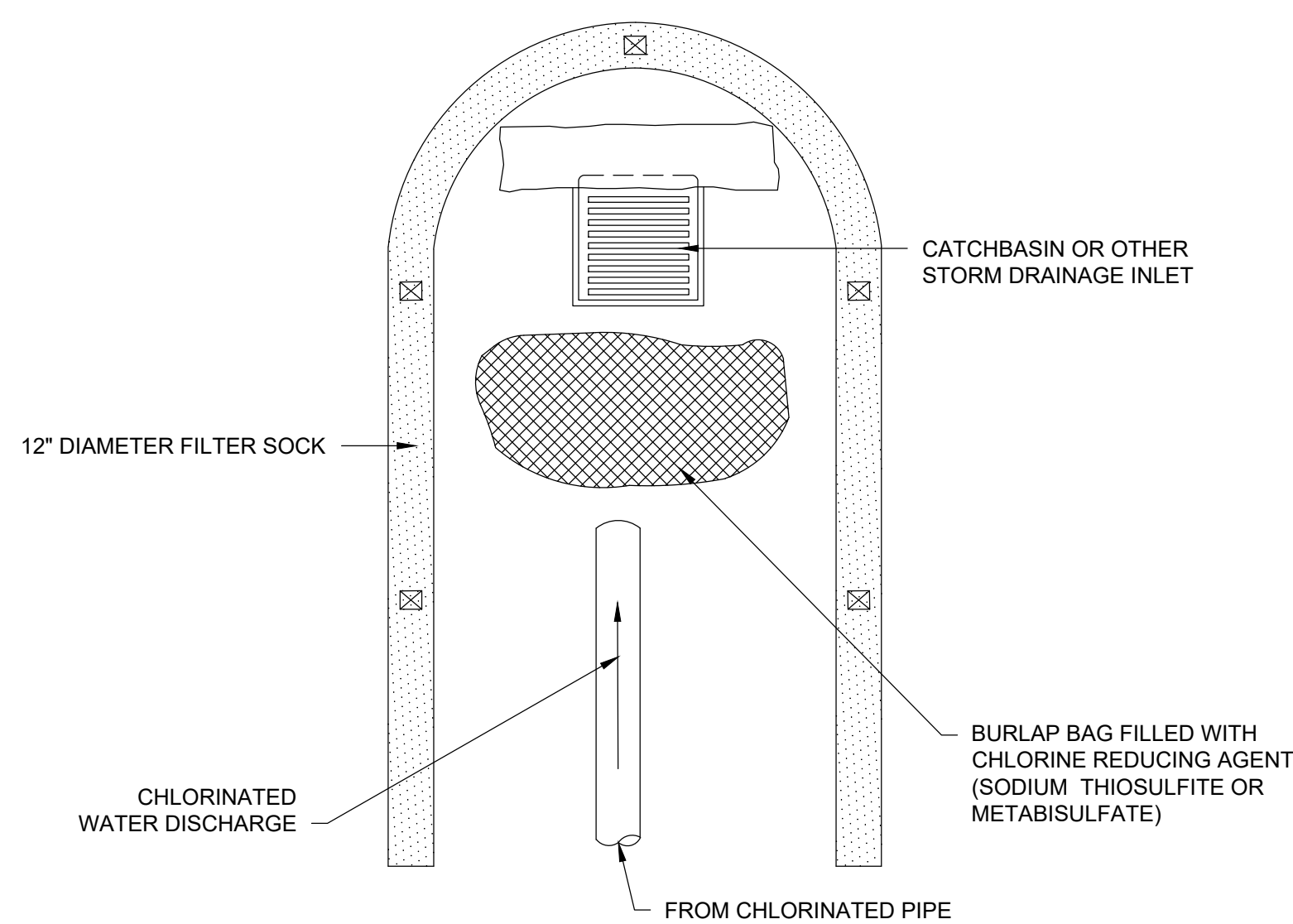
**UTILITY CROSSING DETAIL**  
SCALE: N.T.S.



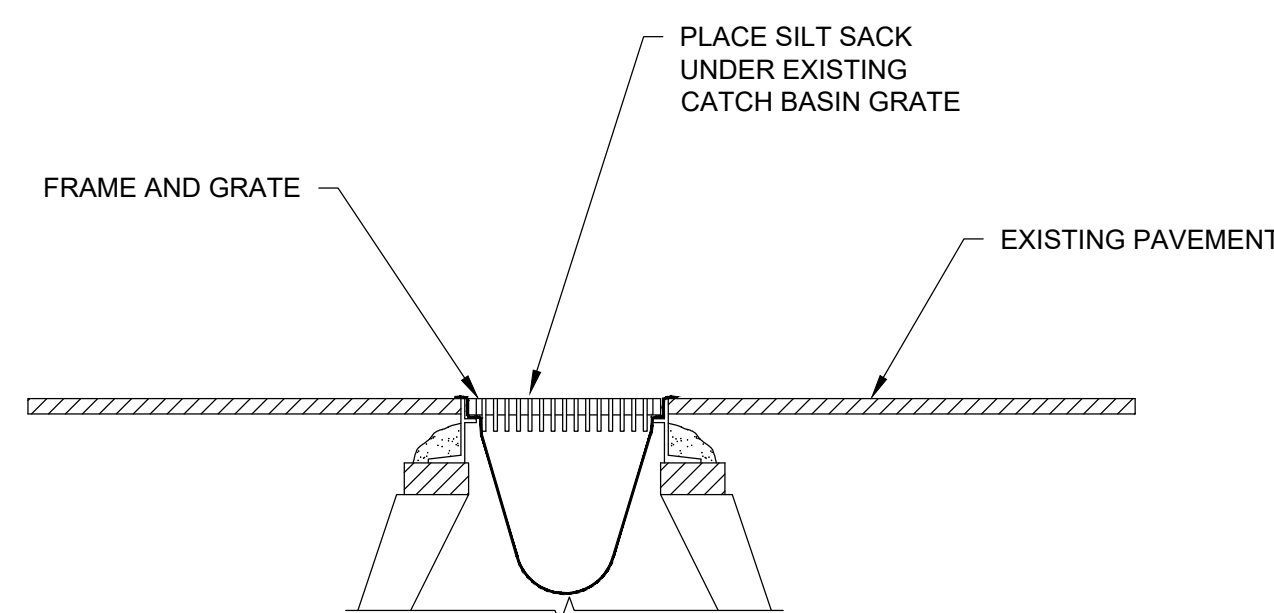
NOTES:

1. ALL GATE VALVE AND VALVE BOXES SHALL BE MANUFACTURED IN NORTH AMERICA.
2. GATE VALVES SHALL OPEN LEFT (COUNTERCLOCKWISE TO OPEN).

**GATE VALVE AND VALVE BOX DETAIL**  
SCALE: N.T.S.



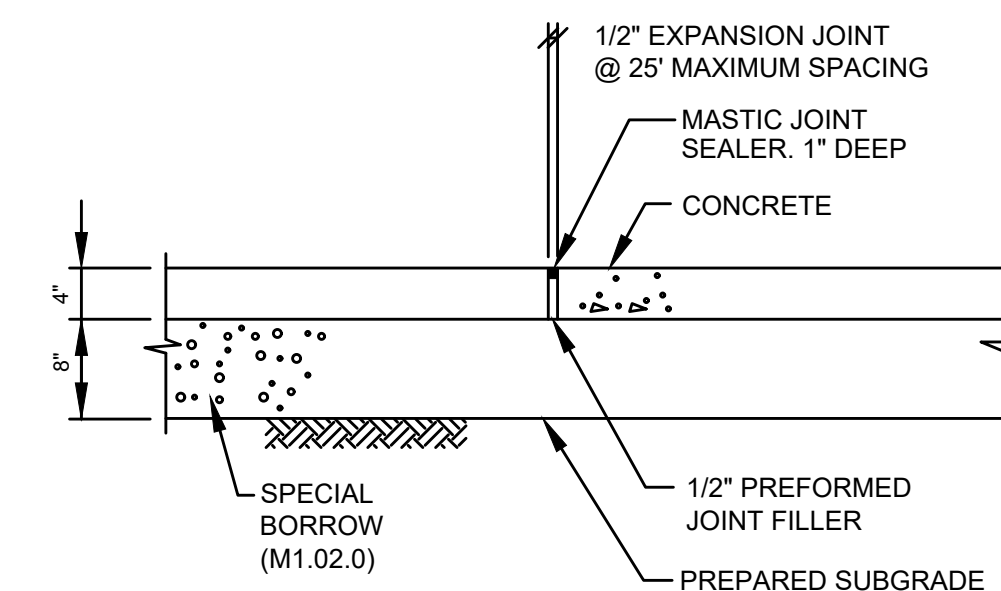
**DECHLORINATION DETAIL**  
SCALE: N.T.S.



NOTES:

1. SILT SACKS SHALL BE INSPECTED WEEKLY AND ACCUMULATED SILT REMOVED TO ALLOW CATCH BASIN TO FUNCTION PROPERLY.
2. SILT SACK AS MANUFACTURED BY ACF ENVIRONMENTAL OR APPROVED EQUAL.

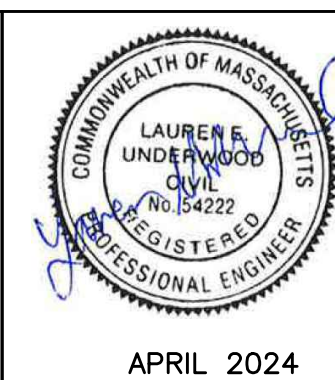
**SEDIMENTATION CONTROL AT CATCH BASINS SILT SACKS**  
SCALE: N.T.S.



NOTES:

1. SCORE CONCRETE; MATCH EXISTING INTERVALS (MIN 5' INTERVALS)
2. MATCH EXISTING SLOPE (MIN 3/16"/FT)
3. SEE VERTICAL CURB DETAIL FOR METHOD OF SETTING GRANITE CURB.
4. MATCH EXISTING SIDEWALK WIDTH. THE ENTIRE WIDTH OF ANY DISTURBED SIDEWALK SHELL BE RESTORED.

**CONCRETE SIDEWALK SECTION**  
SCALE: N.T.S.



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**WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA**

**CONSTRUCTION DETAILS III**

FOR CONSTRUCTION

Sheet No.

**WD-3**



**GENERAL TRAFFIC MANAGEMENT NOTES:**

- ONE LANE OF TRAVEL WILL BE MAINTAINED IN CONSTRUCTION LOCATIONS WHERE ADEQUATE WIDTH CAN BE PROVIDED FOR VEHICULAR ACCESS. (SEE TYPICAL LANE CLOSURE DETAIL.)
- AT THE END OF EACH CONSTRUCTION DAY NO TRAFFIC CONTROL DEVICES SHALL REMAIN IN THE ROADWAY; ROADWAYS WILL BE PATCHED OR PLATED AND OPEN TO TRAVEL AT THE END OF EACH WORK DAY,
- THE CONTRACTOR MUST MAINTAIN ACCESS AND EGRESS AT ALL TIMES TO ALL PROPERTIES AND ROADWAYS ABUTTING THE WORK ZONE UNLESS OTHERWISE APPROVED BY THE OWNER AND/OR ENGINEER.
- ALL DISTANCES MAY BE ADJUSTED TO FIT FIELD CONDITIONS, AS DIRECTED BY THE OWNER AND OR ENGINEER. MINIMUM DISTANCES HOWEVER SHOULD BE MAINTAINED WHERE INDICATED.
- MINIMUM LANE WIDTHS CONSIST OF THE CLEARANCE BETWEEN CHANNELIZING DEVICES SUCH AS DRUMS AND SHALL BE PROVIDED AT ALL TIMES.
- EXISTING PEDESTRIAN WALKWAYS WILL REMAIN OPEN AND CLEAR OF DEBRIS. IN LOCATIONS WHERE EXISTING PEDESTRIAN WALKWAYS HAVE BEEN IMPACTED BY CONSTRUCTION, THE ENTIRE WIDTH OF THE PEDESTRIAN WALKWAY IS TO BE RECONSTRUCTED IN KIND WITH A MINIMUM WIDTH OF 5 FEET EXCLUDING CURBING.
- MAXIMUM SPACING OF CHANNELIZING DEVICES IS EQUAL (IN FEET) TO THE SPEED LIMIT (MPH).
- CHANNELIZATION WILL BE ACCOMPLISHED THROUGH THE USE OF REFLECTORIZED PLASTIC DRUMS. PLASTIC DRUMS WITH ANY FORM OF LIGHTING DEVICE MOUNTED ON THEM MUST PASS THE CRITERIA AS SET FORTH IN NCHRP 350 "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES."
- FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED ON ADVANCE WARNING SIGNS AS DIRECTED BY THE OWNER AND/OR ENGINEER. FLAGS SHALL BE A MINIMUM OF 16" X 16".
- ALL SIGNS SHALL BE MOUNTED ON THEIR OWN STANDARD SIGN SUPPORT.
- ALL TEMPORARY TRAFFIC CONTROL DEVICES AND ADVANCE WARNING SIGNS SHALL BE REMOVED IMMEDIATELY WHEN NO LONGER NEEDED.
- PAVEMENT MARKINGS CONFLICTING WITH TRAFFIC PATTERNS SHALL BE REMOVED FROM THE TRAVEL PATH WITHIN THE LIMITS OF PROPOSED TEMPORARY PAVEMENT MARKINGS AS REQUIRED. UPON COMPLETION OF THE STAGE OF CONSTRUCTION, TEMPORARY MARKINGS SHALL BE REMOVED AND PERMANENT PAVEMENT MARKINGS SHALL BE INSTALLED IN THEIR ORIGINAL LOCATION.
- WRITTEN PERMISSION MUST BE OBTAINED FROM THE SHARON POLICE DEPARTMENT BEFORE THE CLOSING OF ANY ROADS WITHIN THE LIMITS OF THE PROJECT AREA.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING, SETTING UP, AND REMOVING ALL SIGNAGE, CONES, BARRICADES, BARRELS, AND OTHER TRAFFIC CONTROL DEVICES ON A DAILY BASIS.
- THESE TRAFFIC MANAGEMENT PLANS ARE INCLUDED FOR INFORMATIONAL AND PLANNING PURPOSES ONLY. THE CONTRACTOR SHALL SUBMIT A TRAFFIC MANAGEMENT PLAN TO THE SHARON POLICE DEPARTMENT FOR APPROVAL PRIOR TO CONSTRUCTION.

**SIGN SUMMARY**

IDENTIFI- CATION NUMBER	SIZE OF SIGN (IN)		TEXT	TEXT DIMENSIONS (IN)			BACK- GROUND	COLOR	LEGEND	BORDER	UNIT AREA/EACH (S.F.)
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.					
G20-2	36	18		1	1	1	ORANGE	BLACK	BLACK	4.50	
R2-10a	48	36		2	2	2	WHITE	BLACK	BLACK	12.00	
W5-1	36	36		1	1	1	ORANGE	BLACK	BLACK	9.00	
W13-1	24	24		1	1	1	ORANGE	BLACK	BLACK	4.00	
W20-1	36	36		1	1	1	ORANGE	BLACK	BLACK	9.00	
W20-3	36	36		1	1	1	ORANGE	BLACK	BLACK	9.00	
W20-4	36	36		1	1	1	ORANGE	BLACK	BLACK	9.00	
W20-7b	36	36		1	1	1	ORANGE	BLACK	BLACK	9.00	
M4-9L	30	24		1	1	1	ORANGE	BLACK	BLACK	9.00	
M4-9R	30	24		1	1	1	ORANGE	BLACK	BLACK	9.00	

1

SEE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGNS" BY FEDERAL HIGHWAY ADMINISTRATION (LATEST EDITIONS) FOR SPECIFICATIONS ON TEXT DIMENSION AND COLOR. (SEE ALSO THE "MASSACHUSETTS AMENDMENTS TO THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES", AND "GUIDE SIGN POLICY FOR SECONDARY STATE HIGHWAYS" (LATEST EDITIONS) BY THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION).

2

SEE "STANDARD DETAILS AND DRAWINGS FOR THE DEVELOPMENT OF TEMPORARY TRAFFIC CONTROL PLANS" AND "STANDARD HIGHWAY SIGNS" BY THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION (LATEST EDITIONS) FOR SPECIFICATIONS ON TEXT DIMENSION AND COLOR.



APRIL 2024

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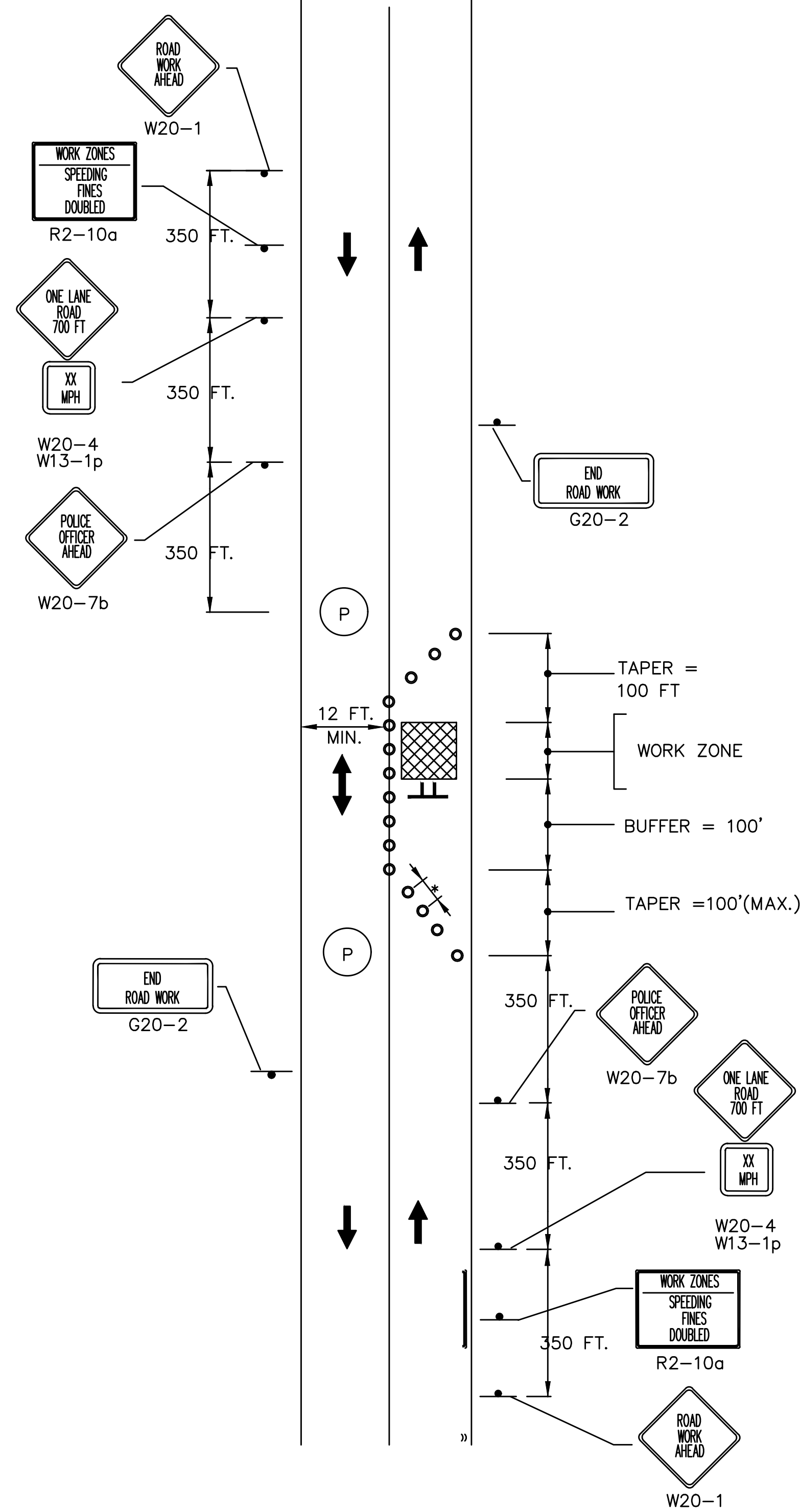
WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA

TRAFFIC MANAGEMENT PLAN I

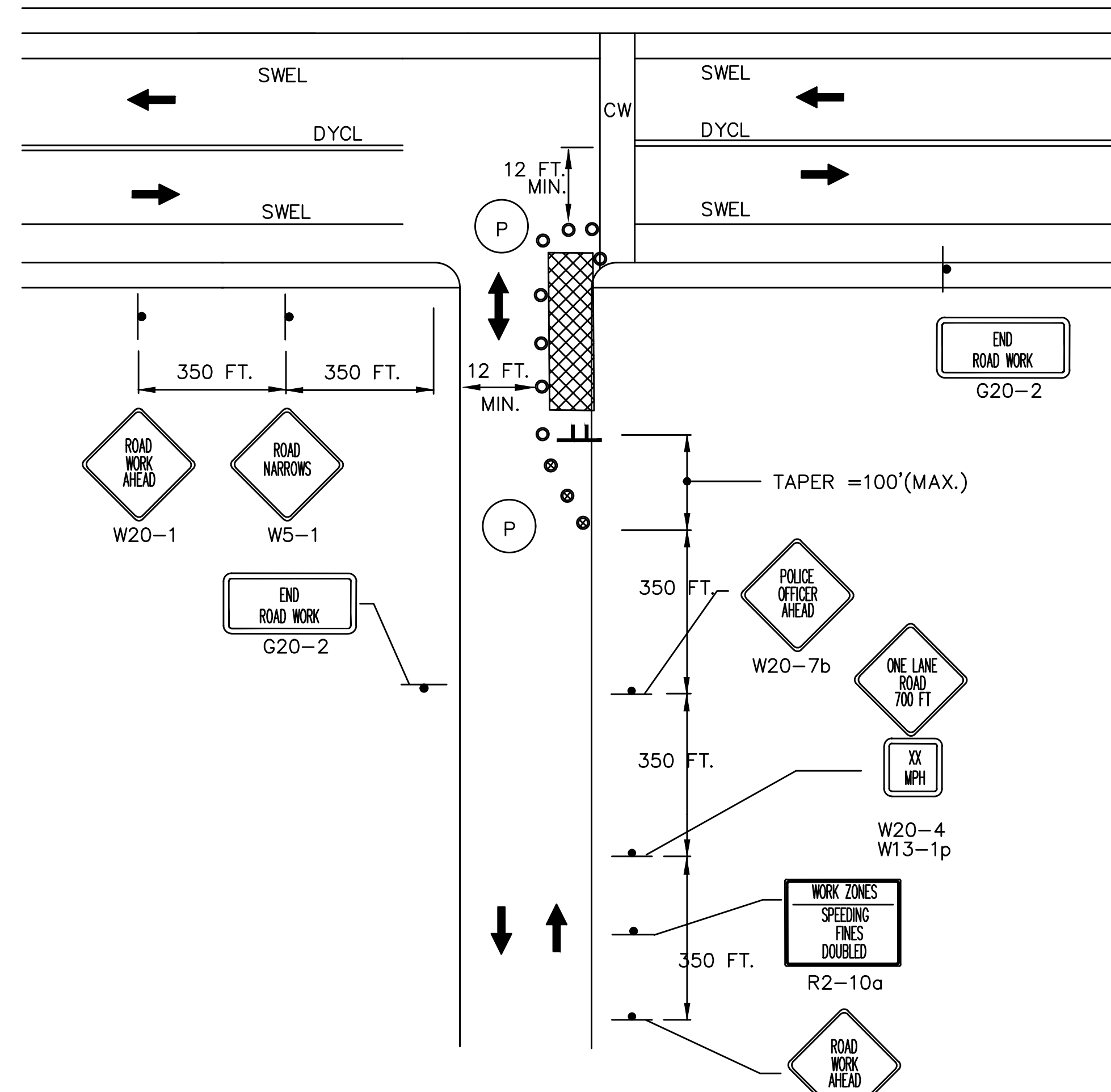
FOR CONSTRUCTION  
Sheet No.

**TMP-1**

Drawing file: I:\Sharon, MA\245245-2103 Well 4 PFAS Treatment System\05 Final Design\Drawings\CAD\04\_2 Water Main Details Sheets.dwg Plot Date: Apr 11, 2024 11:10am



TYPICAL LANE CLOSURE DETAIL  
(2-LANE ROADWAY)  
NOT TO SCALE



TYPICAL LANE CLOSURE DETAIL  
(AT INTERSECTION)  
NOT TO SCALE

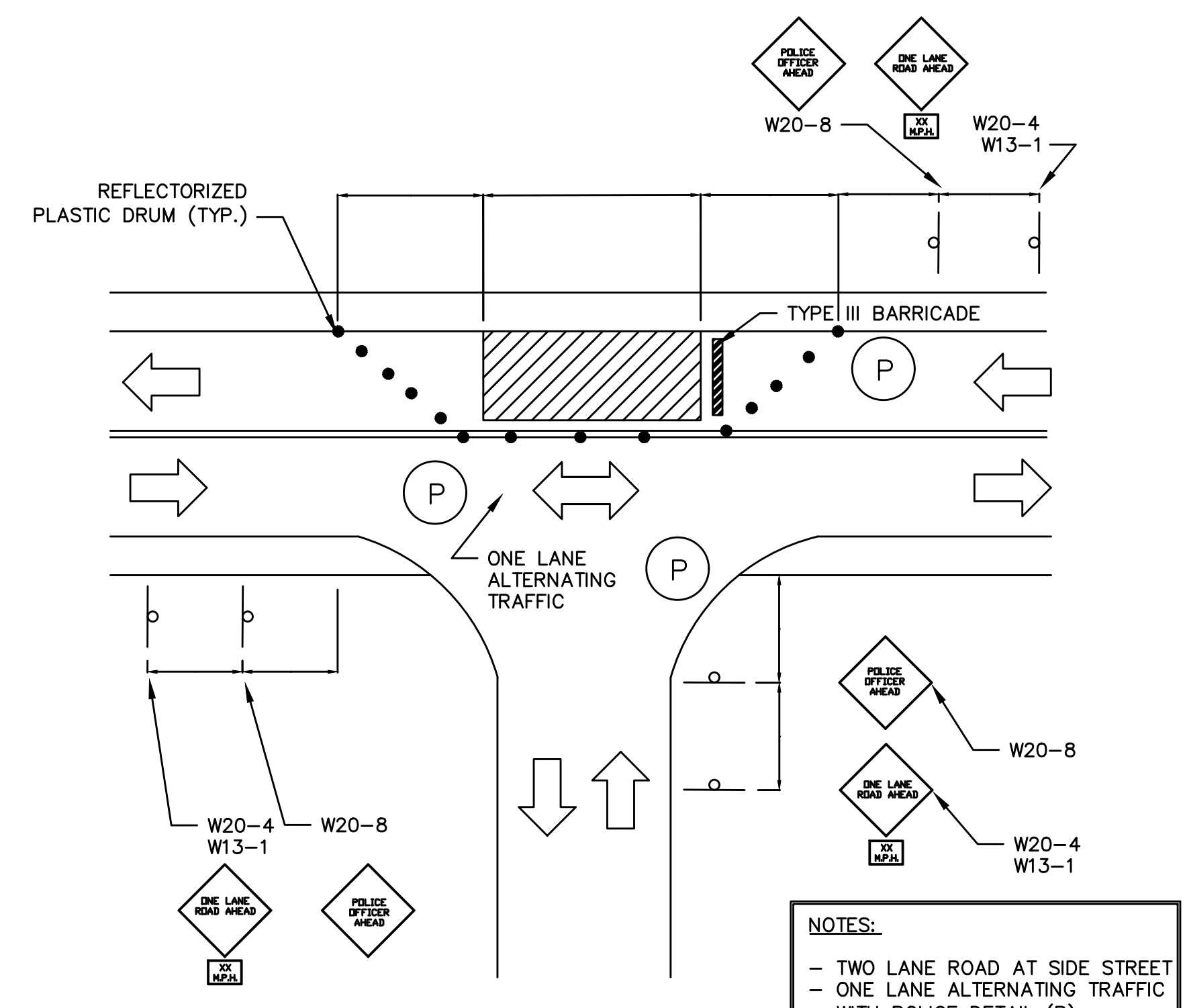
LEGENDS:

- REFLECTORIZED PLASTIC DRUM
- ▼ SIGN
- ▨ WORK ZONE
- ← DIRECTION OF TRAFFIC
- TT TYPE III PORTABLE BREAKAWAY BARRICADE
- P POLICE OFFICER
- \* MAXIMUM SPACING OF CHANNELIZING DEVICES (SEE NOTE 7)

TAPER LENGTH

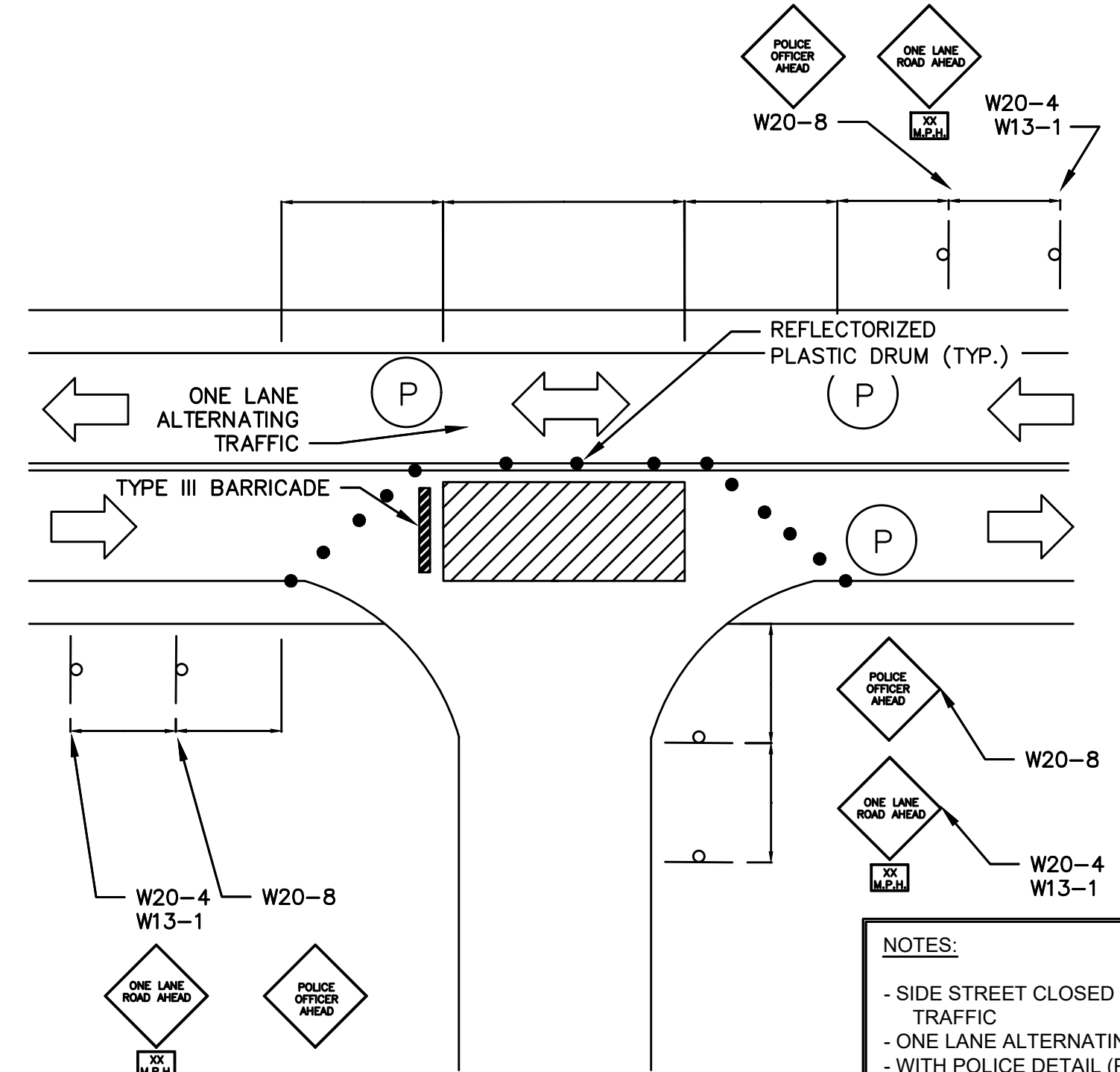
SPEED LIMIT	FORMULA
40 MPH OR LESS	$L = WS/60^2$
45 MPH OR MORE	$L = WS$

L = TAPER LENGTH IN FEET  
W = WIDTH OF OFFSET IN FEET  
S = POSTED SPEED OR OFF-PEAK 85 PERCENTILE SPEED IN MPH



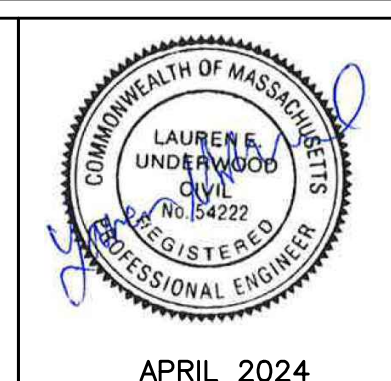
TYPICAL LANE CLOSURE DETAIL  
(AT INTERSECTION)  
NOT TO SCALE

- NOTES:
- TWO LANE ROAD AT SIDE STREET
  - ONE LANE ALTERNATING TRAFFIC
  - WITH POLICE DETAIL (P)



TYPICAL LANE CLOSURE DETAIL  
(AT INTERSECTION)  
NOT TO SCALE

- NOTES:
- SIDE STREET CLOSED TO THROUGH TRAFFIC
  - ONE LANE ALTERNATING TRAFFIC
  - WITH POLICE DETAIL (P)



MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	APRIL 2024
Job No.	245-2103
Designed by	SBS
Drawn by	SBS
Checked by	LEU
Approved by	LEU

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WATER MAIN CONTRACT NO. 2024-10  
TOWN OF SHARON, MA

TRAFFIC MANAGEMENT PLAN II

FOR CONSTRUCTION

Sheet No.

TMP-2

## APPENDIX U

### Supplemental Water Quality Data



Wells 2, 3, and 4 Water Treatment Plant  
Sharon, MA  
Appendix U - Supplemental Water Quality Data

Description	Units	Influent Water			
		Min	Avg	Max	
Operational Flow Rate	gpm	590.0	889.0	1285.0	
Operational Schedule	hour/day	24.0	24.0	16.0	
Daily Volume (average)	Gallons	849600	1280160	1280277	
Sulfate	mg/L	12.7	14.2	16.9	
Nitrate (as NO <sub>3</sub> )	mg/L as NO <sub>3</sub>	3.8	4.4	7.0	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	45.5	65.4	93.0	
Chloride	mg/L	78.3	114.8	204.0	
Fluoride	mg/L	0.10	0.40	0.69	
Perchlorate	ppb	0.14	0.24	0.36	
Calcium (as Ca)	mg/L	18.8	26.9	38.6	
Magnesium (as CaCO <sub>3</sub> )	mg/L	7.2	10.65	14.0	
Sodium	mg/L	25.1	57.0	110.0	
Potassium	mg/L	1.3	19.9	40.1	
Iron	mg/L	0.01	0.09	0.12	
Manganese	mg/L	0.001	0.019	0.032	
pH		6.9	7.6	8.2	
TDS	mg/L	295.0	342.3	338.4	
Total Organic Carbon	TOC	mg/L	1.3	1.6	1.9
Perfluoroheptanoic acid	PFHpA	ng/L (ppt)	2.5	3.0	3.7
Perfluorooctanoic acid	PFOA	ng/L (ppt)	6.9	9.1	12.9
Perfluorononanoic acid	PFNA	ng/L (ppt)		2.0	
Perfluorododecanoic acid	PFDoDA	ng/L (ppt)		2.0	
Perfluorohexanesulfonic acid	PFHxS	ng/L (ppt)	18.1	23.6	31.8
Perfluorooctanesulfonic acid	PFOS	ng/L (ppt)	15.7	21.3	33.0
PFAS6		ng/L (ppt)	43.2	59.0	81.4
Volatile Organic Compounds	VOC	ppb	See Below for List of Detected VOCs		

**List of Detected VOCs:**

Well 4 - Acetone - 16.9 ug/L 8/17/2021

Well 4 - 124-48-1 Chlorodibromomethane - 3.2 ug/L 7/23/2020

Well 2 & 3 - 124-48-1 Chlorodibromomethane - 2.8 ug/L 7/23/2020



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