RM

VOLUME 2 OF 2

COMMONWEALTH OF MASSACHUSETTS

massDOT
Massachusetts Department of Transportation
Highway Division

CONTRACT DOCUMENTS AND SPECIAL PROVISIONS

PROPOSAL NO.	608163-128112
P.V. =	$12,204,000.00
PLANS	YES

FOR

Federal Aid Project No. STP/HSI-0032(043)X
Reconstruction & Improvements on Monson Road,
from the Monson T.L. to Reed Hill Road (1.5 Miles)

in the Town of

WALES

In accordance with the STANDARD SPECIFICATIONS
for HIGHWAYS and BRIDGES dated 2024

This Proposal to be opened and read: **WEDNESDAY, NOVEMBER 13, 2024 at 2:00 P.M.**

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00840

MASSACHUSETTS
Department of Environmental Protection

Water Quality Certificate Application

THIS PAGE IS INTENTIONALLY LEFT BLANK

401 WQC Major Project Certification (BRP WW 10)

MassDOT Project 608163:

Monson Road Transportation Improvement Project

Town of Wales, MA

June 2024

Weston & Sampson

Weston & Sampson Engineers, Inc.
273 Dividend Road
Rocky Hill, Connecticut 06067

www.westonandsampson.com
Tel: 560-513-1473 Fax: 860-513-1483

TABLE OF CONTENTS

Permit Transmittal Cover Letter

MassDEP BRP WW 10 – MAJOR PROJECT

CERTIFICATION

APPENDIX A: PROJECT NARRATIVE

APPENDIX B: ALTERNATIVES ANALYSIS

APPENDIX C: SITE MAPS

APPENDIX D: SITE PHOTOGRAPHS

APPENDIX E: PUBLIC NOTICE

APPENDIX F: APPLICABLE TECHNICAL SPECIFICATIONS

APPENDIX G: MAXIMUM EXTENT PRACTICABLE (MEP) MEMO

APPENDIX H: STORMWATER REPORT

APPENDIX I: WETLAND DELINEATION REPORT

APPENDIX J: PROJECT PLANS

Weston & Sampson

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

June 26, 2024

Ms. Heidi Davis
Massachusetts Department of Environmental Protection
Division of Wetlands and Waterways
100 Cambridge Street, Suite 900
Boston, MA 02114

RE: 401 Water Quality Certification Application
MassDOT Project 608163: Monson Road Transportation Improvement Project
Wales, Massachusetts

Dear Ms. Davis:

On behalf of the Town of Wales, Weston & Sampson Engineers, Inc. is hereby submitting a Water Quality Major Project Certification Application (BRP WW 10), under the regulations (314 CMR 9.00) promulgated under the Massachusetts Clean Waters Act, M.G.L. Chapter 21, Section 26 through and including 53.

This Project consists of full depth pavement reconstruction within an approximately 1.5-mile stretch of Monson Road in Wales, Massachusetts. The Project includes the construction of new four-foot-wide shoulders all along the roadway for pedestrian and bicycle use with minor adjustments to the alignment to improve safety, including a realigned intersection with Reed Hill Road. The project additionally will involve upgrades to several of the existing stream crossings along this stretch of Monson Road, as many of the culverts are undersized and do not currently meet the Massachusetts Stream Crossing Standards.

A Notice of Intent (NOI) is being filed with the Wales Conservation Commission for proposed impacts to Bordering Vegetated Wetlands (BVW) and the 200-foot Riverfront Area (RFA) associated with the roadway reconstruction work. It is important to note that the stream crossing work (culvert upgrades and replacements) that is proposed as part of the overall project is subject to Section 24 of the 2014 Transportation Bond Bill (approved 4/18/2014) and is therefore considered "bridge exempt." Accordingly, the proposed stream crossing work is not subject to Section 61 and Sections 62A to 62I, inclusive, of Chapter 30 of General Laws, Chapter 91 (Waterways Act) of the General Laws and Section 40 of Chapter 131 of the General Laws (Wetlands Protection Act). The culvert work is also exempt from the Massachusetts Environmental Policy Act (MEPA) under the bridge exemption.

Because the stream crossing work is not subject to review under the Wetlands Protection Act (WPA), this work requires permitting under the Water Quality Certification Regulations. The stream crossing activities will result in unavoidable impacts to BVW and Land Under Water (LUW) and require a 401 WQC application pursuant to 314 CMR 9.04(4). Specifically, the stream crossing improvements will result in approximately 4,454 square feet (SF) of permanent alteration to LUW, 194 SF of temporary impacts to LUW, 653 SF of permanent impacts to BVW, and 199 SF of temporary impacts to BVW. A Major Project Certification (BRP WW 10) is required due to the proposed impacts to Waters of the U.S. within the Commonwealth (BVW and LUW) that will exceed 5,000 square feet.

A pre-filing meeting was held on February 28, 2024 with Ryan Hale of MassDEP and members of the project team to discuss the project.

Based on this information, Weston and Sampson is requesting that this Water Quality Major Project Certification Application (BRP WW 10) be reviewed to determine if it meets all requirements under the Massachusetts Clean Waters Act.

As part of the filing, we have attached the following:

Appendix A: Project Description
Appendix B: Alternatives Analysis
Appendix C: Site Maps
Appendix D: Site Photos
Appendix E: Public Notice
Appendix F: Project Specifications
Appendix G: Maximum Extent Practicable (MEP) Analysis, prepared by SLR Consulting
Appendix H: Stormwater Report
Appendix I: Wetland Delineation Report
Appendix J: Project Plans

The applicant for this proposed project is:

Town of Wales – John Grasso
3 Hollow Road
Wales, MA 01081
select@townofwales.net; 413-245-7571

The authorized agent for this proposed project is:

Weston & Sampson Engineers – Mike Joyce
273 Dividend Road
Rocky Hill, CT 06067
joyce.michael@wseinc.com; 860-616-6495

The project proponent hereby requests that the certifying authority review and take action on this CWA 401 certification request within the applicable reasonable period of time.

The project proponent hereby certifies that all information contained herein is true, accurate, and complete to the best of my knowledge and belief.

If you have any questions regarding this submittal, please contact me.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Michael Joyce
Senior Team Leader - Transportation

cc: Wales Conservation Commission
Ryan Hale, MassDEP
Tyler Lewis, MassDEP
Courtney Walker, MassDOT
Melissa Lenker, MassDOT
Kimberly Sloan, MassDOT

MassDEP BRP WW 10 – Major Project Certification

(to be submitted electronically)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands and Waterways

BRP WW 10 Major Project Certification
BRP WW 11 Minor Project Certification

401 water Quality Certification for Fill and excavation Projects in waters and Wetlands

X290071
Transmittal Number #

A. Applicant 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. Which permit category are you applying for?

☒ BRP WW 10 ☐ BRP WW 11

2. Applicant/Owner:

John Grasso, Town of Wales
Name

3 Hollow Road
Address

Wales	MA	01081
City/Town	State	Zip Code

John Grasso
Contact Person

	413-245-7571 x 100
Telephone (home)	(work)

3. Authorized Agent

Weston & Sampson Engineers, Inc.
Name

273 Dividend Road
Address

Rocky Hill	CT	06067
City/Town	State	Zip Code

Mike Joyce
Contact Person

	860-616-6495
Telephone (home)	(work)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands and Waterways

BRP WW 10 Major Project Certification
BRP WW 11 Minor Project Certification

401 water Quality Certification for Fill and excavation Projects in waters and Wetlands

X290071
Transmittal Number #

B. Project Information

1. Project Location:

Monson Road
Address

Wales	MA	860-616-6495
City/Town	State	Zip Code

Vinica Brook
Nearest or Adjacent Waterbody

2. Project Name (if any):

Monson Road Transportation Improvement Project

3. a. Describe project purpose:

The purpose of the project is to make roadway, shoulder, and drainage improvements to a 1.5-mile stretch of Monson Road in Wales. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms. Additionally, Monson Road in this area is experiencing deteriorating roadway conditions. See Appendix A for additional information.

b. Is the project

☐ water-dependent ☒ non water-dependent

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands and Waterways

BRP WW 10 Major Project Certification
BRP WW 11 Minor Project Certification

401 water Quality Certification for Fill and excavation Projects in waters and Wetlands

X290071
Transmittal Number #

B. Project Information (cont.)

4. a. provide a brief description of the proposed project (See Application Instructions and include a copy of the Notice of intent, if any.):

Six of the existing stream crossings (seven pipes/culverts) are proposed for replacement due to being undersized. See Appendix A - Project Description for additional details.

b. Notice of Intent File number (if any): NOI being filed concurrently

5. Identify the loss in square feet of each type of resource area (see Application Instructions for additional information.):

a. Bordering vegetated wetland: 653 SF (permanent), 199 SF (temporary) square feet

b. Isolated vegetated wetland: 0 square feet

c. Land under water: 4,454 SF (permanent), 194 SF (temporary) square feet

d. Total cumulative loss of a. + b. + c.: 5,107 SF (permanent), 393 SF (temporary) square feet

e. Salt marsh: 0 square feet

6. a. Will the proposed project occur in any wetlands or waters designated as “Outstanding Resource Waters”?

☐ Yes ☒ No

If yes has public notice been published in the Environmental Monitor?

☒ Yes ☐ No TBD Date of Publication

b. Is this project a subdivision or any part of a subdivision? ☐ Yes ☒ No

c. Is the project categorically subject to MEPA? ☐ Yes ☒ No

If yes, has final action been taken? ☐ Yes ☒ No

If yes, please include copy of MEPA certificate.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands and Waterways

BRP WW 10 Major Project Certification
BRP WW 11 Minor Project Certification

401 water Quality Certification for Fill and excavation Projects in waters and Wetlands

X290071
Transmittal Number #

B. Project information (cont.)

7. Alternatives Analysis:

   As related to the project purpose, attach a detailed description of alternatives to the proposed project that were considered and why none are available that avoid adverse impacts to wetlands and waters.

   If no alternatives are available, describe how the activity will minimize or mitigate the adverse impacts to wetlands and waters.

   See application instructions for information required. Attach required documentation.

C. Additional Information

1. Is any of your proposed work exempt from the Massachusetts Wetlands Protection Act or taking place in a federal non-state wetland?

   ☒ Yes ☐ No

   If yes, see Application Instructions for additional information needed.

2. Public notice to a newspaper of general circulation within the area of the proposed activity must be published within 10 days of the date of this application. Is proof of public notice submitted?

   ☒ Yes ☐ No

   (See Application Instructions for additional information)

D. Certification

Application is hereby made for water quality certification.

"I certify that I am familiar with the work proposed and that to the best of my knowledge and belief the information contained in this application is true, complete, and accurate"

John A. Grasso Jr.
Applicant's Signature

John A. Grasso Jr.
Print name

Agent's Signature

Michael J. Joyce, P.E.
Print Name

06.26.24
Date

Appendix A

Project Narrative

401 Water Quality Certificate Application
Project Narrative

Introduction

On behalf of the Town of Wales, Weston and Sampson is submitting this application for coverage under the Massachusetts Department of Environmental Protection (MassDEP) Section 401 Water Quality Certification (WQC) for the Monson Road Transportation Improvement Project (the project). This application is being filed pursuant to Section 401 of the federal Clean Water Act (33 U.S.C. 1341), Massachusetts General Laws c. 21, §§ 26-53, and the Massachusetts Department of Environmental Protection's (DEP) Water Quality Certification Regulations at 314 CMR 9.00 (Water Quality Certification Regulations).

The purpose of the project is to make roadway, shoulder, and drainage improvements to an approximately 1.5-mile stretch of Monson Road in Wales. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The project proposes several roadway improvements including full depth pavement reconstruction, new four-foot-wide shoulders along Monson Road for pedestrian and bicycle use, minor adjustments to the alignment to improve safety, and roadway drainage improvements. The project additionally will involve upgrades to several of the existing stream crossings along this stretch of Monson Road, as many of the culverts are undersized and do not currently meet the Massachusetts Stream Crossing Standards.

A Notice of Intent (NOI) is being filed with the Wales Conservation Commission for proposed impacts to Bordering Vegetated Wetlands (BVW) and the 200-foot Riverfront Area (RFA) associated with the roadway reconstruction work. It is important to note that the stream crossing work (culvert upgrades and replacements) that is proposed as part of the overall project is subject to Section 24 of the 2014 Transportation Bond Bill (approved 4/18/2014) and is therefore considered "bridge exempt." Accordingly, the proposed stream crossing work is not subject to Section 61 and Sections 62A to 62I, inclusive, of Chapter 30 of General Laws (the Massachusetts Environmental Policy Act), Chapter 91 (Waterways Act) of the General Laws and Section 40 of Chapter 131 of the General Laws (Wetlands Protection Act).

Because the stream crossing work is not subject to review under the Wetlands Protection Act (WPA), this work requires permitting under the Water Quality Certification Regulations. The stream crossing activities will result in unavoidable impacts to BVW and Land Under Water (LUW) and require a 401 WQC application pursuant to 314 CMR 9.04(4). Specifically, the stream crossing improvements will result in approximately 4,454 square feet (SF) of permanent alteration to LUW, 194 SF of temporary impacts to LUW, 653 SF of permanent impacts to BVW, and 199 SF of temporary impacts to BVW. A Major Project

Certification (BRP WW 10) is required due to the proposed impacts to Waters of the U.S. within the Commonwealth (BVW and LUW) that will exceed 5,000 square feet.

Additionally, approximately 90 cubic yards of dredge impacts are proposed within LUW to facilitate the culvert replacement work. Because the project will not result in greater than 100 cubic yards of dredging within Waters of the U.S., a 401 WQC Dredge Permit is not required.

The project is anticipated to be advertised for construction in August or September of 2024 with the start of construction in Mid-March of 2025. Construction of the project is anticipated to be complete by Fall of 2026.

Additional anticipated permits and regulatory reviews include:

- Massachusetts Environmental Policy Act (MEPA) Environmental Notification Form (ENF) (roadway work)
- Notice of Intent (MA Wetlands Protection Act) – Wales Conservation Commission (roadway work only)
- Massachusetts Endangered Species Act (MESA) Review – concurrent with NOI filing
- Section 404 Pre-Construction Notification (PCN) (roadway and culvert work)

Impacts to wetlands and waterways have been avoided and minimized to the maximum extent practicable; however, due to the nature of the project and the need to improve existing stream crossings and alleviate flooding conditions, certain impacts were unavoidable. Proposed impacts to LUW and BVW associated with the stream crossing work are detailed in the narrative below and on the plans provided in Appendix J. The project proposes to mitigate for the proposed impacts to BVW through the construction of a wetland replication area adjacent to the project site, as described in more detail below.

Existing Conditions

Monson Road is a two-lane, Rural Major Collector. The Project is approximately 1.5 miles long and is located in the western part of Wales, beginning at the Monson Town line and continuing east just beyond the intersection of Monson Road and Reed Hill Road. The land use within the project route includes paved roadway and associated gravel shoulders, adjacent residential properties, wetlands and undeveloped woodlands. Refer to the locus maps provided in Appendix C for a depiction of the project site.

There are a number of wetland resource areas and stream crossings located adjacent to Monson Road within the project limits, including vegetated wetlands, intermittent streams, and perennial streams. A wetland delineation was conducted by Weston & Sampson in October 2023 and March 2024. A wetland delineation report including mapping depicting the limits of the delineated resource areas, along with wetland determination data forms, is included in Appendix I.

Currently the existing site has an open "country" drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The existing outfalls are in relatively stable condition; however, adjacent to the outfalls in several areas the existing banks experience significant erosion which is contributing to poor water quality within the immediately adjacent resource areas.

Nine culvert crossings convey streams (unnamed except for the crossing at Sta. 50+72 which is locally known as Dunham Brook or Schoolhouse Brook) under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta. 15+32, Sta. 24+92, Sta. 43+75, Sta. 46+60, Sta. 50+72, Sta. 55+00, Sta. 82+07, and Sta. 86+00-87+00 (two culverts at this location, one under Monson Road and one under Reed Hill Road). These streams eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road.

The site is not located within the mapped 100-year floodplain, according to the current FEMA FIRM maps (refer to Figures 3.1 through 3.4 in Appendix C).

There is a discrete area of Priority and Estimated Habitat for Rare Species mapped by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) between Peck Road and Maynard Road (see Figure 4 in Appendix C). The applicant is coordinating with NHESP under the streamlined Massachusetts Endangered Species Act (MESA) review through the NOI filing for the roadway work.

Three of the stream crossings, which are perennial watercourses, within the project corridor are designated as coldwater fisheries resources by the Massachusetts Division of Fisheries and Wildlife (MADFW) (refer to Figure 4 in Appendix C). None of the streams are mapped as Outstanding Resource Waters. The project site is not located within an Area of Critical Environmental Concern (ACEC).

The proposed work area is not within 0.25 miles up or downstream of the designated main stem of, or in tributaries within 0.25 miles of the designated main stem of a National Wild and Scenic River; in "bordering and contiguous wetlands" that are adjacent to the designated main stem of a National Wild and Scenic River; and does not have the potential to alter flows within a river within the National Wild and Scenic River System including rivers officially designated by Congress as study rivers for possible inclusion while such rivers are in official study status.

The proposed work area is not within any federal lands including National Wildlife Refuges, National Forests, National Marine Sanctuaries, National Parks, or any other areas administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service, and USACE project lands and easements.

Stream Crossings:

Existing conditions information on each stream crossing is provided in Table 1 below. Six of these stream crossings (seven pipes/culverts) are proposed to be replaced due to structural deficiencies and being undersized, as discussed more in the Proposed Conditions section of this narrative.

Table 1. Summary of Existing Stream Crossings

Location (Station)	Existing Culvert	Stream Classification	Existing Bankfull Width
15+32	40 feet of 12-inch corrugated plastic pipe (CPP)	Intermittent	No bankfull indicators. Wetted width 1-2 feet.
24+92	54 feet of 30-inch PVC 49 feet of 36-inch corrugated metal pipe (CMP)	Perennial	11.5 feet
43+75	49 feet of 12-inch CMP	Perennial	No bankfull indicators. Wetted width 1-2 feet.
46+60	41 feet of 12-inch CPP	Perennial	No bankfull indicators Wetted width 1-2 feet
50+72	61 feet of 36-inch PVC lined CMP	Perennial	15.0 feet
55+00	48 feet of 12-inch CMP	Intermittent	No bankfull indicators. Wetted width 2-3 feet upstream and 5-6 feet downstream.
82+07	43 feet of 12-inch CMP	Intermittent	No bankfull indicators. Wetted width 1-2 feet.
86+00-87+00	54 feet of 24-inch stone box culvert 108 feet of 24-inch stone box culvert	Intermittent	10.5 feet

The following sections describe the existing conditions at each stream crossing in more detail.

Station 15+32

The westernmost stream crossing located at Station 15+32 is a small drainage swale/intermittent stream that originates northeast of Lynch Road and flows west beneath Lynch Road, and along the north side of Monson Road before crossing south under Monson Road via the culvert. The existing culvert consists of a 12" corrugated plastic pipe

(CPP). Bankfull indicators did not exist in the channel at the time of field evaluation. The stream was delineated and is depicted on the plans as bank flag series TOB C, TOB D, TOB BB, and TOB CC.

Station 24+92

The stream crossing at Station 24+92 conveys an unnamed, perennial tributary to Vinica Brook south under Monson Road. The existing crossing consists of a 30" PVC culvert which conveys the unnamed perennial stream and an adjacent 36" CMP relief culvert for storm water whose invert is located 1 ft higher than the perennial stream culvert. The existing relief culvert is regularly dry with no flow present except for during storm events. The stream was delineated and is depicted on the plans as bank flag series TOB E and TOB F. Bankfull width was measured and determined to be approximately 11.5 feet. The stream is mapped by the Massachusetts Division of Fisheries and Wildlife (MADFW) as a coldwater fisheries resource.

Stations 43+75 and 46+60

The stream crossing located at Station 43+75 consists of an existing 12" CMP culvert which conveys an unnamed perennial stream. This existing culvert is collapsed and due to roadway flooding, the stream has diverted its flow path along the north side of Monson Road towards a secondary existing culvert which is a 12" CPP (Station 46+60). Bankfull indicators did not exist in the channel at the time of field evaluation. This stream was delineated and is depicted on the plans as bank flag series TOB I and TOB J. A portion of this stream is located within areas of Priority and Estimated Habitats for Rare Species mapped by the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

Station 50+72

The stream crossing located at Station 50+72 consists of an existing 36" PVC lined CMP culvert which conveys an unnamed, perennial tributary to Vinica Brook. Bankfull width was measured to be approximately 15.0 feet. The stream was delineated and is depicted on the plans as bank flag series TOB K and TOB L. The stream is mapped by the MADFW as a coldwater fisheries resource. This culvert is not proposed to be replaced as part of this project.

Station 55+00

The intermittent stream crossing is located just west of Maynard Road. The stream originates in a wetland south of Monson Road and flows north under Monson Road via a 12-inch CMP culvert. The stream was delineated and is depicted on the plans as bank flag series TOB M / TOB N and TOB AA / TOB BB. Bankfull indicators do not exist at this location. The typical wetted width of the channel is approximately 2 to 3 feet upstream and 5 to 6 feet downstream. Stream substrate consisted of mucky material. This stream crossing is not proposed to be replaced.

Station 82+07

The stream crossing at Station 82+07 conveys an unnamed intermittent stream south under Monson Road via a 12-inch CMP. The stream originates from a small

farm/residential pond on the north side of Monson Road. The existing culvert is deteriorated and undersized. Bankfull indicators do not exist at this location. Based on observations by SLR Consulting on March 19, 2024 under normal spring flow, the typical wetted width of the channel is 1 to 2 feet, and the depth of the channel is 4 to 6 inches. The stream was delineated and is depicted on the plans as bank flag series TOB CC and TOB DD.

Station 86+00 - 87+00
An unnamed intermittent tributary to Vinica Brook flows south under Monson Road into a small depression at the intersection of Reed Hill Road and then flows under Reed Hill Road. This easternmost stream crossing located at Stations 86+00 through 87+00 consists of two disconnected sections of culvert which convey an unnamed intermittent tributary to Vinica Brook. The upstream culvert is a 24" concrete culvert which travels beneath Monson Road and daylights briefly before entering a second 24" concrete culvert that travels beneath Reed Hill Road. This stream was delineated and is depicted on the plans as flag series TOB KK and TOB LL (on the north side of Monson Road) and flag series TOB EE and TOB FF (on the south side of Monson Road). Bankfull width was measured and is approximately 10.5 feet at this crossing. This stream is mapped by the MADFW as a coldwater fisheries resource.

It is important to note that a small, roadside drainage ditch was also GPS-located on the north side of Monson Road, adjacent to intermittent stream TOB Series KK and TOB Series LL. The ditch is depicted as Series "WET N" on the plans, but was determined to be a non-jurisdictional upgradient intermittent stream channel. The channel receives roadway runoff from Monson Road, which discharges into intermittent stream Series KK/LL. The roadside drainage ditch did not contain wetland vegetation, nor did it contain hydric soils when examined during the delineation. The channel was also dry at the time of the delineation and did not contain any standing water.

The existing stream crossings are also described further in the Maximum Extent Practicable (MEP) Analysis in Appendix G.

Proposed Conditions

Roadway Improvements:

The project consists of full depth reconstruction of Monson Road within the project limits and widening of the road from 22 feet to 28 feet (10-foot wide lanes and 4-foot wide shoulders). The 4-foot wide shoulders will allow for safer bicycle and pedestrian use. The project includes sections of bituminous curb and new guardrail with up-to-date terminals for increased safety, proper signage, and new pavement markings. In order to complete the proposed roadway improvements, some tree clearing will be required adjacent to the existing roadway. Limited tree and vegetation removal is proposed within the BVW areas, which is being mitigated to the maximum extent practicable with the proposed BVW replication areas, as shown on the plans.

Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. The intersection with Reed Hill Road will be realigned to improve sight lines. Superelevation is also proposed along horizontal curves. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. In total, 57 new catch basins are proposed where no catch basins and closed drainage systems currently exist within the project limits.

Stream Crossings:

Six of the existing crossing (seven pipes/culverts) are proposed for replacement due to structural deficiencies and being undersized. In accordance with the Massachusetts Transportation Bond Bill of 2014, the proposed stream crossing work is exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00). Therefore, while the roadway reconstruction and widening work will be permitted under a Notice of Intent application with the Wales Conservation Commission, the stream crossing work, which is subject to the bridge exemption, is the subject of this 401 Water Quality Certificate application.

A maximum extent practicable alternatives analysis and stream geomorphic assessment were conducted to assess the conditions at each stream crossing and develop proposed solutions for crossing replacements that would improve drainage and meet the Massachusetts Stream Crossing Standards to the maximum extent practicable. The MEP analysis is included in Appendix G.

Six of the existing stream crossings (seven pipes/culverts) are proposed for replacement due to being undersized. The proposed culvert replacements are summarized in Table 2 below. The selection of each stream crossing replacement is also discussed in more detail in the Culvert Alternatives Analysis included in Appendix B.

Table 2. Summary of Proposed Culvert Replacements

Location (Station)	Existing Culvert	Proposed Culvert
15+32	40 feet of 12-inch CPP	44 feet of 18-inch RCP
24+92	54 feet of 30-inch PVC 49 feet of 36-inch CMP	31.5 feet of 9-ft 10-inch (W) x 5-ft (H) Concrete Box Culvert embedded two-ft below stream with wingwalls, parapets and natural streambed material restoration
43+75	49 feet of 12-inch CMP	41 feet of twin 12-inch RCPs
46+60	41 feet of 12-inch CPP	44 feet of 12-inch RCP
82+07	43 feet of 12-inch CMP	43 feet of 18-inch RCP Concrete headwalls and endwalls

86+45	54 feet of 24-inch stone box culvert 108 feet of 24-inch stone box culvert	46.8 feet of 8-ft (W) x 4.5-ft (H) Concrete Box Culvert embedded two-ft below stream with wingwalls, parapets and natural streambed material restoration

The following sections describe the proposed work at each stream crossing location. Please refer to the Project Plans provided in Appendix J for additional detail.

Station 15+32

Impacts to the intermittent stream at this station will be for the installation of a new culvert and modified rock fill apron to replace the existing 12" CPP. The proposed crossing will consist of an 18" RCP culvert. This work will result in approximately 646 SF of permanent impacts to LUW.

Station 24+92

The proposed work at this stream crossing includes the installation of a 9-foot 10-inch wide 5-foot high box culvert which will replace both existing culverts. Both the upstream and downstream headwalls will be removed and replaced with wingwalls. This work will result in approximately 613 SF of permanent impacts to LUW, 10 SF of temporary impacts to LUW, 41 SF of permanent BVW impacts, and 9 SF of temporary BVW impacts. Natural streambed material will be placed to restore the impacted watercourse within the construction limits and the culvert will be submerged 2-feet to allow for the installation of stream bed material.

Station 43+75 and Station 46+60

The intention at this split stream crossing is to restore perennial stream flow to the natural channel location at Station 43+75, which was diverted to Station 46+60 due to pipe failure, and allow for a secondary intermittent stream to remain on the north side of Monson Road to handle excess stormwater. Station 43+70 is being replaced with two 12" class five RCPs given the shallow elevations of the watercourse and related roadway profile. At 46+60, the existing pipe is being replaced with one 12" class five RCP. Modified rock fill aprons will provide permanent outlet protection and reduce sediment that is discharged into the streams at both locations.

Collectively, this work to restore the perennial stream back to its pre-existing configuration will result in 1,581 square feet of permanent impact to Land Under Water, 89 square feet of temporary impacts to LUW (related to sediment control measures), and 289 square feet of permanent impacts to BVW. While the impact to LUW is fairly high, this diverted perennial watercourse along the northern side of the road didn't exist prior to the failure of the crossing at 43+75. The resulting condition will increase the amount of Land Under Water associated with the intermittent stream by approximately 391 square feet.

Station 82+07

The proposed project will replace the culvert with an 18" RCP with modified rock fill at the outlet and new headwalls at both the inlet and outlet. This work will result in approximately 97 SF of permanent alterations to LUW, 34 SF of temporary alterations to LUW (from the dewatering activities), 75 SF of permanent alterations to BVW, and 80 SF of temporary impacts to BVW (from the sediment control installation).

Station 86+45

The proposed work at this crossing includes consolidating the two existing culverts between Stations 86+00 and 87+00 into a single box culvert at Station 86+45. Specifically, proposed work to this crossing includes relocating the intersection of Reed Hill Road such that only a single culvert will be needed to convey the intermittent stream. The proposed single culvert will be an 8-foot wide x 5-foot high, 47 foot long concrete box. There is currently no headwall on the upstream side, a proposed wingwall will be added. A headwall will also be incorporated into the downstream extent of the culvert as part of the Reed Hill Road relocation. This work will result in approximately 1,517 SF of permanent impacts to LUW, 248 SF of permanent impacts to BVW, and 110 SF of temporary impacts to BVW.

Construction Access and Sequencing:

During construction, Monson Road will remain open to traffic at all times since there is no convenient detour route available for traffic. The majority of the roadway and drainage work can be constructed while maintaining two-way traffic. However, at the two larger box culvert crossings, staged construction and alternating one-way traffic through the use of temporary traffic signalization will be required. Detailed staged construction and temporary control of water plans have been provided with the permit documents.

Dewatering is not anticipated as part of the roadway work, but will be required for the stream crossing activities/culvert replacements. To facilitate the culvert replacement work, flow will be diverted through cofferdams and a temporary pipe downstream, and cofferdams and pumping will be used to dewater the excavation areas. All dewatering and related earthwork shall be conducted in such a manner as to prevent siltation or contamination of the waterway. The pumping discharge shall not be allowed to enter directly into the waterway. The water from the work areas shall be pumped to a settling tank before discharging into the bypass pipe. The tank shall be constructed so as to allow for the pumped water to pass through the tank with sediments settling out before outletting to an area enclosed by hay bales. Please refer to the Water Control plan sheets in the Project Plans in Appendix J (Plan Sheets 178 and 179) for additional detail regarding dewatering.

The means and methods of construction for this project will involve the use of various heavy equipment to ensure efficient and effective execution of the roadway improvements. Key equipment that will be utilized includes excavators for full-depth road reconstruction and the culvert replacements, bulldozers for grading and earthmoving activities, and

graders to achieve precise grading for the roadway base and shoulder construction. Paving machines will be used for the application of new bituminous pavement, and rollers will compact the new pavement and subgrade materials.

Backhoes will be employed for trenching and drainage system installation, while dump trucks will transport materials such as gravel, asphalt, and excavation debris. Chainsaws and wood chippers will be used for tree and vegetation removal, and concrete mixers will be used for constructing the bituminous curb and other concrete elements. A crane or large excavator will be used for installing new guardrails and other heavy precast components, and hydroseeding equipment will be used for applying grass linings in drainage swales. Construction activities will be staged to minimize disruption to traffic and ensure safety. Traffic control measures will be implemented as necessary, including temporary signage, barriers, and flagging operations.

No long-term on-site stockpiling is planned as part of the proposed project. Materials will be brought in and taken from site on a daily basis. Short term stockpiling of materials immediately adjacent to the specific work area will be required at times.

Construction of the project is anticipated to begin in Spring of 2025 and is anticipated to continue through the Fall of 2026.

Proposed Impacts to Waters of the United States

Portions of the project will result in impacts to BVW and LUW. This project proposes a total of 852 SF of impacts to BVW (653 SF permanent and 199 SF temporary) and 4,648 SF of impacts to LUW (4,454 SF permanent and 194 SF temporary) in order to facilitate the culvert replacements and associated headwalls and rip rap aprons. The proposed impacts to Waters of the U.S. are summarized in Table 3 below. Bank impacts associated with the stream crossing improvements at each location are also included in the table as well.

Table 3. Summary of Proposed Impacts associated with the Stream Crossing Work

Location (Station)	Proposed Activity	BVW Impact (SF)	Bank Impact (LF)	LUW Impact (SF)
15+32	Culvert replacement, modified rockfill apron	0 SF	528 LF (permanent)	646 SF (permanent)
24+92	Box culvert installation replacing both existing culverts. Both upstream & downstream headwalls will be removed / replaced with wingwalls	41 SF (permanent), 9 SF (temporary)	58 LF (permanent)	613 SF (permanent), 10 SF (temporary)
43+75 and 46+60	Culvert replacement, modified rockfill apron, temporary cofferdam	289 SF (permanent)	650 LF (permanent)	1,581 SF (permanent), 89 SF

				(temporary)
82+07	Culvert replacement with modified rock fill at the outlet and new inlet/outlet headwalls, temporary cofferdam	75 SF (permanent), 80 SF (temporary)	41 LF (permanent)	97 SF (permanent), 34 SF (temporary)
86+45	Box culvert installation, temporary cofferdam	248 SF (permanent), 110 SF (temporary)	160 LF (permanent)	1,517 SF (permanent), 61 SF (temporary)
CUMULATIVE		**653 SF (permanent), 199 SF (temporary)**	**1,437 LF (permanent)**	**4,454 SF (permanent), 194 SF (temporary)**

Permanent impacts to BVW and LUW will result from excavation and fill needed to remove the existing culverts and install the new, larger culverts, rockfill aprons, and wingwalls.

The proposed temporary impacts to LUW are associated with the temporary cofferdams needed during dewatering operations. The proposed temporary impacts to BVW are associated with sediment control installation along the limits of work during construction.

The proposed culvert crossing at Station 86+45 will result in the creation of new streambed within the new proposed box culvert. The proposed concrete box culvert will have 2 feet of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting new upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. This will result in the addition of approximately 1,500 SF of new/additional streambed/LUW at this crossing.

The culvert replacement work will also result in dredging below LUW at some of the stream crossing locations, which is quantified below in Table 4.

Table 4. Summary of Proposed Dredge Below Land Under Water

Location (Station)	Waterbody Type	Total Impact (SF)	Total Dredge (CY)
15+32	Intermittent	502	1
24+92	Perennial	613	16
82+07	Intermittent	173	3
86+00 – 87+00	Intermittent	1,517	70
CUMULATIVE		2,805 SF	**90 CY**

Mitigation

The proposed project has been designed to minimize impacts to Waters of the U.S. to the maximum extent practicable by utilizing more narrow culvert crossings wherever possible and by reducing the amount of impervious surface being added to the roadway to the extent practicable. The roadway design includes 10-foot travel lanes and 4-foot shoulders. This required a design criteria exception to provide the 4-foot shoulders instead of 5-foot bikes lanes/shoulders or 5-foot buffered bike lanes/shoulders, which most MassDOT projects must provide in accordance with MassDOT's complete streets requirements. This limited the widening of the road to 28 feet wide instead of 30 feet or 34 feet. Additionally, structural best management practices (BMPs) including deep sump catch basins have been incorporated into the stormwater design to reduce roadway erosion while improving stormwater quality.

The overall project (including both the roadway improvements and stream crossing work) will result in the alteration of 891 SF of permanent alteration and 333 SF of temporary alteration to BVW. Of this, 238 SF of permanent alterations to BVW and 134 SF of temporary alterations to BVW will occur as a result of the roadway work, and permitted through the NOI as described above. The remaining proposed 653 SF of permanent BVW alteration and 199 SF of temporary BVW alteration impacts are associated with the stream crossing work and are subject to this application. The proposed permanent impacts to wetlands will be mitigated through the construction of two wetland replication areas, one 217 SF replication area and one 1,204 SF replication area. The mitigation areas have been designed to provide significantly greater than 1:1 mitigation for the proposed permanent vegetated wetland impacts (891 SF permanent BVW impacts proposed; 1,421 SF wetland replacement area proposed).

A planting schedule for the 1,204 SF wetland replication area initially depicted on Sheet 21 is provided on the Wetland Replication Area Detail plan (Sheet 180) in the plans in Appendix K. Proposed plantings include highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and a native wetland seed mix. The smaller 217 SF wetland replication area on Sheet 16 references the same native wetland seed mix indicated on Sheet 180 to be used for this small replication area.

Proposed temporary impacts areas within BVW will be restored in situ after construction from the removal of sediment controls and restoration of these areas to pre-existing grades.

The project also proposes to plant 53 shade trees along the roadway corridor to provide additional mitigation for the roadway widening work. A summary of the proposed species is provided in Table 5 below. Please refer to the project plans in Appendix J for specific planting locations.

Table 5. Summary of Proposed Shade Tree Plantings along the Project Corridor

Scientific Name	Common Name	Caliper	Container	Remarks
Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
Amelanchier x grandiflora	Serviceberry	2-2.5"	B&B	Single-stem
Ulmus americana	American Elm	2-2.5"	B&B	

Additional mitigation proposed seeks to address roadside erosion. The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling has led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway.

Under existing conditions many areas within the limit of work are experiencing significant roadside erosion which is entering adjacent wetland resource areas. The proposed project has been designed for anticipated flows with alterations to the overall grade of the roadway and the addition of closed drainage throughout the corridor. This drainage includes 57 new deep sump catch basins and approximately 3,500 linear feet (LF) of new pipe to support the closed drainage. All discharges adjacent to wetland resources include preformed scour holes to reduce unwanted erosion.

Sediment controls (compost filter tubes or similar) will be installed between the limits of work and adjacent wetlands to protect them during construction. Sediment controls are depicted on the project plans provided in Appendix J.

Stormwater Management

As a redevelopment project, the proposed project has been designed to meet the Massachusetts Stormwater Management Standards to the maximum extent practicable.

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. Approximately 0.88 acres of increase in impervious surface (pavement) is proposed as part of the project. The watershed areas remain consistent with the existing drainage patterns, as only slight modifications to the existing vertical and horizontal alignments are proposed.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. In total, 57 new catch basins are proposed where no catch basins and closed drainage systems currently exist within the project limits.

Seven closed storm sewer systems are proposed along Monson Road. These systems will outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

Of the nine drainage crossings, six of the crossings (seven pipes/culverts) will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained.

Please refer to the Stormwater Management Report in Appendix H for additional information.

Compliance with Massachusetts Stream Crossing Standards

The project has been designed to meet the stream crossing standards to the maximum extent practicable. Compliance with the stream crossing standards is discussed below. Please refer to the MEP Analysis in Appendix G for additional information about the stream crossing design that was selected for each crossing.

1. Type of Crossing – Spans (bridges, 3-sided box culverts, open-bottom culverts or arches) are strongly preferred.

   The two proposed box culverts at Stations 24+92 and 86+45 (consolidating the two existing culverts between Stations 86+00 and 87+00) will be four-sided box culverts for ease of installation, but will have natural streambed material placed along the bottom of the culvert to mimic an open bottom crossing. Thus, this standard is being met to the maximum extent practicable.

   Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs, as described in Table 2 above. Open bottom culverts are not feasible at these locations given site constraints and the intermittent nature of the stream crossings. Additionally, the replacement pipes will not be anticipated to have an effect on wildlife habitat, nor will they create habitat fragmentation since the channels are too small to have instream habitat. Wildlife in this area would be anticipated to cross the road.

2. Embedment – All culverts should be embedded (sunk into stream) a minimum of 2 feet, and round pipe culverts at least 25%. When embedment material includes elements >15 inches in diameter, embedment depths should be at least twice the D_{84} (particle width larger than 84% of particles) of the embedment material.

The two proposed box culverts will have 2-foot embedment.

Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the fact that no bankfull width indicators were observed at these crossings, the crossings have been designed to improve hydraulic capacity. It is not feasible to achieve 25% embedment with pipes of this small size.

3. Crossing Span – Spans channel width (a minimum of 1.2 times the bankfull width of the stream).

This standard is met to the maximum extent practicable.

For the crossings at Stations 24+92 and 86+45, meeting the 1.2 bankfull standard was considered, but was determined to be cost and timeline-prohibitive.

Therefore, a concrete box with a span of 9-ft 10-inches and rise of 5.0 feet with 2 feet embedment (0.85 x bankfull width) is proposed at Station 24+92, which will have many benefits of a 1.2 bankfull structure such as passing sediment, large wood, and the design flood, yet at a reduced cost.

At Station 86+45, a single concrete box with a width of 8 feet (0.8 x bankfull channel width) is proposed. The proposed stream crossing will only cross Monson Road and replace the existing pair of culverts. The proposed alignment will allow for shortening of the crossing by daylighting approximately 100 LF of the channel upstream and approximately 80 LF of the channel downstream. This will reduce the size, costs, and impacts of the proposed structure. This proposed structure will have many benefits of a 1.2 bankfull structure such as transport of sediment and large wood at a reduced cost.

Enlarging the structures at Stations 24+92 and 86+45 to approximately 0.9 times the bankfull channel width achieves many of the benefits of a larger crossing structure. Flood conveyance, sediment transport, and large wood movement will all be improved. Fish passage will be restored, and small mammals will be able to pass through the structures during low flows.

Some of the stream crossings, including those at Stations 15+32, 43+75, 46+60, and 82+07 did not exhibit strong bankfull indicators. For this reason, the proposed replacement crossings at Stations 15+32, 43+75 and 46+60 have been designed to pass the design flow through the structures. At the proposed crossing at Station 82+07, the typical wetted channel width of the channel was observed to be between 12-24 inches and the depth of the channel is 4 to 6 inches based on observations made by SLR Consulting on March 19, 2024 under normal spring flow. To meet the stream crossing standards at this location, the proposed structure was sized based on the required hydraulic capacity to convey the design flood.

4. Openness - Openness ratio (cross-sectional area/crossing length) of at least 0.82 feet (0.25 meters). The crossing should be wide and high relative to its length.

The proposed box culvert at Station 24+92 will exceed the required openness ratio, as the proposed culvert has an openness ratio of 0.93 feet.

The proposed box culvert at Station 86+45 meets this standard to the maximum extent practicable, but ultimately could not achieve the 0.82-foot openness ratio. Several alternative alignments were evaluated for this crossing, given the skewed alignment of the channel and multiple pipe configuration of the existing crossings.

Initially the original watercourse inlet to outlet alignment was evaluated for the new culvert. However, given the skew angle and length of culvert needed to cross the realigned intersection, to meet a maximum span width no longer than 10', the resulting culvert opening width would be approximately 6' and well below the recommended width in the original MEP analysis. The extended length of the culvert would also negatively reduce the openness ratio.

A second alignment analysis pursued a more perpendicular crossing of Monson Road to achieve a culvert span just under 10' in length. While possible, this alternative created several sharp turns in the realigned channel both upstream and downstream of the culvert crossing which were deemed undesirable and inconsistent with the stream crossing standards, and furthermore would have increased wetland impacts and right-of-way impacts to private properties.

The third and preferred alignment for the crossing at Station 86+45 represents a balance of the two previous alternatives which strives to properly and more naturally align the stream and resulting channel trough the culvert, maximize the culvert opening width to 8', and reduce the culvert length as much as possible to maximize the resulting openness ratio. The outcome advances the design of the proposed 8' wide x 4.5' high concrete box culvert with 2' of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. Therefore, the openness ratio at Station 86+45 has been maximized to the extent practicable, based on site conditions.

Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the fact that no bankfull width indicators were observed at these crossings, meet the stream crossing standards at this location, the crossings have been designed to improve hydraulic capacity.

5. Substrate - Natural bottom substrate should be used within the crossing and it should match the upstream and downstream substrates. The substrate and design should resist displacement during floods and maintain an appropriate bottom during normal flows.

   The two proposed box culverts will contain 2 feet of natural streambed material.

   Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the size of the replacement pipes, natural bottom substrate is not proposed. The replacement pipes will not be anticipated to have an effect on habitat, nor will they create habitat fragmentation since the channels are too small to have instream habitat. Wildlife in this area would be anticipated to cross the road.

6. Water Depth and Velocity - Water depths and velocities are comparable to those found in the natural channel at a variety of flows.

   Water depth and velocity at each stream crossing location will be comparable to those found in the natural channels. The culvert crossings have been designed to match the existing gradient of the watercourses between upstream and downstream.

Compliance with Criteria for Evaluation for Discharge of Dredged or Fill Material

Under 314 CMR 9.06(1) through (8), the proposed activities conform to the 401 WQC criteria as follows.

314 CMR 9.06(1) (in part) - No discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences …

The proposed project has minimized and mitigated impacts to wetland resource areas to the maximum extent practicable, while meeting the project goal of upgrading the existing stream crossings to alleviate flooding and drainage issues along this section of Monson Road. The project has minimized impacts by proposing more narrow culvert crossings wherever possible, and by proposing a 28-foot wide roadway which meets the design standards with the smallest increase in impervious area. Please refer to the Alternatives Analysis provided in Appendix B for additional detail.

314 CMR 9.06(2) - No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will avoid and minimize potential adverse impacts to the bordering or isolated vegetated wetlands, land under the water or ocean, or the intertidal zone. For discharges to bordering or isolated vegetated wetlands, such steps shall include a minimum of 1:1 restoration or replication. The Department may waive the requirement for 1:1 restoration or replication for projects which will restore or

otherwise improve the natural capacity of any wetland or other water of the Commonwealth pursuant to 314 CMR 9.06(8). However, no such project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species as specified in 310 CMR 10.00.

The project proposes to construct two wetland replication areas, one 217 SF replication area and one 1,204 SF wetland replication area, which will significantly exceed the 1:1 replication requirement for the proposed permanent BVW alterations.

Additionally, the project will result in stream channel restoration and creation of new LUW at Station 86+45, as the proposed concrete box culvert will have 2 feet of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. This will result in the addition of approximately 1,500 SF of additional streambed/LUW at this crossing.

A portion of the roadway work falls within NHESP-mapped Priority and Estimated Habitat for rare species. The applicant is coordinating this work through the Natural Heritage & Endangered Species Program through the Massachusetts Endangered Species Act (MESA) to ensure that the project will not adversely affect rare species or their habitat.

314 CMR 9.06(3)(a) through (k) (in part) - No discharge of dredged or fill material shall be permitted to Outstanding Resource Waters, except for the activities specified in 314 CMR 9.06(3)(a) through (k), which remain subject to an alternatives analysis and other requirements of 314 CMR 9.06 and/or 314 CMR 9.07 …

Not applicable. The project does not propose discharge of dredged or fill material within ORW.

314 CMR 9.06(4) - Discharge of dredged or fill material to an Outstanding Resource Water specifically identified in 314 CMR 4.06(1)(d) (e.g., vernal pools, within 400 feet of a water supply reservoir and any other areas so designated) is prohibited as provided therein unless a variance is obtained under 314 CMR 9.08.

Not applicable. The project does not propose discharge of dredged or fill material within ORW.

314 CMR 9.06(5) - No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater for purposes of controlling sedimentation or other pollutant attenuation. Discharge of dredged or fill material may be permitted to manage stormwater for flood control purposes only where there is no practicable alternative and provided that best management practices are implemented to prevent sedimentation or other pollution. No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater in Outstanding Resource Waters for any purpose.

The project does not propose the discharge of dredged or fill material for the impoundment or detention of stormwater. The project proposes several culvert upgrades/replacements which will minimize and mitigate impacts to Waters of the U.S. to the maximum extent practicable.

314 CMR 9.06(6)(a) through (f) (in part) - Except as otherwise provided in 314 CMR 9.06(6), stormwater discharges shall be provided with stormwater best management practices to attenuate pollutants and to provide a setback from the receiving water or wetland in accordance with the following Stormwater Management Standards as further defined and specified in the Massachusetts Stormwater Handbook …

Stormwater discharges will be managed in accordance with MassDEP's Stormwater Standards. Refer to the Stormwater Report included in Appendix H for additional information. As a redevelopment project, the project will meet the Stormwater Standards to the maximum extent practicable.

314 CMR 9.06(7) - No discharge of dredged or fill material shall be permitted in the rare circumstances where the activity meets the criteria for evaluation but will result in substantial adverse impacts to the physical, chemical, or biological integrity of surface Waters of the Commonwealth.

The project will not result in substantial adverse impacts on the physical, chemical, or biological integrity of surface Waters of the Commonwealth.

314 CMR 9.06(8) - Notwithstanding the provisions of 314 CMR 9.06(1) through (7), the Department may allow a project which will restore or otherwise improve the natural capacity of any wetland or other water of the Commonwealth. Such projects include, but are not limited to, dam removal, salt marsh restoration, stream restoration, nutrient management, control or removal of aquatic nuisance vegetation, or vegetation management to improve wildlife habitat.

Not applicable.

Conclusion

Weston and Sampson is submitting this Water Quality Certification (WQC) on behalf of the Town of Wales and MassDOT for the Monson Road Transportation Improvement Project. The purpose of the project is to make roadway, shoulder, and drainage improvements to Monson Road. A description of the proposed culvert upgrades has been provided, and proposed impacts to BVW and LUW have been quantified. This project will greatly improve drainage conditions along Monson Road, and will result in stream crossings that have been designed to current standards.

The project has been designed to avoid and minimize impacts to Waters of the U.S. and Commonwealth to the extent practicable. Our opinion is that the proposed project was

designed, and will be constructed, to meet the standards established in 314 CMR 9.00 et seq. as described above. Whereas this work is “exempt” from the WPA, a Section 401 WQC is required pursuant to 314 CMR 9.04(4) - Activities Exempt under MGL c. 131, § 40. The applicant respectfully requests that MassDEP find these measures adequately protective of the interests identified in the 401 Water Quality Regulations and issue a Water Quality Certificate approving the work shown on the accompanying plan set.

Appendix B

Alternatives Analysis

Culvert Alternatives Analysis

Weston & Sampson completed an alternatives analysis for the proposed culvert replacement associated with the Monson Road Transportation Improvements project in the Town of Wales, Massachusetts.

Alternatives considered for culvert sizing were based on the MEP analysis provided in Appendix G.

SUMMARY OF ALTERNATIVES CONSIDERED FOR THE PROJECT CULVERTS

The development of the proposed plan took into account the following alternatives:

- No Action Alternative.
- Replace In Kind
- Replace With Stream Crossing Compliant Culverts
- MEP Recommended Culvert Alternatives

No Action Alternative

The no action alternative was reviewed during the initial stages of the project development. This alternative would leave the roadways and culverts in poor condition with aging infrastructure and drainage problems. This proposed alternative would have no direct impact on wetland resource areas however, there would also be no improvement upon existing conditions. This proposed alternative does not meet the purpose or need for the project which is why it was not considered further.

Replace In Kind

Originally, the project only recommended direct replacement of in kind structures in relation to hydraulic capacity. However, as the project evolved through coordination with MassDOT environmental review applicability of stream crossing standards were analyzed. Subsequently, an MEP analysis (provided in Appendix G) was prepared which identified the available alternatives for the culvert replacements in relation to the stream crossing standards.

Replace With Stream Crossing Compliant Culverts

According to stream crossing standards the optimal culvert sizing should be 1.2 times bankfull width of the existing natural stream conditions. For this project three of the seven existing crossings had defined bankfull characteristics and a more detailed alternatives assessment of these locations was performed (See Appendix G). At these locations the following bankfull width requirements were measured.

- Crossing at 24+92: Bankfull Width 11.5 feet. 1.2x Bankfull Width: 13.8 feet
- Crossing at 50+72: Bankfull Width 15 feet. 1.2x Bankfull Width: 18 feet
- Crossing at 86+45: Bankfull Width 10.5 feet. 1.2x Bankfull Width: 12.6 feet

As indicated above, the culvert crossings would require structures with spans greater than 10 feet in length, as defined in MassDOT's Bridge Manual. However, due to schedule and funding limitations, only culvert crossings that could be justified to be less than 10 feet in length under the MEP analysis were assessed and designed. This approach identified two crossings which would be replaced with culverts with spans less than 10' in length (station 24+92 and 86+45) and one crossing which would not be replaced (50+72) which could not be justified under the MEP analysis to be less than 10 feet.

MEP Recommended Culvert Alternatives

For all of the crossings the design of the replacement culverts were advanced according to and consistent with the MEP analysis (See Appendix G). For the culvert crossing at station 86+45 several alternative alignments were evaluated given the skewed alignment of the channel and multiple pipe configuration.

Initially the original watercourse inlet to outlet alignment was evaluated for the new culvert. However, given the skew angle and length of culvert needed to cross the realigned intersection, to meet a maximum span width no longer than 10' (measured along the direction of travel of Monson Road), the resulting culvert opening width would be approximately 6' and well below the recommended width in the original MEP analysis. The extended length of the culvert would also negatively reduce the openness ratio.

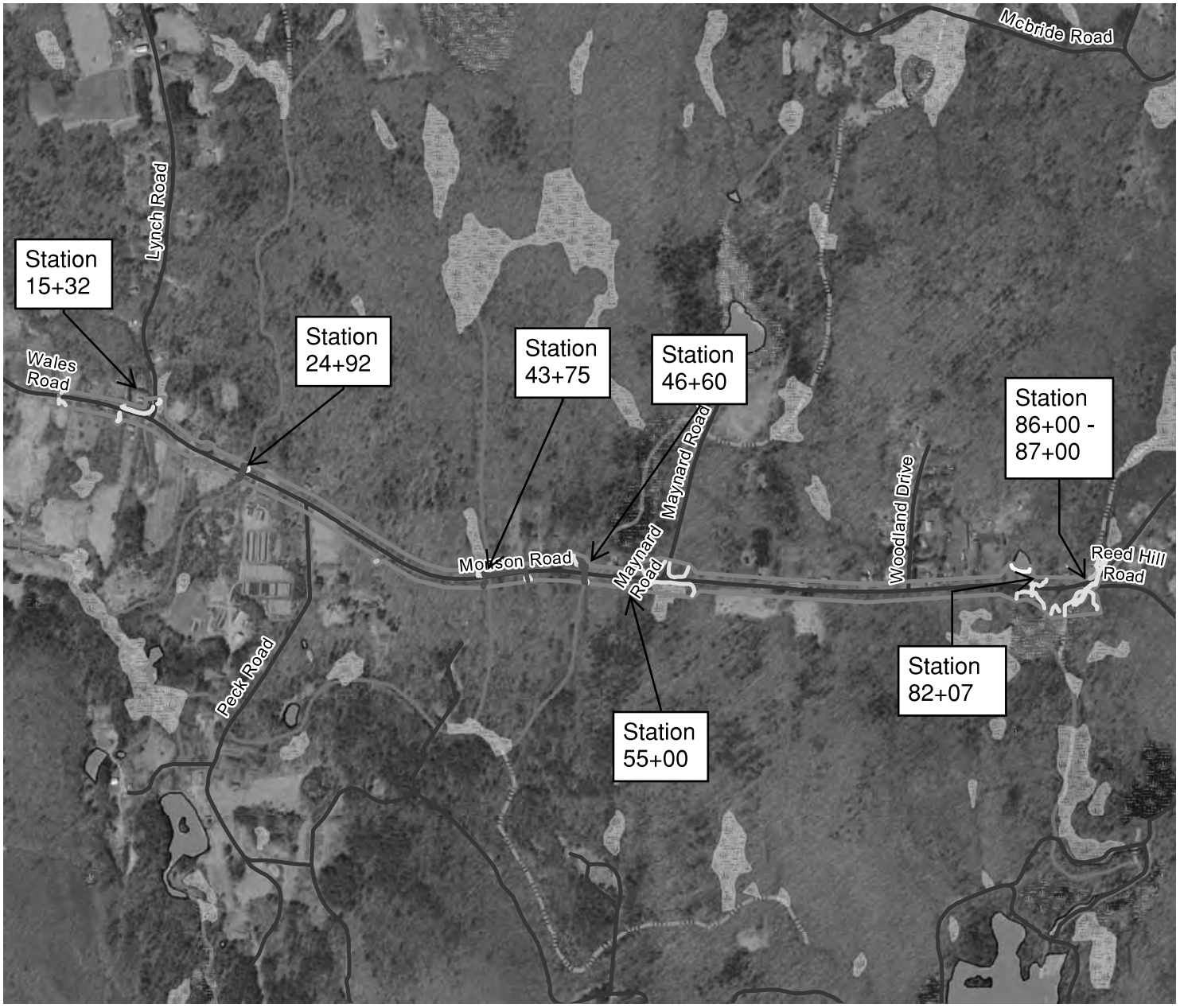
A second alignment analysis pursued a more perpendicular crossing of Monson Road to achieve a culvert span just under 10' in length. While possible, this alternative created several sharp turns in the realigned channel both upstream and downsteam of the culvert crossing which were deemed undesirable and inconsistent with the stream crossing standards, and furthermore would have increased wetland impacts and right-of-way impacts to private properties.

The third and preferred alignment, represents a balance of the two previous alternatives which strives to properly and more naturally align the stream and resulting channel through the culvert, maximize the culvert opening width to 8', and reduce the culvert length as much as possible to maximize the resulting openness ratio. The outcome advances the design of the proposed 8' wide x 4.5' high concrete box culvert with 2' of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse.

Appendix C

Site Maps

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.1.mxd User: Herrick.Devin Saved: 4/15/2024 3:56:01 AM Opened: 4/15/2024 3:56:36 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.1

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.2.mxd User: Herrick.Devin Saved: 4/15/2024 3:59:52 AM Opened: 4/15/2024 4:00:36 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.2

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.3.mxd User: Herrick.Devin Saved: 4/15/2024 4:01:11 AM Opened: 4/15/2024 4:01:40 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.3

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

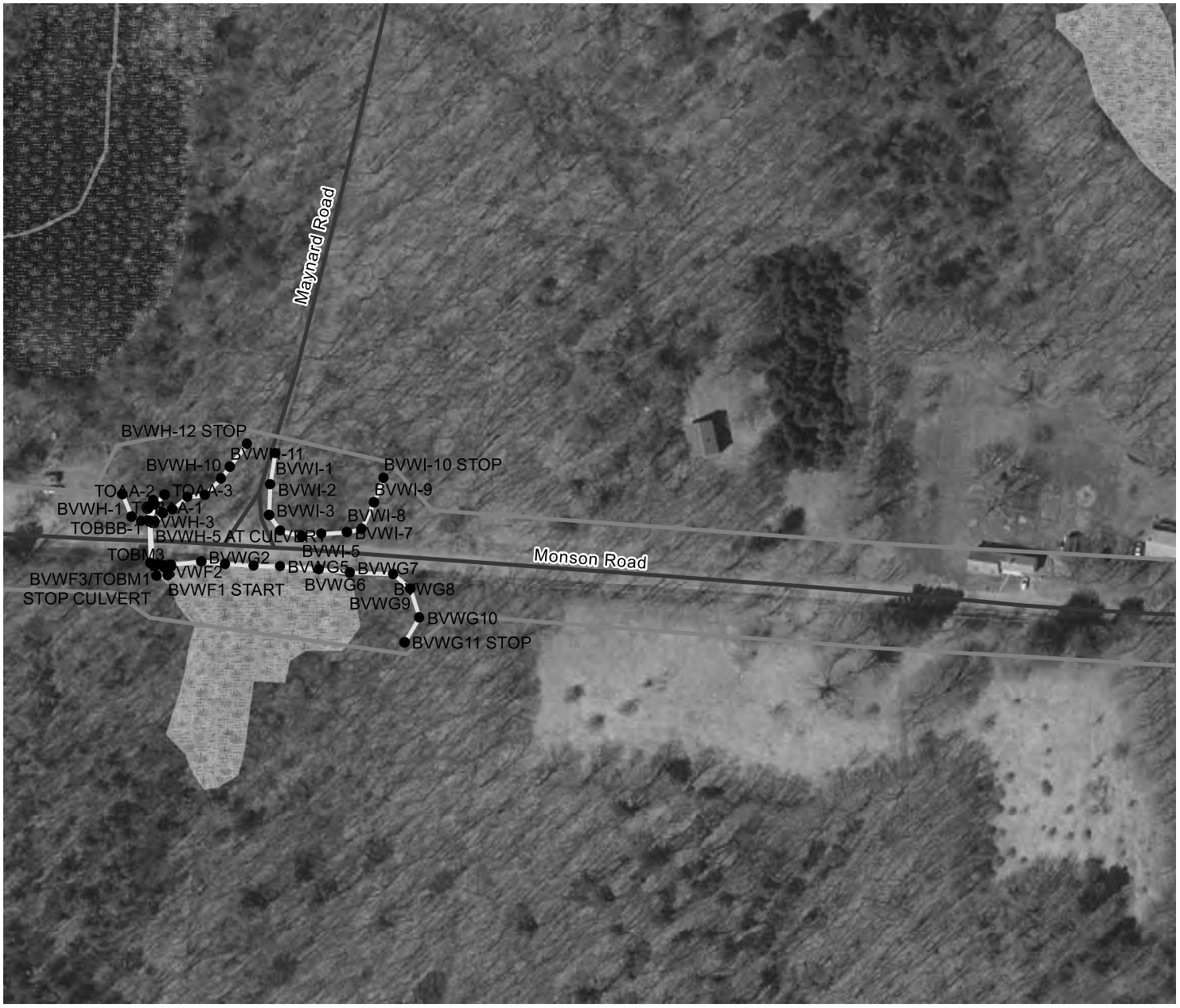
FIGURE 1.4

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.5.mxd User: Herrick.Devin Saved: 4/15/2024 4:03:43 AM Opened: 4/15/2024 4:04:34 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.5

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

N
W E
S

100 50 0 100
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

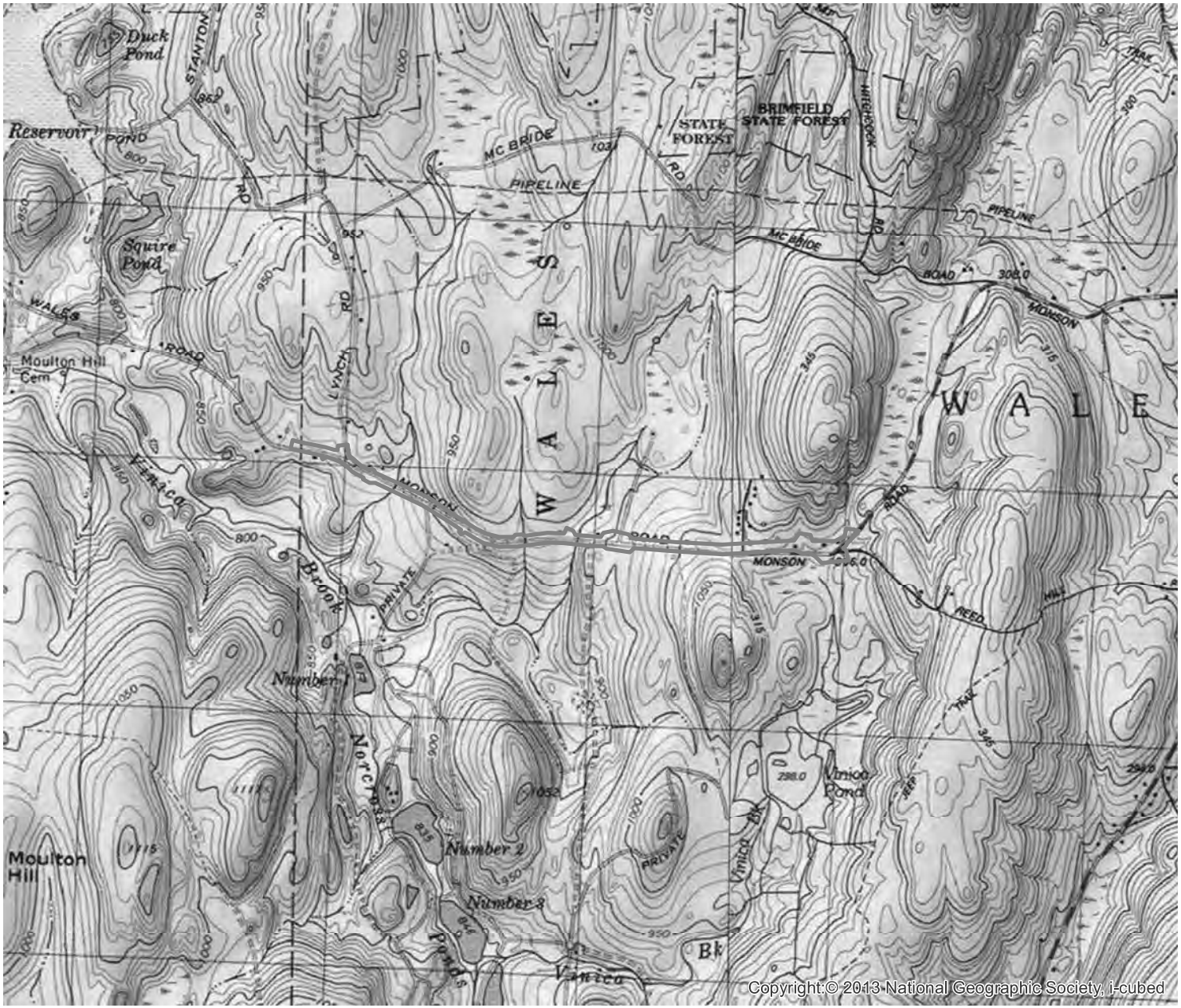
- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.6

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson



N
W E
S

1,000 500 0 1,000
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

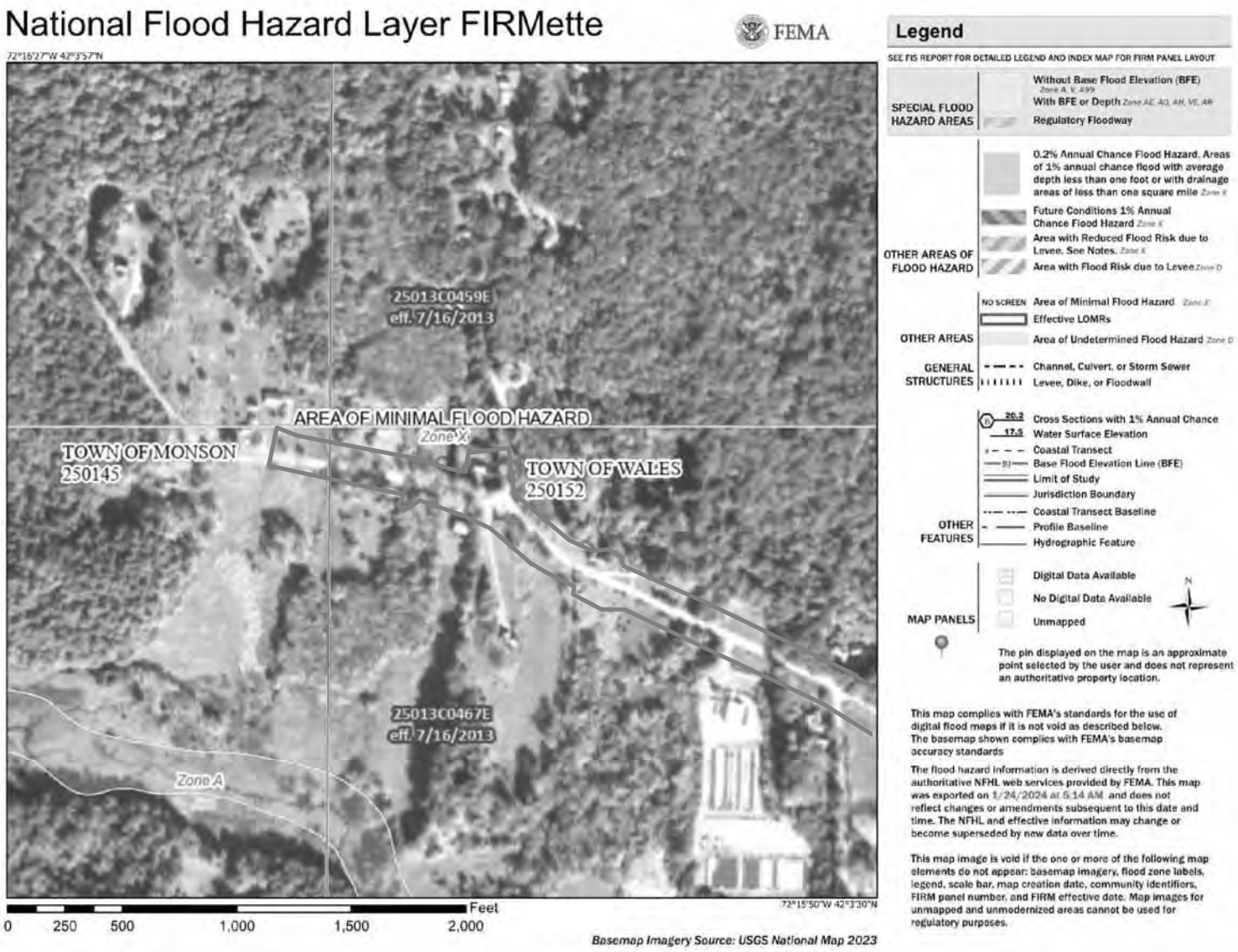
Investigation Area

FIGURE 2

MONSON ROAD
WALES MA

USGS TOPOGRAPHIC MAP

Weston & Sampson



Legend

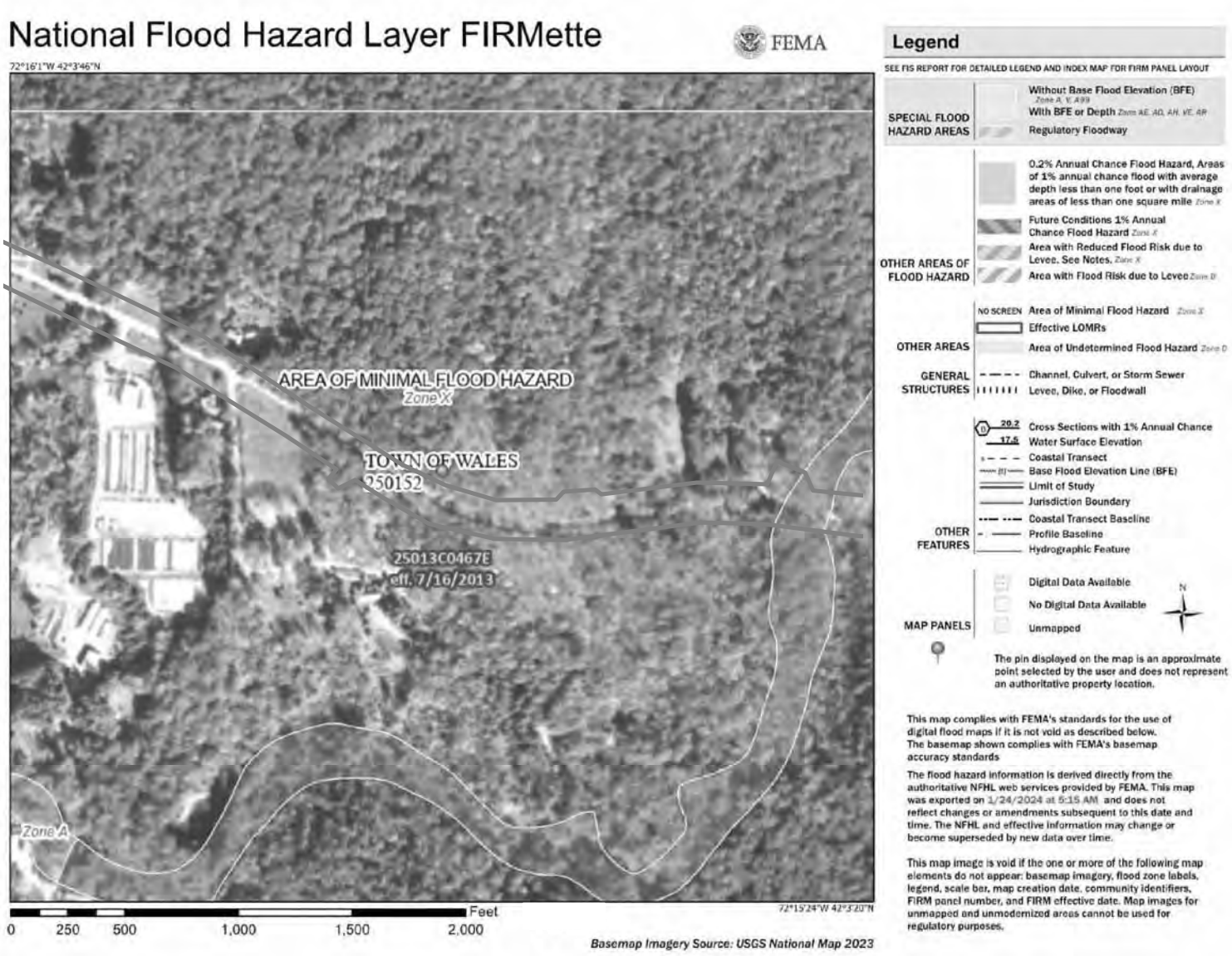
Investigation Area

FIGURE 3.1

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

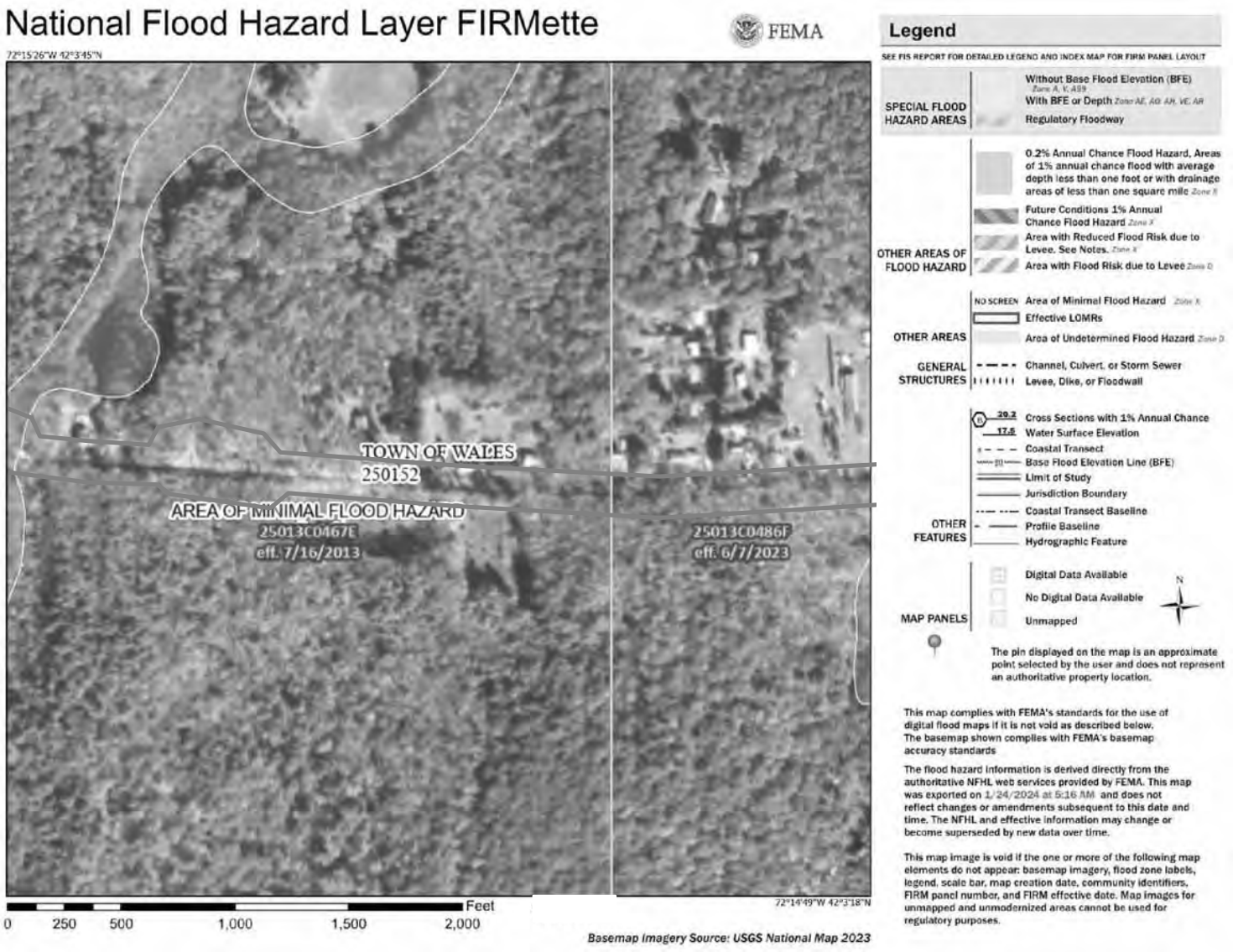
Investigation Area

FIGURE 3.2

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

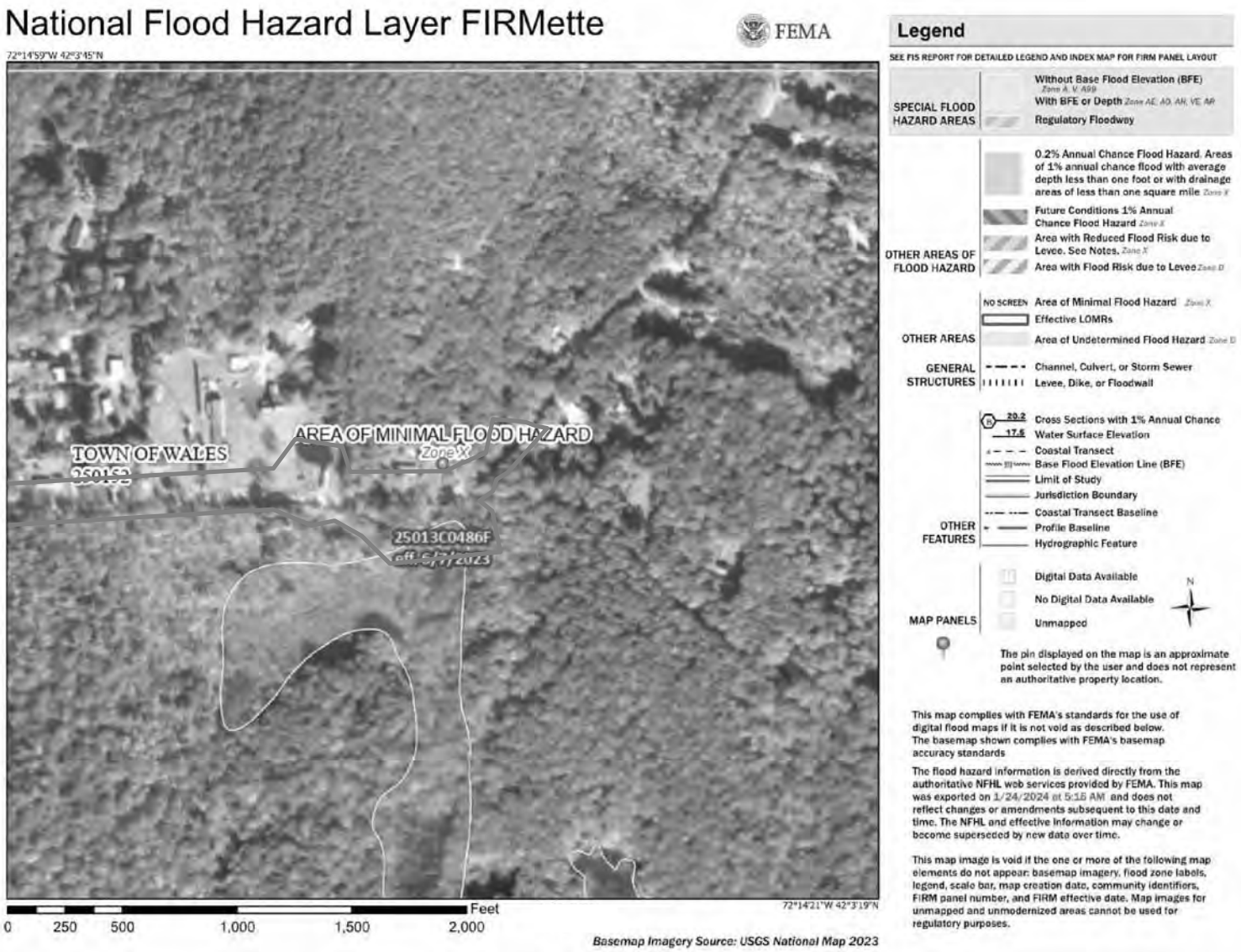
Investigation Area

FIGURE 3.3

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

Investigation Area

FIGURE 3.4

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- MassDOT Roads
- ACECs
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- Cold Water Fisheries
- Public Water Supply Contributor
- ORW for ACEC
- ORW for both Water Supply and Other
- Article 97 Land
- Community Groundwater Source

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

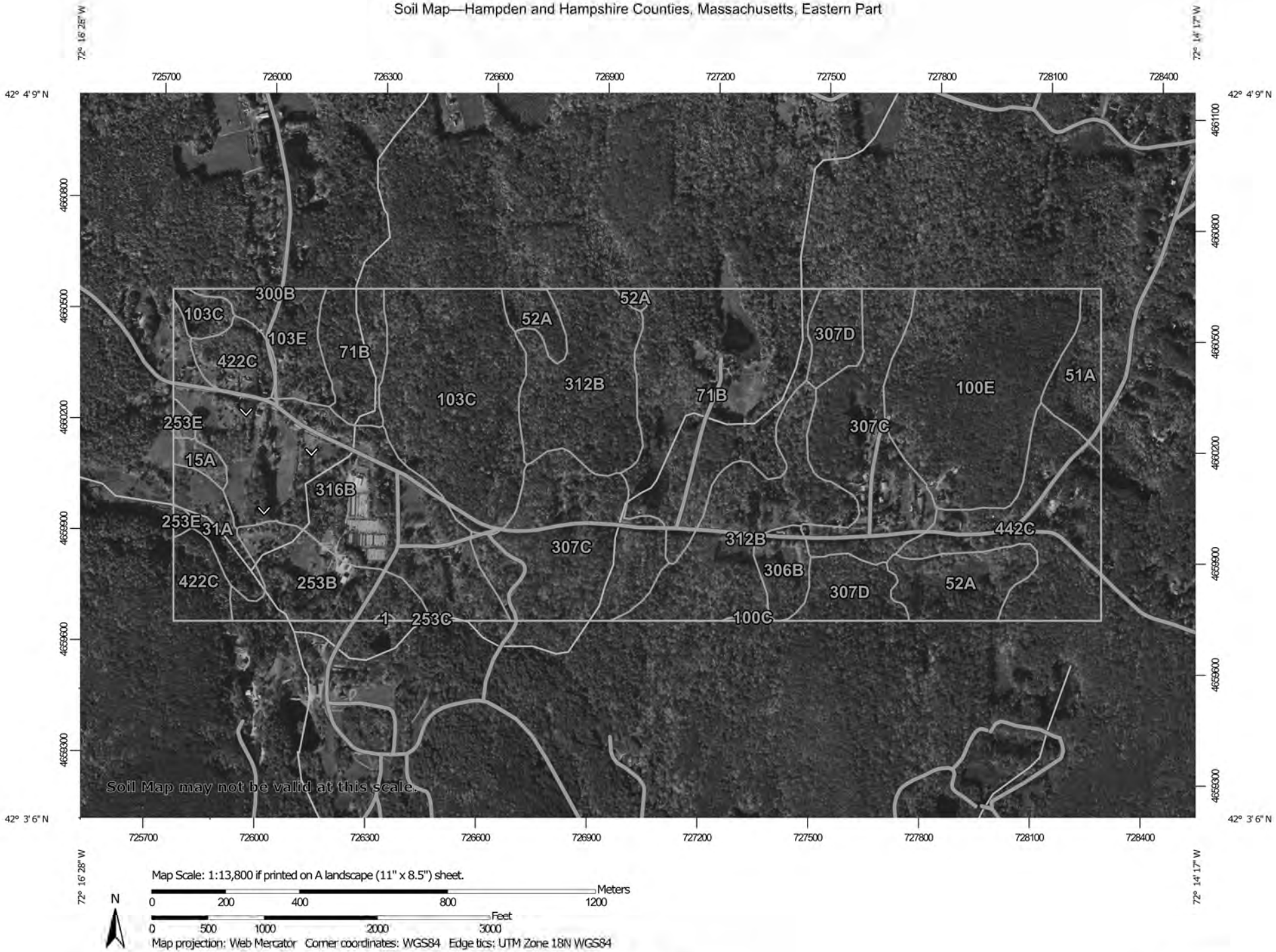
FIGURE 4

MONSON ROAD
WALES MA

ENVIRON. RESOURCES MAP

Weston & Sampson

Soil Map—Hampden and Hampshire Counties, Massachusetts, Eastern Part



Map Scale: 1:13,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hampden and Hampshire Counties, Massachusetts, Eastern Part
Survey Area Data: Version 18, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

A00840 - 51

Proposal No. 608163-128112

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	0.2	0.0%
15A	Scarboro-Rippowam complex, 0 to 2 percent slopes, frequently flooded	2.8	0.5%
31A	Walpole sandy loam, 0 to 3 percent slopes	9.0	1.6%
51A	Swansea muck, 0 to 1 percent slopes	10.2	1.8%
52A	Freetown muck, 0 to 1 percent slopes	21.1	3.8%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	75.6	13.5%
100C	Brookfield-Brimfield-Rock outcrop complex, strongly sloping	0.4	0.1%
100E	Brookfield-Brimfield-Rock outcrop complex, steep	57.7	10.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	55.6	9.9%
103E	Charlton-Hollis-Rock outcrop complex, steep	13.5	2.4%
253B	Hinckley loamy sand, 3 to 8 percent slopes	22.0	3.9%
253C	Hinckley loamy sand, 8 to 15 percent slopes	0.1	0.0%
253E	Hinckley loamy sand, 25 to 35 percent slopes	2.0	0.4%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	0.3	0.1%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	7.3	1.3%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	76.2	13.6%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	18.4	3.3%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	67.8	12.1%
316B	Scituate fine sandy loam, 3 to 8 percent slopes, very stony	66.5	11.9%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	16.6	3.0%
442C	Gloucester gravelly fine sandy loam, 8 to 15 percent slopes, extremely stony	36.0	6.4%
Totals for Area of Interest		**559.4**	**100.0%**

Appendix D

Site Photographs

Photo 1: Wet AA Flag Series

Photo 2: Wet BB Flag Series

Photo 3: TOB AA Flag Series

Photo 4: TOB BB and TOB CC Flag Series

Photo 5: TOB A and TOB B Flag Series

Photo 6: WET A Flag Series

Photo 7: WET B Flag Series

Photo 8: TOB E and TOB F Flag Series

Photo 9: BVW A Flag Series

Photo 10: TOB J and TOB I Flag Series

Photo 11: BVW B Flag Series

Photo 12: TOB K and TOB L Flag Series

Photo 13: BVW D Flag Series

Photo 14: TOB AA and TOB BB Flag Series

Photo 15: BVW G Flag Series

Photo 16: TOB AA and TOB BB Flag Series

Appendix E

Public Notice

Public Notice

Massachusetts Department of Environmental Protection
Division of Wetlands and Waterways
MassDEP Boston Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Pursuant to 33 U.S.C. 1341 and M.G.L. c. 21 §§ 26 - 53, notice is given of a 401 Water Quality Certification application for major fill associated with culvert replacements as part of the proposed projects for reconstruction and improvements on Monson Road, from the Monson town line to Reed Hill Road in Wales, MA, by the town of Wales with construction funding from the Massachusetts Department of Transportation – Highway Division, Ten Park Plaza, Room 7360, Boston, MA 02116. This project will consist of the replacement of four 12-36 inch cross culverts with new pipes and reinforced concrete headwalls, two new concrete box culverts, channel realignment, stream channel restoration, and associated rip rap protection. Additional information may be obtained from the Massachusetts Department of Transportation – Highway Division at the above address, Attention Courtney Walker or by emailing courtney.l.walker@dot.state.ma.us. Written comments should be sent to MassDEP Wetlands Program, Attention Heidi Davis, 100 Cambridge Street, Suite 900, Boston, MA 02114 or heidi.davis@mass.gov within 21 days of this notice.

Any group of ten persons, any aggrieved person, or any governmental body or private organization with a mandate to protect the environment who submits written comments may appeal the Department's Certification. Failure to submit written comments before the end of the public comment period may result in the waiver of any right to an adjudicatory hearing.

Appendix F

Technical Specifications

ENVIRONMENTAL PERMITTING

If Contractor erection, demolition, storage, or other procedures not originally allowed by existing environmental permits require work to occur in or otherwise impact water, wetland resource areas, buffer zones, etc., the Contractor is advised that no associated work can occur until all required environmental permits have been either amended or obtained allowing such work. The Contractor must notify the District #2 Highway Director and Resident Engineer in writing a minimum of 60 days prior to desired commencement of the proposed activity. All environmental submittals, including any contact with Local, State, or Federal environmental agencies, must be coordinated through the District #2 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that the Department will not entertain a delay claim due to the time required to modify or obtain the environmental permits.

ORDER OF CONDITIONS

This project is subject to the Massachusetts General laws, Chapter 131, Section 40 as amended, and has been issued an Order of Conditions ("Order") by the Wales Conservation Commission. The Order and Notice of Intent are to be considered part of this contract and a copy of the Order and all plans/attachments shall be on-site while activities regulated by the Order are being performed. The Contractor is hereby notified that s/he will be responsible and held accountable for performing any/all work necessary to satisfy and comply with the entire Order and Notice of Intent.

The Contractor is advised that no additional compensation will be allowed for work required to establish, achieve, and maintain compliance with the Order and Notice of Intent, as payment for the work shall be included in the respective bid items, unless specified elsewhere.

TREE REMOVAL

The removal of existing trees shown on the plans, or directed by the Engineer, 9 inches in diameter or smaller shall be considered incidental to the project. The Contractor shall coordinate with the Town of Wales Tree Warden prior to marking or removal of any trees within the project limits and will not mark or remove any tree within the project limits without approval from the Town of Wales or MassDOT.

EMERALD ASH BORER ADVISORY

To the extent possible, all trees and brush shall be disposed on site, typically chipped and spread in place. When trees or brush must be removed, such as in urban, or otherwise populated areas, the contractor shall identify proposed location for disposal, and provide written notification to the Engineer for approval. Disposal shall be in city or town of project, or at minimum, within county, of construction operations.

NORTHERN LONG-EARED BAT PROTECTION

The U.S. Fish and Wildlife Service (USFWS) has listed the northern long-eared bat (NLEB) as endangered under the Endangered Species Act (ESA) and the following requirements exist to protect the bat and its habitat. This project has been consulted with the USFWS through the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and Federal Transit Administration (FTA) Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat revised February 5, 2018.

On behalf of FHWA, the lead federal agency for Section 7 consultation, MassDOT submitted a FHWA, FRA, FTA Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bat to the USFWS through the Information for Planning and Consultation (IPaC) webpage and generated a May Affect, Not Likely to Adversely Affect (NLAA) determination (see **Document A00870 USFWS NLAA**). Therefore, the project has completed Section 7 consultation through the ESA. The following Avoidance and Minimization Measures (AMMs) must be strictly adhered to in order to protect NLEB and to be in compliance with the ESA. Contact MassDOT Environmental Services - Wildlife Unit Supervisor for questions about project limits, restrictions, or conservation measures.

General AMM

- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB, including all applicable AMMs. NLEB Bat information (https://www.fws.gov/midwest/endangered/mammals/nleb/) shall be made available to all personnel.

Lighting AMMs

- Direct temporary lighting away from suitable habitat during the active season: **April 1 to October 31.**

Tree Removal AMMs

- If additional cutting is proposed by the Contractor that is outside the scope of this contract, additional review is required by the MassDOT Highway Division's Environmental Services Section, and additional review and restrictions may be required by the USFWS.
- Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).
- No tree cutting shall be conducted during the active season: **April 1 to October 31.**
- In order to protect female northern long-eared bats and their young during the maternity roosting season, **no tree cutting shall be conducted during the active season**: **April 1 to October 31**.
- Do not remove **documented** or NLEB roosts that are still suitable for roosting, or trees within 0.25 miles of roosts, or **documented** foraging habitat any time of year.
- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB, including the **TOY** restriction. If this restriction needs to be waived at any location(s) the Resident Engineer shall send a locus map of the proposed work to MassDOT Highway Division's Environmental Services Section for review and a determination if the restriction can be waived.

ITEM 102.51 INDIVIDUAL TREE PROTECTIONS EACH

GENERAL

The purpose of this item is to prevent damage to branches, stems and root systems of existing individual trees to remain and to ensure their survival. Provisions under this item include steps to minimize soil and root disturbance and to construct protection measures for trees close to construction areas.

The work under this item shall conform to the relevant provisions of Sections 101 and 771 and the following:

Examination of Conditions

The Contractor shall be solely responsible for judging the full extent of the work requirements, including, but not necessarily limited to any equipment and materials necessary for providing tree protection.

Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer and Town Tree Warden to identify which trees will require protection and to determine approved measures. The Arborist shall make recommendations as to appropriate methods to trees. The Engineer will have final decision as to trees and methods.

The Contractor is responsible for the protection of all existing trees and plants within and immediately adjacent to the construction area that are not designated to be removed for the length of the construction period.

Incidental to the cost of these items, the Contractor shall retain the services of a certified arborist, who shall make recommendations as to the specific appropriate treatment of trees within or near the work zone.

SUBMITTALS

Incidental to this item, the Contractor shall provide to the Engineer one (1) copy each of the American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance, Part 1: Pruning. These references shall be kept by the Engineer at his office for the length of the Contract.

Prior to start of work, the Contractor shall submit to the Engineer the name and certification number of the Massachusetts Certified Arborist referenced herein. Cost for Certified Arborist for all activities pertaining to this Item shall be incidental to this item.

MATERIALS

Fence and temporary fence posts shall be subject to the approval of the Engineer.

Staking for individual tree protection fencing shall be steel posts or 2x4 inch stock as directed and approved by the Engineer.

Wood chips shall conform to provisions of Wood Chip Mulch under Materials Section M6.04.3.

Trunk protection shall be 2x4 inch cladding, at least 8 feet in length, clad together with wire. Trunk protection shall include burlap.

Incidental to these items, the Contractor shall provide water for maintaining plants in the construction area that will have exposed root systems for any period during construction.

CONSTRUCTION METHODS

To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain. Where these activities will occur within 10 Feet of the canopy of trees, the Contractor shall provide Individual Tree Protection as specified herein.

Tree Fencing and Armoring

For individual tree protection, the Contractor shall set posts and fencing at the limits of the tree canopy. Where construction activities closer to the trees is unavoidable, the contractor shall tie branches out of the way and place wood chips to a depth of 6 inches on the ground to protect the root systems. The Contractor shall wrap the area of the trunk of the tree with burlap prior to armoring with 2x4 inch cladding. Cladding for tree trunks shall extend from the base of the tree to at least 8 feet from the base.

Where excavation within canopy is unavoidable, the Contractor shall use equipment and methods that shall minimize damage to the tree roots, per recommendations of the Certified Arborist. Such methods may require root pruning prior to, as well as during, any excavation activities.

All fencing, trunk protection, branch protection, and woodchips shall be maintained throughout the duration of the contract. Protective fencing shall be repaired and woodchip mulch replaced as necessary during the duration of the contract at no additional cost.

Cutting and Pruning

Some pruning of roots and branches may be a necessary part of construction. Pruning will be performed on the same side of the tree that roots have been severed.

The Contractor shall retain the services of a Massachusetts State Certified Arborist to oversee any cutting of limbs, stem or roots of existing trees. All cuts shall be clean and executed with an approved tool. Under no circumstances shall excavation in the tree protection area be made with mechanical equipment that might damage the existing root systems.

Any tree root area exposed by construction shall be covered and watered immediately. Exposed tree roots shall be protected by dampened burlap at all times until they can be covered with soil.

Watering

Water each tree within the construction area where work is in progress twice per week until the surrounding soil of each tree is saturated for the duration of construction activities.

Removal of Protection

After all other construction activities are complete, but prior to final seeding, wood chips, temporary fencing, branch protection, and trunk protection materials shall be removed and disposed of off-site by the Contractor at no additional cost.

Tree Damage

The Contractor shall be held responsible for the health and survival of the existing trees in the immediate vicinity of the of the construction area. Damage that, in the Engineer's opinion, can be remedied by corrective measures shall be repaired immediately. Broken limbs shall be pruned according to industry standards. Wounds shall not be painted. Trees or shrubs that are damaged irreparably shall, at the Engineer's discretion, be replaced per the requirements of Division I of these Special Provisions. Cost of replacement trees shall be borne by the Contractor.

BASIS OF PAYMENT

Where the plans show specific, individual trees to remain and where grading or other disturbance is shown within the drip line of these trees or where the Engineer determines that an individual tree must be protected, these trees shall be protected and paid for under ITEM 102.51, Individual Tree Protection.

Item payment shall be scheduled throughout the length of contract: 30 percent of value shall be paid upon installation, 30 percent approximately halfway through the contract, and the remainder to be paid at the end of the contract after completion of construction operations that would disturb plants and after the protection materials have been removed and properly disposed of off-site by the Contractor.

Compensation for Individual Tree Protection will be paid for at the contract unit price PER EACH under Item 102.51. This shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, including the services of a certified arborist, water and fertilizer, and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

Cost of wood chips, as required, shall be incidental to these items.

ITEM 691.01 BALANCE STONE WALL REMOVED AND REBUILD FT

The work under this Item shall conform to the applicable provisions of Sections 685, 690, 901, of the Standard Specifications, the Plans, and the following:

DESCRIPTION

The work under this heading consists of carefully dismantling, stockpiling stone, and rebuilding selected fieldstone balance stone walls in new locations within the project area. Balance stone walls to be removed and rebuilt as identified on the plans. Locations of new walls shall comply with all ROW and clear recovery requirements.

To allow mason greatest selection of local fieldstone in rebuilding balance wall, no stones from balance stone walls shall be discarded from project area until all rebuilt balance walls on project are complete.

The work shall include the total volume of adjusted wall, disassembly of existing wall, and reconstructing wall in new location complete as shown on the plans and as directed by the Engineer.

The work shall include but not be limited to digging and trenching, removal of vegetation, labor, tools, equipment and all incidentals required to complete the work as stated herein, shown on the contract plans, and as directed by the Engineer. The work shall be done in accordance with these specifications, and in close conformity with the lines and grades shown on the plans or established by the Engineer.

MATERIALS

Stone from existing project area balance walls shown to be removed shall be used. Ideally stone from segments of wall shall simply be relocated. No stone from walls not to be removed shall be used.

Most stones are dry laid but vary in size. Some stones may be boulders embedded in the ground.

Any supplemental stones that are required shall be field stones which match the size, color, and texture of the existing stones as closely as is feasible.

Stones from existing walls should not require cleaning. Natural staining or patches of lichen growth is acceptable.

No mortar shall be used anywhere or for any reason in reconstructing dry laid balance walls.

SUBMITTALS

The stonework shall be done by masons who are experienced in construction of dry laid stone walls. At least one of the masons shall have 10 years or more experience constructing mortarless, dry-laid balance stone walls. Resume and projects showing experience shall be

submitted to Engineer and MassDOT Landscape Section for approval.

CONSTRUCTION METHODS

Prior to the disassembly of the existing wall, photographs of the existing conditions of the wall shall be taken to serve as a guide for its reconstruction.

The Contractor shall take care not to damage the existing stones during the disassembly and reconstruction of the wall.

The Contractor shall provide a secure location for stockpiling stone prior to reconstruction, so that stones will not be damaged, lost or stolen.

The rebuilt walls shall maintain a linear appearance and irregular character of local early agricultural farmer walls to as great a degree as possible.

To prepare the base, remove vegetation and excavate a trench up to 12 inches deep as needed to achieve stable, unfrozen soil. Place the bottom row of stones in the trench. Stones from select, existing dismantled walls, shall be used to rebuild the new walls.

The open spaces about the base of the wall shall be filled with the materials excavated from the trench. Surplus excavation shall be used as directed in location or disposed.

The stones shall be laid in a two-over-one, one-over-two pattern so as to break joints and all vertical spaces shall be packed full with spalls or chinking stones. No spalls or chinking shall be allowed in the beds and at least 25% of the stones in the face shall be headers evenly distributed throughout the wall.

Additional available stone may be used to increase height of wall if needed. The walls shall not exceed four feet in height.

Upon completion of all walls, stone shall be disposed of or stockpiled at *(show location here)* as coordinated by Engineer and Municipality.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work under this Item shall be paid for at the Contract unit price per foot for Item 691.01 – Balance Stone Walls Removed and Rebuilt complete and to the satisfaction of the Engineer. Balance Stone Walls Removed and Rebuilt will be measured in place and shall be the length of balance stone walls rebuilt.

Excavation at the new location will be paid for at the contract unit price per cubic yard under the item for Class A Trench Excavation or Class B Rock Excavation. The cost for this work shall include full compensation for, including, but not limited to, all labor, equipment, worker protection, environmental compliance, vegetation removal, materials, tools, material testing, transportation/hauling and any incidentals required to complete the work to the satisfaction of the Engineer in accordance will all requirements of the contract.

ITEM 697.1 SILT SACK EACH

GENERAL

Work under this item shall conform to the relevant provisions of Subsections 227 and 670 of the Standard Specifications and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system.

Sack shall be manufactured by one of the following or an approved equal:

ACF Environmental
ACF Environmental ACF Environmental (ferguson.com)
(800)-448-3636

Siltsack® SI Geosolutions:
www.sigeosolutions.com
(800)621-0444

Dandy Sack™ Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
Email: dlc@dandyproducts.com
Website: www.dandyproducts.com

FLeXstorm Inlet Filters Inlet & Pipe Protection
24137 W. 111th St - Unit A
Naperville, IL 60564
Telephone: (866) 287-8655
Fax: (630) 355-3477

Construction

Silt sacks shall be installed in retained existing and proposed catch basins within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The

filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect and maintain the condition of silt sacks after each rainstorm and during major rain events and in accordance with Part 4.2 Inspection Requirements of the 2022 Construction General Permit (CGP). Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction. All debris accumulated in inlet sedimentation control devices shall be handled and disposed of as specified in Subsection 227 of the Standard Specifications.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Silt sacks will be measured and paid at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 698.3 GEOTEXTILE FABRIC FOR SEPARATION SQUARE YARD

GENERAL

The work under this item shall conform to the requirements of Section M9.50.0 for separation of the Standard Specifications. Construction and installation shall be in accordance with AASHTO M 288 and the following:

This work will consist of furnishing and placing geotextile fabric for separation under stone for pipe ends and under revetment stone slope protection at the locations shown on the Construction Details or as required by the Engineer.

CONSTRUCTION

Atmospheric exposure of the geotextile fabric to the elements following lay down shall be a maximum of 14 days.

For seams that are sewn in the field, the Contractor shall provide at least a six-foot length of sample sewn seam for the approval of the Engineer before the geotextile fabric is installed. The seams sewn for sampling shall be sewn using the same type of equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams for both directions shall be provided. The seam assembly description shall be submitted by the Contractor along with the seam samples. This description shall include the seam type, stitch type, sewing thread, and stitch density. If the Contractor elects to sew seams instead of overlap, colored thread must be used.

Geotextile shall be placed in intimate contact with soils without wrinkles or folds, and shall be anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlaying materials will not excessively stretch or tear it.

Adjacent geotextile sheets shall be joined by either sewing or overlapping. At roll ends, overlapped seams shall overlap a minimum of 12 inches, except when placed under water, where they shall overlap a minimum of 3 feet. Adjacent rolls shall overlap a minimum of 12 inches.

Care shall be taken during installation to prevent damage to the geotextile as a result of the installation process. Should the geotextile be damaged, a geotextile patch shall be placed over the damaged area extending a minimum of 3 feet beyond the limits of the damage.

Any section of fabric that is damaged shall be repaired in accordance with the manufacturer's requirements and AASHTO M 288 and to the satisfaction of the Engineer or it shall be replaced at no cost to the state.

Bedding and Slope Protection:

> The geotextile shall be placed and anchored on a prepared surface approved by the Engineer. The geotextile shall be laid loosely so that placement of the overlaying materials will not stretch or tear the geotextile. The backfill placement shall begin at the toe and proceed up the slope. Successive geotextile sheets shall be overlapped in such a manner that the upstream sheet is placed over the downstream sheet.

Riprap shall not be dropped onto the geotextile from a height greater than 12 inches. Slope protection and smaller sizes of stone filling shall not be dropped onto the geotextile from a height exceeding 3 feet.

The surface upon which the geotextile is to be placed shall be within reasonable conformity to the proposed grade.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 698.3 will be measured for payment by the number of Square Yards actually installed at the locations shown on the plans, in accordance with these specifications, or as directed by the Engineer. Overlapping for seams and joints shall be measured as one layer of fabric. Any

embedment or wrapping at the toe or top of the slope, applied per manufacturer's installation recommendations or the Engineer's direction shall be measured for payment.

Item 698.3 will be paid for at the contract bid price per Square Yard of fabric, complete in place. The price so shall constitute full compensation for furnishing and installing geotextile fabric, all miscellaneous associated assembly material, and all other labor, equipment, material, and incidental costs necessary to complete the work as specified and as directed by the Engineer.

ITEM 755.35 INLAND WETLAND REPLICATION AREA LUMP SUM

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

GENERAL

The work under this item shall conform to the relevant provisions of Sections 120, 770, 771 of the Standard Specifications and the following:

Work under this item shall include furnishing material and the construction and maintenance of inland wetland replication areas as shown on the drawings and as required by the Engineer. Inland Wetland Replication Area shall hereafter be referred to as Replication Area. All work shall be in coordination with an approved Wetland Specialist as specified under that item.

Wetland Restoration work shall be as specified and compensated under that item. Construction of tidal wetlands shall be as specified under the appropriate item for tidal wetland mitigation.

The Replication Area shall be constructed prior to wetland impacts unless otherwise approved by the Engineer, specified herein, or specified in permit conditions and approvals. Construction schedule shall be appropriate to planting and seeding season (see below). Changes to this schedule will require written approval from the Engineer.

Construction of the Replication Area shall be completed as shown on the drawings at the following location (See ITEM 755.44 Wetland Restoration I:

Area at Station: ***85+50*** Area = ***1204*** sf.

Replication Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, - U.S. Army Corps of Engineers Permit.

The Contractor is responsible for protection and preservation of natural areas adjacent to the Replication Area both within and outside the project limits and for the duration of the Contract; including but not limited to damage to soils or vegetation due to erosion, sedimentation, compaction, trampling, vehicles, storage of materials, or other negligence shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

The Wetland Specialist overseeing the Wetland Replication construction work shall not be from the same company as that which is performing planting, seeding, or participating in any aspect of the Wetland Replication construction.

SUBMITTALS - DOCUMENTS

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): As specified below, shall be submitted to the Engineer for distribution to appropriate regulatory agencies.

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.75 and 755.76.

SUBMITTALS - MATERIAL

Soil and Amendments

No soil, compost, or other soil amendment imported to the work site shall contain seeds, roots, stems, or other viable parts of invasive plants or other noxious plants.

At least sixty (60) days prior to installation and prior to ordering, the Contractor shall submit for approval sources of soil, compost, and amendments. Submittal shall include the supplier and location of the source. Off-site sources shall be identified and available for inspection by the Wetland Specialist prior to transport of material to the site to verify that they are likely to be free of invasive plant species, including all viable plant parts.

Samples of tested and approved wetland soil and soil amendments for soil texture, organic carbon content or other routine soil analysis parameters (e.g., pH, Cation Exchange Capacity, Percent Base Saturation) and Soil Organic Matter Analysis will be required if requested by the Engineer. The grab samples shall be collected by the Contractor or Wetland Specialist from multiple representative locations in the wetland topsoil mix following the "UMASS Soil and Plant Tissue Testing Laboratory Sampling and Collection Protocols" (or equivalent certification paperwork provided by the soil supplier). The lab analysis shall be provided to the Engineer along with written certification from the Contractor or Wetland Specialist that the wetland topsoil was collected per the referenced protocol and meets the desired specification. The analysis and written certification of same shall be provided to the Engineer prior to placing the wetland topsoil in the Replication Area.

Seed Mix

Certificate of Materials from the supplier shall be submitted 30 days prior to seeding and must be approved prior to ordering materials. Seed species listed on the certificate shall include ecotype region (i.e., *Asclepias incarnata*, PA Ecotype).

Seed tag from the bag of seed used shall be submitted to the Engineer at the time of seeding. Seed tag shall include ecotype region and species, guaranteed percentages of purity, weed content and germination of the seed, and the net weight. Seed tag shall match the Certificate of Materials, include the name of the supplier, and date material was sent.

Bill of lading or notarized Certificate of Compliance from the Supplier serving as proof of purchase shall be submitted if requested by the Engineer. Document shall include date of sale, quantity, lot number, and address of Supplier. This shall match the seed tag. Notary shall not work for either the contractor or seed supplier.

Plant Certification

Plant Certification shall be per the applicable requirements of Subsection 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the Standard Specifications. The nursery source shall certify the provenance or origin of all plants.

Other Material: Submittals shall be per the respective item.

MATERIALS

Sediment Control Barrier and Erosion Prevention Measures
Sediment control barriers shall be per Item 767.121.

Erosion prevention measures for disturbed areas adjacent to the Replication Area shall include but not necessarily be limited to compost blankets, jute mesh, seeding, and/or combinations thereof as approved by the Engineer.

Sediment controls and erosion prevention devices and measures shall be compensated under the respective items.

Wetland Soil

Soil appropriate for the Replication Area may be either hydric soil excavated from the impacted wetland, a manufactured mix of compost and on-site borrow, or a combination thereof, as approved by the Engineer.

Hydric soil from the impacted wetland area may be spread on the surface of the constructed Replication Area as an inoculant or can be placed in a bulk fashion in a roughly 1:1 ratio of area and depth. Soil shall be handled such that the original soil structure is preserved and shall not be compacted, screened, or otherwise processed.

Hydric soil from the impacted wetland that is infested with invasive plant species identified on the Massachusetts Invasive Plant Advisory Group (MIPAG) shall not be used in the Replication Area unless approved by the Wetland Specialist and Engineer. To the extent possible, infested soil shall be disposed of within the project limits in an upland area outside of regulated areas and as approved by the Invasive Plant Management Strategy item (if in the contract) or by the Engineer.

A manufactured mix suitable for wetlands shall consist of on-site borrow from the proposed Replication Area (if approved by the Wetland Specialist and Engineer) thoroughly mixed with compost to achieve a target organic carbon content of 10-12% (up to 21% percent organic matter) by dry weight. The organic material used for mixing shall be well or partially decomposed. Clean leaf compost is the preferred soil amendment to achieve these standards though other materials may be used if approved by the Wetland Specialist and Engineer. Note that "clean" refers both to a negligible amount (<1%) of physical contaminants such as plastic and to the lack of chemical contaminants that might pose a hazard to plants or animals. Off-site borrow may be used for mixing if approved in advance by the Engineer.

No soil or soil amendment shall be brought on site without approval of the material source by the Wetland Specialist and the Engineer. Soils used in the replacement area shall be free of rocks greater than 4 inches in diameter.

Plants

Plant material shall conform to the applicable requirements of Section 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the latest edition of the Standard Specifications and as amended below.

Plants shall be native species, not cultivars. To the extent possible, plants shall originate from the applicable EPA Level III Ecoregion.

Plant species and sizes to be included in the Replication Area shall be:

- as specified in the plan schedule provided on the construction plans.

Requests for substitutions shall be submitted in writing to the Engineer for review by the Wetland Specialist, MassDOT Landscape Architect, and, if required, the relevant regulatory agency at least thirty (30) days prior to planting. All proposed substitutes shall be in conformance with the requirements herein and suitable for the site conditions.

Transplanting and plant material collected from the wild is prohibited unless approved in writing by the Engineer. Plants shall be selected from certified nurseries that have been inspected by state and/or federal agencies.

Seed Mix

Mix 765.552 Wetland Mix – Obligate Mix

	Botanical Name	Common Name	% PLS By Weight
Grass			
	Carex vulpinoidea	Fox Sedge	26.50%
	Carex lurida	Shallow Sedge	15.00%
	Sparganium eurycarpum	Giant Bur Reed Eco PA	10.00%
	Carex lupulina	Hop Sedge	7.00%
	Carex crinita	Fringed Sedge	6.00%
	Scirpus cyperinus	Woolgrass	4.00%
	Juncus effusus	Soft Rush	3.00%
	Carex comosa	Bearded Sedge	3.00%

Scirpus atrovirens	Green Bulrush	3.00%
Sparganium americanum	Burrweed	2.50%
Scirpus validus	Bulrush, soft-stem	2.00%
Carex stricta	Tussock Sedge	1.00%
Glyceria canadensis	Manna Grass	1.00%
		84.00%
Herb/Forb		
Verbena hastata	Blue Vervain	4.00%
Aster puniceus	Aster - Swamp	2.00%
Eupatorium maculatum	Joe-pye Weed	1.50%
Eupatorium perfoliatum	Boneset	2.00%
Iris versicolor	Blue Flag Iris	2.00%
Alisma subcordatum	Mud Plaintain	1.00%
Vernonia noveboracensis	New York Ironweed	1.00%
Bidens cernua	Nodding Burr Marigold	1.00%
Solidago patula	Roughleaf goldenrod	0.50%
Mimulus ringens	Monkey Flower	0.50%
Chelone glabra	White Turtlehead	0.50%
		16.00%
		100.00%

Seeding Rate:
Species ecotype shall be as native to New England region as possible.
Apply this mix at 20 lbs PLS/acre.

Seeding shall conform to the Standard Specifications Section M6, ROADSIDE DEVELOPMENT MATERIALS.

Fertilizers shall not be used.

Water

The Contractor shall provide water and all equipment required at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plants and wildlife. Water from the adjacent water bodies or waterways shall not be utilized. It is the Contractor's responsibility to correct injury or damage due to the lack of water, too much water, or use of contaminated water.

Mulch/Compost Blanket for Seeding

Hydromulch shall be per the manufacturer’s recommendations and shall be wood fiber or straw mulch only. Mulch shall be incidental to seeding.

Compost Blanket may be used in lieu of mulch for seeding. Compost Blanket shall meet the material and submittal requirements of that Item and shall be applied as specified below. Compost Blanket shall be compensated under that item.

CONSTRUCTION METHODS

SITE PROTECTION MEASURES

Minimizing Damage

The Contractor shall plan and execute operations in a manner minimizing the amount of excavated and exposed fill or other foreign materials that could be washed or otherwise carried into Replication Area and nearby resource areas.

Construction of and access to the Replication Area shall minimize damage to existing vegetation and soils as specified herein. Damage to soils or vegetation shall be repaired to the satisfaction of the Engineer and at the Contractor's expense. If required for soil remediation, tilling and the addition of compost shall be at the Contractor's expense.

Wetland topsoil shall be deposited and graded in the Replication Area in a manner that minimizes travel and subsequent compaction of the subgrade (including any specified pit and mound topography) to the extent practicable, including use of track mounted excavators as appropriate. Should soils be compacted, they shall be loosened by a method such as disking, spring-tooth harrowing and/or rototilling. The Contractor shall use boards, timber or composite mats, or other approved materials as necessary, to protect existing and/or new wetlands from compaction due to heavy foot traffic or if equipment is required to travel over wetland soil. All labor and materials required for protection and preservation of site shall be incidental to this item.

Stockpiling of Soil

Stockpiling of soil, including hydric soil for replication, shall be at least 100 feet from the edge of the bordering and isolated vegetated wetlands and inland banks, unless approved otherwise by the Engineer. Stockpiled soils shall be securely stabilized and contained. Any areas of exposed soil or stockpiles within and adjacent to the Replication Area that will remain inactive for more than 7 calendar days shall be sown with a mix of rapid germinating annual grasses (e.g., annual rye) covered with a layer of straw mulch applied at a rate of 90 pounds per 1,000 square feet. As necessary, the mulch shall be anchored with a tacking coat (non-tar) applied by a hydro seeder or other method recommended by the Wetland Specialist in consultation with the Engineer. In the event that there is excess borrow, it shall be disposed of under Excavation, Item 120.1.

Sediment Barriers

Placement: Sediment barriers shall be installed along the downslope perimeter of the Replication Area beginning and ending in the surrounding upland so that no excavated material or disturbed soil can enter adjacent wetlands or waters. Where construction work is immediately upgradient of the wetland, barriers shall be located so as to protect the Replication Area until slopes are stabilized. Sediment barriers shall be in place and approved by the Engineer prior to excavation work. No work shall take place outside the barriers.

Maintenance: The Contractor shall ensure that all sediment barriers function as intended and at all times per the specifications of those respective items.

Existing Trees to Remain

Tree protection shall be per the relevant specifications and as shown on the plans or as required by the Engineer. To protect root systems of existing trees to remain, the limits of the Replication Area may be adjusted, but the total area of replication required by the permits shall not be reduced. Access route may be adjusted as required.

Trees to be retained as snags (upright dead or dying trees left for wildlife habitat) within or adjacent to the Replication Area shall be as shown on the plans or as directed by the Wetland Specialist or Landscape Architect during the initial site walk. Trees to remain as snags shall be clearly marked prior to clearing. Trees that pose a potential fall hazard (i.e., are near a roadway) should have limbs and trunk cut such that the tree does not pose a fall hazard.

Coarse woody debris in the form of cut trees, stumps, logs, and brush shall be incorporated as shown on the plans or as directed by the Wetland Specialist or Landscape Architect. On site material shall be selected and marked by the Wetland Specialist, retained on the project site, and placed as specified below under Placement of Coarse Woody Debris.

All trees, stumps, or brush not specified to remain shall be removed and shall not be stockpiled in the wetland resource areas while awaiting disposal.

Work shall be coordinated with Clearing or Tree Removal Item and compensated under that Item.

PRE-WETLAND CONSTRUCTION SITE WALK

Delineating the Replication Area and Access Route. The Contractor shall stake out the Replication Area boundaries and the intended access route and set grade stakes for approval by the Wetland Specialist and Engineer. Following staking and demarcation of areas, the Engineer and Wetland Specialist shall approve or modify as necessary the limits of work, the access route, final location and configuration of replication, grade stake elevations, proposed location of sediment barriers, and review proposed construction methods.

As part of the delineation and approval process, the Wetland Specialist shall mark trees to be converted to snags, select course woody debris to be retained for re-use, and select rocks or other elements to be used for habitat features.

Invasive Plants: As part of the initial site walk, the wetland to be impacted and the proposed replication site shall be inspected for the presence of invasive plants. If invasive plants are found, they shall be addressed as described herein under Invasive Plants.

SOIL WORK

Final grades in the Replication Area shall meet the target elevations as shown on the Plans or as adjusted by the Wetland Specialist to achieve the desired hydrology and micro-habitat. If adjustments are required, a Request for Information (RFI) shall be submitted to the Engineer for approval. Adjustments shall be documented and included in the As-Built plans (if required) and/or other applicable required documents.

<u>Excavation & Grading</u>

When required by permits, the Wetland Specialist shall notify MADEP and the ACOE (as applicable) at least 72 hours prior to excavation.

Soil in the proposed wetland areas that must be removed for grades to conform to the proposed elevations shall be stripped and disposed of, or, if suitable for reuse, be stockpiled in an approved location. Stockpiled soils shall be kept wet and not allowed to dry out. Procedures for maintaining appropriate moisture levels shall be documented by the Wetland Specialist and provided to the Engineer and the Contractor.

Replication area shall be excavated as shown on the drawings. Where replication area is adjacent to existing reference wetland, finish grade of replication shall generally match existing grades and micro-topography, notwithstanding any deviations that are necessary to achieve the desired hydrology and habitat in the Replication Area.

Prior to placement of backfill, scarify subgrade to a depth of 4 to 6 inches.

Placement of Wetland Soil

Following excavation, scarification, and grading of sub-grade, and after the sub-grade elevations are approved by the Wetland Specialist, suitable soil previously removed or an evenly mixed organic/mineral soil created on-site shall be spread to the design depth and thickness over the proposed wetland areas as shown on the plans and as directed by the Wetland Specialist.

Vehicles used to transport soil from offsite shall be washed or cleaned with air pressure to prevent exotic or invasive seeds or root fragments from contaminating the Replication Area.

Final Grading

The finished grade of the Replication Area shall be at an elevation that will provide an unrestricted hydrologic connection between the Replication Area and adjacent resource areas. The hydrologic connection should be in keeping with restoring the intended function of the replacement wetland relative to the impacted reference wetland. The Contractor shall verify that this elevation is not at a level that could negatively alter the hydrology of an adjacent wetland. Microtopography in the form of hummocks, pits and mounds shall be as shown on the plans or as adjusted by the Wetland Specialist. Final elevations and grading of wetland soil shall be approved by the Wetland Specialist and the Engineer.

To avoid compaction once soil has been placed, no heavy equipment shall travel across placed soil and no work shall occur in wet or moist soil. Soil that is compacted due to construction activities shall be replaced with soil as specified herein and at the Contractor’s expense.

Installation of Monitoring Wells in Replication Area

For a constructed Replication Area over 1,000 square feet, a representative number of monitoring wells shall be installed in locations as shown on the Plans. Monitoring wells shall include data loggers. For purposes of this specification, a data logger refers to a battery powered device that records groundwater level. Data shall be collected by the Wetland Specialist and submitted with Monitoring Reports and as required by applicable permits. Wells shall be installed immediately following completion of construction of the Wetland Replication Area.

Wells shall be installed in accordance with USDA/NRCS technical report entitled: "Sprecher, S.W. 2008. Installing monitoring wells in soils (Version 1.0). National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, NE." or equivalent methodology approved by Engineer.

RESTORING VEGETATION

Placement of Coarse Woody Material

If specified within this Contract or if directed by the Wetland Specialist or Landscape Architect during the initial site walk, woody debris shall be placed in the Replication Area and/or adjacent upland buffer. Material shall be placed as shown on the plans or as directed following placement of wetland soil and prior to application of compost and/or seed. Woody material shall cover a minimum of 5-20 percent of the Replication Area, depending on whether it is a meadow or woodland wetland and how much wood is available from construction clearing. Where trees are cut for construction purposes, logs of a minimum length of 8 feet must comprise a minimum of 50% of the woody material left on site. Brush shall be included along with logs and stumps as directed. Woody material shall be placed in a deliberate and naturalistic manner.

Planting

Following placement of wetland soil and approval of final grade and conditions, Replication Area shall be planted. Planting shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUNDCOVER of the Division I Standard Specifications and as amended below.

Planting Season shall be May 15-June 15 and September 1-November 1 unless otherwise specified in applicable permit conditions.

Prior to planting, the Wetland Specialist shall approve the condition of the plant material and the method of installation and shall oversee the planting work. Replication Area shall be planted in the dry. Plants shall be placed according to the planting details and within the range of target elevations and at the spacing shown on the Plans or, if spacing is not indicated on the Plans, at the direction of the Wetland Specialist. Unless otherwise noted on the Plans, final plant locations shall be determined on site and located with regard to expected hydrology, plant growth characteristics, habitat desired, and water protection.

Plant material shall be installed as soon as possible after delivery. Plants stored on-site prior to installation shall be stored in the shade and watered twice daily up until time of installation. Plants showing signs of stress or compromised health may be rejected by the Engineer or Wetland Specialist and shall be replaced at the Contractor's expense.

Plant material shall be furnished and installed as indicated including all labor, materials, plants, equipment, incidentals, re-setting of plants (frost heaves, etc.), irrigation, re-planting and clean up. If previously approved species are not available at the time of planting, the Wetland Specialist may propose substitutions relative to species, size, and quantities for review and approval by the MassDOT Landscape Architect. Upon approval by MassDOT, substitutions shall be approved by the regulating authority, if and as necessary. Provisions shall be made for a growth warranty of at least two (2) calendar years from the date of Conditional Acceptance as described below or as required by permits.

Seeding

Following placement of wetland soil and planting (if included), the Replication Area shall be seeded using one of the following methods:

- Broadcast by hand or with a hand-held spreader followed by application of straw mulch. If necessary, seed shall be lightly raked to insure good seed-to-soil contact.
- Hydro-seeded with hydro mulch per the Standard Specifications and per the manufacturer's directions.
- Hand broadcast seed with Compost Blanket pneumatically applied at the same time to ensure light cover of soil topdressing over seed.

If spring conditions are drier than usual, supplemental watering may be required. If sowing during the summer months, supplemental watering will likely be required until germination.

If required, seeding limits for different seed mixes shall be determined by the Wetland Specialist.

PLANT ESTABLISHMENT AND INVASIVE MANAGEMENT

Plants shall be watered as necessary to maintain healthy establishment. Plants that fail by September 1 after spring planting or by May 15 after fall planting shall be replaced within the immediate or next planting period and at the Contractor's expense.

Seeding that fails to establish according to the conditions of acceptance below shall be over-seeded as required by the Engineer. Washouts and channels shall be repaired and stabilized prior to overseeding. Excessive weed growth shall be pulled out by the roots or, with approval from the Engineer, cut prior to over-seeding. Soil repair and weed control are incidental to this item.

Invasive Plants: Corrective measures shall be taken to remove or treat invasive plant species in the Replication Areas. Invasive plants shall include those listed as invasive by Massachusetts Invasive Plant Advisory Group (MIPAG) and the US Army Corp of Engineer's New England District's Compensatory Mitigation Guidance

The strategy for chemical and/or manual removal shall be as directed by the Wetland Specialist, shall continue for the duration of the monitoring period, and shall be incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland construction work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist demonstrating that the wetland replication construction work was done according to plans (or how modified) and meets required permit conditions. The narrative shall include photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Replication Area and surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

- The final finished target elevations have been met and maintained relative to the approved plans and reference wetland. Areas that are too high or too low should be identified along with suggested corrective measures.
- Hydrology meets performance standards.
- Specified seed mix has been seeded. If inspected 30 or more days after seeding, seeded species in the wetland and adjacent upland shall show signs of good germination and healthy growth.
- Planted woody and herbaceous species meet specifications and are establishing well.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- There are no invasive plants visible in the replication area.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Replication work is not approved, MassDOT will issue a rejection letter requiring corrective actions. The Wetland Specialist shall recommend corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

REQUEST FOR CERTIFICATE OF COMPLIANCE

If required, a request for a Certificate of Compliance (Partial or Full) pursuant to the Massachusetts Wetlands Protection Act regulations shall be prepared and submitted to MassDOT within 30 days following Conditional Acceptance.

The Request for Certificate of Compliance shall include the following:

- A brief narrative of the work on company letterhead signed by the Wetland Specialist. Narrative shall be prepared as a MS Word document and shall include substantive explanation that demonstrates compliance with EACH relevant permit condition. Narrative shall note variations from the originally permitted design.
- As-built Drawings signed by the Contractor's PE registered in the Commonwealth of Massachusetts. As-built drawings shall show hydrologic conditions, status of plantings and seeding, and shall include a narrative and minimum of 4 photographs documenting site conditions. Plans should note variations from the originally permitted design.

  When required, drawings shall meet the Army Corp of Engineer's New England District's Compensatory Replication Guidance, including: scale in the range of 1"=20' to 1" = 100', contours at 1' intervals, spot elevations for intermediate elevations, and polygons outlining each Replication Area, and, as applicable, plant community types. The As-built Drawings shall be provided to the Engineer electronically in Portable Document Format (PDF). If requested by the Engineer, the Drawings shall be provided

in printed paper format (11" x 17" sheets, unless otherwise directed). Drawings must be scalable.

- Other documents as required.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Contractor, Wetland Specialist and regulatory representative (if required) shall assess the Replication Area. Final Acceptance will initiate the start of the Wetland Monitoring Period.

The following conditions shall be inspected and approved for acceptance and payment.

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover at least 95 percent of the Replication Area, excluding areas of open water areas or planned bare soil.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species (if included) are living and establishing well.
- There are no visible invasive plants.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

If the mitigation work does not meet the above condition and is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions. Work not approved will be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover 95 percent of the area, excluding areas of open water areas or planned bare soil.
- No sediments have entered into wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species (if included) are living and establishing well.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.35 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, equipment, submittals, maintenance, all required soil, site preparation, grading, wetland seeding, planting, mulching, watering, monitoring wells, registered surveyor, as-built plans, Request for Certificate of Compliance, and all incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 60% upon Conditional Acceptance.
- 20% after receipt and acceptance of Certificate of Compliance by the Engineer and once all permit construction requirements have been met and approved.
- 20% upon Final Acceptance.

Excavation will be paid under Item 120.1
Sediment Control Barrier will be paid under Item 767.121
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76

ITEM 755.45 WETLAND RESTORATION SQUARE YARD

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

DESCRIPTION

The work under this item shall conform to the relevant provisions of Subsections 120, 751, 765, 767, and 771 of the Standard Specifications and the following:

The work under this item shall include all labor and furnishing of materials to complete the work specified herein to protect and restore existing inland wetland areas that will be temporarily impacted as shown on the drawings and as required by the Engineer.

Inland Wetland Replication work shall be as specified and compensated under that item. Tidal wetland mitigation shall be as specified under the appropriate item for tidal wetlands.

Restoration Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, U.S. Army Corps of Engineers General Permit.

All work shall be in coordination with an approved Wetland Specialist. Wetland Specialist qualifications and requirements shall be per Item 755.75, Wetland Specialist.

SUBMITTALS – DOCUMENTS

Survey: To establish or confirm pre-construction baseline elevation of temporarily impacted area(s), a survey shall be submitted to the Engineer prior to any fill or other land disturbance.

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): If applicable, request for a Certificate of Compliance shall be submitted to the Engineer for distribution to appropriate regulatory agencies as specified below.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.76 Wetland Monitoring Reports.

ASSOCIATED ITEMS AND MATERIALS

Compost shall be in accordance with Subsection 751 and M1.06.0 Organic Soil Additives of the Standard Specifications. Compost shall not contain seeds, roots, stems, or other viable parts of invasive plants or other noxious plants. Off-site sources shall be identified and available for inspection prior to transport of material to the site to verify that they are likely to be free of invasive plant species, including all viable plant parts.

Compost Blanket shall be as specified under that item.

Seed Mix

Required submittals include:

- Certificate of Materials from the supplier shall be submitted and approved 30 days prior to ordering seed. Seed species listed on the certificate shall include ecotype region (i.e., *Asclepias incarnata*, PA Ecotype).

- Seed tag from the bag of seed used shall be submitted to the Engineer at the time of seeding. Seed tag shall include ecotype region and species, guaranteed percentages of purity, weed content and germination of the seed, and the net weight. Seed tag shall match the Certificate of Materials, include the name of the supplier, and date material was sent.

- Bill of lading or a notarized Certificate of Compliance from the Supplier serving as proof of purchase shall be submitted if requested by the Engineer. Document shall include date of sale, quantity, lot number, and address of Supplier. This shall match the seed tag. Notary shall not work for either the contractor or seed supplier.

Seed mix shall be:

Mix 765.552 Wetland Mix – Obligate Mix

	Botanical Name	Common Name	% PLS By Weight
Grass			
	Carex vulpinoidea	Fox Sedge	26.50%
	Carex lurida	Shallow Sedge	15.00%
	Sparganium eurycarpum	Giant Bur Reed Eco PA	10.00%
	Carex lupulina	Hop Sedge	7.00%
	Carex crinita	Fringed Sedge	6.00%
	Scirpus cyperinus	Woolgrass	4.00%
	Juncus effusus	Soft Rush	3.00%
	Carex comosa	Bearded Sedge	3.00%
	Scirpus atrovirens	Green Bulrush	3.00%
	Sparganium americanum	Burrweed	2.50%
	Scirpus validus	Bulrush, soft-stem	2.00%
	Carex stricta	Tussock Sedge	1.00%
	Glyceria canadensis	Manna Grass	1.00%
			84.00%
Herb/Forb			
	Verbena hastata	Blue Vervain	4.00%
	Aster puniceus	Aster - Swamp	2.00%
	Eupatorium maculatum	Joe-pye Weed	1.50%
	Eupatorium perfoliatum	Boneset	2.00%
	Iris versicolor	Blue Flag Iris	2.00%
	Alisma subcordatum	Mud Plaintain	1.00%
	Vernonia noveboracensis	New York Ironweed	1.00%
	Bidens cernua	Nodding Burr Marigold	1.00%
	Solidago patula	Roughleaf goldenrod	0.50%
	Mimulus ringens	Monkey Flower	0.50%
	Chelone glabra	White Turtlehead	0.50%
			16.00%
			100.00%

Seeding Rate:
Species ecotype shall be as native to New England region as possible.
Apply this mix at 20 lbs PLS/acre.

Fertilizers shall not be used.

Straw mulch or hydromulch shall be per Section M6 of the Standard Specifications.

Plants

Plant material shall conform to the applicable requirements of Subsection 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the Standard Specifications and as amended below.

Plant Certifications shall be submitted at the time of delivery and shall conform to the Standard Specifications. Plants shall be native species, not cultivars. To the extent possible, plants shall originate from the applicable EPA Level III Ecoregion. The nursery source shall certify the provenance or origin of all plants.

Plant species and sizes to be included in the Restoration Area shall be as specified on the plans.

Requests for substitutions shall be submitted in writing to the Engineer for review by the MassDOT Landscape Architect, and, if required, the relevant regulatory agency at least thirty (30) days prior to planting. All proposed substitutes shall be in conformance with the requirements herein and suitable for the site conditions.

Transplanting and plant material collected from the wild is prohibited unless approved in writing by the Engineer. Plants shall be selected from certified nurseries.

Dead and failing plants shall be replaced per the requirements of Subsection 771 of the Standard Specifications.

Water

The Contractor shall provide water and all equipment required at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plants and wildlife. Water from the adjacent water bodies or waterways shall not be utilized. It is the Contractor's responsibility to correct injury or damage due to the lack of water, too much water, or use of contaminated water.

CONSTRUCTION METHODS & SEQUENCE

Site Protection Prior to Impacts

Prior to any land work, as part of the initial site-walk, the Wetland Specialist shall photo-document the site and provide a summary report of existing conditions as outlined under Item 755.75 Wetland Specialist.

Where and as required vegetation shall be cut flush and area surveyed to establish pre-construction elevations.

Following the cutting and surveying, temporary separation fabric or timber matting shall be placed as required to protect soil and vegetation from compaction, contamination, and/or other damages. Fabric and timber mats shall be placed as specified under the respective items and the Engineer shall approval placement.

Restoration Upon Completion of Roadway Construction Work

Sediment Barriers

If required for sediment control during Restoration work (i.e, tilling is required to restore soil), sediment barriers shall be installed along the downslope perimeter of the Restoration Area beginning and ending in the surrounding upland so that no disturbed soil can enter adjacent wetlands or waters. Sediment barriers shall be in place and approved by the Engineer prior to any soil disturbance. No work shall take place outside the barriers.

Removal of Fill and Grading

Fill and temporary separation fabric or mats shall be removed and disposed of as specified under the respective items.

If required, grades shall be restored to pre-construction elevations as shown in the baseline survey or as required by the Engineer and Wetland Specialist to restore hydrologic functions. Final elevations shall be approved by the Engineer prior to soil preparation and seeding. Grading shall be incidental to this item.

Following approval of grading to elevations required, soil shall be prepared and seeded as follows.

Soil Scarification

Compacted soil shall be scarified with equipment approved by the Engineer. Upon approval of soil scarification, the area shall ***be seeded with mulch.***

Seeding with Mulch

Upon approval of prepared soil, area shall be seeded. Seeding shall be hand broadcast with straw mulch applied per the Standard Specifications and per the manufacturer's directions. Hydromulch shall be straw or wood fiber only and shall be per the manufacturer's recommendations.

Planting

Planting shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUNDCOVER of the Division I Standard Specifications and as amended below.

Planting Season is May 15-June 15 and September 1-November 1 unless otherwise specified in applicable permit conditions.

Restoration Area shall be planted in the dry. Plants shall be placed according to the planting details and within the range of target elevations and at the spacing shown on the Plans or, if spacing is not indicated on the Plans, at the direction of the Wetland Specialist or the MassDOT Landscape Architect. Unless otherwise noted on the Plans, final plant locations shall be determined on site and located with regard to expected hydrology, plant growth characteristics, habitat desired, and water protection.

Plant material shall be installed as soon as possible after delivery. Plants stored on-site prior to installation shall be stored in the shade and watered twice daily up until time of installation. Plants showing signs of stress or compromised health may be rejected by the Engineer and shall be replaced at the Contractor's expense.

Plants shall be watered as necessary to maintain healthy establishment. Plants that fail by September 1 after spring planting or by June 1 after fall planting shall be replaced at the Contractor's expense.

Plant material shall be furnished and installed as indicated including all labor, materials, plants, equipment, incidentals, re-setting of plants (frost heaves, etc), irrigation, re-planting and clean up.

If previously approved species are not available at the time of planting, the MassDOT Landscape Architect will propose substitutions relative to species, size, and quantities. Substitutions shall then be approved by the regulating authority if necessary. Provisions shall be made for a growth warranty as described below or as required by permits.

PLANT AND SEED ESTABLISHMENT

Plants shall be watered as necessary to maintain healthy establishment. Plants that fail by September 1 after spring planting or by May 15 after fall planting shall be replaced within the immediate or next planting period and at the Contractor's expense.

Seeding that fails to establish according to the conditions of acceptance below shall be over-seeded as required by the Engineer. Washouts and channels shall be repaired and stabilized prior to overseeding. Excessive weed growth shall be pulled out by the roots or, with approval from the Engineer, cut prior to over-seeding. Soil repair and weed control are incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland restoration work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist (if applicable to project) demonstrating that the wetland restoration work was done according to plans (or how modified) and meets required permit conditions (if applicable). The narrative shall include, photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Restoration Area and the surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

- The target elevations have been restored per the survey or adjusted per the Engineer. Areas that are too high or too low should be identified along with suggested corrective measures.
- Soil compaction has been mitigated.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- Hydrology meets performance standards and has been adequately restored.
- Specified seed mix has been seeded and seeded species in the wetland and adjacent upland show signs of good germination and healthy growth.
- Planted woody and herbaceous species (if included) meet specifications and are establishing well.
- There are no invasive plants visible in the restored wetland area.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Restoration work is not approved, MassDOT will issue a rejection letter requiring corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Wetland Specialist and regulatory representative (if required) shall assess the Restoration Area. Final Acceptance will initiate the start of the Monitoring Period (if required).

The following conditions shall be inspected and approved for acceptance and payment:

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover 100 percent of the restoration area, excluding areas of open water, large boulders or planned bare soil.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- Planted woody and herbaceous species (if included) meet specifications and are establishing well.
- There are no visible invasive plants.

If the restoration work is not approved, MassDOT will issue a rejection letter requiring corrective action. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation. Work not approved shall be addressed by the Contractor at no extra cost.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended, relative to the preexisting condition of the restored wetland.
- Seeded species are establishing well and cover 100 percent of the area, excluding areas of open water areas or planned bare soil.
- No sediments have entered into wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species (if included) are living and establishing well.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.45 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, compost and amendments, seed, mulch, equipment, submittals, maintenance, grading, and incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 50% upon completion of soil preparation and seeding
- 25% upon Conditional Acceptance
- 25% upon Final Acceptance or approval of the Engineer

Excavation of temporary fill will be paid under Item 120.1
Geotextile Fabric for Temporary Soil Protection will be paid under Item 698.31
Sediment Control Barrier will be paid under Item 767.121
Compost Blanket will be paid under Item 751.73
Timber Mat will be paid under Item 767.91
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76
Plants will be paid under the respective items.

ITEM 755.75 WETLAND SPECIALIST HOUR

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

Work under this Item shall be for services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications hereafter referred to as the "Wetland Specialist."

"Wetland Mitigation" shall be used herein for applicable wetland work. For this project, applicable wetland work is for: Item 755.35 Inland Wetland Replication Area.

The Wetland Specialist shall demonstrate knowledge and expertise to coordinate and oversee all work associated with the Wetland Mitigation as defined herein, as shown on the Plans, as required by permits, and as specified under the relevant Wetland Mitigation items.

Regulatory monitoring reports following Final Acceptance of the Wetland Mitigation shall be per Item 755.76, Wetland Monitoring Reports.

For all onsite work, the Wetland Specialist shall sign in and sign out with the Engineer.

The Wetland Specialist shall not be from the same company as the company responsible for planting, seeding, and/or maintaining the wetland.

QUALIFICATIONS

The Wetland Specialist shall have a minimum of five (5) years of experience with construction and monitoring of wetland mitigation areas similar in size, type, and complexity to the Contract mitigation. When required by permits, at least ten (10) years of experience may be required. The Wetland Specialist shall be thoroughly versed in the Commonwealth of Massachusetts Wetlands Protection Act (MGL C.131, s.40), U.S. Army Corps of Engineers New England District Compensatory Mitigation Guidance, and all other relevant regulations of the Massachusetts Department of Environmental Protection and the U.S. Army Corps of Engineers New England District.

SUBMITTALS - QUALIFICATION

Within sixty (60) days following the Notice to Proceed, the Contractor shall provide proof of qualifications for the Wetland Specialist to the Engineer for approval. Submittals shall include, but not be limited to, the following:

- Resume of the individual on-site implementing the Wetland Specialist work. If the Wetland Specialist changes over the course of the project, the new individual shall submit resume and qualifications for approval 30 days prior to doing any work on-site.
- Resume of any personnel working on-site in place of the Wetland Specialist. Individual shall be approved prior to work on-site.
- Narrative describing the company, its expertise, technical qualifications and experience with wetland construction.
- At least three (3) references from prior work of a similar nature completed in the last five (5) years and by the individuals who will perform the work. Provide contact information for each reference including address, phone number and email.
- A summary of each reference project including nature of the work, project size, dates, and period of construction and monitoring, methodologies used, and summary of success (or not) in terms of meeting performance objectives. Summary shall include a minimum of one before and one after photo for each project.

SUBMITTALS – DOCUMENTATION AND REPORTS

Wetland Construction Oversight

Wetland Specialist shall provide documentation of pre-existing conditions and wetland construction as specified below and as part of fulfilling the Scope of Work described below. Documentation shall include photos that are clear and legible. Photos are incidental to this item.

- ***Site Walk Prior to Disturbance and Construction of Wetlands:*** Provide brief assessment with photos, including documentation of the existing wetlands to be impacted (both permanent and temporary), proposed wetland replication area, and reference/model wetland areas (typically an adjacent undisturbed wetland or the existing wetland to be impacted). Photos of existing wetlands that will be temporarily impacted shall include a view from at least 3 angles.
- ***Excavation and Grading:*** Documentation shall include minimum of two photos of the

excavated wetland and two photos after final grading prior to planting and seeding. For restoration areas, photos shall show soil preparation (i.e, tilling and grading), if applicable.

- ***Approval of Subgrades**:* The Wetland Specialist shall inspect the sub-grade of the Replication Area to ensure that proper hydrology is likely to be established and shall provide the Engineer with written confirmation and photographs upon completion of subgrade excavation work. Written confirmation shall include recommended field adjustments, based on field observations, to achieve the desired hydrology and designed wetland system.
- ***Planting and Seeding:*** Provide assessment and photos of vegetation upon completion of planting and seeding work.
- ***Data logger output from Monitoring Wells*** shall be submitted with reports, if applicable and requested.

Wetland construction documentation and reports shall be submitted with Request for Conditional Acceptance and for the Order of Conditions, Water Quality Certifications, and other regulatory permits as required.

Requests for Acceptance of Work & Regulatory Compliance

The Wetland Specialist shall submit the following documents if and as specified herein and under Item the relevant Wetland Mitigation items:

- Request for Conditional Acceptance.
- Request for Certificate of Compliance (Partial or Full) when applicable.
- Request for Final Acceptance.

SCOPE OF WORK

In the event of discrepancies with the applicable permits, the Wetland Specialist shall submit a Request for Information (RFI) to the Engineer.

General

The Wetland Specialist shall be responsible for the following:

- Review and have a comprehensive knowledge of the environmental permits relevant to the specific mitigation work being done so as to ensure compliance throughout the duration of the contract.
- Identify and inform the Contractor and Engineer of unique site conditions which may require adjustments to the schedule, design, or construction methods. For example, wildlife nesting, illegal dumping, or rare species.
- Identify and inform the Contractor and Engineer of any sediment or erosion control problems observed within mitigation areas.
- Advise so as to avoid impacts to adjacent areas and regulated wetland resources.
- Participate in necessary meetings as required by permits and when requested by the Engineer.

Inspections & Construction Oversight

The Wetland Specialist shall be responsible for, but not limited to, the following:

- Pre-Construction Site Walk
    - Following surveying, flagging, and staking of all relevant boundaries and elevations by the Contractor, the Wetland Specialist shall walk the site with the Engineer and the Contractor to review existing and proposed conditions, recommend changes if necessary, and approve the following: location and boundaries of the Mitigation Area, target elevations and grades, location of tree protection associated with the Mitigation Area, and final layout and limits of clearing for access route.
    - Select and mark snags, logs, and woody material to be retained for placement in the Wetland Mitigation, as appropriate.
    - Note invasive plants in and adjacent to Wetland Mitigation.
    - Provide summary report if and as specified under Wetland Mitigation items.
- Excavation, Soil Placement, Grading for Replication Areas
    - Approve excavated depth and grading for appropriate wetland hydrology, subsoil preparation, and finished grade of placed wetland soil.
    - Adjust grades as required and approve microtopography. If grades need to be adjusted, submit an RFI to the Engineer.
    - If requested by the Engineer, the Wetland Specialist shall inspect stockpiled wetland soil for moisture content and signs of undesirable weeds.
- Soil Protection and Restoration Measures for Restoration Areas
    - Review and approve methods of soil protection and restoration if required.
    - Confirm decompaction will adequately restore appropriate wetland hydrology. If decompaction measures need to be adjusted, submit an RFI to the Engineer.
- Re-vegetation of Mitigation Area
    - Placement of woody material to be re-used.
    - Verify seed used complies with specifications and site conditions, determine limits for wetland seeding based on elevations, approve seeding and mulching methods, and collect seed tags to submit with Request for Conditional Acceptance.
    - Review planting methods (if applicable) prior to installation and oversee layout of wetland plants.

Conditional Acceptance

Upon completion of construction of the wetland, as part of the Request for Conditional Acceptance, the Wetland Specialist shall provide a brief narrative demonstrating that the wetland construction work was done according to plans (or how modified) and meets the conditions required for acceptance as specified under the Wetland Mitigation items. Submittal shall include a report and photo documentation of pre-construction conditions, construction work, seeding, planting, and other work as specified under the Wetland Mitigation items. Photos of completed Wetland Restoration areas shall include the same views as the pre-construction reference photos.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the Wetland Mitigation items.

Upon approval, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Mitigation work is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

Request for Certificate of Compliance

If required, a Request for Certificate of Compliance shall be prepared and submitted to the Engineer immediately following Conditional Acceptance. Request shall be as specified under the relevant Wetland Mitigation items.

Request for Final Acceptance

Following one full growing season, the Wetland Specialist shall provide a brief narrative of the status of the Wetland Mitigation to be submitted with the Request for Final Acceptance.

Upon receipt of the Request, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the relevant Wetland Mitigation items.

If the Wetland Mitigation is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

METHOD OF MEASUREMENT

Item 755.75 Wetland Specialist shall be measured per hour for on-site service provided by the Wetland Specialist.

Work shall include all inspections, photos, submittals, and associated tasks for construction and restoration oversight, narratives for Conditional and Final Acceptance, Request for Certificate of Compliance (Partial or Full) if required, documentation required for permits, and all other work specified above. Payment shall not include travel time or time spent off-site on reports. Decimal Pay Limits will be 0.25 hours.

BASIS OF PAYMENT

Item 755.75 Wetland Specialist shall be paid at the Contractor bid price for each hour, or fraction thereof, spent on-site to perform the work as described above. Reports and photo documentation are required for payment.

Post wetland construction reports shall be per Item 755.76, Wetland Monitoring Reports.

ITEM 755.76 WETLAND MONITORING REPORTS LUMP SUM

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

Work under this item shall be for the submittal of Wetland Monitoring Reports following the completion of wetland construction and shall include all inspections, photos, and other work required to complete those reports as specified herein.

"Wetland Mitigation" shall be used herein for applicable wetland work, whether Wetland Replication (creation of a new wetland) and/or Wetland Restoration (restoration after temporary impacts).

The Contractor shall retain the services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications, hereafter referred to as the "Wetland Specialist," to complete the Wetland Monitoring reports. Wetland Specialist shall meet requirements specified under Item 755.75 Wetland Specialist.

All on-site Wetland Specialist services required to complete the construction and revegetation of the wetland replication, including preparation and submission of monitoring reports during construction, shall be per Item 755.75 Wetland Specialist.

SCOPE OF WORK

Post-Construction Wetland Monitoring Reports

Final Acceptance of the wetland construction work as specified under item 755.35 and/or 755.45 shall initiate the beginning of the Monitoring Period.

Inspections and reports shall be performed to ensure compliance with mitigation requirements defined under the relevant Wetland Mitigation items and with all applicable environmental permits. Monitoring reports shall cover the following:

- Identification of all plant species present
- Percent cover for each plant species and overall percent surface area cover by indigenous wetland plant species for replication area and upland
- Description of the viability, health, and vigor of installed plants as well as volunteer plant species within the replication areas
- Description of remedial measures taken to ensure criteria are met
- Depth to apparent water table and/or depth of surface inundation, both as measured from the soil surface and data loggers, as appropriate.
- A conclusion regarding the success of the wetland mitigation area relative to the performance standards at 310 CMR 10.55(4)(b) (unless varied), the design plans, and performance criteria established by MADEP in the variance conditions (when applicable), and the reference wetland.
- Recommendation for a corrective plan of action if needed.

Reports shall be submitted to the Engineer as a digital copy in Portable Document Format (PDF) unless otherwise requested. Hard copies shall be provided as requested by the Engineer. All reports shall be marked with the applicable permit numbers and identifying information as required in the permits. Reports shall include photo documentation of the wetland/s being monitored and shall include a minimum of 3 views from different orientations. Views shall be labeled.

Spring Reports, when required, shall be submitted to the Engineer by July 1 for dispersal to the appropriate permitting agencies.

End of Year Reports (which may serve as the Fall Report) shall be based on inspections that

occur prior to October 15th. Reports shall be submitted to the Engineer no later than November 1 of each year.

Monitoring Reports shall be as follows for ***XX*** years: ***[Select/amend as required for permits. If monitoring is required beyond 2 years after expected close of construction contract, please coordinate with MassDOT Environmental].***

- *MassDEP: # Reports - (note if spring and/or 1 end of year).*
- *ACOE: # Reports (note if spring and/or 1 end of year).*
- *Conservation Commission: # Reports (note if spring and/or 1 end of year).*
- *Other: # Reports (note if spring and/or 1 end of year).*

BASIS OF PAYMENT AND METHOD OF MEASUREMENT

Item 755.76 Wetland Monitoring Reports and associated inspections shall be at the Contract unit price per Lump Sum and shall include all labor, materials, equipment, and all incidental costs required to complete the work. Lump Sum will be paid in equal installments of the Lump Sum divided by the number of reports submitted. Payment shall be upon submittal and acceptance of each report, based on the following schedule:

- Year 1 = ***2 Reports***
- Year 2 = ***2 Reports***

ITEM 756. NPDES STORM WATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit (CGP) issued by the U.S. Environmental Protection Agency (EPA).

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the EPA for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. The Contractor shall be fully responsible for compliance with the most recently issued CGP and any subsequent revisions. Should a fine or penalty be assessed against it, or MassDOT, as a result of a local, state, or federal enforcement action due to non-compliance with the CGP, the Contractor shall take full responsibility.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a fourteen (14) day review period commencing from the date on which EPA enters the Notice into their database. Based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan (SWPPP) for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the

Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The CGP also requires the preparation and implementation of a SWPPP in accordance with the afore-mentioned statutes and regulations. The Plan will include the CGP conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. The contractor shall prepare the SWPPP and update it as necessary. The Contractor shall submit the Plan to the Engineer for approval at least four (4) weeks prior to any site activities. It is the responsibility of the Contractor to comply with the CGP conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to the project and to include in the SWPPP the methods and means necessary to comply with applicable conditions of said permits.

ITEM 756. (Continued)

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA CGP, provide all information required, and obtain any and all certifications as required by the CGP. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, regulations, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

In addition to the CGP requirements for inspections, MassDOT requires inspection of all erosion controls and site conditions on a weekly basis. Inspections are also required at portions of sites that discharge to sediment or nutrient impaired or high quality waters per the CGP when each incidence of rainfall exceeding 0.25 inches in twenty-four hours or after snowmelt discharge from a storm event that produces 3.25 inches or more of snow within twenty-four hours occurs. The CGP requires that inspections be performed by a qualified individual as outlined in the CGP. MassDOT requires proof of completion of a 4 hour minimum sedimentation and erosion control training class current to the latest CGP. This individual can be, but not limited to, someone that is either a certified inspector, certified professional, or certified storm water inspector. The documentation shall be included as an appendix in the SWPPP. The inspector's qualifications shall be submitted to the Engineer for approval prior to beginning any work. This individual shall be on-site during construction to perform these inspections. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the CGP. The Standard Specifications require adequate erosion control for the duration of the Contract. All control measures must be properly selected, installed, and maintained in accordance with manufacturer specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or is no longer adequate, it is the responsibility of the Contractor to replace or modify the control for site conditions at no additional cost to the Department. The Contractor must maintain all control measures and other protective measures in effective operating conditions and shall consider replacement of erosion controls for each construction season.

This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, and preparation of monthly reports. In addition, any erosion controls beyond those specified in bid items which are selected by the Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

ITEM 756. (Continued)

The CGP provides specific requirements for temporary and final stabilization. This shall be incorporated into the project schedule. The permit defines specific deadline requirements for Initial Stabilization ("immediately", i.e., no later than the end of the next work day following the day when earth-disturbing activities have temporarily or permanently ceased) and for Complete Stabilization Activities (no later than 14 calendar days after the initiation of stabilization). Stabilization criteria for vegetative and non-vegetative measures are provided in the CGP.

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved, as well as removal and proper disposal of all construction materials, waste and waste handling devices, removal of all equipment and construction vehicles, removal of all temporary stormwater controls, etc. Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate. The permittee shall use EPA's website to prepare and submit the NOT.

Compensation

Payment for all work under this Item shall be made at the contract unit price, lump sum, which shall include all work detailed above, including Plan preparation, required revisions, revisions/addenda during construction, monthly reports and filing fees.

Payment of fifty (50) % of the contract price shall be made upon acceptance of the NPDES Stormwater Pollution Prevention plan. Payment of forty (40) % of the contract price shall be made in equal installments over the expected duration of stormwater pollution prevention measures. Payment of the final ten (10) % of the contract price shall be paid upon satisfactory submission of a Notice of Termination (NOT) when final stabilization has been achieved.

ITEM 767.121 SEDIMENT CONTROL BARRIER FOOT

The work under this item shall conform to the relevant provisions of Subsections 670, 751 and 767 of the Standard Specifications and shall include the furnishing and placement of a sediment control barrier. Sediment control barrier shall be installed prior to disturbing upslope soil.

The purpose of the sediment control barrier is to slow runoff velocity and filter suspended sediments from storm water flow. Sediment barrier may be used to contain stockpile sediments, to break slope length, and to slow or prevent upgradient water or water off road surfaces from flowing into a work zone. The contractor shall be responsible for ensuring that barriers fulfill the intent of adequately controlling siltation and runoff.

Twelve-inch diameter (after installation) compost filter tubes with biodegradable natural fabric (i.e., cotton, jute, burlap) are intended to be the primary sedimentation control barrier. Photo-biodegradable fabric shall not be used.

For small areas of disturbance with minimal slope and slope length, the Engineer may approve the following sediment control methods:

- 9-inch compost filter tubes
- Straw bales which shall be trenched

No straw wattles may be used. Additional compost filter tubes (adding depth or height) shall be used at specific locations of concentrated flow such as at gully points, steep slopes, or identified failure points in the sediment capture line.

When required by permits, additional sediment barrier shall be stored on-site for emergency use and replacement for the duration of the contract.

Where shown on the plans or when required by permits, sedimentation fence shall be used in addition to compost filter tubes and straw bales and shall be compensated under that item.

Sediment control barriers shall be installed in the approximate location as shown on the plans and as required so that no excavated or disturbed soil can enter mitigation areas or adjacent wetlands or waterways. If necessary to accommodate field conditions and to maximize effectiveness, barrier locations may be shifted with approval from the Engineer. Barriers shall be in place prior to excavation work. No work shall take place outside the barriers.

MATERIALS AND CONSTRUCTION

Prior to initial placement of barriers, the Contractor and the Engineer shall review locations specified on the plans and adjust placement to ensure that the placement will provide maximum effectiveness.

Barriers shall be staked, trenched, and/or wedged as specified herein and according to the Manufacturer’s instructions. Barriers shall be securely in contact with existing soil such that there is no flow beneath the barrier.

Compost Filter Tube

Compost material inside the filter tube shall meet M1.06.0, except for the following: no peat, manure or bio-solids shall be used; no kiln-dried wood or construction debris shall be allowed; material shall pass through a 2-inch sieve; and the C:N ratio shall be disregarded.

Outer tube fabric shall be made of 100% biodegradable materials (i.e., cotton, hemp or jute) and shall have a knitted mesh with openings that allow for sufficient water flow and effective sediment capture.

Tubes shall be tamped, but not trenched, to ensure good contact with soil. When reinforcement is necessary, tubes shall be stacked as shown on the detail plans.

Straw Bales

Straw bales shall be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

Bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. All bales should be either wire-bound or string-tied. Straw bales should be installed so that bindings are oriented around the sides (rather than along the tops and bottoms) of the bales in order to prevent deterioration of the bindings.

The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material which might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.

Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.

The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency. Wedging must be done carefully in order not to separate the bales.

When used in a swale, the barrier should be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

Sedimentation Fence

Materials and Installation shall be per Subsection 670.40 and 670.60 of the Standard Specifications and the following:

Sedimentation fence shall only be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

When used with compost filter tubes, the tube shall be placed on a minimum of 8 inches of folded fabric on the upslope side of the fence. Fabric does not need to be trenched.

When used with straw bales, an 8-inch deep and 4-inch wide trench or V-trench shall be dug on the upslope side of the fence line. One foot of fabric shall be placed in the bottom of the trench followed by backfilling with compacted earth or gravel. Stakes shall be on the down slope side of the trench and shall be spaced such that the fence remains vertical and effective.

Width of fabric shall be sufficient to provide a 36-inch high barrier after fabric is folded or trenched. Sagging fabric will require additional staking or other anchoring.

MAINTENANCE

Maintenance of the sediment control barrier shall be per Section 670.60 of the Standard Specifications or per the Stormwater Pollution Prevention Plan (SWPPP), whichever is more restrictive.

The contractor shall inspect the sediment barrier in accordance with relevant permits. At a minimum, barriers shall be inspected at least once every 7 calendar days and after a rain event resulting in 0.25 inches or more of rainfall. Contractor shall be responsible for ensuring that an effective barrier is in place and working effectively for all phases of the Contract.

Barriers that decompose such that they no longer provide the function required shall be repaired or replaced as directed. If the resulting berm of compost within the fabric tube is sufficiently intact (despite fabric decay) and continues to provide effective water and sediment control, barrier does not necessarily require replacement.

DISMANTLING & REMOVING

Barriers shall be dismantled and/or removed, as required, when construction work is complete and upslope areas have been permanently stabilized and after receiving permission to do so from the Engineer.

Regardless of site context, nonbiodegradable material and components of the sediment barriers, including photo-biodegradable fabric, plastic netting, nylon twine, and sedimentation fence, shall be removed and disposed off-site by the Contractor.

For naturalized areas, biodegradable, natural fabric and material may be left in place to decompose on-site. In urban, residential, or other locations where aesthetics is a concern, the following shall apply:

- Compost filter tube fabric shall be cut and removed, and compost shall be raked to blend evenly (as would be done with a soil amendment or mulch). No more than a 2-inch depth shall be left on soil substrate.

- Straw bales shall be removed and disposed off-site by the Contractor. Areas of trenching shall be raked smooth and disturbed soils stabilized with a seed mix matching adjacent seeding or existing grasses (i.e., lawn or native grass mix).
- Sedimentation fence, stakes, and other debris shall be removed and disposed off-site. Site shall be restored to a neat and clean condition.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 767.121 will be measured and paid for at the contract unit price per foot of sediment control barrier which price shall include all labor, equipment, materials, maintenance, dismantling, removal, restoration of soil, and all incidental costs required to complete the work.

Additional barrier, such as double or triple stacking of compost filter tubes, will be paid for per foot of tube installed.

Barriers that have been driven over or otherwise damaged by construction activities shall be repaired or replaced as directed by the Engineer at the Contractor's expense.

ITEM 767.9 JUTE MESH SQUARE YARD

REV. 2022.02.01 (REV. DATE TO BE REMOVED BY CONTRACTS)

The work under this item shall conform to the relevant provisions of Section 700 of the Standard Specifications and the following.

The work under this item shall consist of furnishing and installing jute mesh fabric to prevent soil erosion. Jute mesh shall be placed over all areas of exposed soil in locations shown on the plans or as required by the Engineer.

MATERIALS

Jute netting or similar material shall be new, unused, undyed, and unbleached 100% biodegradable yarn (no polypropylene) and of uniform plain weave. The materials should weigh approximately 1.0 (+/- 5%) pounds per linear yard (assuming a 4-foot width).

Shall meet the following minimum requirements:

Open Area:	70-75%
Mesh Size:	approximately 1/2 inch with an open area of 60-65%.
Roll Weight:	approximately 1.0 (+/- 5%) pounds per linear yard
Warp Ends:	78 per linear yard
Weft Ends:	41 per linear yard
Recommended flow:	6 fps (1.8 m/s)
Functional Longevity:	6-9 months

Anchoring devices shall be 11-gauge steel staples 6-inch minimum length. In loose soils the length of the staples shall be 9-inches.

For areas that will be routinely mowed anchoring devices shall consist of minimum 8" wooden stakes. Longer stakes shall be used where loose soils or other conditions obligate, as required by the Engineer.

CONSTRUCTION METHODS

Area shall be seeded prior to installation of jute netting.

Installation shall be such as to ensure continuous contact with soil without folds or wrinkles. Jute netting shall be laid such that upslope fabric is placed over lower slope fabric by a minimum of 3 feet. Adjoining rolls shall be overlapped a minimum 6 inches. The netting shall extend beyond at least 1 foot beyond the edge of the seeded area.

The Contractor shall bury the ends of the jute netting 6-8 inches in anchor trenches at top and bottom of slopes.

Jute netting shall be anchored in place with vertically driven metal staples. The staples shall be driven in until their tops are flush with the soil. Staples shall be placed at 12-inch intervals along the top of a slope and in staggered courses along the face of the slope to achieve a minimum of 3 staples per square yard, or at manufacturer's recommendations for the given site conditions.

Contractor shall reseed all trenched and otherwise disturbed areas with specified seed mix. The Contractor shall maintain the jute netting and make satisfactory repairs of any areas damaged until acceptance of seed establishment.

METHOD OF MEASUREMENT

Jute Mesh will be measured by the number of Square Yards complete in place, including anchoring, as measured across the surface of grade and does not include buried or overlapped portions. The quantity measured for payment shall not exceed that shown on the plans or as directed by the Engineer.

Mesh that becomes loose or that is not otherwise functioning to stabilize soil shall be repaired and new or additional jute matting installed as required at the Contractor's expense. Soil erosion shall be repaired, and area shall be raked and reseeded with the original specified mix as required by the Engineer at the Contractors expense.

BASIS OF PAYMENT

Item 767.9 will be paid for at the contract unit price per Square Yard, which price shall include all labor, materials, equipment, trenching, placing, and stapling of jute fabric, reseeding of trenched and disturbed areas, and all incidental costs required to complete the work.

ITEM 983.522 NATURAL STREAMBED MATERIAL CUBIC YARD

DESCRIPTION

The purpose of this item is to provide natural streambed material to naturalize the channel in the proposed culvert, and in the channel where finer sediment is encountered.

The work to be done under this item shall conform to the relevant provisions of Section 983 of the Standard Specifications and the following:

This work shall consist of furnishing and placing streambed material inside, upstream and downstream of a culvert to set the desired channel profile, establish a natural bed, and maintain aquatic organism passage.

The ultimate product will to the extent possible replicate the function and appearance of natural areas of the existing stream adjacent to the culvert.

The streambed material is an important element to comply with environmental permits issued for the project. In order to satisfy those requirements and ensure the restoration is constructed as designed, MassDOT Environmental Services will be providing a Fluvial Geomorphologist (Geomorphologist) to provide on-site oversight and assistance during streambed restoration.

At least 30 days prior to the commencement of construction, the Contractor or Resident Engineer shall coordinate with MassDOT's Geomorphologist. At this meeting, the Geomorphologist will provide an overview of the channel restoration work, and will discuss the Contractor's proposed streambed restoration material source, anticipated means, methods, and schedule.

Related Items:

Stone for Pipe Ends. Shall conform to the requirements of Item M2.02.3 Stone for Pipe Ends and shall be paid for under item 258.

The Geomorphologist will be on site periodically during construction to assist the Contractor and Resident Engineer on installation of the streambed material in accordance with the environmental permits.

MATERIAL

The streambed material is to be installed as depicted on the plans.

Any stone excavated from the existing streambed during the project shall be stockpiled and reused for streambed restoration, provided the excavated stone is characteristic of the existing stream material upstream and downstream of the work area, or meets the below criteria.

If the excavated material is not suitable or there is not enough material, the streambed material shall be locally sourced, rounded river stone, that matches the composition of the native riverbed. The following gradation may be used as a guide.

Streambed Material Gradation

Stone/Sieve Size	% Finer
900 mm (36 inches)	90-100
300 mm (12 inches)	75-90
150 mm (6 inches)	30-75
4.75 mm (No. 4)	4-30
75 µm (No. 200)	0-4

The streambed material shall be well graded and shall be approved by the Resident Engineer and Geomorphologist prior to use.

Stone placed inside of the culvert shall be placed such that the structure is not damaged. Care shall be taken to limit segregation of the materials. Add sand borrow item as needed to seal the bed and prevent subsurface flow. There shall be no subsurface flow upon final inspection.

Larger material will project up through the bed to create habitat and hydraulic roughness.

CONSTRUCTION METHODS

See the plans for construction details for the natural streambed material over the riprap in the culvert, and for the natural material in the channel, as needed.

The streambed material shall fill / choke the voids in the underlying riprap. The riprap shall be choked with finer streambed material, and shall consist of a well-graded mix of cobble, gravel, sand and silt that represents the local streambed. Fill voids by hand tamping with metal tamping rods, by shaking stone with the teeth of an excavator bucket, and/or by spraying water to settle fines between large stones. Plate compactors shall not be used. The purpose for filling the voids is to prevent subsurface flow where water disappears into the large voids in the stone fill below the channel bed surface.

The material shall be installed during dewatered conditions in accordance with the environmental permits. Boulders that are part of the natural streambed material shall project above the bed to maintain a natural level of hydraulic roughness and to re-establish fish habitat.

Once all material has been placed in the culvert and approved by the Geomorphologist and Resident Engineer, the Contractor shall restore flow in such a way to slowly wet the stream to minimize the initial sediment pulse. Every attempt shall be made to minimize the downstream movement of sediment.

The final streambed in the culvert and approaches shall look like a natural riverbed, shall match nearby river reaches, and there shall be minimal subsurface flow upon final inspection by the Project Engineer and Geomorphologist.

The Contractor shall submit to the Resident Engineer for approval prior to the start of operations, a placement plan and method of placement.

METHOD OF MEASUREMENT

The quantity of streambed material to be measured for payment will be the number of cubic yards
streambed material imported to the site and installed in the complete and accepted work, measured within
the limits shown on the Plans or as directed by the Engineer.

BASIS OF PAYMENT

The accepted quantity streambed material will be paid for at the Contract unit price per cubic yard.

Payment will be full compensation for furnishing, transporting, and placing the material specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Measurement and Payment for streambed material will be measured for payment by the cubic yard, complete in place. Streambed material will be paid for at the Contract unit price per cubic yard, which price shall include all labor, materials, equipment, transportation and incidental costs required to complete the work.

Excavation required for the streambed material, including stockpiling of on-site materials, shall be considered as included under the work for this item.

The Geomorphologist will be provided by MassDOT at no cost to the Contractor.

ITEM 991.1	**CONTROL OF WATER – LOCATION 1**	**LUMP SUM**
ITEM 991.2	**CONTROL OF WATER – LOCATION 2**	**LUMP SUM**
ITEM 991.3	**CONTROL OF WATER – LOCATION 3**	**LUMP SUM**
ITEM 991.4	**CONTROL OF WATER – LOCATION 4**	**LUMP SUM**
ITEM 991.5	**CONTROL OF WATER – LOCATION 5**	**LUMP SUM**

GENERAL

The work to be performed under this Item shall include all pumping, cofferdam, sandbagging, earth and bridge excavation, by-pass piping and other measures, inclusive of optional sheeting not otherwise included under Item 953.1 for Temporary Support of Excavation, necessary for sufficient water control to accomplish the removal of the existing structure and the construction of the proposed structure and its associated excavation within the channel and the placement of natural streambed material as depicted on the plans.

Dewatering shall be conducted to ensure that all structural concrete is placed and cured in the dry. For demolition purposes, dewatering shall be conducted on an as needed basis as determined by the Contractor.

It is the responsibility of the Contractor to determine the need and extent of dewatering required and to submit methods and materials the Contractor proposes to use for the Engineer's approval.

All necessary permitting, documents and fees required for all dewatering work shall be the responsibility of the contractor and shall be included in the cost of this item.

CONSTRUCTION METHODS

Plans and calculations for all sandbagging, pipes, dikes, optional sheeting and other water control measures shall be developed by the Contractor for this Item. These plans and calculations shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and shall be submitted for the approval of the Engineer prior to the start of construction.

The Contractor shall use such equipment and shall perform his/her operations in such a manner that boiling or other disturbances of the soil in the foundation area will be prevented and that turbidity is not released into the river or wetland. The Contractor shall keep the area being excavated dry by such means that water will be prevented from entering from the adjacent soils and adversely affecting the stability of the foundation material or supporting soils.

All dewatering and related earthwork shall be conducted in such a manner as to prevent siltation or contamination of the waterway.

The pumping discharge shall not be allowed to enter directly into the waterway. The water from the work areas shall be pumped to a settling tank before discharge into the bypass pipe. The tank shall be constructed so as to allow for the pumped water to pass through the tank with sediments settling out before outletting to an area enclosed by hay bales. Storage volume shall be determined by the following formula: Cubic feet of storage required = Pump discharge rate x 16. The tank can be constructed of concrete, fiberglass or any other material that will meet the following:

1. Approximately 70 percent sedimentation trapping efficiency shall be achieved with a typical tank to ensure that the tanks are adequately sized to prevent overtopping from dewatering and to provide the required filtering.
2. The outlet from the settling tank shall not cause erosion of the surrounding area. An approved method of controlling erosion, such as an erosion control blanket, stone, etc., shall be used at the outlet of the tank.

The settling tanks shall be maintained as follows:

1. Inspect at least twice daily during dewatering operations.
2. Repair any damage immediately.
3. Clean tank outlet daily. Remove any debris immediately.
4. Remove sediments when deposits reach 8 inches below the outlet invert.
5. Dispose sediments outside of wetland areas at a location approved by the Engineer.

The Contractor shall inspect compost filter tubes or hay bales that surround the outlet daily and shall immediately replace any that are damaged.

Pumping shall be conducted in a manner, which will not adversely affect the freshly placed

concrete within the excavation.

The Contractor shall provide and maintain ample pumps, pipes and other devices to promptly and continually remove and dispose of water from the excavation areas. The size and configuration of pumps and pipes shall be selected by the Contractor. Continuous power supply (including back-up) shall be provided for operation of water control pump(s).

The Contractor shall provide the means of removing all sediment from water pumped from the excavation areas; this shall include the use of sedimentation basins, check dams, sedimentation fences or tanks as directed as directed by the Engineer. The Contractor shall provide a dewatering filter basin sized to have a minimum retention time of 24 hour.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

There will be no measurement under this item. Payment of 75% of the lump sum bid price of this item will be made upon complete installation to the satisfaction and approval of the Engineer. The remaining 25% of the lump sum bid price of this Item will be paid following proper complete removal of all temporary water control measures from the site, as determined by the Engineer.

ITEM 995.011	**CULVERT STRUCTURE, CULVERT NO. 1**	**LUMP SUM**
ITEM 995.021	**CULVERT STRUCTURE, CULVERT NO. 2**	**LUMP SUM**

This work shall consist of designing, fabricating, furnishing, and installing a precast concrete box culvert, precast cut-off and return walls as shown on the Plans.

The culvert sections shall be manufactured in accordance with the applicable requirements of Section 901 of the Standard Specifications, Supplemental Specifications, the Plans, and this Special Provision.

MATERIALS

The following materials shall meet the requirements specified in the following Subsection of Division III, Materials, unless indicated otherwise on the Construction Drawings:

Precast Concrete Box Culvert	M4.02.14
Reinforcing Bars	M8.01.0
Welded Steel Wire Fabric	M8.01.2

Preformed flexible joint sealants between precast units shall be in accordance with AASHTO M 198-B.

Bituminous Damp-proofing shall be in accordance with Section 970 of the Standard Specifications.

The work shall also include the designing, detailing, fabricating and installing of a precast concrete box culvert at the locations indicated on the Contract Plans by the Contractor.

Manufacturers offering prefabricated precast concrete box culvert which meet the basic geometric requirements indicated on the Contract Plans include, but are not limited to, the following:

Old Castle Infrastructure
41 Almeida Road
Rehoboth, MA 02769

Concrete Systems, Inc.
14 Park Avenue
Hudson, NH 03051

Precast concrete box culvert design shall conform to the AASHTO LRFD Bridge Design Specifications 9th edition 2020 and the MassDOT Bridge Design Manual. The design and fabrication shall comply with the following material standards:

- Epoxy coated reinforcing steel bars shall meet the requirements of AASHTO M 31 and AASHTO M 284.
- Cement shall meet the requirements of AASHTO M 85.
- Aggregates shall meet the requirements AASHTO M 6/M 80.
- Air-entraining admixtures shall meet the requirements of AASHTO M 154.
- Admixtures other than the air-entraining shall meet the requirements of AASHTO M 194.
- Concrete minimum compressive strength at 28 days shall be 5000 psi, Type III standard gray cement with local sand and aggregates unless otherwise directed by the Engineer.
- Bituminous damp-proofing shall be Sonneborn Hydrocide 700B and shall meet the requirements of ASTM D1227, Type 2, Class 1, and ASTM D1187 Type 1.

All steel components and fasteners shall be galvanized in accordance with Subsection M7.10.0 of Division III, Materials.

DESIGN

The Contractor shall submit design computations for the culvert units to the Engineer for review and approval. The computations shall be prepared in accordance with the AASHTO LRFD Bridge Design Specifications and the latest MassDOT LRFD Bridge Manual and HL-93 live loading. The calculations shall include load ratings prepared in accordance with the MassDOT Bridge Manual. To expedite the review and approval process, submissions containing computer computations shall include electronic copies of the actual input and output files. The design computations shall consider all loadings as are appropriate for each stage of fabrication, shipment, construction, and upon completion. Design computations and shop drawings shall be prepared and stamped by a Structural Professional Engineer with experience in culvert design and licensed to practice in the Commonwealth of Massachusetts.

Prior to fabrication, eight sets of complete shop drawings showing, as a minimum, the following information shall be submitted to the Engineer for approval:

1. Professional Engineer stamp licensed to practice in the Commonwealth of Massachusetts.
2. Plan layout of the structure indicating the piece mark of each unit.
3. Complete details of all precast units, including all dimensions and tolerances, locations and types of reinforcement, finish treatments, and concrete strengths at lifting and at 28 days.
4. Joint dimensions and details including type and brand of joint sealing materials.
5. Locations and methods of forming lifting holes, type and location of lifting devices, and the method of handling and transporting all precast units to the job site.

The minimum cover of concrete over the reinforcement shall be 2 inches or as indicated on the plans.

MANUFACTURE

Slump and air content tests shall be taken and recorded for every manufactured culvert section along with four (4) test cylinders.

Any of the methods of curing as stipulated in Section M4.02.14 of the Standard Specifications shall be used and the preferred method of curing shall be submitted to the Engineer for approval.

Handling devices shall be permitted in each unit for the purposes of handling and placing. Each culvert cell section shall contain the necessary temporary hardware so it may be connected and drawn and held to the adjacent culvert section. Bolts shall conform to ASTM Designation A307. After the full length of culvert for each stage of construction has been connected and drawn tight as approved by the Engineer, all temporary hardware and bolts shall be removed.

Any inserts on the inside surface of the culvert shall be recessed into the wall and grouted over after assembly in order to maintain a smooth, unbroken inside wall surface. Each culvert section shall contain a suitable number of reinforced lifting fixtures to insure safe and level handling and to prevent any damage during fabrication, handling, transportation and installation.

Unless otherwise shown on the plans, each separate culvert cell section shall have a male and female ship-lap joint with not less than 1-1/2 in. of concrete overlap. Each section shall have one pre-placed 1 in. preformed flexible joint sealant cemented to the joint surface.

Repairs

Culvert sections shall be repaired because of occasional imperfections in manufacture or handling damage and will be acceptable if, in the opinion of the Engineer, the repairs are sound, properly finished and cured, and the repaired sections conform to the requirements of this specification.

Inspection

Inspection shall be performed in accordance with Section M4.02.14 Paragraph G.

Rejection

Culvert sections shall be subject to rejection due to the failure to conform to any of the specification requirements. Individual sections may be rejected because of any of the following:

1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint;
2. Defects that indicate imperfect proportioning, mixing and molding;
3. Excessive honeycombed or open texture;
4. Damaged ends at time of delivery, where such damage would prevent making a satisfactory joint.

Marking

The following information shall be clearly marked on the interior of each section by indentation, waterproof paint, or other approved means:

1. Date of manufacture and lot number;
2. Name and trademark of the manufacturer.

Installation

The precast concrete culvert system shall be installed in a workmanlike manner in accordance with the lines and grades indicated on the Plans and the requirements described in the Plans and specification. The contractor shall supply competent workmen and equipment sufficient to install the sections in a safe, accurate, workmanlike manner.

The Contractor shall ensure the stability of the precast box culvert units during transportation and construction.

Backfilling operations shall not begin until the following check(s) have been made:

1. All joint seals are properly placed.

Backfill shall be paid for under separate items. The backfilling procedures shall be in accordance with Sections 120, 150, and 170 of the Standards.

996.01 ENDWALL STRUCTURE, WALL NO. 1 LUMP SUM

GENERAL

This item shall consist of furnishing and placing Portland cement concrete endwall unit on a prepared subgrade or sub-base in accordance with these specifications and in reasonably close conformity with the lines, grades and dimensions shown on the plans.

MATERIALS

Materials shall meet the requirements specified in the following Subsections of Division III,

Materials:
Cement and Cement Concrete Materials.....M4
Precast Concrete Highway Units.....M4.02.14
High Performance Concrete.....M4.06.1
Steel Reinforcement.....M8.01.0
Epoxy Coated Reinforcing Bars M8.01.7

CONSTRUCTION METHODS

The subgrade shall be properly shaped and compacted as specified in Subsection 170: Grading.

The Endwall Structure unit shall be placed on a previously compacted gravel foundation.

Finishing, Curing, and Protective Sealing

The Endwall Structure unit shall be finished, cured, and sealed according to the applicable specifications of M4.02.14: Precast Concrete Highway Units.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Endwall Strucutre, Wall No. 1 will be measured and paid for as an individual unit, as shown on the plans, which includes full compensation for all labor, equipment; materials including finishing, curing, protective sealing, reinforcing steel, and all incidental work necessary to complete the work as specified.

Gravel borrow for the foundation of the barriers and between the sections will be paid for under Item 151; Gravel Borrow.

Appendix G

Maximum Extent Practicable (MEP) Analysis

Memorandum

To: Courtney Walker, Melissa Lenker, Dave Paulson, and Tim Dexter – MassDOT

Michael Joyce – Weston & Sampson

From: Roy Schiff and Elizabeth Richards – SLR Consulting

Date: March 21, 2024

Subject: MEP Analysis
608163 WALES Monson Road

Introduction

A maximum extent practicable (MEP) alternatives analysis started by Weston & Sampson has been expanded by SLR following a rapid stream geomorphic assessment (see the SLR memorandum dated March 1, 2023). Three perennial crossings (24+92, 50+72 and 86+00/87+00) have been evaluated that are all located on mapped Coldwater Fish Resources according to the Massachusetts Division of Fisheries and Wildlife. Other crossings are located in drainage swales (15+30) or wetland areas (43+75/46+60, 55+20, and 82+07). A site visit with MassDOT, Town of Wales, Weston & Sampson, and SLR was conducted on July 31, 2023 to discuss the designs.

Station 15+30

The western-most crossing is a small drainage swale that was dry at the time of the visit. This culvert conveys intermittent flow under Monson Road from a wetland to the east of Lynch Road that passes under Lynch Road in a 12-inch metal pipe outside of the project limits. The flow than enters a narrow swale just west of Lynch Road and then travels along Monson Road to the crossing (Figure 1). Bankfull indicators do not exist in the channel and thus meeting the stream crossing standards will primarily rely on passing the design flow through the structure. The crossing is currently a 12-inch corrugated plastic pipe that will be replaced with an 18-inch reinforced concrete pipe as part of the project.

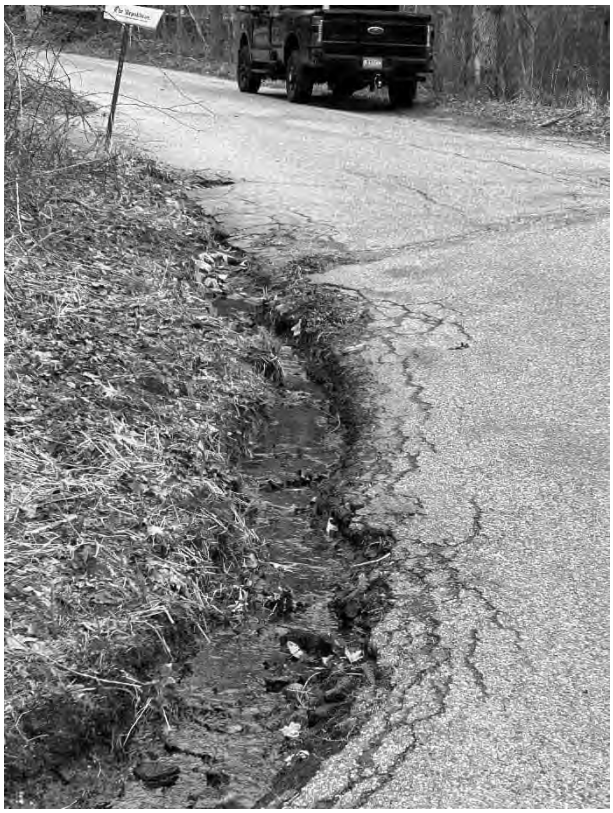


Figure 1: Drainage swale west of Lynch Road upstream of the Monson Road crossing at 15+30

Station 24+92

The tributary of Vinica Brook has a drainage area of 0.9 square miles at the crossing and appears to be a perennial channel with well-defined banks and bedforms (Figure 2). The bankfull channel width was measured in the field to be 11.5 feet.

Meeting the 1.2 bankfull standard was determined to be cost and timeline-prohibitive due to the need for bridge review for structures over 10 feet (Appendix A). Therefore, a concrete box with a span of 9.8 feet and rise of 5.0 feet with 2 feet embeddment (0.85 x bankfull width) is recommended (Table 1). This structure would have many benefits of a 1.2 bankfull structure such as passing sediment, large wood, and the design flood, yet at a reduced cost.

Figure 2: Culvert outlet at 24+92

Table 1: Proposed Structures 24+92

Existing Structure	Proposed
36” Dia. CMP w Overflow CMP	0.85 x Bankfull Concrete Box (9.8’ x 5.0’ w embeddment)

Depending on available cover, a thicker top to the box culvert may be necessary. This size box culvert will still pass most sediment and large wood, and will be hydraulically adequate for the design flood. This replacement will require limited channel restoration near the structure due to deposition upstream of the structure and scour downstream. Survey may be necessary to determine if a grade control structure is needed to eliminate the outlet drop and to protect the upstream woods road culvert that is outside of the Town right-of-way.

Station 43+75 / 46+60

The intermittent channel in this location flows through a stone wall upstream of Monson Road (Figure 3) and then is diverted into a roadside drainage swale as the culvert under the road is reported to be clogged. The downstream channel is currently dry (Figure 4). The wetted channel width upstream of the road was measured to be 1 to 2 feet. The banks of the small channel are poorly formed and thus repeat measurements were not made. Good bankfull indicators do not exist due to the intermittent nature of this wetland channel. Meeting the stream crossing standards will primarily rely on passing the design flow through the structures. 12-inch reinforced concrete pipes are proposed at both crossing locations.

Figure 3: Wetland and intermittent channel upstream of Monson Road at 43+75

Figure 4: Dry intermittent channel downstream of Monson Road at 43+75

Station 50+72

The perennial stream in this location is a woodland drainage that is a tributary of Vinica Brook. The channel passes under a tall road embankment in a 30-inch thick walled smooth plastic pipe (Figure 5). An outlet drop exists that is about 1 foot tall. The bankfull channel width was measured to be 15.0 feet. A large deposit of wood exists upstream of the crossing.

Currently a new structure is not proposed at this location. This crossing requires a large structure, and therefore it is recommended to decouple this structure replacement from the current project. The existing structure is very undersized and should be replaced with a bridge (Table 2).

Figure 5: Culvert Outlet at 50+72

Table 2: Proposed Structure 50+72

Existing Structure	Proposed
30" Dia. CMP	Bridge with 18-Foot Span

Due to this structure replacement being decoupled from the Monson Road Improvement project, timeline is not considered a limitation. Therefore, it is recommended that a 1.2 bankfull structure is installed at a minimum (Appendix B). Due to the tall road embankment and large volume of fill, a bridge is likely the best option at this site. The bridge would pass the accumulation of sediment and large wood located upstream of the crossing.

Station 55+20

The outflow from a wetland flows north under Monson Road through a 12-inch corrugated metal pipe (Figure 6). Overland flow takes place in the wetland. The channel is a function of the concentrated overland flow in the culvert and not migrating channel processes. Bankfull indicators do not exist. The typical wetted width of the channel is 2 to 3 feet upstream and 5 to 6 feet downstream. To meet stream crossing standards, structure sizing at this location should be determined by required hydraulic capacity to convey the design flood.

Figure 6: Existing culvert inlet upstream of Monson Road

Station 82+07

The outflow from a small farm / residential pond flows towards Monson Road into a depression (Figure 7) and then passes under the road in a small, deteriorated culvert. The flow then enters a wetland with a small channel (Figure 8). Overland flow takes place in the wetland. The channel is a function of the concentrated overland flow in the culvert and not migrating channel processes. Bankfull indicators do not exist. Based on observations made by SLR Consulting on March 19, 2024 under normal spring flow, the typical wetted width of the channel is 12 to 24 inches and the depth of the channel is 4 to 6 inches. To meet stream crossing standards, structure sizing at this location should be determined by required hydraulic capacity to convey the design flood. The existing 12-inch corrugated metal pipe will be replaced with an 18-inch reinforced concrete pipe.

Figure 7: Ponding upstream of Monson Road

Figure 8: Wetland channel

Station 86+00/87+00

A tributary of Vinica Brook crosses Monson Road in this location. The woodland channel flows under the road into a small depression at the intersection of Reed Hill Road and then flows under Reed Hill Road (Figure 9). The channel farther downstream appears to have been straightened. The measured bankfull channel width is 10.5 feet.

For this site, meeting the 1.2 bankfull standard was considered, but was determined to be cost and timeline-prohibitive due to the need for bridge review for structures over 10 feet (Appendix C). Therefore, a single concrete box with a width of 9.6 feet (0.9 x bankfull channel width) is recommended (Table 3). The structure is skewed to naturalize the stream alignment and shorten the culvert length and thus the effective hydraulic opening width of the proposed culvert is 8 feet. The stream crossing would only cross Monson Road and replace the existing pair of culverts. The proposed new alignment will allow for shortening the crossing by daylighting 20 to 30 feet of the channel on each end of the structure. This would reduce the size, costs, and impacts of the proposed structure. This structure would have many benefits of a 1.2 bankfull structure such as transport of sediment and large wood at a reduced cost.

Figure 9: Culvert outlet at 86+00/87+00

Table 3: Proposed Structures 86+00/87+00

Existing Structure	Proposed
24” Dia. CMP (2 Segments)	0.9 x Bankfull Concrete Box (9.6’ x 4.5’ w 2’ embedment, Length 46.8 feet)

General Design Recommendations

- It has been determined that increasing the sizes to fully meet the 1.2 bankfull width standard is not possible given the existing timeline and budget of the road improvement project. However, based on the updated maximum extent practicable (MEP) analysis, enlarging two structures (24+92 and 86+00/87+00) to approximately 0.9 times the bankfull channel width achieves many of the benefits of a larger crossing structure. Flood conveyance, sediment transport, and large wood movement will all be improved. Fish passage will be restored, and small mammals will be able to pass through the structures during low flows.

- The structure replacement at 50+72 should be a bridge that has a span of at least 1.2 the bankfull channel width. This crossing upgrade should be decoupled from the road improvement project and performed in the future.

- Small channels cross Monson Road at 15+30, 43+75 / 46+60, and 82+07. These drainage channels are not formed by bankfull alluvial processes, but by concentrated overland drainage. To meet stream crossing standards, these crossings shall be sized according to conveyance of the design flood.

- A streambed restoration special provision to excavate, stockpile, and reuse the native bed material at the crossing structures is recommended to naturalize the channel in and around the proposed structures.

APPENDIX A

MEP Table for Crossing 15+30

Station	Stream	Notes
15+30	Drainage swale	Intermittent. From wetland east of Lynch Road.

Bankfull Width = N/A
Bankfull Depth = N/A

SLR field notes from initial site visit

The flow than enters a narrow swale just west of Lynch Road and then travels along Monson Road to the crossing. Bankfull indicators do not exist in the channel and thus meeting the stream crossing standards will primarily rely on passing the design flow through the structure.

Upstream

MEP Criteria			WS Alternative 1 - Replace 12-inch corrugated plastic pipe with 18-inch reinforced concrete pipe
1	Flooding	The potential for downstream flooding	No anticipated change to downstream flooding are anticipated in this headwater setting.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	No change to habitat is expected as the pipe sizes are similar. The wetland is on the east side of Lynch Road, while the crossing under Monson Road is on the west side of Lynch Road, separated by culvert outside of the project limits.
3	Erosion	Potential for erosion and head-cutting	This pipe replacement should reduce potential erosion along the edge of Monson Road. Headcutting is not anticipated in this intermittent water course.
4	Stream stability	Stream stability	This structure is located on an intermittent watercourse that is a drainage swale along the road and thus will not influence stability of stream channels.
5	Fragmentation	Habitat fragmentation caused by the crossing	This structure does not fragment habitat as the channel is too small and intermittent to have instream habitat. Wildlife in this rural area will cross the road.
6	Reconnection	The amount of stream mileage made accessible by the improvements	None exist and none are proposed.
7	Flooding	Storm flow conveyance	The larger culvert would improve flood conveyance to pass the design storm.
8	Constraints	Engineering design constraints specific to the crossing	The pipe sits high, just under the road so a reinforced concrete pipe is needed.
9	Hydrology	Hydrologic constraints specific to the crossing	With such little flow, there is no storage located at this structure.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	This structure does not influence wetlands given the upstream culvert under Lunch Road lies between the subject culvert and the wetland.
11	Property and infrastructure	Potential to affect property and infrastructure	It is unlikely that this culvert influences property. Allowing more water to drain out of the swale will reduce saturation along the edge of the road embankment.
12	Cost	Cost of replacement	The proposed culvert is a cost-effective approach to improve local drainage at Monson Road.
Summary			**This structure will improve local drainage in this intermittent watercourse.**

APPENDIX B

MEP Table for Crossing 24+92

Station	Stream	Notes
24+92	Tributary of Vinica Brook	Perennial. Upstream woods road crossing. Two culverts exist. Proposed is likely a single culvert.

Bankfull Width = 11.5 ft
Bankfull Depth = 0.9 ft

SLR field notes from initial site visit

The tributary of Vinica Brook has a drainage area of 0.89 square miles at the crossing and appears to be a perennial channel with well-defined banks and bedforms (Figure 4). The estimated bankfull channel width is 14.3 feet (Table 1). The bankfull channel width was measured in the field to be 11.5 feet (Table 2). The existing twin pipe culverts should be converted to a single structure with a width of 13.8 feet to meet the 1.2 bankfull standard. An embedded, closed-bottom pipe may be a cost-effective solution. Otherwise, a maximum extent practicable (MEP) alternatives analysis should take place to identify if a smaller structure is possible (310.cmr10.53(8)).

Downstream

	MEP Criteria		SLR Alternative 2 - 0.85 x bankfull concrete box (9.8' x 5.0' w 1.5 to 2' embedded)	SLR Alternative 1 - 1.2 x bankfull concrete box (13.8' x 6.5' w 2' embedded)	W&S Alternative 3: Meet minimum applicable "Stream Crossing Standards 6'x6.5 box (with 2' stone)	W&S Alternative 2: Meet General Performance "Standards for Bank and LUWW 2 pipes with 24" Diameter	W&S Alternative 1 (Selected): Replace in-kind 36" Diameter
1	Flooding	The potential for downstream flooding	A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding in this headwater setting. Due to having a span smaller than BFW, it will be slightly more difficult for this box to pass large wood.	A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding in this headwater setting.	Significantly larger opening. Higher potential for downstream flooding due to larger culvert passage size.	Larger cumulative culvert openings. Higher potential for downstream flooding due to larger culvert passage size.	No Change. Potential for downstream flooding is minimal as current conditions do not show downstream flooding.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	Any project at this site will need channel restoration and wetland protection to ensure the presence of in-stream habitat. Any adequate replacement will include channel restoration, and sizing that allows for passage of large wood.	Any project at this site will need channel restoration and wetland protection to ensure the presence of in-stream habitat. Any adequate replacement will include channel restoration, and sizing that allows for passage of large wood.	Stream simulation within crossing and higher organism passage. Water will continue to flow freely.	Larger cumulative culvert openings could allow for additional organism passage. Water will continue to flow freely.	No Change. Conditions to remain the same. Water currently flows freely with no backup.
3	Erosion	Potential for erosion and head-cutting	With proper consturction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	With proper consturction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	Decrease potential for erosion with stream simulation.	Decrease potential for erosion with splash pad.	No Change. Conditions to remain the same. No evidence of current scour.
4	Stream stability	Stream stability	A large structure will increase channel stability with bank lines that run through the structure and a more natural uniform profile where a wide range of flows can pass through the structure. *This structure is slightly undersized according to standard, and therefore there is minimal room for natural shelves running through the structure.*	A large structure will increase channel stability with bank lines that run through the structure and a more natural uniform profile where a wide range of flows can pass through the structure.	Decrease potential for erosion with stream simulation.	Decrease potential for erosion with splash pad.	No Change. Conditions to remain the same. No evidence of current scour.
5	Fragmentation	Habitat fragmentation caused by the crossing	The larger structure would reduce local habitat fragmentation. The natural channel would pass through the structure allowing bed features and sediment to exist.	The larger structure would reduce local habitat fragmentation. The natural channel would pass through the structure allowing bed features and sediment to exist.	Reduced habitat fragmentation by providing maximum span.	Larger cumulative culvert openings could allow for additional organism passage and decreased fragmentation.	No Change. Conditions to remain the same. No evidence of current fragmentation.
6	Reconnection	The amount of stream mileage made accessible by the improvements	A small woods road culvert exists upstream that is a block to aquatic organism passge during high flows. The culvert is partially backwatered and thus passable during low and normal flows. A velocity barrier would exist due to the small contraction during higher flows.	A small woods road culvert exists upstream that is a block to aquatic organism passge during high flows. The culvert is partially backwatered and thus passable during low and normal flows. A velocity barrier would exist due to the small contraction during higher flows.	The size could potentially allow recreational accessibility.	The culverts not large enough to allow recreational accessibility.	No Change. Conditions to remain the same. The culvert is not large enough to allow recreational accessibility.
7	Flooding	Storm flow conveyance	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. *This box culvert will have less additional space for material transport, but will likely still pass most debris and will be hydraulically adequate for the design flood.*	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The box culvert would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	Box opening could allow for additional storm flow conveyance.	Larger cumulative culvert openings could allow for additional storm flow convey	No Change. Conditions to remain the same. Water currently flows freely with no backup.
8	Constraints	Engineering design constraints specific to the crossing	Removing the twin pipes for a single box culvert does not have constraints. The box would be placed lower in the channel and thus road profile. Depending on available cover, a thicker top to the box culvert may be needed for less cover application. A single culvert will be easier to maintain once installed.	Removing the twin pipes for a single box culvert does not have constraints. The box would be placed lower in the channel and thus road profile. Depending on available cover, a thicker top to the box culvert may be needed for less cover application. A single culvert will be easier to maintain once installed.	Box opening would mean the road needs to be raised to provide minimum cover over pipes and impacts to adjacent properties likely.	Larger culverts would mean the road needs to be raised to provide minimum cover over pipes.	No Change. Conditions to remain the same.
9	Hydrology	Hydrologic constraints specific to the crossing	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	Box opening could allow for additional storm flow conveyance.	Larger cumulative culvert openings could allow for additional storm flow conveyance.	No Change. Conditions to remain the same. Water currently flows freely with no backup.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	The box culvert would restore the streambed resulting in more Land Under Water.	The box culvert would restore the streambed resulting in more Land Under Water.	Box opening would mean more Land under Water.	Larger cumulative culvert openings would mean more Land under Water and more Bank.	No Change. Conditions to remain the same. No increase in wetland resource areas.
11	Property and infrastructure	Potential to affect property and infrastructure	It is unlikely that the box culvert will impact properties beyond the ROW because it is mostly located under the roadway.	It is unlikely that the box culvert will impact properties beyond the ROW because it is mostly located under the roadway.	Box culvert would mean additional road changes that could require obtaining an easement from adjacent properties to complete the work.	Larger culverts would mean additional road changes that could require obtaining an easement from adjacent properties to complete the work.	No Change. Conditions to remain the same.
12	Cost	Cost of replacement	The 0.85 bankfull width culvert will likely achieve most of the benfits of the 1.2 bankfull culvert at a reduced cost. Modeling should be used to verify hydraulic performance, and costing could be used to realize the actual cost savings.	This is the primary concern for this alternative in that the culvert will be a high cost, and an increase in installation cost is likely over smaller structures. *Additionally, a box of this size will require bridge review.* However, recent flooding shows that maintenance and replacement costs are reduced in the long term when a 1.2x bankfull width culvert is installed.	Twice as expensive as Alternative 2.	Moderately Expensive	Least expensive
	Summary		**This structure has many benefits of a 1.2 bankfull structure (good habitat connectivity but with a lower openness ratio), at a reduced cost. This structure is more likely to fit in the project timeline due to not requiring bridge review. Therefore, this is the recommended alternative.**	**This option would result in the most resilient structure with the least maintenance, and would best connect upstream and downstream habitat. However, it is cost and timeline-prohibitive, and therefore is not recommended.**	**This structure is not recommended as it would leave the crossing undersized and likely require more maintenance. At a structure width of 56% of the measured bankfull channel width the crossing could have issues with transport of large wood. Permitting may be complicated.**	**This structure is not recommended as it would leave the crossing severely undersized and require more maintenance. At a combined structure width of 35% of the measured bankfull channel width the crossing could have issues with transport of large wood. The stagnation point between the twin pipes would increase clogging potential. Permitting may be complicated.**	**This structure is not recommended as it would leave the crossing severely undersized and require more maintenance. At a combined structure width of 26% of the measured bankfull channel width the crossing could have issues with transport of large wood. The stagnation point between the twin pipes would increase clogging potential. Permitting may be complicated.**

Proposal No. 608163-128112

APPENDIX C

MEP Table for Crossing 43+75/46+60

Station	Stream	Notes
43+75/46+60	**Drainage swale**	**Intermittent. From wetland North of Monson Road.**

Bankfull Width = N/A
Bankfull Depth = N/A

SLR field notes from initial site visit

The intermittent channel in this location flows through a stone wall upstream of Monson Road and then is diverted into a roadside drainage swale as the culvert under the road is reported to be clogged. The downstream channel is currently dry. The wetted channel width upstream of the road was measured to be 1 to 2 feet. The banks of the small channel are poorly formed and thus repeat measurements were not made. Good bankfull indicators do not exist due to the intermittent nature of this wetland channel. Meeting the stream crossing standards will primarily rely on passing the design flow through the structures.

Upstream

MEP Criteria			WS Alternative 1 - Replace existing damaged pipes with 12-inch reinforced concrete pipes
1	Flooding	The potential for downstream flooding	No anticipated change to downstream flooding is anticipated in this headwater setting.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	No change to habitat is expected as the pipe sizes are similar and flow is regulated by a stacked stone wall upstream of the pipes.
3	Erosion	Potential for erosion and head-cutting	This pipe replacement should reduce potential erosion along the edge of Monson Road. Headcutting is not expected in this intermittent water course.
4	Stream stability	Stream stability	This structure is located on an intermittent watercourse that is a drainage swale along the road and thus will not influence stability of stream channels.
5	Fragmentation	Habitat fragmentation caused by the crossing	This structure does not fragment habitat as the channel is too small and intermittent to have instream habitat. Wildlife in this rural area will cross the road.
6	Reconnection	The amount of stream mileage made accessible by the improvements	None exist and none are proposed.
7	Flooding	Storm flow conveyance	Two functioning culverts would improve flood conveyance to pass the design storm.
8	Constraints	Engineering design constraints specific to the crossing	The pipe sits high, just under the road so a reinforced concrete pipe is needed.
9	Hydrology	Hydrologic constraints specific to the crossing	With such little flow, there is no storage located at this structure. The storage is located further upstream in the wetland.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	This structure will not change the wetland hydrology.
11	Property and infrastructure	Potential to affect property and infrastructure	It is unlikely that this culvert influences property. Allowing more water to drain out of the swale will reduce saturation along the edge of the road embankment.
12	Cost	Cost of replacement	The proposed culvert is a cost-effective approach to improve local drainage at Monson Road.
Summary			**This structure will improve local drainage in this intermittent watercourse.**

APPENDIX D

MEP Table for Crossing 50+72

Station	Stream	Notes
50+72	Tributary of Vinica Brook	Perennial. Tall road embankment. Upstream large wood build up. One culvert exists. Proposed is likely a single large culvert or small bridge.

Bankfull Width = 15 ft
Bankfull Depth = 0.9 ft

SLR field notes from initial site visit
The perennial stream in this location is a woodland drainage that is a tributary of Vinica Brook (Figure 8). The ch annel passes under a tall road embankment in a 30
inch thick walled smooth plastic pipe (Figure 9). An outlet perch exists that is about 1 foot tall. The estimated bankfull channel width is 14.5 feet (Table 3). The bankfull width of the channel was measured to be 15.0 feet (Table 4). A deposit of large wood exists upstream of the crossing in a local flat spot in the channel (Figure 10). This material appears to be a long-term accumulation and should be removed if the structure is changed.

At this time a new crossing is not proposed as it will be large and expensive. A bridge is the ideal structure for this setting with a tall road embankment to eliminate the large floodplain fill. Also, a bridge will pass the high volume of large wood and sediment that exists at the project site, some of which will need to get removed during construction.

Downstream

Upstream

	MEP Criteria		SLR Alternative 3 - 1.0 x bankfull concrete box (15' x 6.0' w 2' embedded)	SLR Alternative 2 - 1.2 x bankfull concrete box (18' x 6.5' w 2' embedded)	SLR Alternative 1 - Bridge with 18' Span	No W&S Alternatives
1	Flooding	The potential for downstream flooding	The channel is steep and thus the potential flood storage and release behind this culvert is small. A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding.	The channel is steep and thus the potential flood storage and release behind this culvert is small. A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding.	The channel is steep and thus the potential flood storage and release behind this culvert is small. A bridge will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding is anticipated. The downstream corridor is undeveloped so some limited floodplain inundation is acceptable.	
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	Will improve upstream and downstream habitat through the reestablishment of sediment and large wood transport.	Will improve upstream and downstream habitat through the reestablishment of sediment and large wood transport.	*A bridge will best improve upstream and downstream habitat through the reestablishment of sediment and large wood transport, and improved fish and wildlife passage.*	
3	Erosion	Potential for erosion and head-cutting	With proper construction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	With proper construction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	With proper construction techniques, erosion potential and head-cutting will be reduced. A bridge will establish a uniform grade through the structrure.	
4	Stream stability	Stream stability	A large structure will increase channel stability with bank lines that run through the structure and a more natural uniform profile where a wide range of flows can pass through the structure. *This structure is slighly undersized according to standard, and therefore there is minimal room for natural shelves running through the structure.*	A large structure will increase channel stability with bank lines that run through the sturcture and a more natural uniform profile where a wide range of flows can pass through the structure.	A large structure will increase channel stability with bank lines that run through the sturcture and a more natural uniform profile where a wide range of flows can pass through the structure.	
5	Fragmentation	Habitat fragmentation caused by the crossing	The larger structure would reduce local habitat fragmentation. The natural channel would pass through the structure allowing bed features and sediment to exist.	The larger structure would reduce local habitat fragmentation. The natural channel would pass through the structure allowing bed features and sediment to exist.	The larger structure would reduce local habitat fragmentation. The natural channel would pass through the structure allowing bed features and sediment to exist.	
6	Reconnection	The amount of stream mileage made accessible by the improvements	McBride Road Bridge is approximately 1 mile upstream. The passability at this structure is unknown.	McBride Road Bridge is approximately 1 mile upstream. The passability at this structure is unknown.	McBride Road Bridge is approximately 1 mile upstream. The passability at this structure is unknown.	
7	Flooding	Storm flow conveyance	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The box culvert would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The box culvert would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The bridge would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	
8	Constraints	Engineering design constraints specific to the crossing	This channel passes under a tall road embankment that would need to be excavated to remove and replace the structure. *There is enough cover available to meet minimum requirements for fill over the structure, but will require extensive excavation as well as backfilling to install a box.*	This channel passes under a tall road embankment that would need to be excavated to remove and replace the structure. *There is enough cover available to meet minimum requirements for fill over the structure, but will require extensive excavation as well as backfilling to install a box.*	This channel passes under a tall road embankment that would need to be excavated to remove and replace the structure. *A bridge will be the best option at this location due to the amount of fill.*	
9	Hydrology	Hydrologic constraints specific to the crossing	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	The box culvert would restore the streambed so more Land Under Water.	The box culvert would restore the streambed so more Land Under Water.	The bridge would restore the streambed so more Land Under Water.	
11	Property and infrastructure	Potential to affect property and infrastructure	*The box culvert is mostly located under the roadway, however, due to the extent of the excavation, there may be issues with ROW or property easements for construction.*	*The box culvert is mostly located under the roadway, however, due to the extent of the excavation, there may be issues with ROW or property easements for construction.*	*The bridge will benefit nearby property by preventing upstream ponding, sedimentation, and large wood accumulation at the existing culvert.*	
12	Cost	Cost of replacement	*The bankfull width culvert will likely achieve most of the benefits of the 1.2 bankfull culvert at a reduced cost.* Modeling should be used to verify hydraulic performance, and costing could be used to realize the actual cost savings.	*This structure cost may be in the same order of magnitude as a bridge replacement (pending comparison). An increase in installation cost is likely over smaller structures.* However, recent flooding shows that maintenance and replacement costs are reduced in the long term when a 1.2x bankfull width culvert is installed.	*This is the primary concern for this alternative in that the bridge may be the highest cost alternative, pending comparison with a culvert of equal span.* An increase in installation cost is likely over smaller structures. However, recent flooding shows that maintenance and replacement costs are reduced in the long term when a 1.2x bankfull width bridge is installed rather than undersized culverts.	
	Summary		**This structure will slighlty reduce the cost of the replacement, however, the actual amount of savings may not be worth the loss of benefits present in a 1.2 bankfull width bridge or larger culvert. Therefore, this alternative is not recommended.**	**Due to the size of the structure and the amount of excavation required, this alternative may not present cost savings compared to a bridge, and therefore is not recommended.**	**This option would result in the most resilient structure with the least maintenance, and would best connect upstream and downstream habitat. This would allow for the large amount of upstream large wood to begin to move through the stream system. This replacement is decoupled from the Monson Road project but is recommended for the future.**	

A00840 - 137

Proposal No. 608163-128112

APPENDIX E

MEP Table for Crossing 55+20

Station	Stream	Notes
55+20	Drainage swale	Intermittent. From wetland North of Monson Road.

Bankfull Width = N/A
Bankfull Depth = N/A

SLR field notes from initial site visit

The outflow from a wetland flows north under Monson Road through a 12-inch corrugated metal pipe. Overland flow takes place in the wetland. The channel is a function of the concentrated overland flow in the culvert and not migrating channel processes. Bankfull indicators do not exist. The typical wetted width of the channel is 2 to 3 feet upstream and 5 to 6 feet downstream. To meet stream crossing standards, structure sizing at this location should be determined by required hydraulic capacity to convey the design flood.

Upstream

MEP Criteria			WS Alternative 1 - Retain existing pipe
1	Flooding	The potential for downstream flooding	No anticipated change to downstream flooding is anticipated in this headwater setting.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	No change to habitat is expected.
3	Erosion	Potential for erosion and head-cutting	No change anticipated.
4	Stream stability	Stream stability	This structure is located on an intermittent watercourse and thus will not influence stability of stream channels.
5	Fragmentation	Habitat fragmentation caused by the crossing	This structure does not fragment habitat as the channel is too small and intermittent to have instream habitat. Wildlife in this rural area will cross the road.
6	Reconnection	The amount of stream mileage made accessible by the improvements	None exist and none are proposed.
7	Flooding	Storm flow conveyance	No change anticipated. Current culvert properly sized based on hydrology analysis.
8	Constraints	Engineering design constraints specific to the crossing	The pipe sits high, just under the road so shallow cover exists.
9	Hydrology	Hydrologic constraints specific to the crossing	With such little flow, there is no storage located at this structure. The storage is located further upstream in the wetland.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	No change anticipated
11	Property and infrastructure	Potential to affect property and infrastructure	It is unlikely that this culvert influences property. Allowing more water to drain out of the swale will reduce saturation along the edge of the road embankment.
12	Cost	Cost of replacement	The proposed culvert is a cost-effective approach to improve local drainage at Monson Road.
Summary			**Retain existing structure.**

APPENDIX F

MEP Table for Crossing 82+07

Station	Stream	Notes
82+07	Drainage swale	Intermittent. From pond North of Monson Road.

Bankfull Width = N/A
Bankfull Depth = N/A

SLR field notes from initial site visit

The outflow from a small farm / residential pond flows towards Monson Road into a depression and then passes under the road in a small, deteriorated culvert. The flow then enters a wetland with a small channel. Overland flow takes place in the wetland. The channel is a function of the concentrated overland flow in the culvert and not migrating channel processes. Bankfull indicators do not exist. Based on observations made by SLR Consulting on March 19, 2024 under normal spring flow, the typical wetted width of the channel is 12 to 24 inches and the depth of the channel is 4 to 6 inches. To meet stream crossing standards, structure sizing at this location should be determined by required hydraulic capacity to convey the design flood.

Downstream wetland channel

MEP Criteria			WS Alternative 1 - Replace existing 12-inch plastic corrugated pipe with an 18-inch reinforced concrete pipes
1	Flooding	The potential for downstream flooding	No anticipated change to downstream flooding is anticipated in this headwater setting.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	No change to habitat is expected as the pipe sizes are similar.
3	Erosion	Potential for erosion and head-cutting	This pipe replacement should reduce potential erosion along the edge of Monson Road. Headcutting is not expected in this intermittent water course.
4	Stream stability	Stream stability	This structure is located on an intermittent watercourse that is a pond outlet and thus will not influence stability of stream channels.
5	Fragmentation	Habitat fragmentation caused by the crossing	This structure does not fragment habitat as the channel is too small and intermittent to have instream habitat. Wildlife in this rural area will cross the road.
6	Reconnection	The amount of stream mileage made accessible by the improvements	None exist and none are proposed.
7	Flooding	Storm flow conveyance	A larger culvert would improve conveyance and likely limit flow over the embankment.
8	Constraints	Engineering design constraints specific to the crossing	The pipe sits high, just under the road so a reinforced concrete pipe is needed.
9	Hydrology	Hydrologic constraints specific to the crossing	With such little flow, there is no storage located at this structure. The storage is located in the wetlands.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	This structure will not change the wetland hydrology.
11	Property and infrastructure	Potential to affect property and infrastructure	It is unlikely that this culvert influences property.
12	Cost	Cost of replacement	The proposed culvert is a cost-effective approach to improve local drainage at Monson Road.
Summary			**This structure will improve local drainage in this intermittent watercourse.**

APPENDIX G

MEP Table for Crossing 86+00 / 87+00

Station	Stream	Notes
86+00/87+00	Tributary of Vinica Brook	Two structures exist that flow from upstream channel into median area and then to downstream channel. Road alignment change proposed.

Bankfull Width = 10.5 ft
Bankfull Depth = 0.7 ft

SLR field notes from initial site visit
A tributary of Vinica Brook crosses Monson Road in this location. The small woodland channel flows under Monson Road into a small depression at the intersection of Reed Hill Road and then flows under Read Hill Road (Figure 11). The channel farther downstream appears to have been straightened (Figure 12). It is not clear if this channel is perennial or intermittent based on winter field observations.
The estimated bankfull channel width is 10.4 feet (Table 5). The measured bankfull channel width is 10.5 feet (Table 6). Many measurements in this area are not ideal, reflecting either over-widened or confined conditions. The new structure should have a width of 12.6 feet to meet the 1.2 bankfull standard. Otherwise, an MEP alternatives analysis should take place to identify if a small structure is possible (310.cmr10.53(8)).

	MEP Criteria		SLR Alternative 3 - Single 0.9 x bankfull concrete box (9.6' x 4.5' w 1.5 to 2' embedded) - Realigned for a length of approx. 50'	SLR Alternative 2 - Single 1.2 x bankfull concrete box (12.6' x 5.5' w 2' embedded) - Length appr. 50'	SLR Alternative 1 - Single Approx. 40' Span Bridge on Monson Road with Additional Changes to Reed Hill intersection	W&S Alternative 3: Meet Min Stream and Crossing Standards - 6'x6.5 box w 2' stone	W&S Alternative 2 (Selected): Meet General Performance Standards for Bank and LUWW - 42" Diameter Culvert - Length appr. 120'	W&S Alternative 1: Replace in kind - 2 (in line) x 24" Diameter Culvert Segments
1	Flooding	The potential for downstream flooding	A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding in this headwater setting.	A larger box will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding in this headwater setting.	A bridge will naturalize the pulses of water, sediment, large wood, and ice moving through system. No anticipated change to downstream flooding in this headwater setting.	Significantly larger opening. Higher potential for downstream flooding due to larger culvert passage size.	Larger culvert opening. Higher potential for downstream flooding due to larger culvert passage size.	No Change. Potential for downstream flooding is minimal as current conditions do not show downstream flooding.
2	Habitat	Upstream and downstream habitat (in-stream habitat, wetlands)	Any project at this site will need channel restoration and wetland protection to ensure the presence of in-stream habitat. Any adequate replacement will include channel restoration, and sizing that allows for passage of large wood.	Any project at this site will need channel restoration and wetland protection to ensure the presence of in-stream habitat. Any adequate replacement will include channel restoration, and sizing that allows for passage of large wood.	*A bridge will best improve upstream and downstream habitat through the reestablishment of sediment and large wood transport, and improved fish and wildlife passage.*	Stream simulation within crossing and higher organism passage. Water will continue to flow freely.	Larger culvert opening could allow for additional organism passage. Water will continue to flow freely.	No Change. Conditions to remain the same. Water currently flows freely with no backup.
3	Erosion	Potential for erosion and head-cutting	With proper construction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	With proper construction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	With proper construction techniques, erosion potential and head-cutting will be reduced. A grade control weir may be needed to set the channel profile.	Decrease potential for erosion with stream simulation.	Decrease potential for erosion with splash pad.	No Change. Conditions to remain the same. No evidence of current scour.
4	Stream stability	Stream stability	A large structure will increase channel stability with bank lines that run through the structure and a more natural uniform profile where a wide range of flows can pass through the structure. *This structure is slightly undersized according to standard, and therefore there is minimal room for natural shelves running through the structure.*	A large structure will increase channel stability with bank lines that run through the structure and a more natural uniform profile where a wide range of flows can pass through the structure.	A large single structure will increase channel stability with bank lines that run through the sturcture and a more natural uniform profile where a wide range of flows can pass through the structure.	Decrease potential for erosion with stream simulation.	Decrease potential for erosion with splash pad.	No Change. Conditions to remain the same. No evidence of current scour.
5	Fragmentation	Habitat fragmentation caused by the crossing	A long culvert will have a lower openness ratio than a bridge, and therefore has the potential to disrupt habitat connectivity, along with fish and wildlife movement. However, this is an improvement over the suggested length of 120'. Channel would be daylighted an additional 20-30' on either side of the road. Any larger structure should reduce habitat fragmentation if channel restoration also takes place at the intersection of Monson Road and Reed Hill Road. *The 0.9xBFW structure allows less space for natural shelves for wildlife passage.* Vinica Brook and its tributaries are Coldwater Fish Resources according to the Div of Fisheries and Wildlife.	A long culvert will have a lower openness ratio than a bridge, and therefore has the potential to disrupt habitat connectivity, along with fish and wildlife movement. However, this is an improvement over the suggested length of 120'. Channel would be daylighted an additional 20-30' on either side of the road. Any larger structure should reduce habitat fragmentation if channel restoration also takes place at the intersection of Monson Road and Reed Hill Road. *A 1.2xBFW structure would allow space for natural shelves for wildlife passage.* Vinica Brook and its tributaries are Coldwater Fish Resources according to the Div of Fisheries and Wildlife.	*A bridge will have the highest openness ratio, and therefore provide the best passage for fish and wildlife. A bridge would allow space for natural shelves for wildlife passage.* Vinica Brook and its tributaries are Coldwater Fish Resources according to the Division of Fisheries and Wildlife.	Reduced habitat fragmentation by providing maximum span.	Larger culvert opening could allow for additional organism passage and decreased fragmentation.	No Change. Conditions to remain the same. No evidence of current fragmentation.
6	Reconnection	The amount of stream mileage made accessible by the improvements	The fish and wildlife passage would be improved to the headwaters.	The fish and wildlife passage would be improved to the headwaters.	The fish and wildlife passage would be improved to the headwaters.	The size could potentially allow recreational accessibility.	The culverts not large enough to allow recreational accessibility.	No Change. Conditions to remain the same. The culvert is not large enough to allow recreational accessibility.
7	Flooding	Storm flow conveyance	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The box culvert would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	The larger culvert would improve flood conveyance, especially in terms of sediment and large wood. The box culvert would have space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	The larger structure would improve flood conveyance, especially in terms of sediment and large wood. The bridge would have *the most* space beyond the design flood for material transport, and also be able to pass larger floods that are occuring in our region more these days.	Box opening could allow for additional storm flow conveyance.	Larger culvert opening could allow for additional storm flow conveyance.	No Change. Conditions to remain the same. Water currently flows freely with no backup.
8	Constraints	Engineering design constraints specific to the crossing	The box would be placed lower in the channel and thus road profile. Depending on available cover, a thicker top to the box culvert may be needed for less cover application. A single culvert will be easier to maintain than current two culverts once installed. *This option will not require any more changes to the road geometry than are already being proposed.*	The box would be placed lower in the channel and thus road profile. Depending on available cover, a thicker top to the box culvert may be needed for less cover application. A single culvert will be easier to maintain than current two culverts once installed. *This option will not require any more changes to the road geometry than are already being proposed.*	The small woodland channel flows under Monson Road into a small depression at the intersection of Reed Hill Road and then flows under Reed Hill Road, any replacement will include road realignment. The bridge would negate the need for cover over a box. A single bridge will be easier to maintain than two culverts. *This alternative would require additional changes to geometry of the Reed Hill Road approach.*	Box opening would mean the road needs to be raised to provide minimum cover over pipes and impacts to adjacent properties likely.	Larger culverts would mean the road needs to be raised to provide minimum cover over pipes.	No Change. Conditions to remain the same.
9	Hydrology	Hydrologic constraints specific to the crossing	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	The crossing has limited, short-term flood storage so hydrology is not a concern with enlarging the structure at this crossing location.	Box opening could allow for additional storm flow conveyance.	Larger culvert opening could allow for additional storm flow conveyance.	No Change. Conditions to remain the same. Water currently flows freely with no backup.
10	Wetlands	Impacts to wetlands that would occur by improving the crossing	The box culvert would restore the streambed for 20-30' on either side of the crossing and result in more Land Under Water.	The box culvert would restore the streambed for 20-30' on either side of the crossing and result in more Land Under Water.	The bridge would restore the streambed and result in more Land Under Water. It is likely that riparian wetlands would return arund the edges of the bridge.	Box opening would mean more Land under Water. Daylighting next to Reed Hill Road.	Larger culvert opening would mean more Land under Water. Daylighting next to Reed Hill Road.	No Change. Conditions to remain the same. No increase in wetland resource areas.
11	Property and infrastructure	Potential to affect property and infrastructure	*New shorter layout may require additional easements and ROW issues at the culvert inlet.*	*New shorter layout may require additional easements and ROW issues at the culvert inlet.*	The bridge would require that the Reed Hill Road intersection move further east, impacting the properties on that side of the intersection. *ROW issues could emerge.*	Box culvert would mean additional road changes that could require obtaining an easement from adjacent properties to complete the work.	Larger culverts would mean additional road changes that could require obtaining an easement from adjacent properties to complete the work.	No Change. Conditions to remain the same.
12	Cost	Cost of replacement	*The 0.9 bankfull culvert will likely achieve most of the benefits of the 1.2 bankfull culvert at a reduced cost.* Modeling should be used to verify hydraulic performance, and costing could be used to realize the actual cost savings.	*This is the primary concern for this alternative in that the culvert will be a high cost, and an increase in installation cost is likely over smaller structures.* However, recent flooding shows that maintenance and replacement costs are reduced in the long term when a 1.2x bankfull width culvert is installed.	*This approach is expensive and likely a stand-alone project from the road reconstruction.* However, maintenance costs are likely lower and the risk of future flood damages is lower.	Twice as expensive as Alternative 2	Moderately Expensive	Least expensive
	Summary		**This structure has many benefits of a bridge (good habitat connectivity but with a lower openness ratio), at a reduced cost. This structure is more likely to fit in the project timeline due to not requiring bridge review. The channel alginment is naturalized and the culvert can be shorter that improves the stream channel conditions and passage. Therefore, this is the recommended alternative.**	**This structure has many benefits of a bridge (with a lower openness ratio), at a reduced cost. However, this structure is likely also not feasible in the required timeline due to bridge review.**	**This option would result in the most resilient structure with the least maintenance, and would best connect upstream and downstream habitat. However, it is cost and timeline-prohibitive, and therefore is not recommended.**	**This structure is not recommended as it would be very long and leave the crossing undersized and likely require more maintenance. At a structure width of 62% of the measured bankfull channel width the crossing could have issues with transport of large wood. Permitting may be complicated.**	**This structure is not recommended as it would be very long and leave the crossing severely undersized and likely require more maintenance. At a structure width of 33% of the measured bankfull channel width the crossing could have issues with transport of large wood. Permitting may be complicated.**	**This structure is not recommended as it would be very long and leave the crossing severely undersized and likely require more maintenance. At a structure width of 20% of the measured bankfull channel width the crossing could have issues with transport of large wood. Permitting may be complicated.**

Appendix H

Stormwater Management Report

WESTON & SAMPSON ENGINEERS, INC.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

June 2024

TOWN OF
Wales
MASSACHUSETTS

STORMWATER MANAGEMENT REPORT
Monson Road Reconstruction
Project File No.608163

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF ATTACHMENTS ii

1.0 INTRODUCTION 1

2.0 DESIGN METHODOLOGIES 1

3.0 EXISTING DRAINAGE CONDITIONS 2

4.0 PROPOSED DRAINAGE CONDITIONS 2

5.0 THE STORMWATER MANAGEMENT STANDARDS 3

6.0 EROSION & SEDIMENTATION CONTROL MEASURES 7

7.0 SUMMARY 8

REGISTERED PROFESSIONAL ENGINEER'S CERTIFICATION 8

LIST OF ATTACHMENTS

Attachment A ..... Figures

Attachment B ..... Stormwater Checklist

Attachment C ..... Drainage Report

Attachment D ..... Operation and Maintenance Plan

Attachment E ..... Erosion and Sedimentation Control Plan and Pollution Prevention Plan

1.0 INTRODUCTION

This Stormwater Management Report has been developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. See Attachment A for a Locus Map of the Project Location. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has an open "country" drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 4.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project site is considered to be categorized as a redevelopment project according to the definition within volume 2, chapter 3 of the Massachusetts Stormwater Handbook. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

The drainage requirements are summarized in the Stormwater Checklist found in Attachment B.

2.0 DESIGN METHODOLOGIES

The survey performed for this project has been used in conjunction with the Mass GIS LIDAR Data to delineate drainage area limits for this project. The watershed area for each structure (both existing and proposed) was finalized based on a detailed field investigation.

The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design. Rational Method is used for determining runoff peak flows and design spreads of the road drainage system for a 10-year frequency design storm. The storm drainage systems were evaluated and designed using *Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2023*. An IDF curve for the project site was derived to depict the current precipitation intensities as summarized in the NOAA Atlas 14 Precipitation Data.

A proposed drainage area spreadsheet was composed to compute total areas and C-values for each catch basin. The runoff coefficients used are 0.9 for paved areas, 0.3 for grassy areas and 0.2 for unimproved areas (woods). A minimum time of concentration of 5 minutes was used for paved areas.

The hydraulic flow capacity of each drainage system was determined through gutter flow, storm sewer design, and hydraulic grade line analyses. The results of these calculations are presented using the Hydraflow Storm Sewers Program (see Attachment C for Drainage Report).

The culverts that cross Monson Road are designed for a 25-year frequency design storm because Monson Road is a Rural Major Collector. The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. The HY-8 Reports are included in the Drainage Report in Attachment C.

3.0 EXISTING DRAINAGE CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.2 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.5 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Nine culvert crossings convey brooks (unnamed except for the crossing at 50+72 which is locally known as either Dunham or Schoolhouse Brook) under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+32, Sta. 24+92, Sta. 43+75, Sta. 46+60, Sta. 50+72, Sta 82+07, Sta 86+00, and Sta. 87+00. These brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Attachment C for Drainage Report and HY-8 output.

4.0 PROPOSED DRAINAGE CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. The proposed impervious area within the project limits is 5.3 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 3.8 acres. 0.70 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. Based on site investigations, historical records, and GIS data, the proposed drainage areas were determined which can be found in the Drainage Report in Attachment C.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. See Attachment C for the Drainage Report that describes each swale and contains swale design calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

Seven closed storm sewer systems are proposed along Monson Road. See Attachment C for the Drainage Report that describes each system and contains Hydraflow Storm Sewer Reports. These

systems shall outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Attachment C for the Drainage Report which contains the proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 2 Design Methodologies. The 12" CPP culvert at STA 15+32 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9-ft,10-in and rise 5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+75 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+60 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain and the 12" CMP crossing at STA 55+20 will also remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, two separate sections of 24" stone box culvert which cross diagonally under Monson Road and Reed Hill Road near Sta. 86+00 and Sta. 87+00, respectively, will be replaced by a concrete box culvert of span 8 ft and rise 4.5 ft at Sta. 86+45. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50. The box culverts proposed at Sta. 24+92 and 86+45 will both be submerged 2-ft to allow for the placement of natural stream bed material, consistent with the upstream and downstream channel restoration.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+32, STA 43+75, STA 46+60, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in the Drainage Report in Attachment C.

Water Quality:

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis.

At the existing outfalls, there is no evidence of erosion. All banks are stable with heavy vegetation and scour holes containing large rocks. A long-term Pollution Prevention Plan/ Operation and Maintenance Plan is included in Attachment D. This plan clearly identifies that the Town Highway maintenance will be responsible for inspections and periodic maintenance, which includes street sweeping and sediment removal.

5.0 THE STORMWATER MANAGEMENT STANDARDS

The Massachusetts Department of Environmental Protection (MassDEP) developed the Stormwater Policy that includes the ten Stormwater Management Standards. These standards address water quality and water quantity. It should be noted that the upstream watershed areas are unchanged. Minor

increases in flows will have negligible effect on the discharges in Vinica Brook. This roadway redevelopment project was designed to comply with the standards up to the maximum extent practicable. See Attachment B for the Stormwater Checklist.

Standard 1: *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The proposed project will create seven new closed drainage systems, but none of these systems will include new untreated discharges. The redevelopment project includes widening Monson Road and adding a shoulder for the safety of pedestrians and bikes. The total increase in impervious area is 0.88 acres, and the total increase in flow for a 10-yr storm event is 3.83%. The new pipe discharges will be treated by standard water quality measures to the maximum extent practicable as indicated in the Standard 4 explanation. Modified rockfill outfall protection is proposed for each new outfall and is summarized with backup calculations in the Drainage Report in Attachment C.

Standard 2: *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

The proposed project will include roadway widening with the addition of 4-ft shoulders to improve safety conditions and meet the requirements of MassDOT. Retention or detention is not practicable within the roadway right of way. The total increase in flows is 1.7 cfs for the 10 Year storm, which is a 3.83% increase over the pre-development peak discharge rate. The total increase in flows for the 2 Year storm is 1.2 cfs. The increase in flow is distributed across multiple outfalls and culvert crossings as shown in Tables 1 and 2 below. The increase in flow was calculated with the Rational Method based on the increase in impervious area per drainage area. This flow will be treated with catch basins with deep sumps as well as natural grass and lined swales. The flow will discharge to areas with outlet protection (level spreaders, modified rockfill aprons, or scour holes), which will reduce the velocity of the flow allowing sediment to deposit and decrease potential erosion.

Table 1. Increase in Flows for 10-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	4.47	4.56	0.09
Sta 15+32 Crossing	8.21	8.42	0.21
Sta 24+92 Crossing	8.15	8.41	0.26
Sta 31+62 Outlet/ Runoff	5.39	5.61	0.22
Sta 43+75 Crossing	1.42	1.52	0.10
Sta. 46+60 Crossing	1.82	1.76	-0.05
Sta 50+72 Crossing	5.34	5.65	0.31
Sta 73+23 Outlet/ Runoff	3.36	3.50	0.13
Sta 82+07 Outlet/ Runoff	4.57	4.85	0.28
Sta 85+72 Outlet/ Crossing	2.20	2.36	0.16
Total	**44.9**	**46.6**	**1.7**

The largest increase in flow is 0.31 cfs at the 50+72 crossing. The flow will be dissipated by an existing scour hole before traveling downstream to an unnamed brook. At all the crossings with proposed improvements, there will be a reduction in velocity due to increased openness ratios in the box culverts and larger proposed pipe diameters.

Table 2. Increase in Flows for 2-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	3.05	3.11	0.06
Sta 15+30 Crossing	5.60	5.75	0.15
Sta 24+92 Crossing	5.55	5.73	0.18
Sta 31+62 Outlet/ Runoff	3.67	3.82	0.15
Sta 43+75 Crossing	0.96	1.03	0.07
Sta. 46+60 Crossing	1.24	1.20	-0.04
Sta 50+72 Crossing	3.64	3.85	0.21
Sta 73+23 Outlet/ Runoff	2.29	2.38	0.09
Sta 82+07 Outlet/ Runoff	3.11	3.30	0.19
Sta 85+72 Outlet/ Crossing	1.50	1.61	0.11
Total	30.6	31.8	1.2

This roadway project requires road widening, which causes an increase in flow. The site does not contain areas to detain or retain stormwater runoff due to lack of available space within the public layout. The stormwater is treated before discharge, and the outlets contain outlet protection to reduce potential erosion. This roadway redevelopment project will comply with this standard up to the maximum extent practicable.

Standard 3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration to the maximum extent possible. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type*

Due to the limitations of right-of-way and existing utilities, there is insufficient space for the installation of recharge BMPs. Efforts were made to reduce the amount of curbing to allow roadway runoff into pervious areas. Roadside swales, including natural grass swales as well as modified rockfill lined swales are proposed along the corridor to help promote infiltration and provide disconnection. Additionally, the creation of approximately 75 linear feet of re-routed and daylighted stream channel increases the land under water area and promotes further recharge. Due to this project being a redevelopment, this standard complies to the maximum extent practicable.

Standard 4: *For new development, stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS)*

This project is a limited project that does not include modifications to the upstream watersheds, but only improvements to the existing roadway and storm drainage systems. All proposed drainage structures will have 4' deep sumps. Natural grass and lined swales are proposed to the maximum extent practicable to keep stormwater off of the roadway, promote infiltration, and contribute to TSS removal.

Standard 5: *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs. The use of infiltration practices without pretreatment is prohibited*

This standard is not applicable because roadways are not among the areas classified as having higher potential pollutant loads.

Standard 6: *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas*

The three perennial brooks crossing Monson Road within the project are designated as Cold-Water Fisheries. These crossings are Vinica Brook at the Reed Hill Road intersection, Schoolhouse Brook (STA 50 +72) and the unnamed brook at STA 24+92. Stormwater discharges have been proposed near existing outfall locations in order to maintain the existing drainage patterns. All new outfalls are proposed outside of wetlands and streams and outfall protection is proposed in advance of the critical areas in order to reduce erosion and excess sediment. Additionally deep sump catch basins are proposed throughout the entire proposed closed drainage system(s) as an approved pretreatment BMP. This proposed BMP together with the proposed roadway improvements represent a significant improvement over the existing conditions given the lack of existing pretreatment of roadway runoff and roadside embankment erosion which is contributing to poor stormwater quality especially near the resource and critical areas immediately adjacent to each culvert crossing.

Regarding other BMPs such as dry water quality swales, wet water quality swales, bioretention cells, and drainage channels, insufficient space within the public layout restricts the installation of additional water quality measures. Linear stormwater infiltration practices, like the ones listed above, were considered for the project, however, due to the relocation of the existing stone walls within the remaining town layout limits to reduce the total length of removal of stone walls below the MEPA threshold, many of the stone walls occupy locations where excavated infiltration swales could be installed without more significant right-of-way impacts. Additionally, in many areas long, linear and parallel wetlands and watercourses run along the roadway and occupy portions of the roadway town layout which also normally be considered for linear practices. Lastly, in order to qualify as a linear stormwater practice, the design would need to provide a certain depth and width in order to provide the minimum quality volume characteristics which significantly increase the easements needed on the abutting private properties which include single family developed and undeveloped residential and large parcels of undeveloped wildlife sanctuary property all of which are densely vegetated with mature shade and other tree species.

Standard 7: *Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.*

This project qualifies as a redevelopment project according to the definition within volume 2, chapter 3 of the *Massachusetts Stormwater Handbook.* The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

Piped stormwater systems and roadside swales are proposed to improve the conveyance and quality of stormwater. Stormwater water quality measures including deep sump catch basins are included to increase the removal of total suspended solids. Provision of structural SCMs beyond deep sump catch

basins such as linear infiltration was investigated for this project however provision of such measures is not feasible due to lack of available space within the project right of way.

Standard 8: *Erosion and Sedimentation Controls must be implemented to prevent impacts during construction or land disturbance activities*

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment E. The location of proposed erosion control measures and installation details are shown on the plans. These measures include inlet protection on all catch basins and sediment barriers down gradient of all disturbances within the wetland buffer zones. Because the project will disturb more than an acre of land the contractor will request coverage under the NPDES Construction General Permit and will provide a Stormwater Pollution Prevention Plan (SWPPP).

Standard 9: *All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed*

An Operation and Maintenance Plan is provided in Attachment D.

Standard 10: *All illicit discharges to the system are prohibited*

Illicit discharges are not permitted in the Town of Wales. The project's stormwater management system, as shown on the plans submitted with this report, have been designed in full compliance with Standard 10. The project area does not have any known illicit connections. Any illicit connections to the stormwater management system found in the project limit of work during construction will be removed and/or resolved through MassDOT's Illicit Discharge Detention and Elimination (IDDE) Program. The Long-Term Pollution Prevention Plan, provided in Appendix E, includes measures to prevent illicit discharges.

6.0 EROSION & SEDIMENTATION CONTROL MEASURES

To protect the adjacent properties from construction related activities, a Soil Erosion and Sediment Control Plan has been developed in accordance with the latest Massachusetts Department of Environmental Protection (MassDEP) Erosion and Sediment Control Guidelines. This plan will be implemented prior to the start of any site disturbance and will involve the combined use of compost filter tubes, silt fencing, silt sacks, and vegetative stabilization. Refer to Design Plans for soil erosion and sediment control notes and details.

Once a construction schedule has been established, a responsible person shall be named who will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials, installation, and maintenance of erosion and sediment structures, and the communication and detailed explanation of the requirements and objectives of the erosion and sediment control measures to all people involved in the site work.

Weston & Sampson shall be notified at 1-860-616-6495 of any proposed alteration to the erosion and sediment control plan prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

7.0 SUMMARY

The proposed project will improve the roadway, traffic and drainage conditions at the project site. The proposed roadway redevelopment will comply with the standards to the maximum extent practicable. The proposed project shall satisfy the stormwater requirements of the Massachusetts Stormwater Handbook.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Management Report, including the soils information, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, and the plans showing the stormwater management system, and have assessed that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also assessed that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

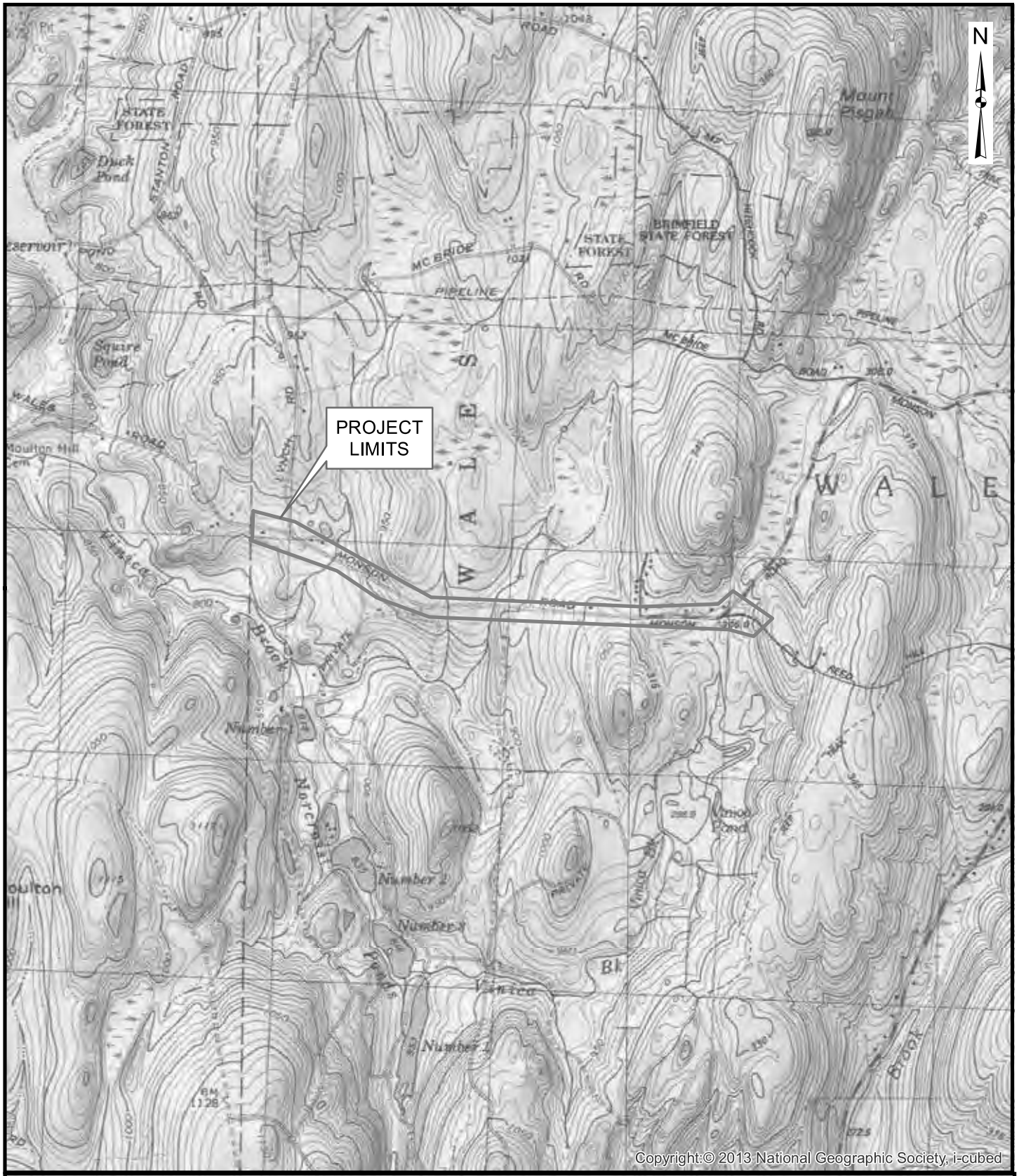
Registered Professional Engineer Block and Signature

Conrad C. Nuthmann 6/4/2024

Signature and Date

ATTACHMENT A

Figures



Project Limits

FIGURE 1
MONSON ROAD IMPROVEMENTS
Wales, MA

LOCUS MAP

1 inch = 2,000 feet

1,000 0 1,000

Scale In Feet

Weston & Sampson

Path: P:\MA\Wales, MA\2170841 Monson Rd Reconstruction\CAD\GIS\LocusMap.mxd User: ColesL Saved: 1/31/2018 2:49:29 PM Opened: 1/31/2018 2:49:49 PM

ATTACHMENT B

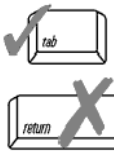
Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

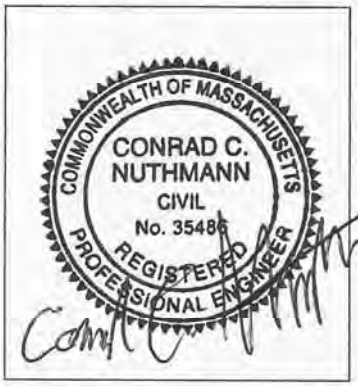
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Conrad C. Nuthmann 6/5/2024
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

☒ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

ATTACHMENT C

Drainage Report

Weston & Sampson

westonandsampson.com

712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

April 2024

TOWN OF
Wales
MASSACHUSETTS

DRAINAGE REPORT
Monson Road Reconstruction
Project File No.608163

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF APPENDICES ii

1.0 INTRODUCTION 1

2.0 METHODOLIGIES 1

3.0 DESIGN SUMMARY 2
3.1 Drainage Regulations 2
3.2 Rational Method Factors 2

4.0 EXISTING CONDITIONS 3

5.0 PROPOSED CONDITIONS 3
5.1 Drainage Swales 3
5.2 Storm Sewer Systems 4
5.3 Cross Culverts 5
5.4 HY-8 6
5.5 HEC-RAS 6
5.6 Temporary Water Handling 7

6.0 WATER QUALITY MEASURES 7

7.0 CONCLUSION 7

LIST OF APPENDICES

Appendix A ..... Watershed Maps

Appendix B ..... Rational Method Data

Appendix C ..... Hydraflow Reports

Appendix D ..... HY-8 Reports

Appendix E ..... HEC-RAS

Appendix F ..... Drainage Swales

Appendix G ..... Outlet Protection

DRAINAGE REPORT

1.0 INTRODUCTION

This Drainage Report was developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has stormwater sheet off the road into undefined swales and wetlands. Drainage issues include roadside sediment deposits that cause water to flood the road, which damages the road structure. Pavement unraveling causes erosion at the edge of the pavement. There are also minimal water quality measures. There are nine culvert crossings that convey unnamed streams under Monson Road. The culverts also convey stormwater runoff that travels via roadside swales. These streams eventually discharge into Vinica Brook, which closest point is located approximately 1,000-ft to the south of the Monson Road intersection with Lynch Road. The existing culverts are inadequately sized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 5.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

This report summarizes the existing drainage conditions and issues, the methodology used to perform the drainage analysis, and the proposed improvements to the storm drainage system.

2.0 METHODOLIGIES

Watershed areas were established through the use of project topographic survey, Mass GIS LIDAR Data, and site visits to verify watershed area limits. Site investigation of the entire project area included review of the condition of existing roads, utilities, culverts, and general surroundings. Field observations provided a better understanding of drainage patterns, watershed areas, and structures not included on mapping. Following site investigations, the layout of each drainage system was finalized and mapped. See Appendix A for Drainage Area Maps.

The Rational Method was used to determine the peak surface runoff rate of this watershed. The Rational Method involves three factors: the drainage area, the runoff coefficients based on surface features, and rainfall intensity based on the time of concentration of the drainage area. Individual peak surface runoff rates were determined for each catch basin where storm water is collected. The individual runoff rates were then combined into an overall system to represent the existing conditions. This was done for each of the systems studied, and the findings are discussed in the following sections.

Hydraflow Storm Sewers Extensions for AutoCAD Civil 3D 2023 was used to model the proposed piped drainage systems. The computer program used the Rational Method to determine peak flow rates based

on specific parameters input by the user. The capacity of each pipe was analyzed and compared to the flow in cubic feet per second (cfs) through the system. The software also computed gutter spreads and hydraulic grade lines. The Rational Method input is attached in Appendix B. Hydraflow results are included in Appendix C. The proposed systems were finalized to improve drainage conditions in a cost-effective manner, improve water quality, minimize property impacts, and maintain roadway conditions in the future.

The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. HY-8 is a computerized implementation of Federal Highway Administration (FHWA) culvert hydraulic design. The program calculates the capacity of the culvert with headwater and tail water influences. The program also calculates energy dissipation. The HY-8 Reports are included in Appendix D.

3.0 DESIGN SUMMARY

The closed drainage systems and cross culverts were designed to meet MassDOT Standards.

3.1 Drainage Regulations

- The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design.
- The roadway storm drain system is designed for a 10-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide. A 25-year design storm frequency was checked for systems with low points.
- The cross culverts are designed for a 25-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide.

3.2 Rational Method Factors

- Drainage Area - The properties within the watershed limits of the storm drainage systems consist of woods and residential and commercial lots.
- Runoff coefficients were based on land cover obtained from aerial photography, survey, and field observations. The following runoff coefficients were used:
  - Impervious Areas (Asphalt, Concrete, Roofs, Etc.) = 0.90
  - Grass (open space) = 0.3
  - Woods = 0.2
- Precipitation data is based on the most current information taken from NOAA Atlas 14, Volume 10, Version 2, Precipitation Frequency Data Server for Wales, MA.
- Time of concentrations were based on the TR-55 method. A 5-minute minimum time of concentration was used for paved areas. The time of concentrations range from five minutes to twenty-four minutes.

4.0 EXISTING CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.6 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.5 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Eight culvert crossings convey unnamed brooks under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+33, Sta. 24+92, Sta. 34+50 Sta. 43+76, Sta. 46+65, Sta. 50+72, Sta 82+07, and Sta 86+53. These unnamed brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Appendix D for existing culvert reports.

5.0 PROPOSED CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and also improve the existing drainage conditions. The proposed impervious area within the project limits is 5.3 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 3.8 acres. 0.70 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. See utility plans under separate cover.

5.1 Drainage Swales

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. See Appendix E for Swale Calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

The modified rockfill swale from STA 14+50 to 17+00 has two sections: the first part conveys water from Sta. 17+00 into the culvert crossing at STA 15+25 and the second part continues west of the culvert crossing to outlet into the 15" RCP under the two residential driveways. This 15" RCP outlets into the grass swale which runs from STA 13+50 to STA 11+50. The existing grade from STA 11+00 to 11+50 carries the water from the swale into the existing wetlands. Curbing is provided from STA 13+50 to 15+00 on the south side of the road to protect runoff from getting in the yard of the house at 170 Monson Road. From STA 15+25 to STA 17+25, due to the superelevation of the roadway and the existing drainage patterns, the flow all sheets off to the southwest into the outlet area of the 18" RCP cross culvert at STA 15+25.

A modified rockfill drainage swale is proposed from STA 31+75 to 39+50 (flowing to the west) to catch the large amount of runoff traveling from the north side of Monson Road down into the project site. There will be no curbing on the northern side of the road to allow the runoff from the road to enter the swale. In addition, there will be no curbing on the south side of the road to allow any water on the high side of

the superelevation to naturally sheet off and follow the existing drainage patterns. At the high point of the roadway, STA 40+30, the modified rockfill swale will tie into a proposed grass swale which will flow to the east to outlet into the twin 12" RCP cross culverts.

After the initiation of the design project, the Town of Wales dug a roadside ditch from Sta. 44+00 to Sta. 46+65 to divert flow away from the existing plugged culvert at Sta. 43+76. The Town then installed a 12" CPP crossing at Sta. 46+65 to convey the diverted flow across Monson Road. This diversion created new wetlands along the side of the road as well as on the south side of the road where the 12" CPP outlets. The proposed conditions will replace the culvert at Sta. 43+76 with twin 12" RCPs and maintain the roadside ditch to divert a portion of the flow away from Sta. 43+76 during large storm events, so stormwater can travel east to the existing low point off the roadway at Sta. 46+65 and enter a proposed 12" RCP culvert to cross Monson Road to the south side. These proposed conditions will maintain the newly created wetlands as well as the existing drainage patterns.

A modified rockfill swale is proposed on the south side of the road from STA 70+50 to the outfall location at STA 73+25. This area of the project site, based on the natural topography, has water travelling onto the roadway from the south. This proposed swale will catch a large area of runoff before it can reach the roadway.

5.2 Storm Sewer Systems

Seven closed storm sewer systems are proposed along Monson Road. See Appendix B for drainage area information and see Appendix C for the Hydraflow Storm Sewer Reports. These systems shall outfall into streams or wooded areas. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts. See Appendix F for outlet protection calculations.

System Sta. 22+25

This system contains six catch basins and 12" or 15" reinforced concrete pipes (RCP). The system captures approximately 650 feet of roadway drainage along Monson Road between Lynch Road and the culvert at STA 24+93.This system also captures off-road drainage which is currently settling in the front yard of property 155 Monson Rd. This system discharges into the modified rockfill outlet protection at Sta. 22+25 directly before the flagged B-series wetlands.

System Sta. 25+50

This system contains two catch basins, and pipes are 12" RCP. The system captures approximately 700 feet of roadway drainage along the southern lane of Monson Road between the culvert at STA 24+93 and Sta. 30+00 (Peck Road). This system discharges into the outlet protection area of the two cross culverts near STA 25+00.

System Sta. 50+50

This system contains six catch basins, and pipes are 12" RCP. The system captures approximately 400 feet of roadway drainage along Monson Road between STA 48+00 and STA 52+00. The low point is located at STA 50+38 where this system outfalls into the proposed outlet protection near the existing 36" PVC cross culvert.

System Sta. 51+24

This system contains fourteen catch basins, and pipes are 12" RCP. The system captures approximately 1835 feet of roadway drainage along of Monson Road between STA 52+00 and STA

70+35. This system flows to the west and outlets into the proposed outlet protection for the existing 36" PVC cross culvert at STA 51+24.

System Sta. 73+30

This system contains five catch basins, and pipes are 12" RCP. The system captures approximately 500 feet of roadway drainage along Monson Road between STA 70+35 and STA 75+33. This system outfalls near the low point of the roadway at STA 73+25 with a proposed modified rockfill apron as outlet protection. The proposed swale on the south side of the road also outlets at the same location.

System Sta. 81+97

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 590 feet of roadway drainage along Monson Road between STA 75+35 and STA 81+25. There is no curb on the south side of the roadway from STA 76+50 to STA 79+20 so that water can sheet of naturally and eventually flow into the wetlands. At the low point at STA 82+75, there is no curb on either side of the road to allow water to sheet off into the adjacent wetlands. The water from the closed system discharges onto a modified rockfill apron which is part of the outlet protection for the 18" RCP culvert crossing at STA 82+05.

System Sta. 85+72

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 315 feet of roadway drainage along Monson Road between Sta 83+85 and Sta. 87+00. This system is located at a low point (STA 85+85) and outfalls into the graded rockfill channel which is in the place of the existing Reed Hill Rd. intersection. The adjacent wetland replication area adjoins the existing wetlands to accept the water from this closed system in addition to the box culvert coming from the north side of Monson Road and the proposed 18" culvert which crosses the relocated Reed Hill Road intersection. A proposed grass swale also helps convey water on the south side of Monson Road from STA 84+50 into the wetland replication area.

5.3 Cross Culverts

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Appendix D for proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 3 Design Summary. The 12" CPP culvert at STA 15+33 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9.5 ft and rise 6.5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+76 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+65 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain. The 12" CMP crossing at STA 55+20 was modeled using Hydraflow, which shows that a 12" pipe has enough capacity to convey the small contributing drainage area during a 25-year storm event, therefore the existing pipe will remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, the 24" stone box culvert which crossed diagonally under Monson Road near STA 86+53 will be replaced by a well-defined box culvert of span 8 ft and rise 4.5 ft. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+33, STA 43+76, STA 46+65, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in Appendix F.

5.4 HY-8

The primary software used for hydraulic analysis of culvert is HY-8. The crossings at STA 1+50, 15+33, 43+76, 46+65 and 82+07 were analyzed for existing and proposed conditions. The FHWA Culvert Hydraulic Analysis Program (HY-8) enables to analyze culvert performance for a crossing that has multiple culvert barrels that share the same tailwater and roadway overtopping.
Refer Appendix D for detailed results.

5.5 HEC-RAS

Culvert crossings at St. 24+92, 50+72 and 86+53 were evaluated using HEC-RAS program. Water surface profiles for the brook's 2, 10, 25, 50, and 100-year return frequency flood events were developed in a manner consistent with the standards used to develop water surface profiles under the NFIP. Survey information acquired for the project base plans was input using the HEC-RAS computer application and used as a basis for assembling a flood elevation profile hydraulic model of the project site. In the completed model, the channel and overbanks were assigned roughness coefficients (Manning's "n"). These values were selected based on aerial maps and field visit. All flood simulations performed with the project HEC-RAS model were done in a mixed flow mode and employed the upstream and downstream stream slope as the upstream and downstream boundary condition respectively.

A detailed hydraulic analysis was performed for the culvert crossings (both existing and proposed) in order to evaluate for 2, 5, 10, 25-year storm design. This investigation was conducted in a manner consistent with American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Department of Transport (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

The HEC-RAS model was performed for both existing as well as proposed conditions for the crossing 24+92, the existing crossing at 50+72 and the proposed crossing at 83+56. The geometry data, manning's constant and culvert data were input. Refer Appendix D for output data.

At Station (24+92): A four-sided precast concrete box culvert is proposed at this crossing. The span of culvert is 9.5 ft and rise of 6.5 ft. Two feet of the box culvert will be filled with natural stream bottom material. The results show this crossing will handle up to a 100-year event.

At Station (50+72): A 36" PVC pipe culvert exists for this crossing with the invert elevations of 922.04 on the upstream side and 920.04 on the downstream side. Existing structure was modeled using HEC-RAS. The results show this crossing will not overtop during a 25-year design period.

At Station (86+53): A 24" Stone box culvert exists over the entire crossing. A tributary of Vinica Brook crosses Monson Road at this station. The small woodland channel flows under Monson Road into a small depression near the intersection of Reed Hill Road. A precast concrete box culvert of span 8 ft

and rise 4.5 ft is proposed for this crossing. 2-feet of natural material will be filled at the bottom. Results indicate the crossing will adequately handle up to a 100-yr storm event.

6.0 TEMPORARY WATER HANDLING

Temporary water handling will be provided using temporary bypass pipes and sandbag systems as shown on the plans. (see design plans for sizes and invert elevations) will be installed. Sandbags in form of cofferdams will. The size of temporary pipes and flow through sandbags was based on HEC-RAS modeling information. A steady flow analysis was performed with approximate inverts and 2-year return period. The 2-year return period is a common design standard for temporary water handling structures and is considered a reasonable balance between the risk of failure and the cost of construction.

7.0 WATER QUALITY MEASURES

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis. Due to limitations in the amount of public right-of-way, there will be no proposed water quality BMP's in an effort to reduce impacts on private property.

8.0 CONCLUSION

The proposed storm drainage systems are designed in accordance with the guidelines set in Chapter 8 (Drainage and Erosion Control) of the Mass Highway manual. The Hydraflow results show that the proposed systems are designed to convey a 10-year storm. The culverts are designed to convey a 25-year storm. The piped systems will assist in capturing roadway runoff to alleviate any potential flooding. The proposed drainage systems adequately address water quality to the maximum extent practicable.

APPENDIX A

Watershed Maps

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on: 5-Apr-2024 11:53 AM
N
DRAINAGE AREA MAPS
MONSON ROAD

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	8
PROJECT FILE NO. 608163			

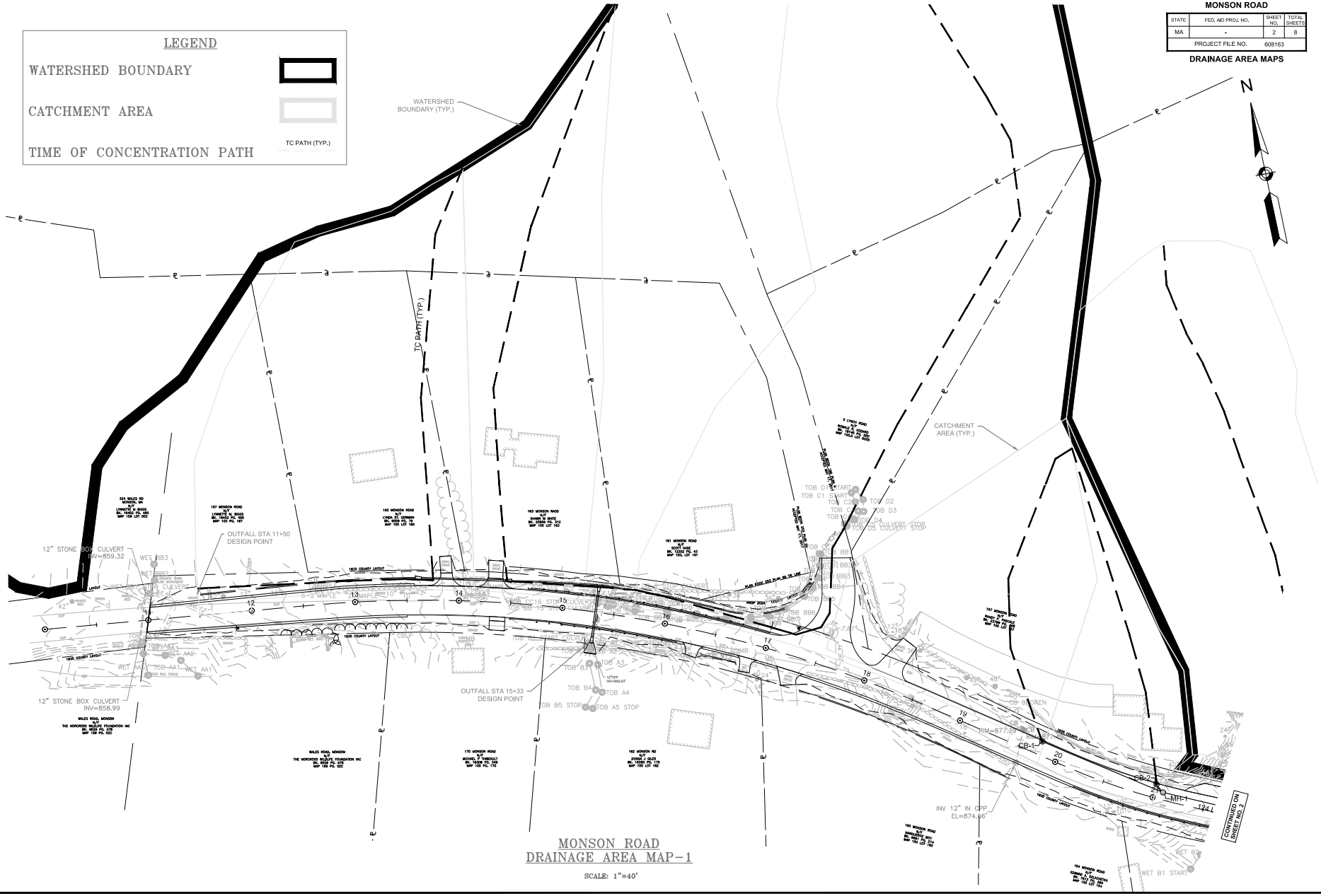
DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)



MONSON ROAD
DRAINAGE AREA MAP-1

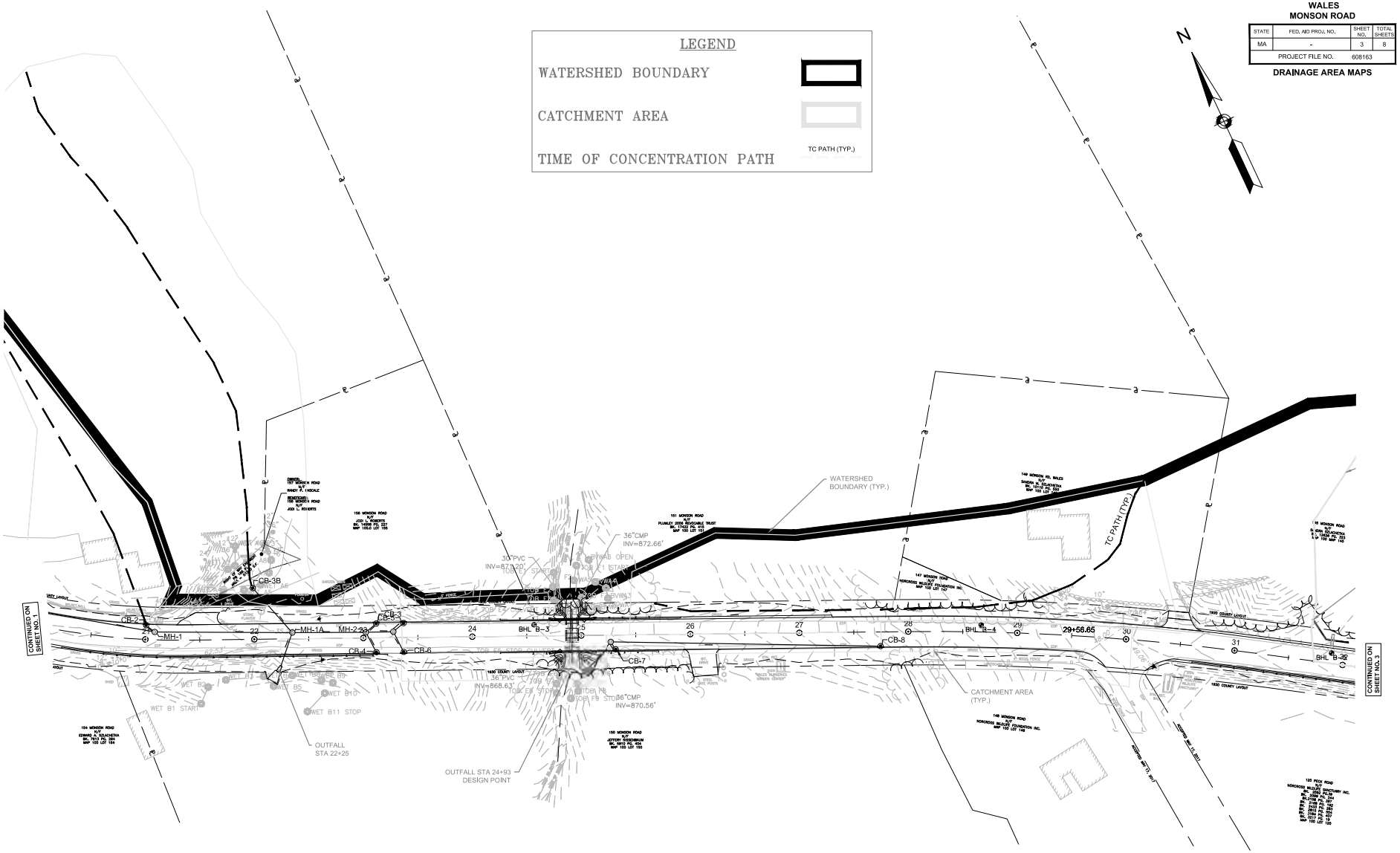
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-120112
A000840 - 181

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



MONSON ROAD
DRAINAGE AREA MAP-2

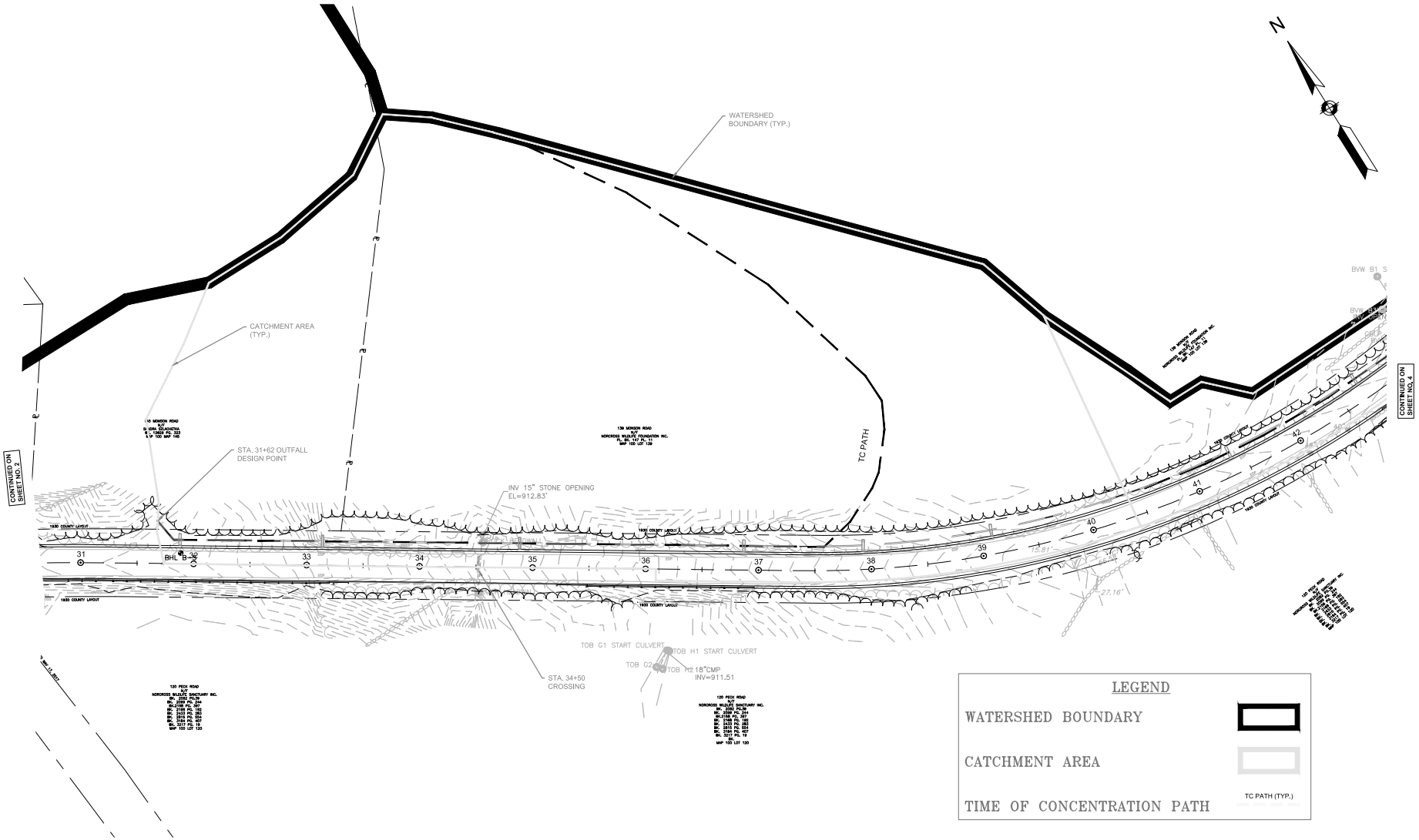
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-128112
A00934 - 182

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



LEGEND

WATERSHED BOUNDARY	
CATCHMENT AREA	
TIME OF CONCENTRATION PATH	TC PATH (TYP.)

MONSON ROAD
DRAINAGE AREA MAP-3

SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM

Proposal No. 608163-128112

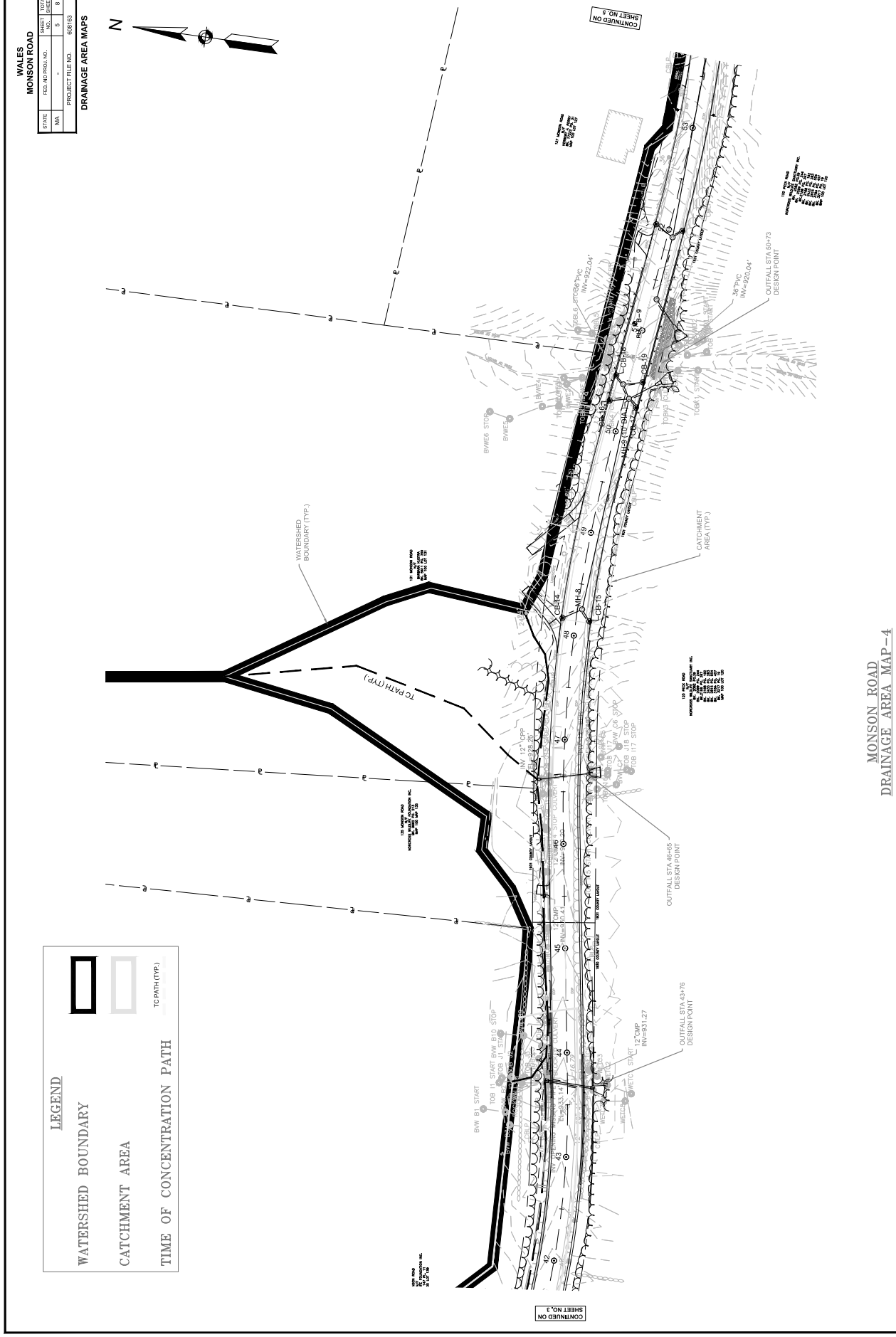
A00018h-183

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
	PROJECT FILE NO.	608163	

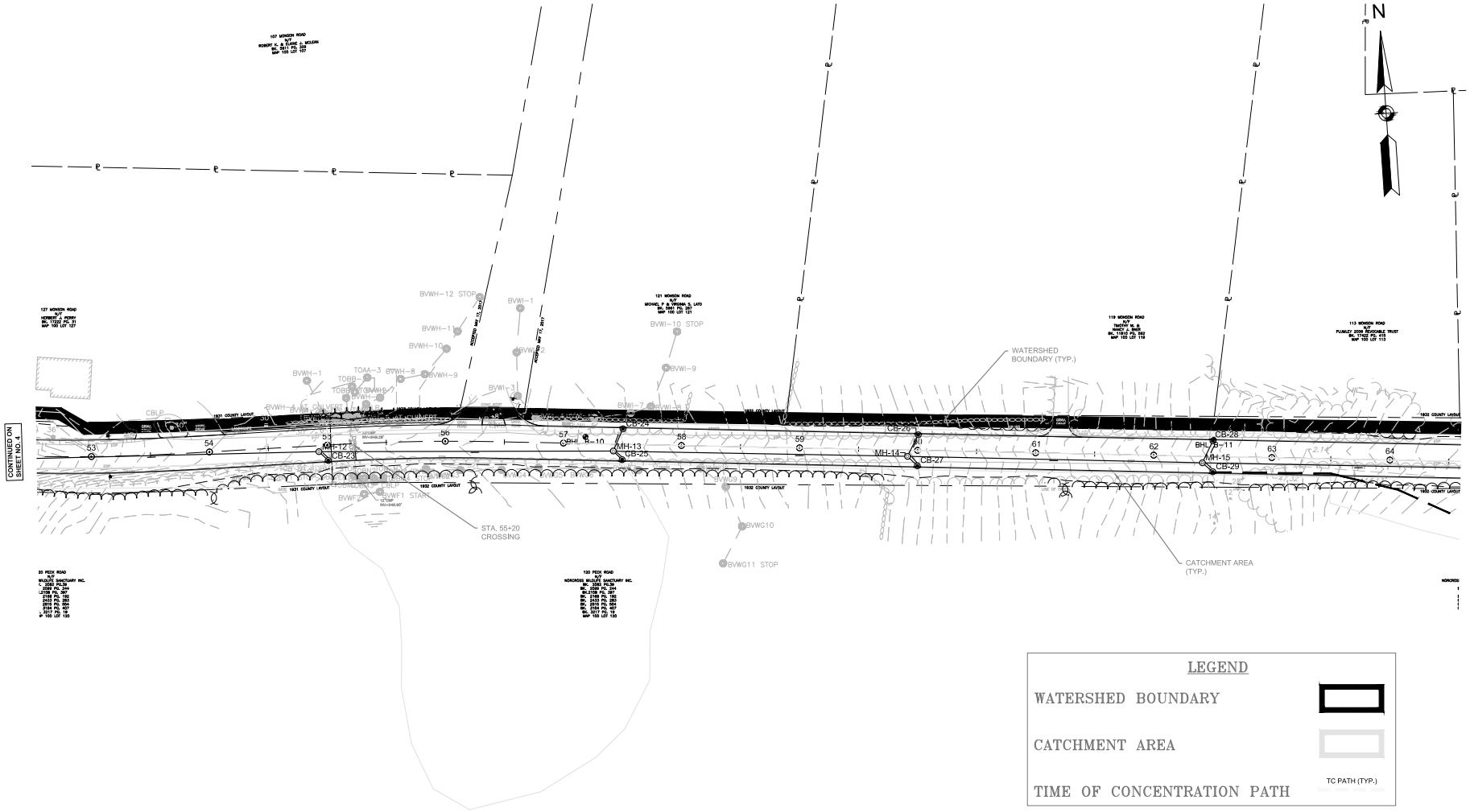
DRAINAGE AREA MAPS



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)

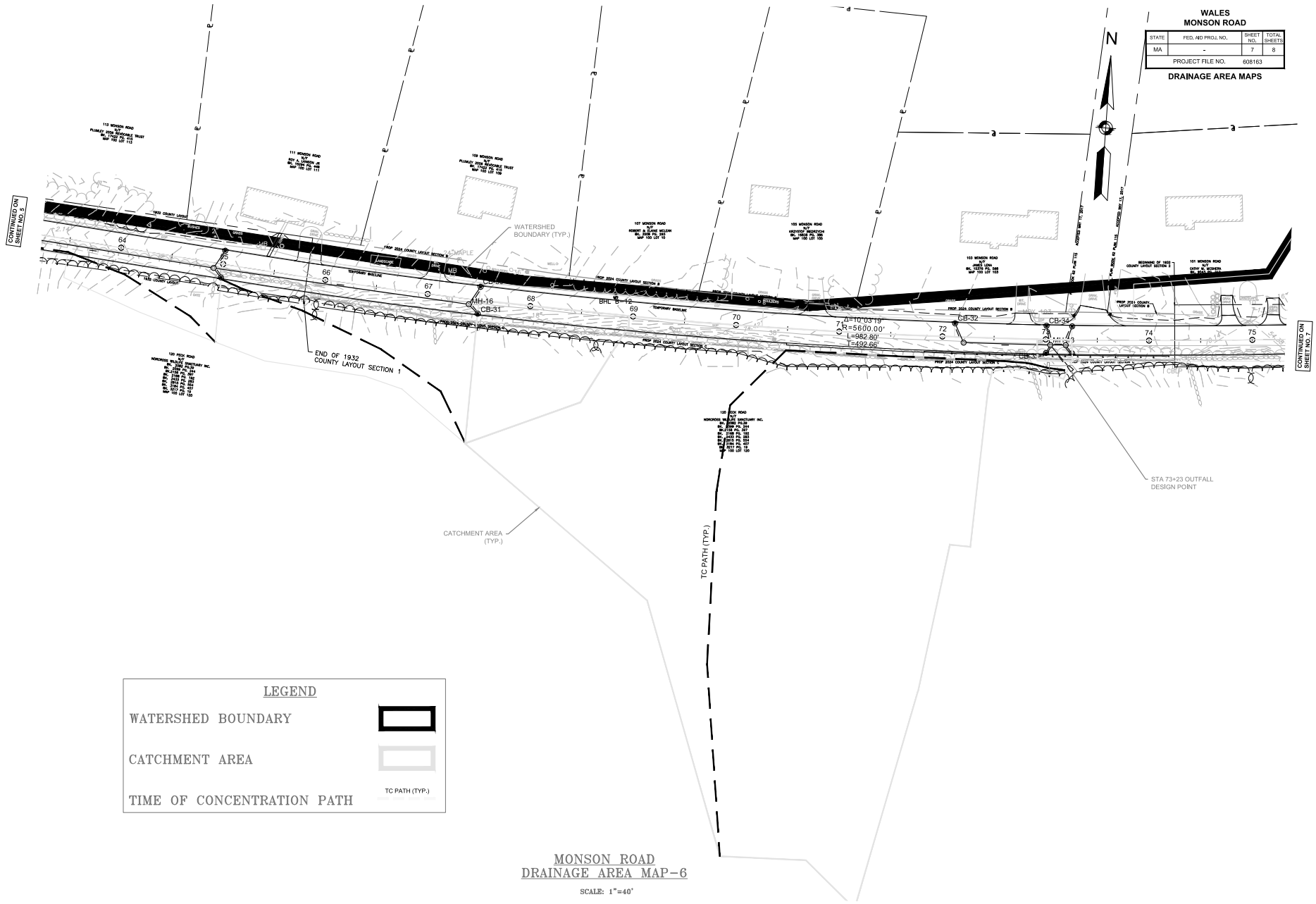
MONSON ROAD
DRAINAGE AREA MAP–5

SCALE: 1"=40'

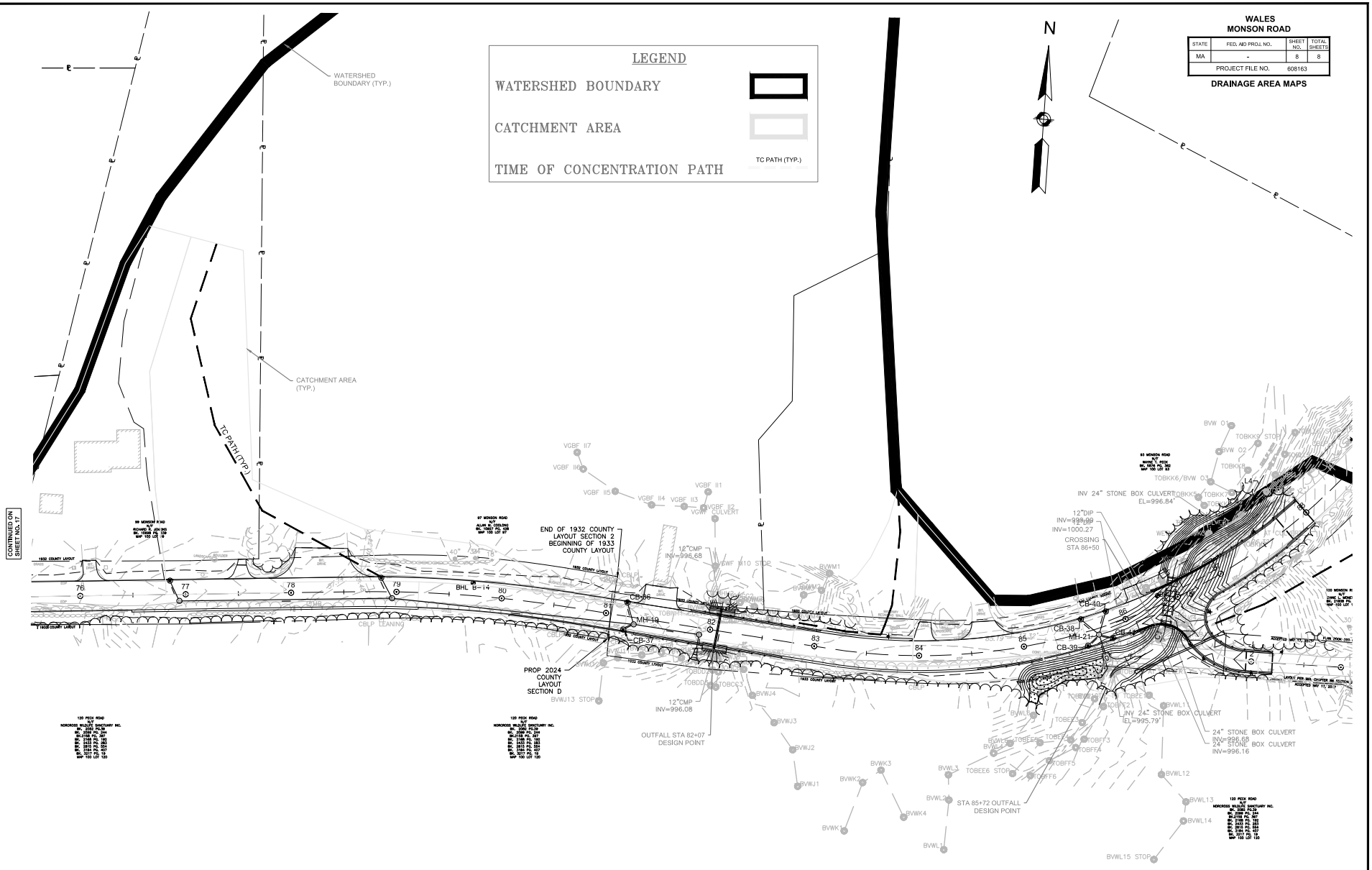
MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM

Proposal No. 608163-128112

A00040 - 185



MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM
Proposal No. 608163-12012
A00940 - 186



MONSON ROAD
DRAINAGE AREA MAP–7

SCALE: 1"=40'

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:51 AM

Proposal No. 608163-120112

AV0000-187

APPENDIX B

Rational Method Data

Monson Road Reconstruction
Wales, MA

Date: 4/8/2024
By: NSD
Checked By: RSV

Weston & Sampson

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)
Proposed Drainage System								
	STA 24+84							
CB1		48,140	**1.105**	2,722	7,922	37,496	0.26	11
CB2		24,150	**0.554**	5,996	16,154	2,000	0.44	5
CB3		9,479	**0.218**	5,061	4,418		0.62	5
CB3B		92,066	**2.114**	2,150	5,730	84,186	0.22	15
CB4		372	**0.009**	372			0.90	5
CB5		5,665	**0.130**	2,370	3,295		0.55	5
CB6		5,703	**0.131**	2,720	948	2,035	0.55	5
	STA 25+00							
CB7		4,854	**0.111**	4,050	804		0.80	5
CB8		7,359	**0.169**	6,261	1,098		0.81	5
	STA 50+61							
CB14		2,813	**0.065**	769	2,044		0.46	5
CB15		3,181	**0.073**	2,086		1,095	0.66	5
CB16		3,387	**0.078**	762	417	2,208	0.37	5
CB17		4,558	**0.105**	2,885	158	1,515	0.65	5
CB18		7,714	**0.177**	3,404	1,284	3,026	0.53	5
CB19		4,866	**0.112**	2,185	758	1,923	0.53	5
	STA 51+24							
CB20		9,120	**0.209**	6,483	1,406	1,231	0.71	5
CB21		6,026	**0.138**	2,414	1,437	2,175	0.50	5
CB22		2,673	**0.061**	1,854	819		0.72	5
CB23		6,334	**0.145**	5,584		750	0.82	5
CB24		5,414	**0.124**	4,364		1,050	0.76	5
CB25		4,912	**0.113**	4,350		562	0.82	5
CB26		4,444	**0.102**	3,664	780		0.79	5
CB27		3,941	**0.090**	3,578	363		0.84	5
CB28		5,465	**0.125**	3,756	1,709		0.71	5
CB29		10,177	**0.234**	3,549		6,628	0.44	5
CB28B		4,735	**0.109**	3,765	970		0.78	5
CB29B		23,495	**0.539**	3,627		19,868	0.31	7.3
CB30		4,950	**0.114**	3,994	956		0.78	5
CB31		14,123	**0.324**	2,122	12,001		0.39	5
	STA 73+30							
CB32		3,093	**0.071**	2,762	331		0.84	5
CB34		1,830	**0.042**	1,649	181		0.84	5
CB35		700	**0.016**	470	230		0.70	5
CB34B		11,104	**0.255**	4,501	6,603		0.54	5
CB35B		4,454	**0.102**	3,140	1,314		0.72	5
	STA 81+97							
CB36		6,857	**0.157**	1,065	5,792		0.39	5.0
CB36B		36,290	**0.833**	6,103	30,187		0.40	10.0
CB36C		31,245	**0.717**	5,437	25,808		0.40	10.0
CB37		5,183	**0.119**	4,845		338	0.85	5
	STA 85+72							
CB38		11,348	**0.261**	6,499	4,849		0.64	5
CB39		1,038	**0.024**	758		280	0.71	5
CB40		5,335	**0.122**	3,556	1,187	592	0.69	5
CB41		359	**0.008**	273	86		0.76	5

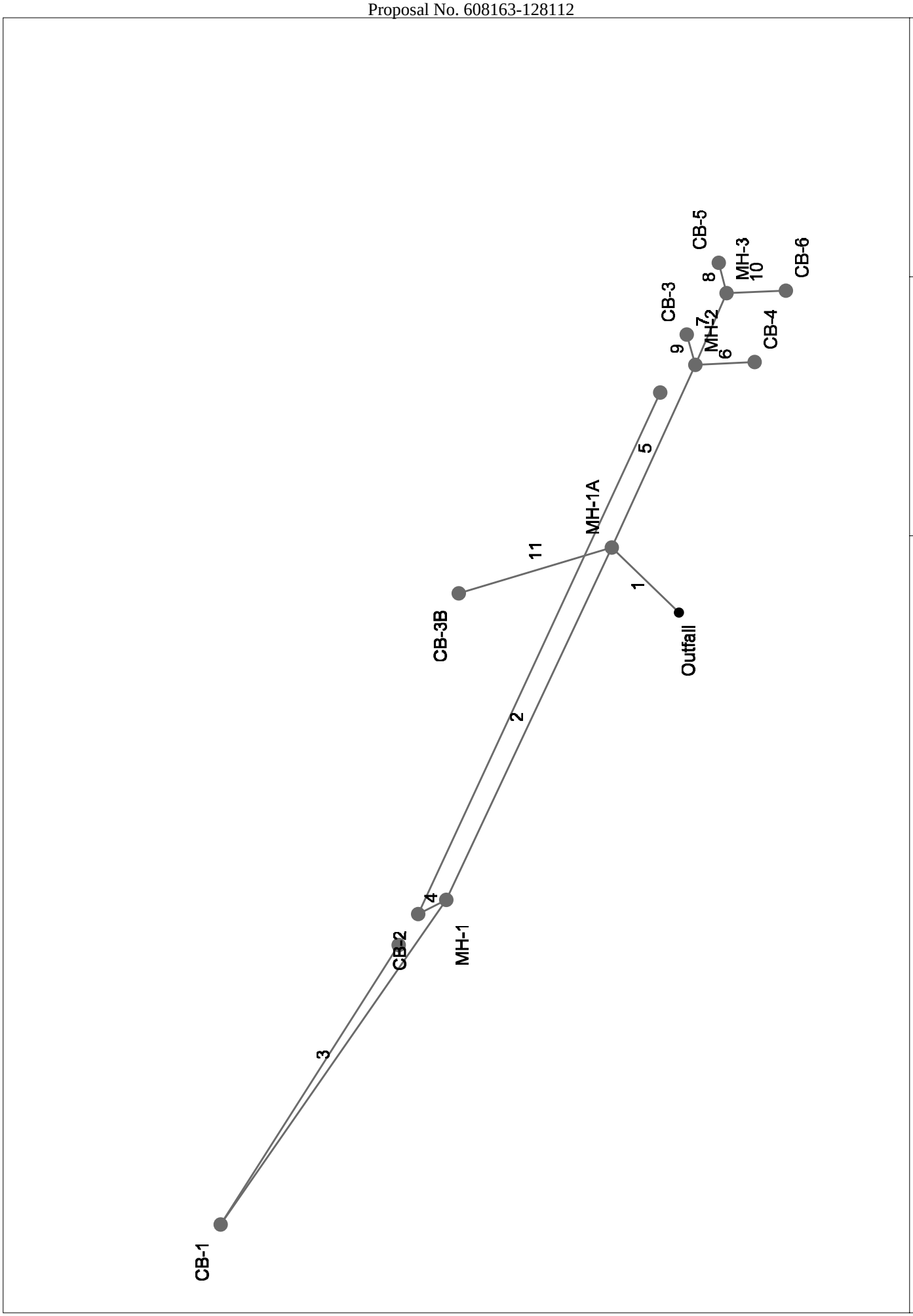
NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover		C
Impervious		0.9
Grass		0.3
Unimproved (Woods)		0.2

APPENDIX C

Hydraflow Reports

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

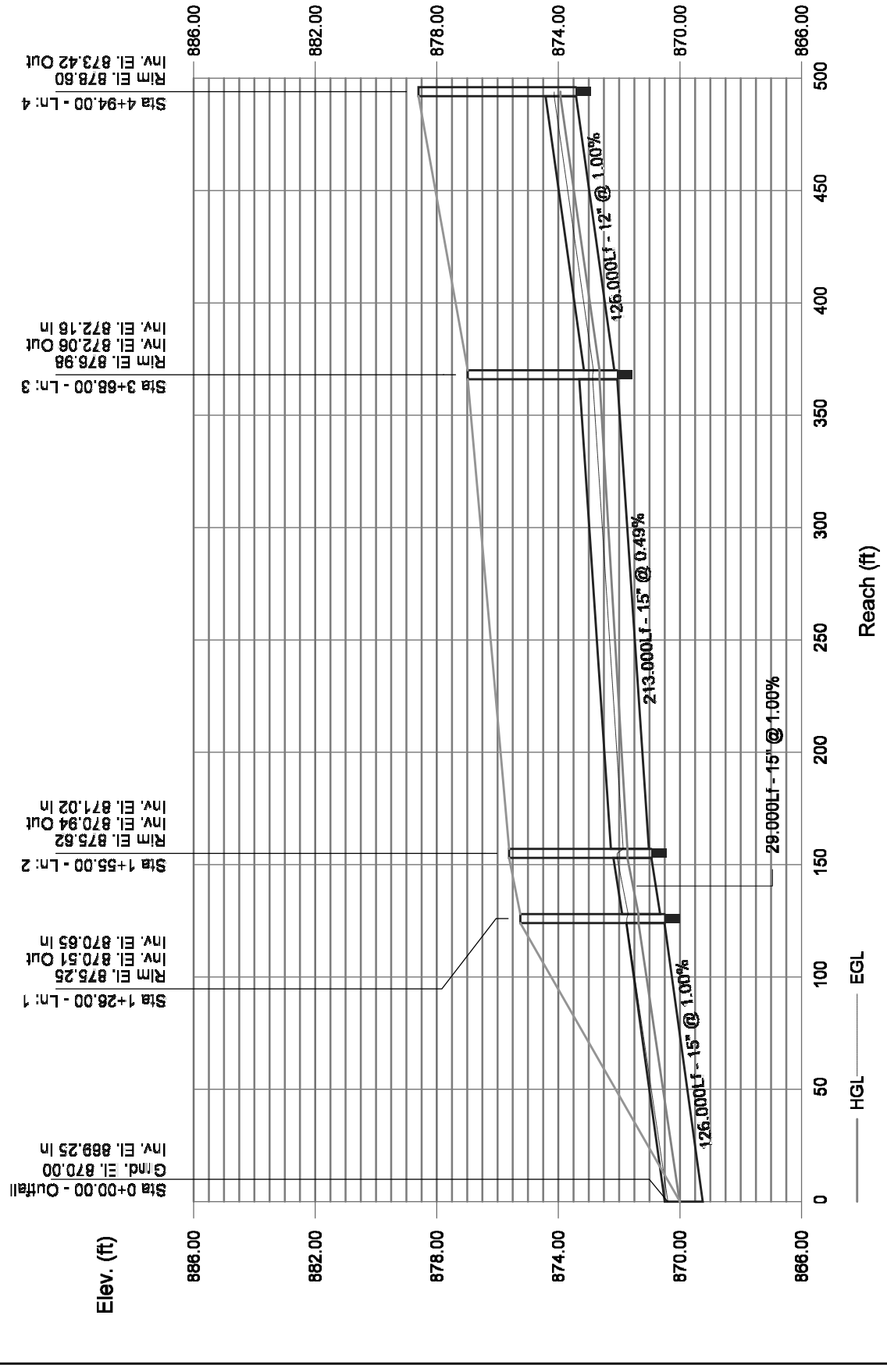


Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Date: 3/15/2024

Storm Sewers v2023.00

Storm Sewer Profile

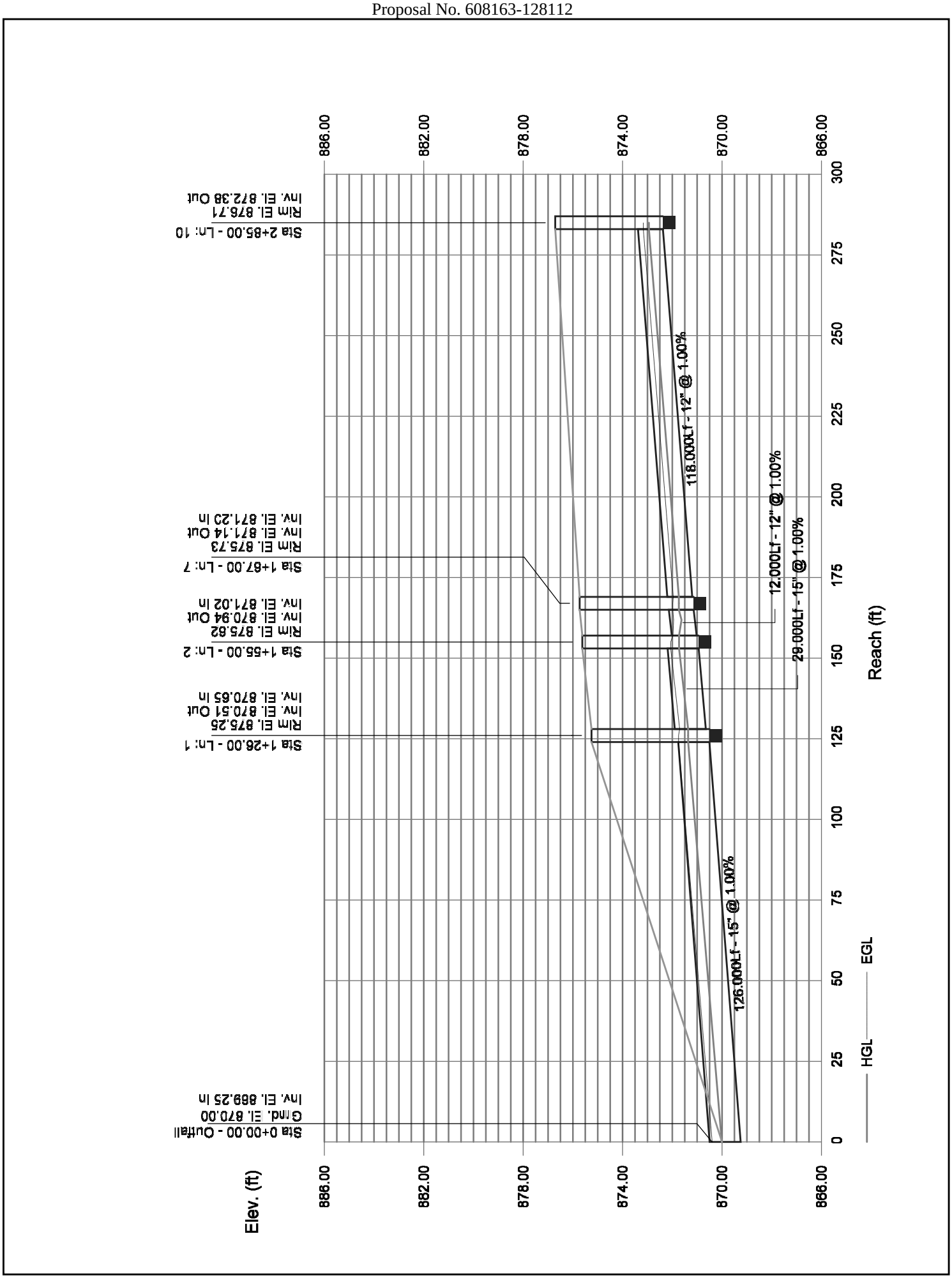
Proj. file: Sta.24+84.stm



Storm Sewers

Storm Sewer Profile

Proj. file: Sta.24+84.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-1A	Manhole	875.51	Cir	4.00	4.00	15	Cir	869.82	12 12 12	Cir Cir Cir	870.00 870.00 870.00
2	MH-1	Manhole	876.90	Cir	4.00	4.00	12	Cir	872.06	12 12	Cir Cir	872.16 872.16
3	CB-1	Combination	878.65	Cir	4.00	4.00	12	Cir	873.42			
4	CB-2	Combination	876.63	Cir	4.00	4.00	12	Cir	872.26			
5	MH-2	Manhole	875.15	Cir	4.00	4.00	12	Cir	870.68	12 12 12	Cir Cir Cir	871.02 870.75 871.02
6	CB-4	Combination	874.99	Cir	4.00	4.00	12	Cir	871.22			
7	MH-3	Manhole	875.16	Cir	4.00	4.00	12	Cir	870.88	12 12	Cir Cir	871.00 871.00
8	CB-5	Combination	875.45	Cir	4.00	4.00	12	Cir	871.12			
9	CB-3	Combination	874.99	Cir	4.00	4.00	12	Cir	871.14			
10	CB-6	Combination	875.54	Cir	4.00	4.00	12	Cir	871.21			
11	CB-3B	Combination	874.88	Cir	4.00	4.00	12	Cir	870.55			

Project File: Sta.24+84-REV2.stm | Number of Structures: 11 | Run Date: 3/15/2024

A00840 - 194

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	15.9	3.7	4.51	5.78	5.11	15	1.07	869.50	869.82	870.33	870.68	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	4.3	2.14	3.98	3.96	12	1.66	870.00	872.06	870.68	872.69	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	4.4	1.47	3.56	3.56	12	1.00	872.16	873.42	872.69	873.93	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	5.9	0.97	3.56	2.75	12	1.00	872.16	872.26	872.69	872.67	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.4	5.8	1.46	3.67	3.09	12	1.06	870.00	870.68	870.68	871.19	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	5.9	0.03	3.65	0.78	12	1.05	871.02	871.22	871.19	871.29	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	5.9	1.07	2.57	3.12	12	0.52	870.75	870.88	871.20	871.33	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.90	2.08	12	1.20	871.00	871.12	871.47	871.42	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	5.9	0.39	3.38	2.65	12	1.20	871.02	871.14	871.25	871.40	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.74	2.08	12	1.11	871.00	871.21	871.47	871.51	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	3.7	1.74	3.70	3.44	12	1.08	870.00	870.55	870.68	871.11	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 195

Proposal No. 6081163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.47	0.00	1.07	0.40	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.20	4.86	0.29	2.69	2.0	4
4	CB-2	0.97	0.40	1.13	0.24	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.21	3.69	0.28	1.92	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.03	0.00	0.03	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.12	0.76	0.05	0.76	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
9	CB-3	0.39	0.12	0.51	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.00	0.19	3.00	2.0	Off
10	CB-6	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
11	CB-3B	1.74	0.00	1.74	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.17	8.35	0.33	8.35	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 196

Proposal No. 6081163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	16.0	4.6	5.55	5.78	5.36	15	1.07	869.50	869.82	870.48	870.80	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	5.3	2.64	3.98	3.94	12	1.66	870.00	872.06	871.25	872.76	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	5.4	1.80	3.56	3.79	12	1.00	872.16	873.42	872.76	873.99	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	7.2	1.19	3.56	2.91	12	1.00	872.16	872.26	872.76	872.72	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.5	7.0	1.78	3.67	2.64	12	1.06	870.00	870.68	871.25	871.38	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	7.2	0.04	3.65	0.69	12	1.05	871.02	871.22	871.51	871.30	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	7.1	1.30	2.57	2.21	12	0.52	870.75	870.88	871.51	871.53	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.90	2.06	12	1.20	871.00	871.12	871.62	871.46	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	7.2	0.48	3.38	1.91	12	1.20	871.02	871.14	871.51	871.43	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.74	2.06	12	1.11	871.00	871.21	871.62	871.55	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	4.6	2.14	3.70	2.86	12	1.08	870.00	870.55	871.25	871.40	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-RFV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840 - 197

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.80	0.00	1.25	0.55	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.21	5.63	0.30	3.04	2.0	4
4	CB-2	1.19	0.55	1.36	0.38	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.23	4.03	0.30	2.27	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.04	0.00	0.04	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.85	0.05	0.85	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
9	CB-3	0.48	0.38	0.85	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.38	0.25	4.38	2.0	Off
10	CB-6	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
11	CB-3B	2.14	0.00	2.14	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.20	9.92	0.37	9.92	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 198

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

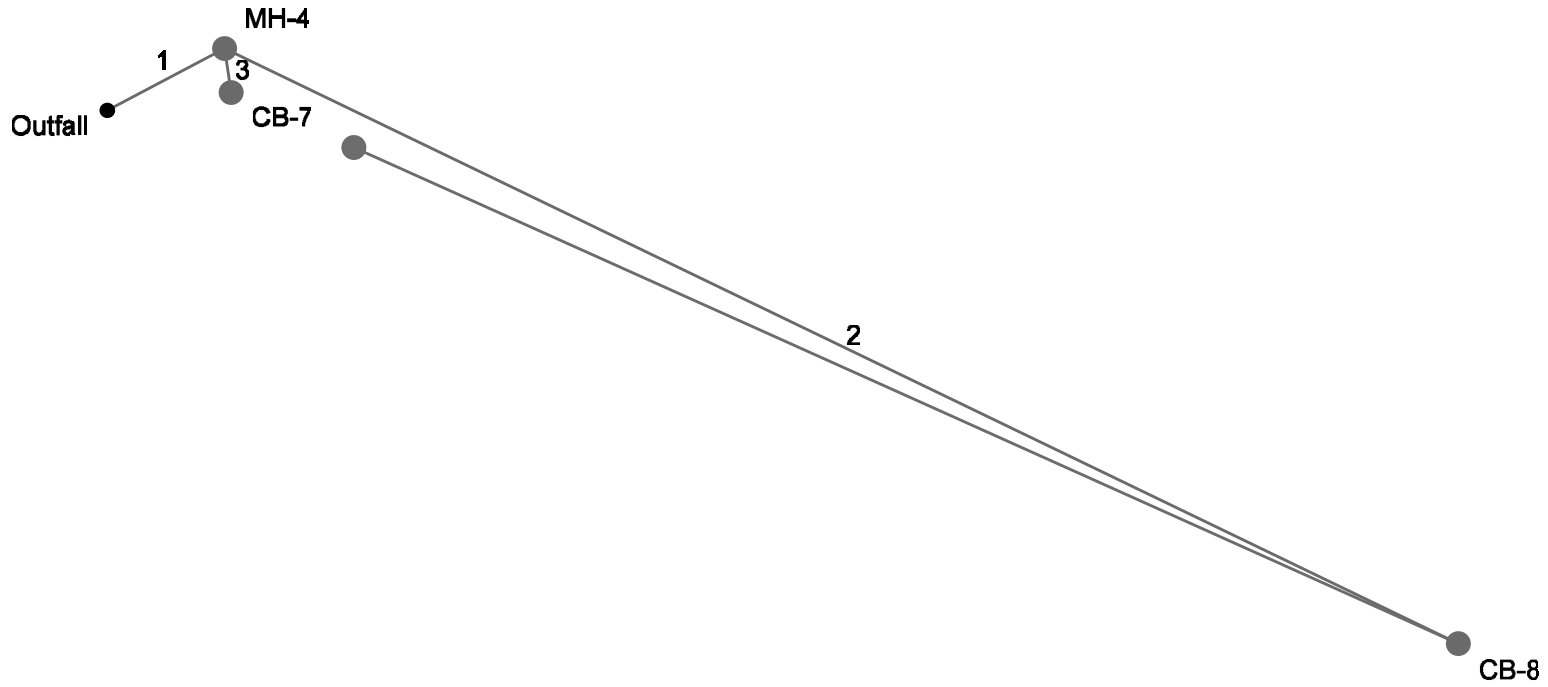
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH1A-OUTLET	User																		0.00
2	MH1-MH1A	User																		0.00
3	CB1-MH1	TR55	0.800	30.00	3.10	5.00	10.05	270.00	7.70	UnPaved	4.48	1.01								11.05
4	CB2-MH1	TR55	0.240	33.00	3.10	5.80	3.90	300.00	8.00	UnPaved	4.56	1.10								5.00
5	MH2-MH1A	User																		0.00
6	CB4-MH2	User																		5.00
7	MH3-MH2	User																		0.00
8	CB5-MH3	User																		5.00
9	CB3-MH2	User																		5.00
10	CB6-MH3	User																		5.00
11	CB3B-MH1A	TR55	0.400	50.00	3.10	1.76	13.19	480.00	4.00	UnPaved	3.23	2.48								15.67

Project File: Sta.24+84-REV2.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 11 | Date: 3/15/2024

A00840 - 199

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.25+00.stm	Number of lines: 3	Date: 12/5/2023

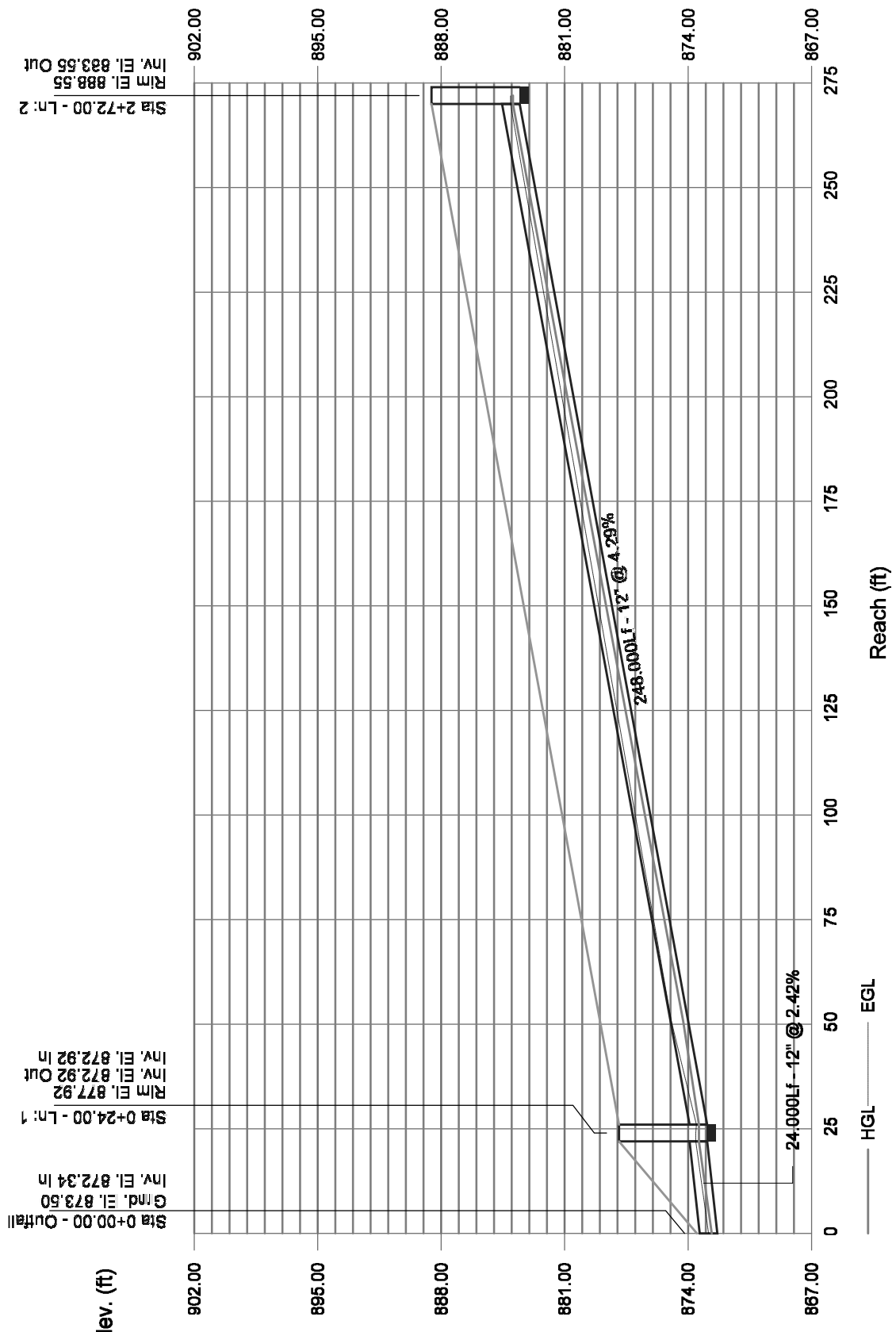
Storm Sewers v2023.00

A00840 - 200

Proposal No. 608163-128112

Storm Sewer Profile

Proj. file: Sta.25+00.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-4	Manhole	877.92	Cir	4.00	4.00	12	Cir	872.92	12 12	Cir Cir	872.92 872.92
2	CB-8	Combination	888.55	Cir	4.00	4.00	12	Cir	883.55			
3	CB-7	Combination	877.89	Cir	4.00	4.00	12	Cir	873.06			

Project File: Sta.25+00.stm | Number of Structures: 3 | Run Date: 12/5/2023

A00840 - 202

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	24.000	0.00	0.28	0.00	0.00	0.23	0.0	6.6	5.4	1.22	5.54	4.53	12	2.42	872.34	872.92	872.66	873.39	873.50	877.92	MH4-OUTLET
2	1	248.000	0.17	0.17	0.81	0.14	0.14	5.0	5.0	5.9	0.81	7.37	2.64	12	4.29	872.92	883.55	873.39	883.93	877.92	888.55	CB8-MH4
3	1	8.000	0.11	0.11	0.80	0.09	0.09	5.0	5.0	5.9	0.52	4.71	2.04	12	1.75	872.92	873.06	873.39	873.36	877.92	877.89	CB7-MH4

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 203

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-8	0.81	0.00	0.59	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.060	4.00	0.020	0.020	0.013	0.09	4.42	0.22	2.74	2.0	3
3	CB-7	0.52	0.23	0.51	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.020	0.020	0.013	0.10	5.04	0.23	3.27	2.0	Off

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES: Inlet N-Values = 0.015; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

A00840 - 204

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

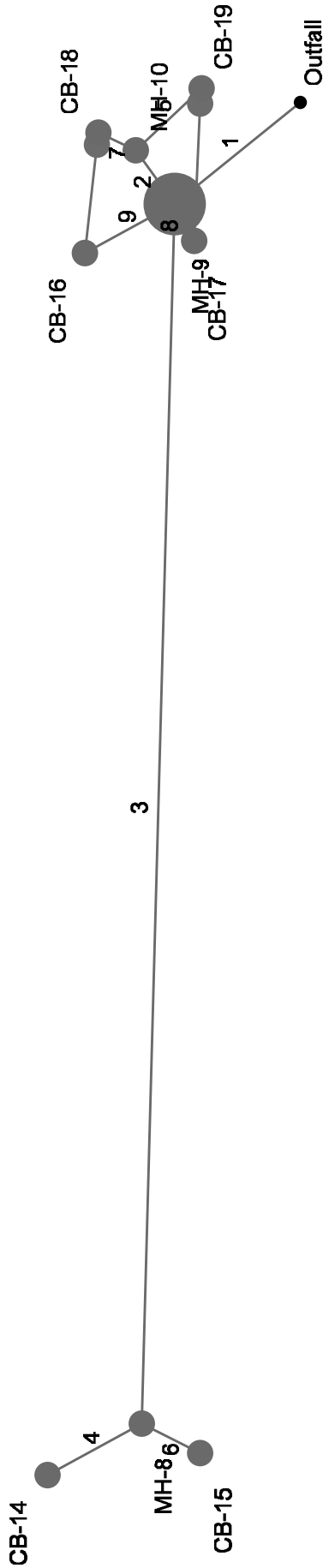
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH4-OUTLET	User																		0.00
2	CB8-MH4	User																		5.00
3	CB7-MH4	User																		5.00

Project File: Sta.25+00.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 3 | Date: 12/5/2023

A00840 - 205

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.50+70.stm

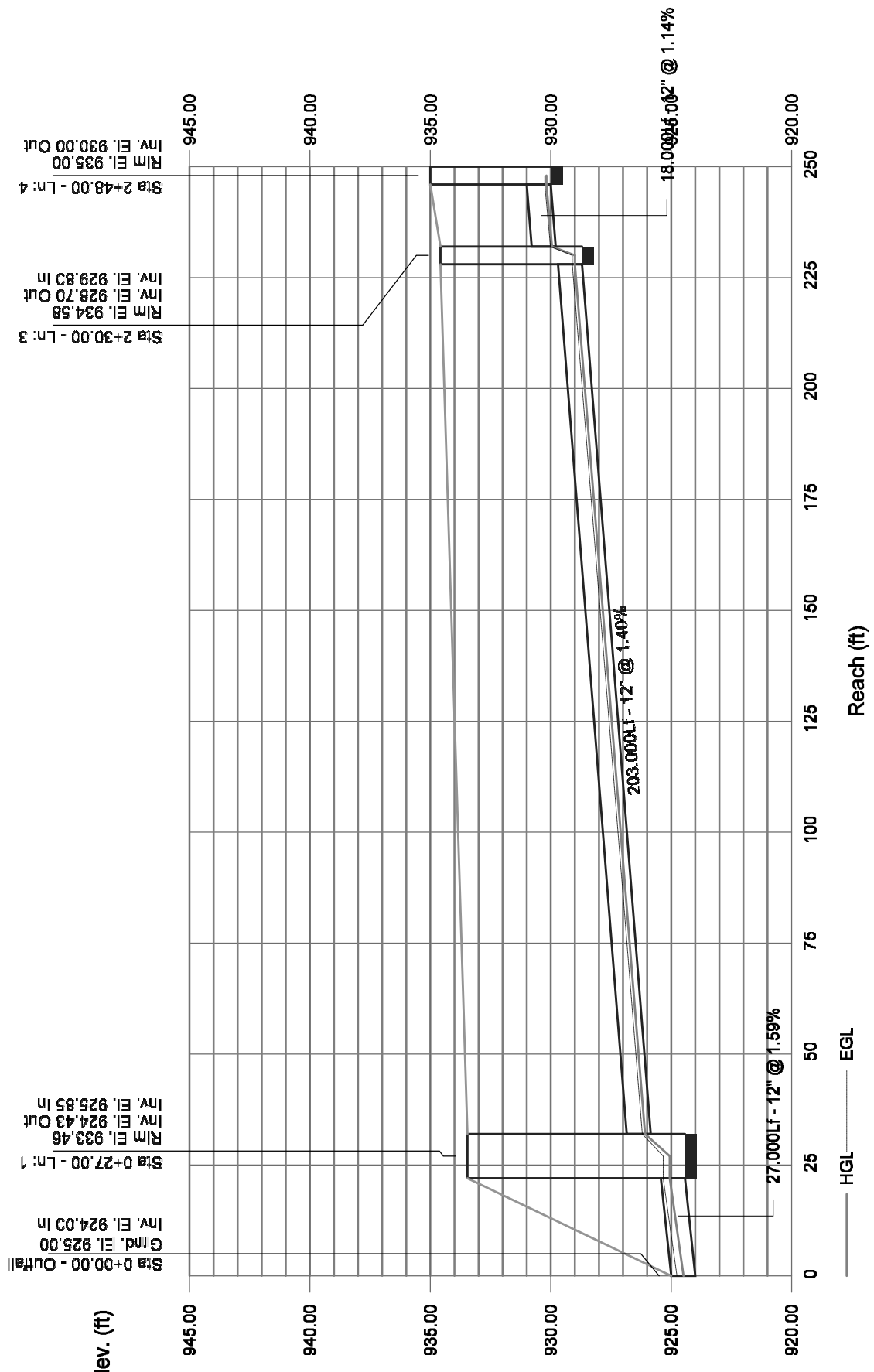
Number of lines: 9

Date: 3/15/2024

Storm Sewers v2023.00

Proj. file: Sta.50+70.stm

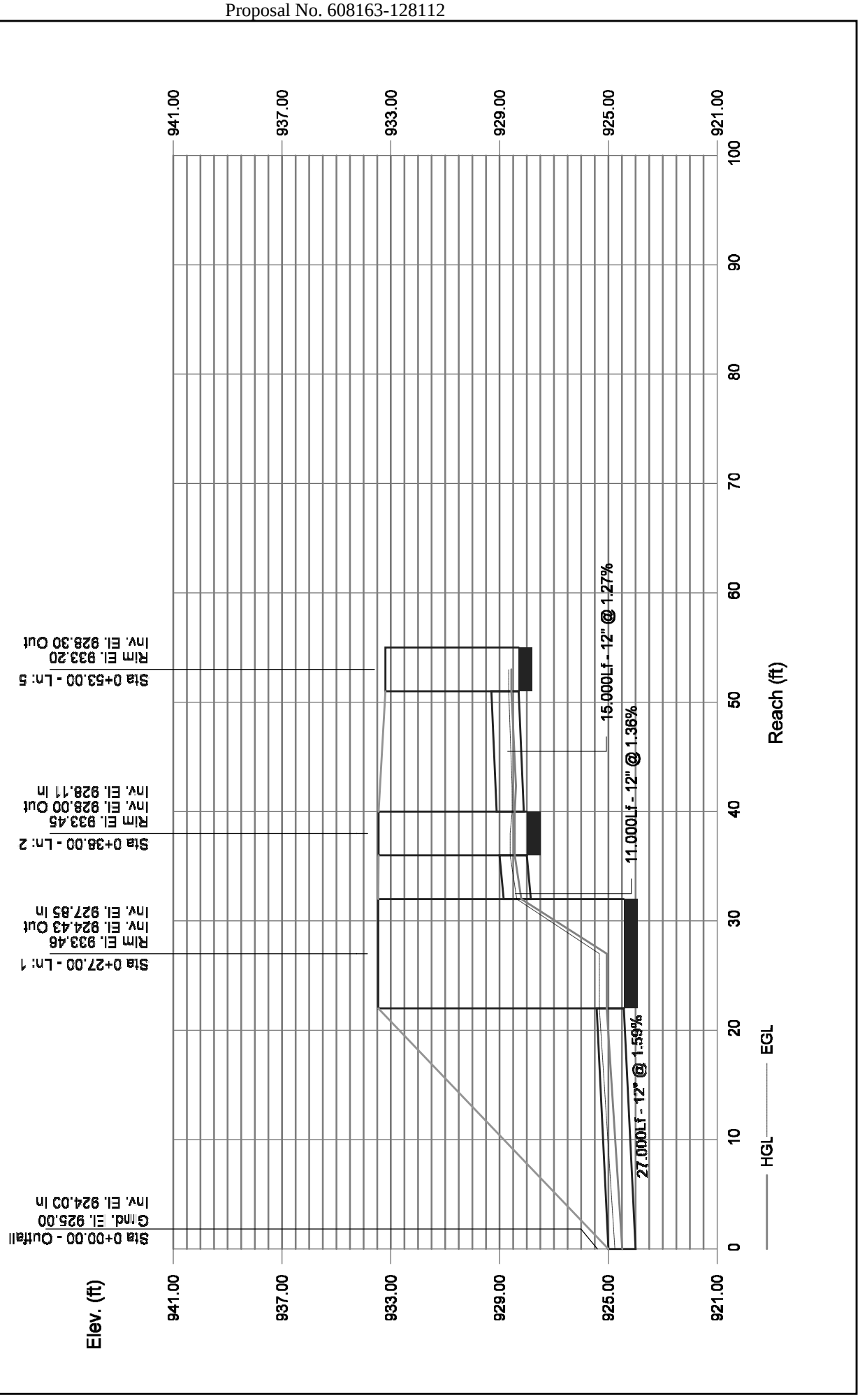
Storm Sewer Profile



Storm Sewers

Storm Sewer Profile

Proj. file: Sta.50+70.stm



Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-9	Manhole	933.46	Cir	10.00	10.00	12	Cir	924.43	12 12 12 12	Cir Cir Cir Cir	927.85 925.85 928.26 928.44
2	MH-10	Manhole	933.45	Cir	4.00	4.00	12	Cir	928.00	12 12	Cir Cir	928.11 928.20
3	MH-8	Manhole	934.58	Cir	4.00	4.00	12	Cir	928.70	12 12	Cir Cir	929.80 928.84
4	CB-14	Combination	935.00	Cir	4.00	4.00	12	Cir	930.00			
5	CB-19	Combination	933.20	Cir	4.00	4.00	12	Cir	928.30			
6	CB-15	Combination	934.02	Cir	4.00	4.00	12	Cir	928.97			
7	CB-18	Combination	933.32	Cir	4.00	4.00	12	Cir	928.31			
8	CB-17	Combination	933.36	Cir	4.00	4.00	12	Cir	928.37			
9	CB-16	Combination	933.61	Cir	4.00	4.00	12	Cir	928.63			

Project File: Sta.50+70.stm | Number of Structures: 9 | Run Date: 3/15/2024

A00840 - 209

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.3	5.5	1.77	4.49	4.62	12	1.59	924.00	924.43	924.44	925.00	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	5.9	0.90	4.16	3.66	12	1.36	927.85	928.00	928.17	928.40	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	5.9	0.43	4.22	2.98	12	1.40	925.85	928.70	926.07	928.97	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	5.9	0.16	3.80	2.16	12	1.14	929.80	930.00	929.94	930.17	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	5.9	0.34	4.01	2.10	12	1.27	928.11	928.30	928.40	928.54	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	5.9	0.27	3.87	2.52	12	1.18	928.84	928.97	929.02	929.18	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	5.9	0.56	4.46	3.29	12	1.57	928.20	928.31	928.44	928.62	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	5.9	0.38	4.46	2.95	12	1.57	928.26	928.37	928.46	928.63	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	5.9	0.17	3.76	2.20	12	1.12	928.44	928.63	928.59	928.80	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 210

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (In)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (In)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.16	0.00	0.15	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.06	3.02	0.19	1.22	2.0	Off
5	CB-19	0.34	0.09	0.44	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.73	0.17	2.73	2.0	Off
6	CB-15	0.27	0.00	0.27	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.10	2.12	0.17	0.13	2.0	Off
7	CB-18	0.56	0.02	0.58	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.04	3.30	0.20	3.30	2.0	Off
8	CB-17	0.38	0.00	0.29	0.09	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.09	4.44	0.22	2.63	2.0	5
9	CB-16	0.17	0.00	0.15	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.31	0.20	1.49	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 211

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.2	6.7	2.17	4.49	4.92	12	1.59	924.00	924.43	924.49	925.06	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	7.2	1.10	4.16	3.88	12	1.36	927.85	928.00	928.20	928.44	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	7.2	0.53	4.22	3.16	12	1.40	925.85	928.70	926.09	929.00	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	7.2	0.20	3.80	2.29	12	1.14	929.80	930.00	929.95	930.18	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	7.2	0.42	4.01	2.17	12	1.27	928.11	928.30	928.44	928.57	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	7.2	0.33	3.87	2.67	12	1.18	928.84	928.97	929.04	929.21	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	7.2	0.69	4.46	3.49	12	1.57	928.20	928.31	928.47	928.66	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	7.2	0.47	4.46	3.12	12	1.57	928.26	928.37	928.48	928.65	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	7.2	0.21	3.76	2.33	12	1.12	928.44	928.63	928.60	928.82	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840 - 212

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.20	0.00	0.17	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.07	3.25	0.20	1.48	2.0	Off
5	CB-19	0.42	0.13	0.55	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.17	0.20	3.17	2.0	Off
6	CB-15	0.33	0.00	0.33	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.11	2.28	0.19	0.43	2.0	Off
7	CB-18	0.69	0.03	0.72	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.07	3.79	0.23	3.79	2.0	Off
8	CB-17	0.47	0.00	0.34	0.13	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.10	4.78	0.23	2.95	2.0	5
9	CB-16	0.21	0.00	0.18	0.03	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.56	0.20	1.76	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

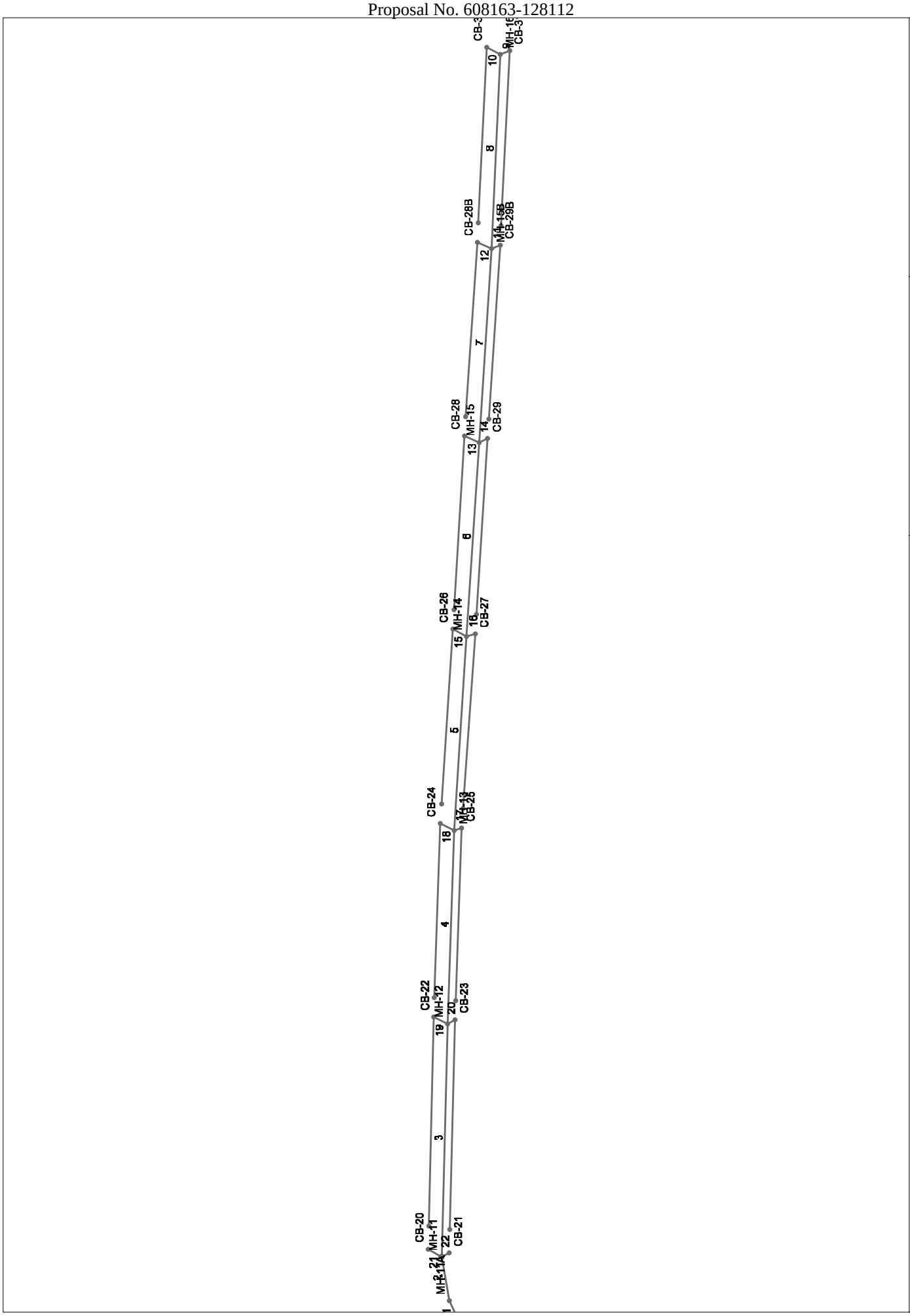
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH9-OUTLET	User																		0.00
2	MH10-MH9	User																		0.00
3	MH8-MH9	User																		0.00
4	CB14-MH8	User																		5.00
5	CB19-MH10	User																		5.00
6	CB15-MH8	User																		5.00
7	CB18-MH10	User																		5.00
8	CB17-MH9	User																		5.00
9	CB16-MH9	User																		5.00

Project File: Sta.50+70.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 9 | Date: 3/15/2024

A00840 - 214

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.51+24.stm

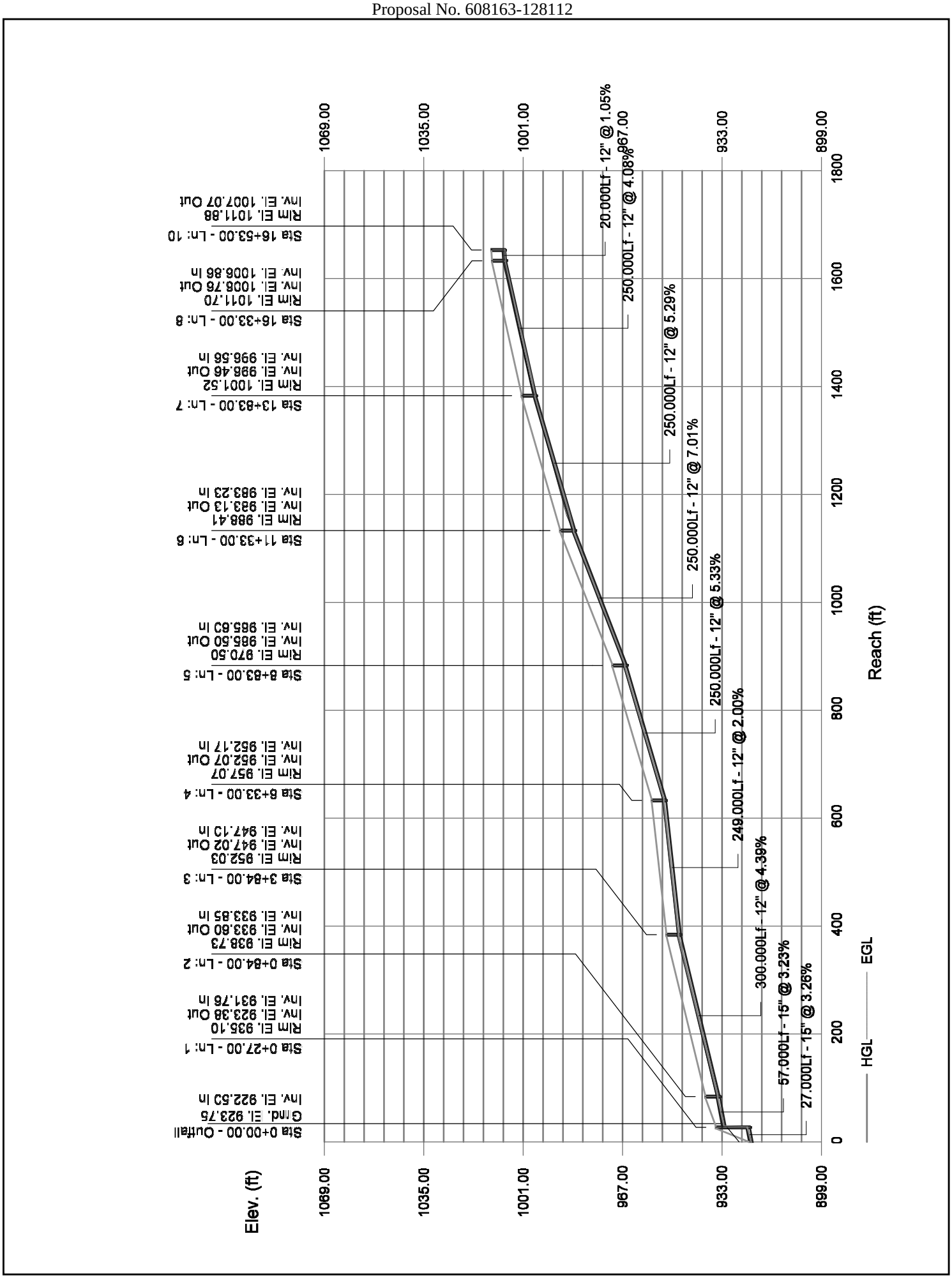
Number of lines: 22

Date: 3/15/2024

Storm Sewers v2023.00

Storm Sewer Profile

Proj. file: Sta.51+24.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-11A	Manhole	935.10	Cir	4.00	4.00	15	Cir	923.38	15	Cir	931.76
2	MH-11	Manhole	938.73	Rect	4.00	4.00	15	Cir	933.60	12	Cir	933.85
										12	Cir	933.64
										12	Cir	934.36
3	MH-12	Manhole	952.03	Cir	4.00	4.00	12	Cir	947.02	12	Cir	947.10
										12	Cir	947.21
										12	Cir	947.12
4	MH-13	Manhole	957.07	Cir	4.00	4.00	12	Cir	952.07	12	Cir	952.17
										12	Cir	952.17
										12	Cir	952.17
5	MH-14	Manhole	970.50	Cir	4.00	4.00	12	Cir	965.50	12	Cir	965.60
										12	Cir	965.75
										12	Cir	965.82
6	MH-15	Manhole	988.41	Cir	4.00	4.00	12	Cir	983.13	12	Cir	983.23
										12	Cir	983.34
										12	Cir	983.45
7	MH-15B	Manhole	1001.52	Cir	4.00	4.00	12	Cir	996.46	12	Cir	996.56
										12	Cir	996.67
										12	Cir	996.56
8	MH-16	Manhole	1011.70	Cir	4.00	4.00	12	Cir	1006.76	12	Cir	1007.06
										12	Cir	1006.86
9	CB-31	Combination	1011.79	Cir	4.00	2.00	12	Cir	1007.19			
10	CB-30	Combination	1011.88	Cir	4.00	4.00	12	Cir	1007.07			
11	CB-29B	Combination	1001.78	Cir	4.00	4.00	12	Cir	996.78			
12	CB-28B	Combination	1001.70	Cir	4.00	4.00	12	Cir	996.76			
13	CB-28	Combination	988.60	Cir	4.00	4.00	12	Cir	983.54			
14	CB-29	Combination	988.57	Cir	4.00	4.00	12	Cir	983.57			
15	CB-26	Combination	970.98	Cir	4.00	4.00	12	Cir	965.95			
16	CB-27	Combination	970.94	Cir	4.00	4.00	12	Cir	965.94			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00840 - 217

Proposal No. 608163-128112

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
17	CB-25	Combination	957.22	Cir	4.00	4.00	12	Cir	952.27			
18	CB-24	Combination	957.26	Cir	4.00	4.00	12	Cir	952.37			
19	CB-22	Combination	952.45	Cir	4.00	4.00	12	Cir	947.41			
20	CB-23	Combination	951.93	Cir	4.00	4.00	12	Cir	947.23			
21	CB-20	Combination	938.84	Cir	4.00	4.00	12	Cir	933.84			
22	CB-21	Combination	939.47	Cir	4.00	4.00	12	Cir	934.47			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00840 - 218

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	2.38	0.00	0.00	1.35	0.0	16.4	3.6	4.91	11.66	7.15	15	3.26	922.50	923.38	923.07	924.28	923.75	935.10	MH11A-OUTLET
2	1	57.000	0.00	2.38	0.00	0.00	1.35	0.0	16.3	3.7	4.94	11.60	7.14	15	3.23	931.76	933.60	932.33	934.50	935.10	938.73	MH11-MH11A
3	2	300.000	0.00	2.03	0.00	0.00	1.13	0.0	15.6	3.7	4.23	7.46	6.84	12	4.39	933.85	947.02	934.50	947.89	938.73	952.03	MH12-MH11
4	3	249.000	0.00	1.82	0.00	0.00	0.96	0.0	14.8	3.8	3.70	5.03	5.48	12	2.00	947.10	952.07	947.89	952.89	952.03	957.07	MH13-MH12
5	4	250.000	0.00	1.63	0.00	0.00	0.81	0.0	14.0	3.9	3.21	8.22	5.14	12	5.33	952.17	965.50	952.89	966.27	957.07	970.50	MH14-MH13
6	5	250.000	0.00	1.44	0.00	0.00	0.66	0.0	13.1	4.1	2.68	9.43	4.69	12	7.01	965.60	983.13	966.27	983.83	970.50	988.41	MH15-MH14
7	6	250.000	0.00	1.08	0.00	0.00	0.46	0.0	12.1	4.2	1.96	8.19	4.00	12	5.29	983.23	996.46	983.83	997.06	988.41	1001.52	MH15B-MH15
8	7	250.000	0.00	0.43	0.00	0.00	0.21	0.0	5.1	5.9	1.23	7.19	3.29	12	4.08	996.56	1006.76	997.06	1007.23	1001.52	1011.70	MH16-MH15B
9	8	13.000	0.32	0.32	0.39	0.12	0.12	5.0	5.0	5.9	0.74	3.56	3.25	12	1.00	1007.06	1007.19	1007.37	1007.55	1011.70	1011.79	CB31-MH16
10	8	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.65	2.27	12	1.05	1006.86	1007.07	1007.23	1007.37	1011.70	1011.88	CB30-MH16
11	7	12.000	0.54	0.54	0.31	0.17	0.17	12.0	12.0	4.2	0.71	3.41	2.71	12	0.92	996.67	996.78	997.06	997.13	1001.52	1001.78	CB29B-MH15B
12	7	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.56	1.96	12	1.00	996.56	996.76	997.06	997.06	1001.52	1001.70	CB28B-MH15B
13	6	21.000	0.13	0.13	0.71	0.09	0.09	5.0	5.0	5.9	0.55	3.48	2.05	12	0.95	983.34	983.54	983.83	983.85	988.41	988.60	CB28-MH15
14	6	12.000	0.23	0.23	0.44	0.10	0.10	5.0	5.0	5.9	0.60	3.56	2.46	12	1.00	983.45	983.57	983.83	983.89	988.41	988.57	CB29-MH15
15	5	20.000	0.10	0.10	0.79	0.08	0.08	5.0	5.0	5.9	0.47	3.56	1.85	12	1.00	965.75	965.95	966.27	966.23	970.50	970.98	CB26-MH14
16	5	12.000	0.09	0.09	0.84	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.92	12	1.00	965.82	965.94	966.27	966.22	970.50	970.94	CB27-MH14
17	4	10.000	0.09	0.09	0.82	0.07	0.07	5.0	5.0	5.9	0.44	3.56	1.62	12	1.00	952.17	952.27	952.89	952.54	957.07	957.22	CB25-MH13
18	4	20.000	0.10	0.10	0.76	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.64	12	1.00	952.17	952.37	952.89	952.65	957.07	957.26	CB24-MH13
19	3	20.000	0.06	0.06	0.72	0.04	0.04	5.0	5.0	5.9	0.26	3.56	1.31	12	1.00	947.21	947.41	947.89	947.62	952.03	952.45	CB22-MH12
20	3	11.000	0.15	0.15	0.82	0.12	0.12	5.0	5.0	5.9	0.73	3.56	2.01	12	1.00	947.12	947.23	947.89	947.59	952.03	951.93	CB23-MH12
21	2	20.000	0.21	0.21	0.71	0.15	0.15	5.0	5.0	5.9	0.88	3.56	2.15	12	1.00	933.64	933.84	934.50	934.23	938.73	938.84	CB20-MH11
22	2	11.000	0.14	0.14	0.50	0.07	0.07	5.0	5.0	5.9	0.41	3.56	2.75	12	1.00	934.36	934.47	934.59	934.74	938.73	939.47	CB21-MH11

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 219

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-11A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-11	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	1
3	MH-12	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	MH-13	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	MH-14	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	MH-15	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	MH-15B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	MH-16	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	CB-31	0.74	0.00	0.53	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.57	0.22	2.86	2.0	11
10	CB-30	0.51	0.00	0.39	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.08	3.97	0.21	2.28	2.0	12
11	CB-29B	0.71	0.21	0.63	0.29	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.10	4.97	0.23	3.24	2.0	14
12	CB-28B	0.51	0.11	0.46	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.29	0.22	2.59	2.0	13
13	CB-28	0.55	0.16	0.53	0.18	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.12	0.22	2.45	2.0	15
14	CB-29	0.60	0.29	0.64	0.26	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.82	2.0	16
15	CB-26	0.47	0.18	0.50	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	3.92	0.21	2.25	2.0	18
16	CB-27	0.45	0.26	0.53	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	4.05	0.21	2.38	2.0	17
17	CB-25	0.44	0.17	0.45	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.31	0.22	2.61	2.0	20
18	CB-24	0.45	0.15	0.44	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.28	0.22	2.58	2.0	19
19	CB-22	0.26	0.15	0.31	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.68	2.0	21
20	CB-23	0.73	0.16	0.60	0.28	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.024	0.024	0.013	0.13	5.34	0.25	3.49	2.0	22
21	CB-20	0.88	0.10	0.78	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.028	0.028	0.013	0.11	3.77	0.23	2.10	2.0	Off
22	CB-21	0.41	0.28	0.52	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.09	0.22	2.43	2.0	Off

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 220

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

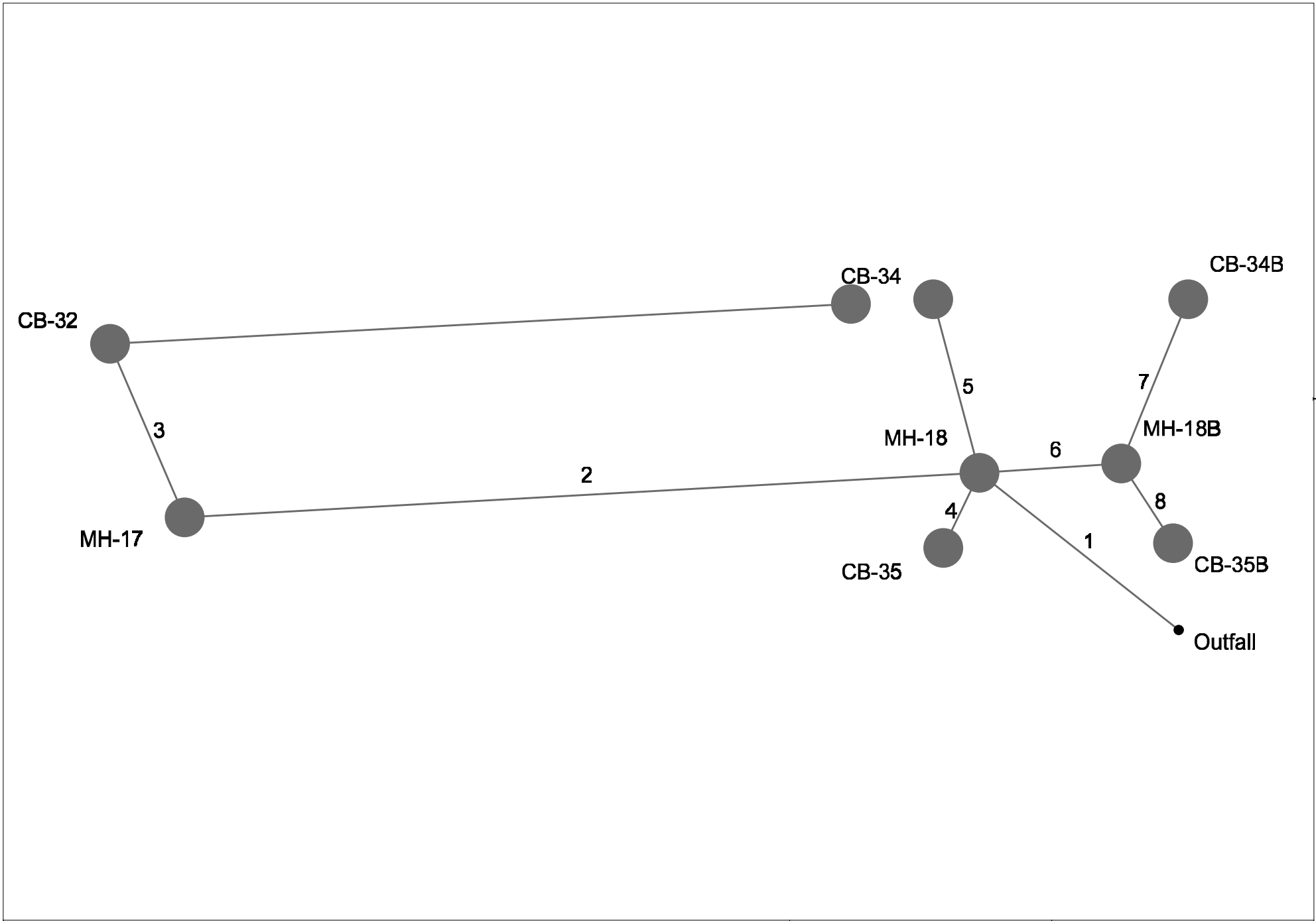
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH11A-OUTLET	User																		0.00
2	MH11-MH11A	User																		0.00
3	MH12-MH11	User																		0.00
4	MH13-MH12	User																		0.00
5	MH14-MH13	User																		0.00
6	MH15-MH14	User																		0.00
7	MH15B-MH15	User																		0.00
8	MH16-MH15B	User																		0.00
9	CB31-MH16	User																		5.00
10	CB30-MH16	User																		5.00
11	CB29B-MH15B	TR55	0.800	30.00	3.10	4.00	10.99	170.00 100.00	13.00 4.00	UnPaved UnPaved	5.82 3.23	0.49 0.52								12.00
12	CB28B-MH15B	User																		5.00
13	CB28-MH15	User																		5.00
14	CB29-MH15	User																		5.00
15	CB26-MH14	User																		5.00
16	CB27-MH14	User																		5.00
17	CB25-MH13	User																		5.00
18	CB24-MH13	User																		5.00
19	CB22-MH12	User																		5.00
20	CB23-MH12	User																		5.00
21	CB20-MH11	User																		5.00
22	CB21-MH11	User																		5.00

Project File: Sta.51+24.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 22 | Date: 3/15/2024

A00840 - 221

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

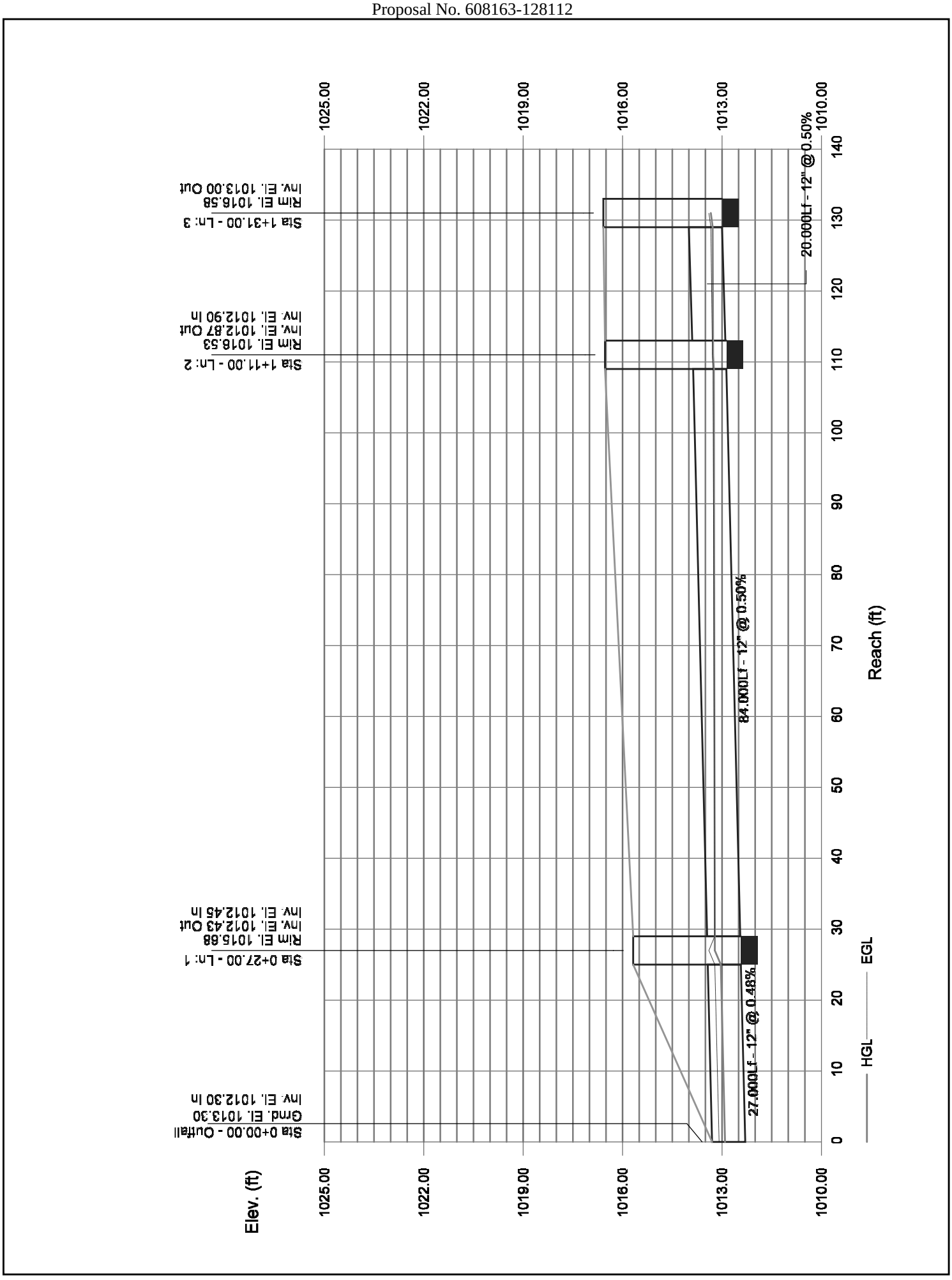


Project File: Sta.73+25.stm	Number of lines: 8	Date: 3/15/2024

Storm Sewers v2023.00

Storm Sewer Profile

Proj. file: Sta.73+25.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-18	Manhole	1015.68	Cir	4.00	4.00	12	Cir	1012.43	12 12 12 12	Cir Cir Cir Cir	1012.45 1012.45 1012.44 1012.45
2	MH-17	Manhole	1016.53	Cir	4.00	4.00	12	Cir	1012.87	12	Cir	1012.90
3	CB-32	Combination	1016.58	Cir	4.00	2.00	12	Cir	1013.00			
4	CB-35	Combination	1015.93	Cir	4.00	4.00	12	Cir	1012.49			
5	CB-34	Combination	1015.52	Cir	4.00	2.00	12	Cir	1012.53			
6	MH-18B	Manhole	1015.73	Cir	4.00	4.00	12	Cir	1012.52	12 12	Cir Cir	1012.53 1012.55
7	CB-34B	Combination	1015.61	Cir	4.00	4.00	12	Cir	1012.63			
8	CB-35B	Combination	1016.00	Cir	4.00	4.00	12	Cir	1012.60			

Project File: Sta.73+25.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00840 - 224

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.7	5.4	1.69	2.47	3.39	12	0.48	1012.30	1012.43	1012.91	1013.04	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	5.8	0.34	2.52	0.90	12	0.50	1012.45	1012.87	1013.22	1013.25	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	5.9	0.35	2.52	1.61	12	0.50	1012.90	1013.00	1013.27	1013.28	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	5.9	0.07	2.37	0.11	12	0.44	1012.45	1012.49	1013.22	1013.22	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	5.9	0.20	2.45	0.32	12	0.47	1012.44	1012.53	1013.22	1013.22	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	5.8	1.24	2.43	2.00	12	0.47	1012.45	1012.52	1013.22	1013.23	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	5.9	0.83	2.58	1.39	12	0.53	1012.53	1012.63	1013.29	1013.30	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	5.9	0.43	2.52	0.71	12	0.50	1012.55	1012.60	1013.29	1013.29	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 225

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (In)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (In)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.35	0.00	0.28	0.07	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	3.81	0.21	2.07	2.0	5
4	CB-35	0.07	0.00	0.07	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.18	0.07	1.18	2.0	Off
5	CB-34	0.20	0.07	0.27	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.04	2.00	0.12	2.00	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	0.83	0.00	0.83	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.26	0.25	4.26	2.0	Off
8	CB-35B	0.43	0.00	0.43	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.67	0.16	2.67	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 226

Proposal No. 6081163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.9	6.5	2.06	2.47	3.76	12	0.48	1012.30	1012.43	1012.91	1013.14	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	7.1	0.42	2.52	0.85	12	0.50	1012.45	1012.87	1013.33	1013.35	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	7.2	0.42	2.52	1.40	12	0.50	1012.90	1013.00	1013.36	1013.37	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	7.2	0.08	2.37	0.11	12	0.44	1012.45	1012.49	1013.33	1013.33	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	7.2	0.24	2.45	0.34	12	0.47	1012.44	1012.53	1013.33	1013.33	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	7.1	1.51	2.43	2.13	12	0.47	1012.45	1012.52	1013.33	1013.35	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	7.2	1.01	2.58	1.45	12	0.53	1012.53	1012.63	1013.41	1013.42	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	7.2	0.52	2.52	0.74	12	0.50	1012.55	1012.60	1013.41	1013.42	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840 - 227

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.42	0.00	0.33	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	4.11	0.21	2.38	2.0	5
4	CB-35	0.08	0.00	0.08	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.31	0.08	1.31	2.0	Off
5	CB-34	0.24	0.10	0.34	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.02	2.30	0.14	2.30	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	1.01	0.00	1.01	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.10	5.17	0.27	5.17	2.0	Off
8	CB-35B	0.52	0.00	0.52	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.05	0.19	3.05	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

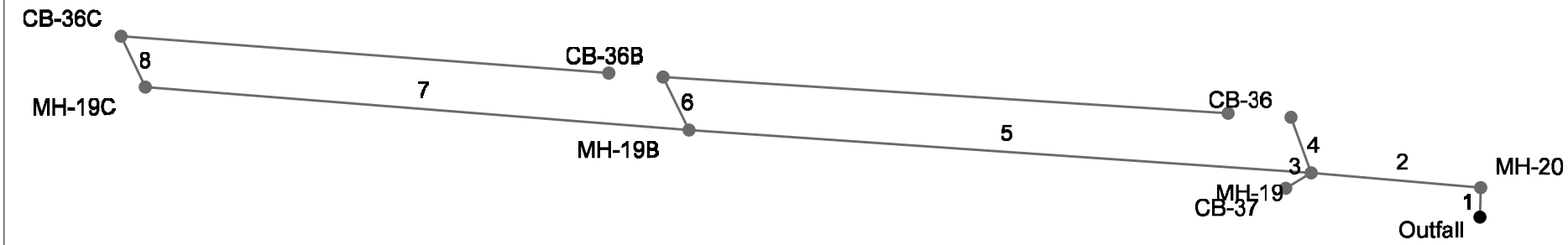
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH18-OUTLET	User																		0.00
2	MH17-MH18	User																		0.00
3	CB32-MH17	User																		5.00
4	CB35-MH18	User																		5.00
5	CB34-MH18	User																		5.00
6	MH18B-MH18	User																		0.00
7	CB34B-MH18B	User																		5.00
8	CB35B-MH18B	User																		5.00

Project File: Sta.73+25.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00840 - 229

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.81+97.stm	Number of lines: 8	Date: 3/15/2024

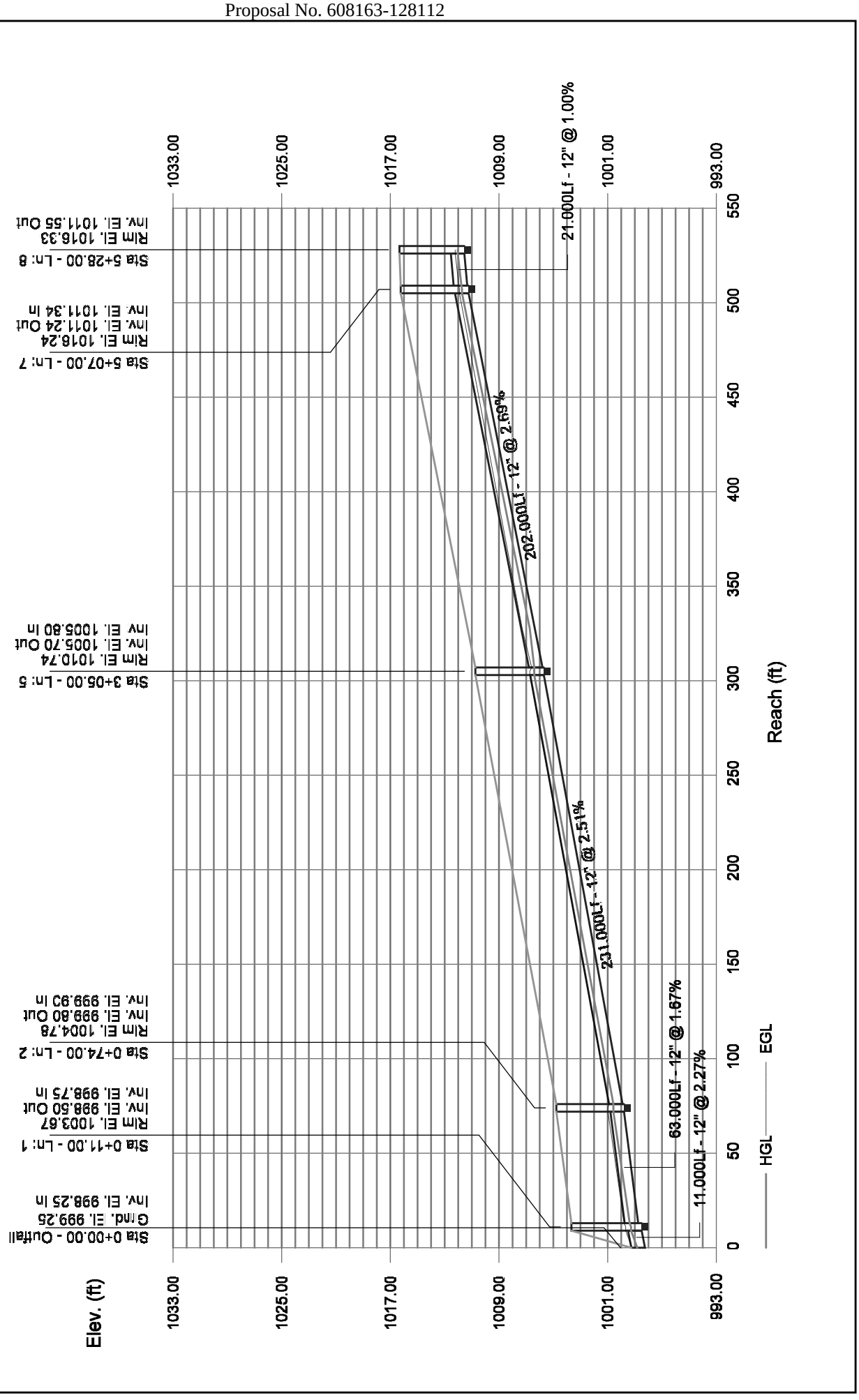
Storm Sewers v2023.00

A00840 - 230

Proposal No. 608163-128112

Storm Sewer Profile

Proj. file: Sta.81+97.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-20	Manhole	1003.67	Cir	4.00	4.00	12	Cir	998.50	12	Cir	998.75
2	MH-19	Manhole	1004.78	Cir	4.00	4.00	12	Cir	999.80	12 12 12	Cir Cir Cir	999.90 1000.00 999.90
3	CB-37	Combination	1004.87	Cir	4.00	2.00	12	Cir	1000.01			
4	CB-36	Combination	1005.13	Cir	4.00	2.00	12	Cir	1000.22			
5	MH-19B	Manhole	1010.74	Cir	4.00	4.00	12	Cir	1005.70	12 12	Cir Cir	1006.45 1005.80
6	CB-36B	Combination	1011.71	Cir	4.00	4.00	12	Cir	1006.67			
7	MH-19C	Manhole	1016.24	Cir	4.00	4.00	12	Cir	1011.24	12	Cir	1011.34
8	CB-36C	Combination	1016.33	Cir	4.00	2.00	12	Cir	1011.55			

Project File: Sta.81+97.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00840 - 232

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	11.000	0.00	1.83	0.00	0.00	0.78	0.0	12.2	4.2	3.31	5.37	6.12	12	2.27	998.25	998.50	998.82	999.28	999.25	1003.67	MH20-OUTLET
2	1	63.000	0.00	1.83	0.00	0.00	0.78	0.0	12.0	4.2	3.33	4.60	5.72	12	1.67	998.75	999.80	999.38	1000.58	1003.67	1004.78	MH19-MH20
3	2	11.000	0.12	0.12	0.85	0.10	0.10	5.0	5.0	5.9	0.60	3.56	1.90	12	1.00	999.90	1000.01	1000.58	1000.33	1004.78	1004.87	CB37-MH19
4	2	22.000	0.16	0.16	0.39	0.06	0.06	5.0	5.0	5.9	0.37	3.56	1.59	12	1.00	1000.00	1000.22	1000.58	1000.47	1004.78	1005.13	CB36-MH19
5	2	231.000	0.00	1.55	0.00	0.00	0.62	0.0	11.2	4.4	2.72	5.64	4.68	12	2.51	999.90	1005.70	1000.58	1006.41	1004.78	1010.74	MH19B-MH19
6	5	22.000	0.83	0.83	0.40	0.33	0.33	10.0	10.0	4.6	1.53	3.56	4.01	12	1.00	1006.45	1006.67	1006.91	1007.19	1010.74	1011.71	CB36B-MH19B
7	5	202.000	0.00	0.72	0.00	0.00	0.29	0.0	10.1	4.6	1.32	5.84	3.07	12	2.69	1005.80	1011.24	1006.41	1011.73	1010.74	1016.24	MH19C-MH19B
8	7	21.000	0.72	0.72	0.40	0.29	0.29	10.0	10.0	4.6	1.33	3.56	3.85	12	1.00	1011.34	1011.55	1011.76	1012.04	1016.24	1016.33	CB36C-MH19C

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 233

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-20	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-19	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-37	0.60	0.00	0.55	0.06	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.042	0.020	0.013	0.12	2.92	0.22	1.20	2.0	Off
4	CB-36	0.37	0.92	0.90	0.39	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.031	0.020	0.013	0.15	5.07	0.26	3.00	2.0	Off
5	MH-19B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	2
6	CB-36B	1.53	0.52	1.13	0.92	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.15	7.27	0.27	5.39	2.0	4
7	MH-19C	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	5
8	CB-36C	1.33	0.00	0.81	0.52	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.12	6.18	0.25	4.34	2.0	6

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 234

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

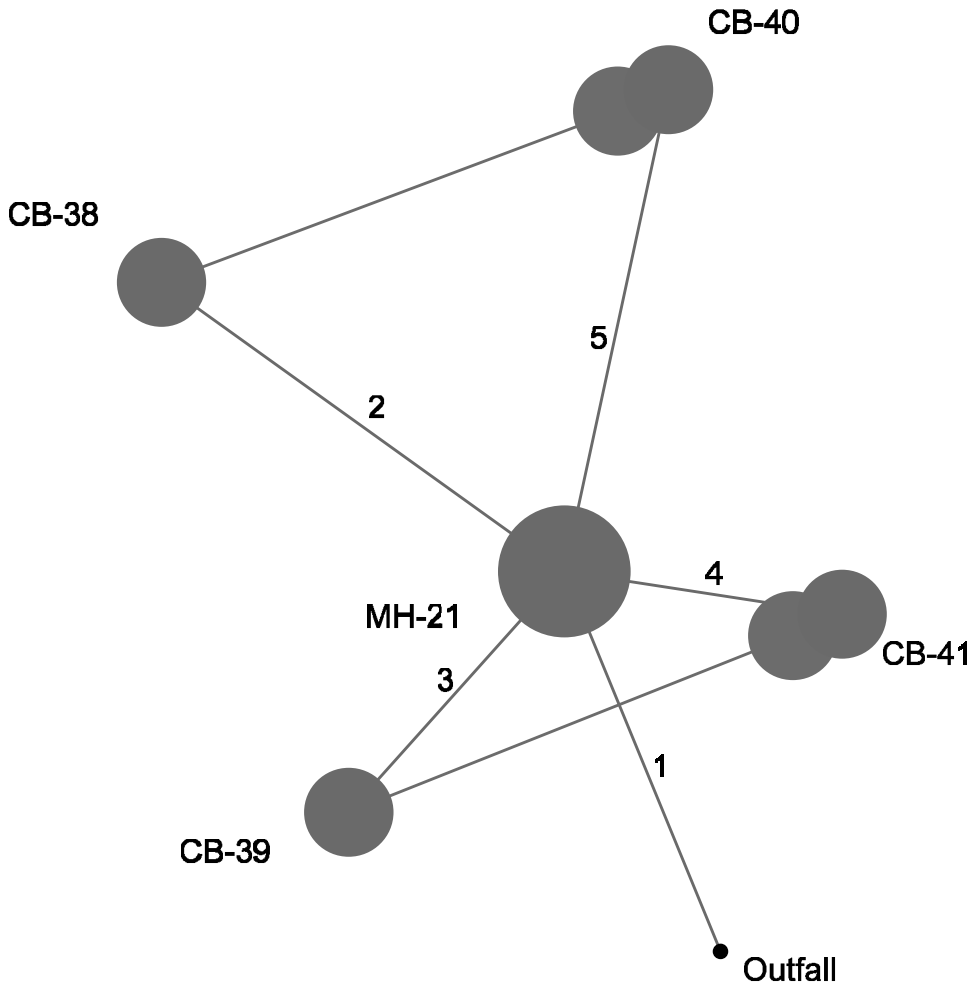
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH20-OUTLET	User																		0.00
2	MH19-MH20	User																		0.00
3	CB37-MH19	User																		5.00
4	CB36-MH19	User																		5.00
5	MH19B-MH19	User																		0.00
6	CB36B-MH19B	User																		10.00
7	MH19C-MH19B	User																		0.00
8	CB36C-MH19C	User																		10.00

Project File: Sta.81+97.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00840 - 235

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



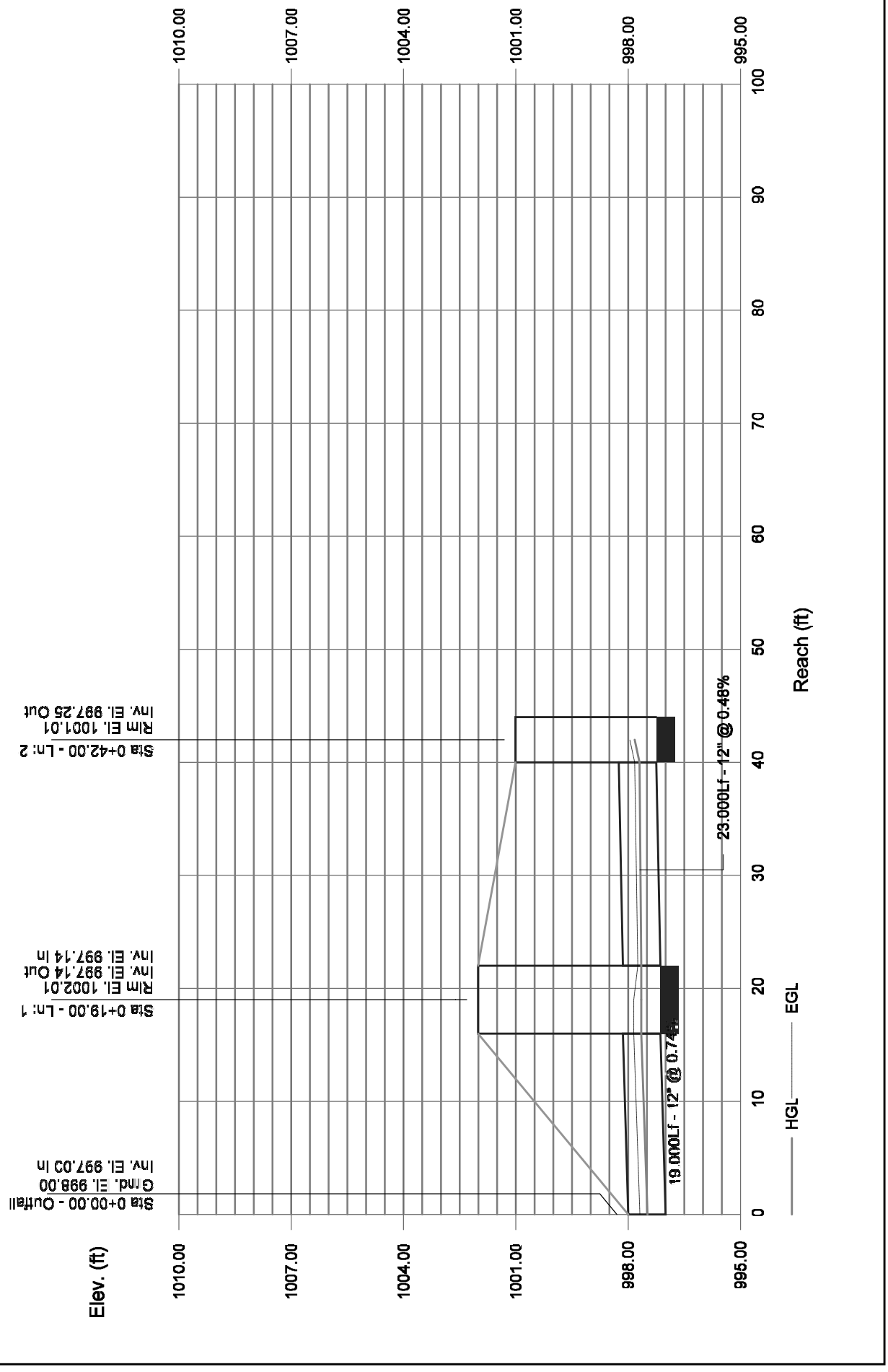
Project File: Sta.85+72.stm	Number of lines: 5	Date: 4/8/2024

Storm Sewers v2023.00

Storm Sewer Profile

Proj. file: Sta.85+72.stm

Storm Sewers



Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-21	Manhole	1002.01	Cir	6.00	6.00	12	Cir	997.14	12 12 12 12	Cir Cir Cir Cir	997.14 997.14 997.14 997.14
2	CB-38	Combination	1001.01	Cir	4.00	4.00	12	Cir	997.25			
3	CB-39	Combination	1002.33	Cir	4.00	4.00	12	Cir	997.21			
4	CB-41	Combination	1002.17	Cir	4.00	4.00	12	Cir	997.21			
5	CB-40	Combination	1000.85	Cir	4.00	4.00	12	Cir	997.25			

Project File: Sta.85+72.stm | Number of Structures: 5 | Run Date: 4/8/2024

A00840 - 238

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	5.4	1.45	3.06	3.72	12	0.74	997.00	997.14	997.49	997.65	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	5.9	0.98	2.46	2.66	12	0.48	997.14	997.25	997.65	997.70	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	5.9	0.08	2.43	0.23	12	0.47	997.14	997.21	997.65	997.65	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	5.9	0.04	2.61	0.12	12	0.54	997.14	997.21	997.65	997.65	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	5.9	0.49	2.46	1.42	12	0.48	997.14	997.25	997.65	997.66	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 - 239

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	0.98	0.00	0.87	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.19	3.22	0.25	1.43	2.0	5
3	CB-39	0.08	0.00	0.08	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.55	0.18	0.70	2.0	4
4	CB-41	0.04	0.00	0.05	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.99	0.06	0.99	2.0	Off
5	CB-40	0.49	0.11	0.60	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.04	2.04	0.21	2.04	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 - 240

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	6.6	1.78	3.06	3.96	12	0.74	997.00	997.14	997.55	997.71	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	7.2	1.20	2.46	2.80	12	0.48	997.14	997.25	997.71	997.76	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	7.2	0.10	2.43	0.24	12	0.47	997.14	997.21	997.71	997.71	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	7.2	0.05	2.61	0.13	12	0.54	997.14	997.21	997.71	997.71	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	7.2	0.60	2.46	1.48	12	0.48	997.14	997.25	997.71	997.72	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840 - 241

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	1.20	0.00	1.02	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.21	3.47	0.27	1.69	2.0	5
3	CB-39	0.10	0.00	0.10	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.75	0.18	0.90	2.0	4
4	CB-41	0.05	0.01	0.06	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.10	1.12	0.07	1.12	2.0	Off
5	CB-40	0.60	0.17	0.77	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.08	2.41	0.25	2.41	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH21-OUTLET	User																		0.00
2	CB38-MH21	User																		5.00
3	CB39-MH21	User																		5.00
4	CB41-MH21	User																		5.00
5	CB40-MH21	User																		5.00

Project File: Sta.85+72.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 5 | Date: 4/8/2024

A00840 - 243

Proposal No. 608163-128112

APPENDIX D

HY-8 Reports

DRAINAGE REPORT

Existing

HY-8 Reports

STA 15+33 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

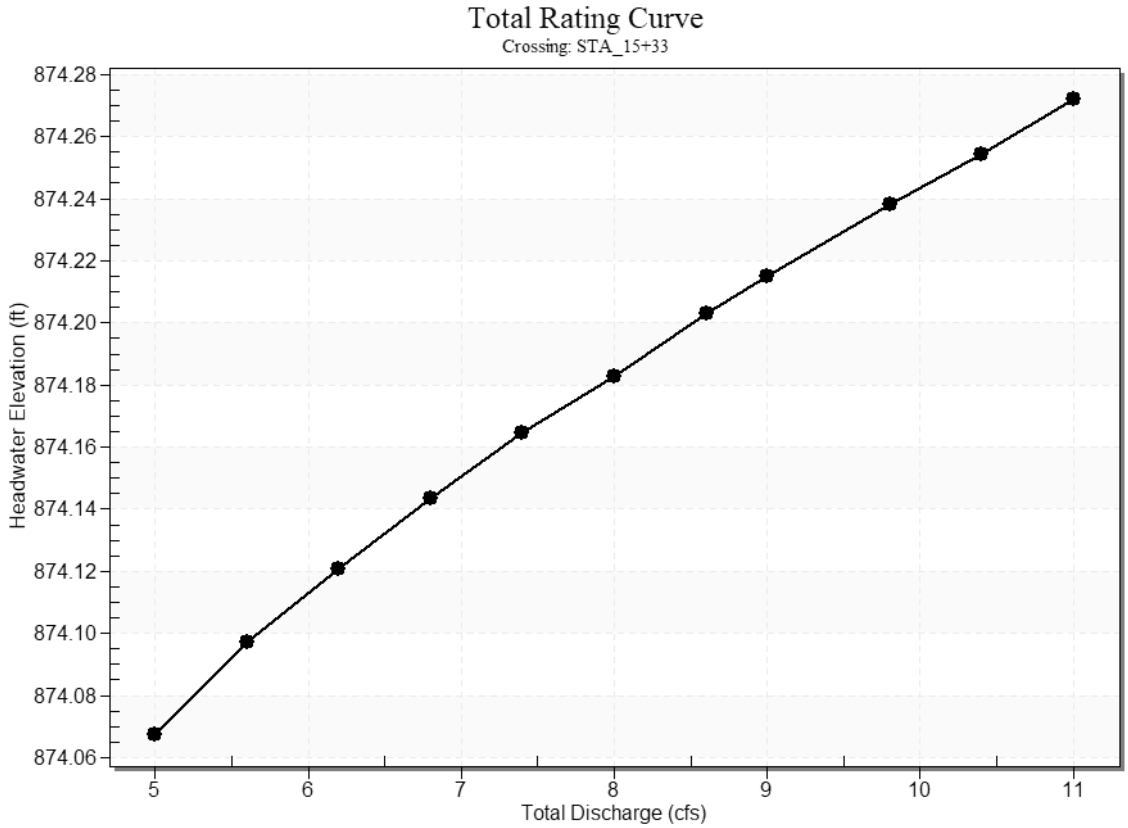
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA_15+33

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
874.07	5.00	4.15	0.84	16
874.10	5.60	4.17	1.40	4
874.12	6.20	4.18	2.00	4
874.14	6.80	4.19	2.59	4
874.16	7.40	4.21	3.16	3
874.18	8.00	4.22	3.75	3
874.20	8.60	4.23	4.35	3
874.21	9.00	4.23	4.75	3
874.24	9.80	4.25	5.54	3
874.25	10.40	4.26	6.14	3
874.27	11.00	4.26	6.73	3
874.00	4.11	4.11	0.00	Overtopping

Rating Curve Plot for Crossing: STA_15+33



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	4.15 cfs	874.07	1.75	3.818	7-M2c	1.00	0.86	0.86	0.13	5.78	2.08
5.60 cfs	4.17 cfs	874.10	1.75	3.847	7-M2c	1.00	0.86	0.86	0.14	5.79	2.18
6.20 cfs	4.18 cfs	874.12	1.76	3.871	7-M2c	1.00	0.86	0.86	0.15	5.80	2.27
6.80 cfs	4.19 cfs	874.14	1.77	3.894	7-M2c	1.00	0.86	0.86	0.16	5.82	2.35

7.40 cfs	4.21 cfs	874.16	1.77	3.915	7-M2c	1.00	0.86	0.86	0.16	5.83	2.42
8.00 cfs	4.22 cfs	874.18	1.78	3.933	7-M2c	1.00	0.87	0.87	0.17	5.84	2.50
8.60 cfs	4.23 cfs	874.20	1.79	3.953	7-M2c	1.00	0.87	0.87	0.18	5.85	2.57
9.00 cfs	4.23 cfs	874.21	1.79	3.965	7-M2c	1.00	0.87	0.87	0.18	5.85	2.61
9.80 cfs	4.25 cfs	874.24	1.80	3.988	7-M2c	1.00	0.87	0.87	0.19	5.87	2.70
10.40 cfs	4.26 cfs	874.25	1.80	4.004	7-M2c	1.00	0.87	0.87	0.20	5.88	2.76
11.00 cfs	4.26 cfs	874.27	1.81	4.022	7-M2c	1.00	0.87	0.87	0.21	5.88	2.82

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

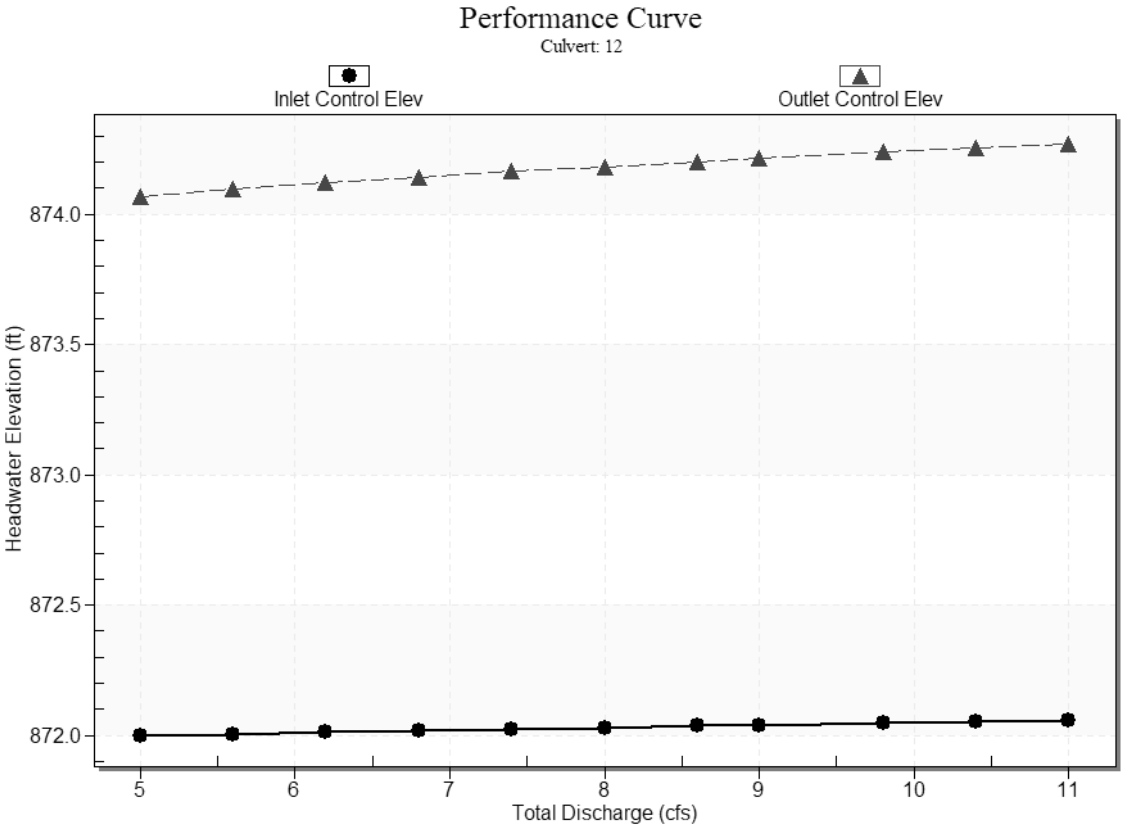
Inlet Elevation (invert): 870.25 ft,

Outlet Elevation (invert): 869.63 ft

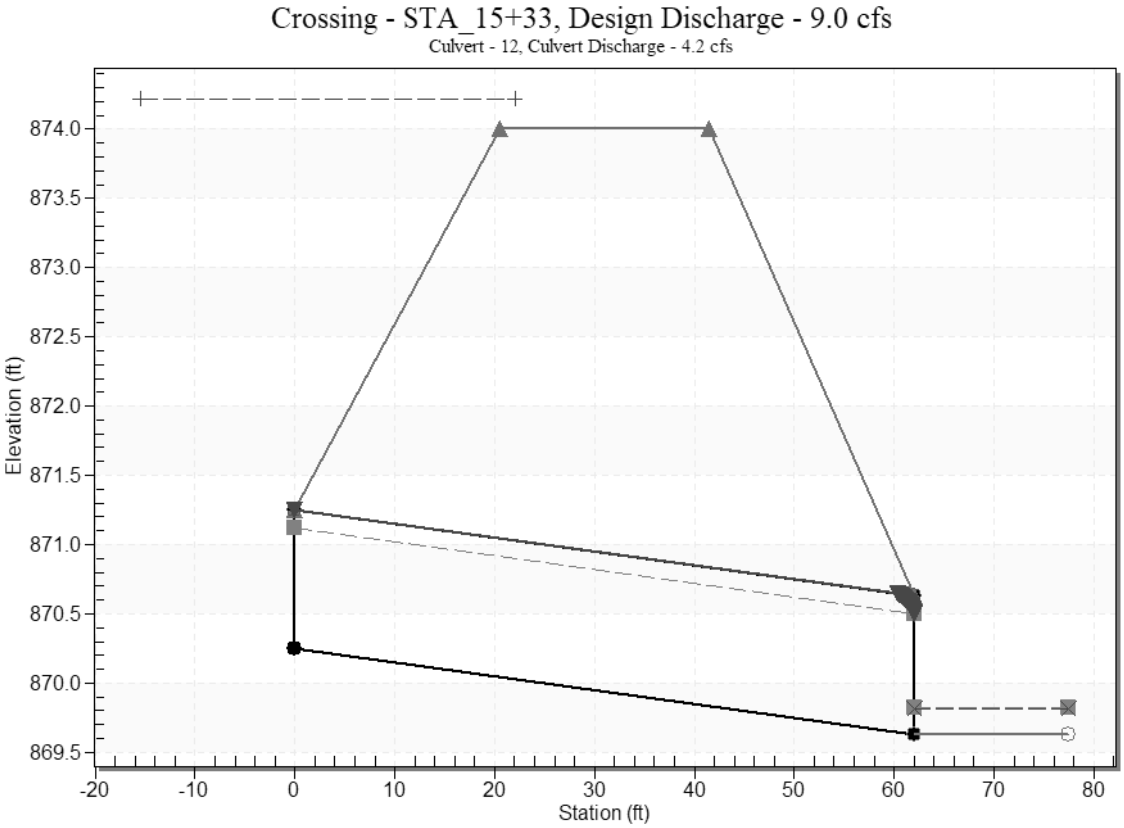
Culvert Length: 62.00 ft,

Culvert Slope: 0.0100

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.25 ft

Outlet Station: 62.00 ft

Outlet Elevation: 869.63 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA_15+33

Table 3 - Downstream Channel Rating Curve (Crossing: STA_15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.76	0.13	2.08	0.40	1.03
5.60	869.77	0.14	2.18	0.43	1.05
6.20	869.78	0.15	2.27	0.46	1.06
6.80	869.79	0.16	2.35	0.49	1.07
7.40	869.79	0.16	2.42	0.51	1.07
8.00	869.80	0.17	2.50	0.53	1.08
8.60	869.81	0.18	2.57	0.56	1.09
9.00	869.81	0.18	2.61	0.57	1.09
9.80	869.82	0.19	2.70	0.60	1.10
10.40	869.83	0.20	2.76	0.63	1.11
11.00	869.84	0.21	2.82	0.65	1.12

Tailwater Channel Data - STA_15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 18.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.63 ft

Roadway Data for Crossing: STA_15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 874.00 ft

Roadway Surface: Paved

Roadway Top Width: 21.00 ft

STA 25+92 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 22.00 cfs

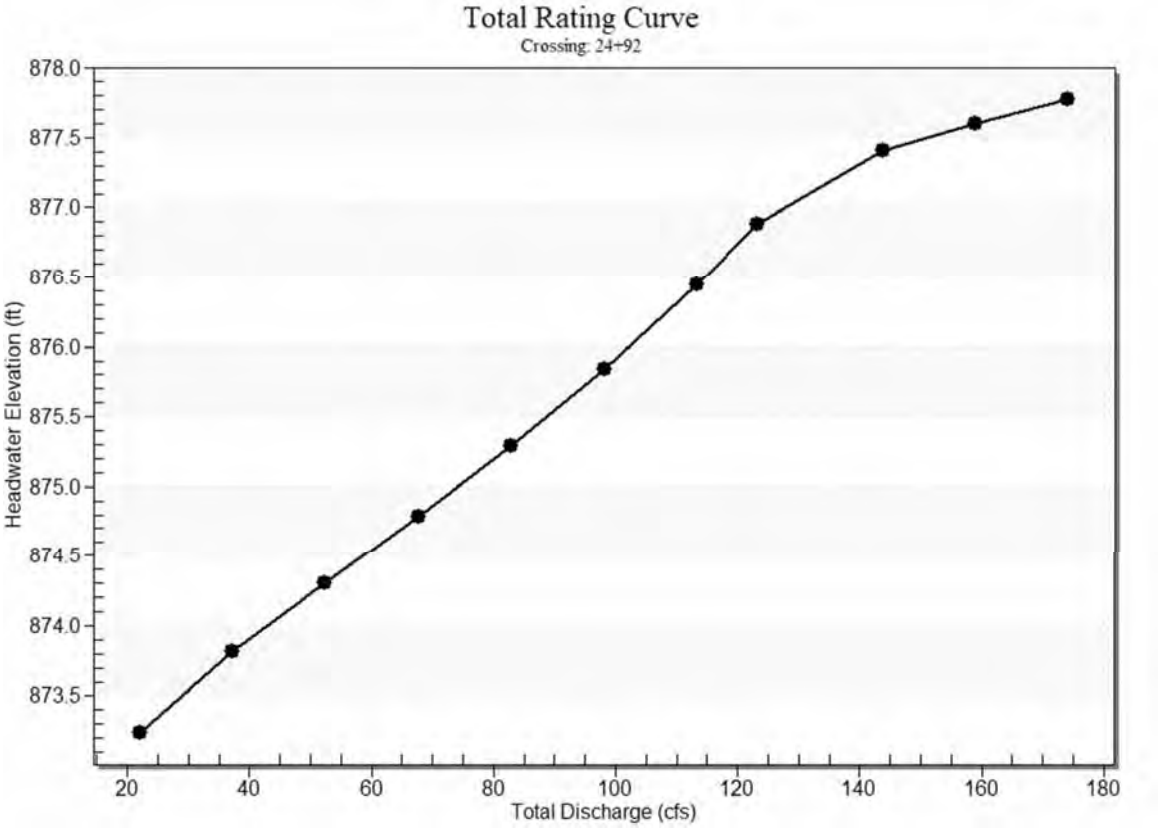
Design Flow: 123.00 cfs

Maximum Flow: 174.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 24+92

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
873.24	22.00	19.92	2.07	0.00	6
873.81	37.20	29.45	7.75	0.00	4
874.30	52.40	37.68	14.74	0.00	2
874.79	67.60	45.15	22.45	0.00	3
875.29	82.80	51.89	30.92	0.00	3
875.84	98.00	58.27	39.73	0.00	4
876.45	113.20	64.64	48.57	0.00	4
876.89	123.00	68.78	54.18	0.00	8
877.40	143.60	73.35	60.17	10.07	6
877.60	158.80	75.00	62.29	21.48	5
877.77	174.00	76.41	64.07	33.43	4
877.10	127.41	70.70	56.72	0.00	Overtopping

Rating Curve Plot for Crossing: 24+92



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	19.92 cfs	873.24	2.04	0.0*	1-S2n	0.73	1.43	0.84	0.24	12.27	4.39
37.20 cfs	29.45 cfs	873.81	2.61	0.321	1-S2n	0.89	1.76	1.06	0.33	13.16	5.34
52.40 cfs	37.68 cfs	874.30	3.10	0.863	5-S2n	1.01	2.00	1.23	0.40	13.74	6.06
67.60 cfs	45.15 cfs	874.79	3.59	1.392	5-S2n	1.11	2.19	1.38	0.46	14.23	6.66

82.80 cfs	51.89 cfs	875.29	4.09	2.232	5-S2n	1.20	2.34	1.50	0.52	14.65	7.16
98.00 cfs	58.27 cfs	875.84	4.64	2.680	5-S2n	1.28	2.47	1.61	0.58	15.03	7.60
113.20 cfs	64.64 cfs	876.45	5.25	3.162	5-S2n	1.35	2.58	1.72	0.63	15.41	8.00
123.00 cfs	68.78 cfs	876.89	5.69	3.495	5-S2n	1.40	2.64	1.79	0.66	15.66	8.24
143.60 cfs	73.35 cfs	877.40	6.20	3.878	5-S2n	1.46	2.70	1.86	0.72	15.94	8.69
158.80 cfs	75.00 cfs	877.60	6.40	4.022	5-S2n	1.47	2.72	1.88	0.77	16.04	9.00
174.00 cfs	76.41 cfs	877.77	6.57	4.146	5-S2n	1.49	2.73	1.91	0.81	16.13	9.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

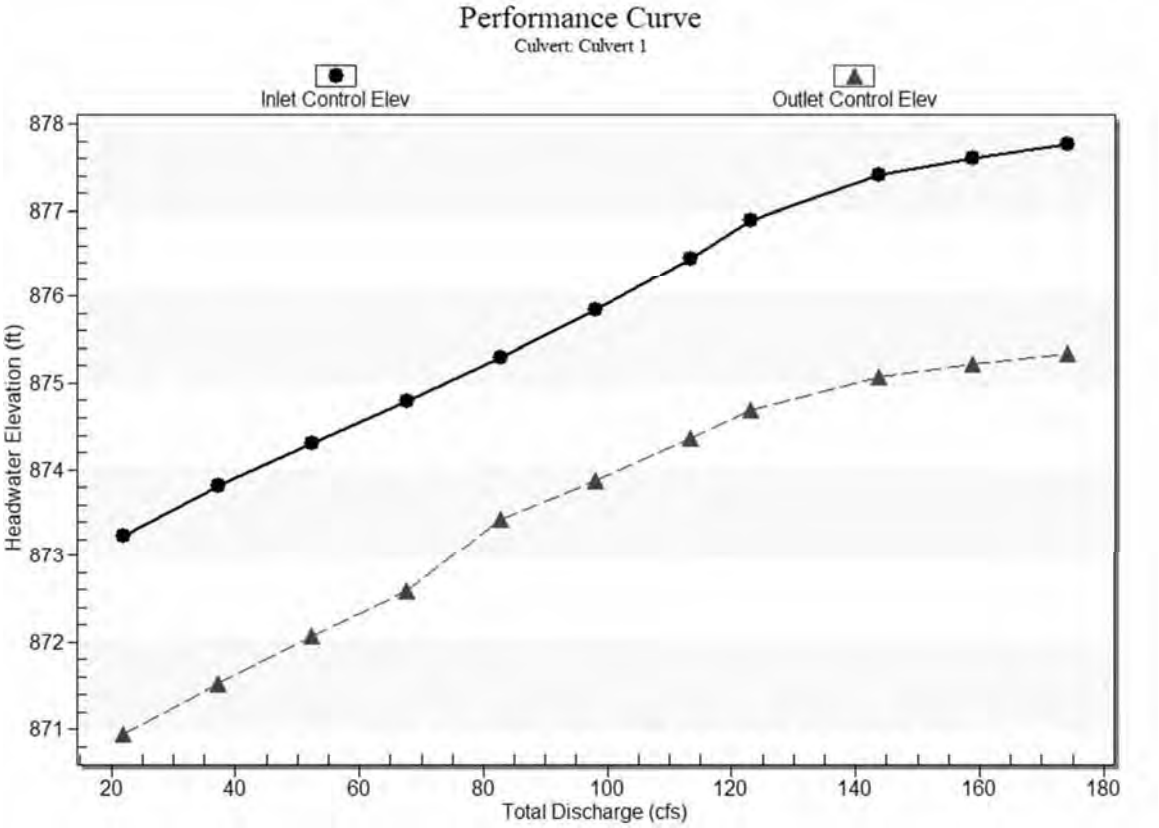
Inlet Elevation (invert): 871.20 ft,

Outlet Elevation (invert): 869.29 ft

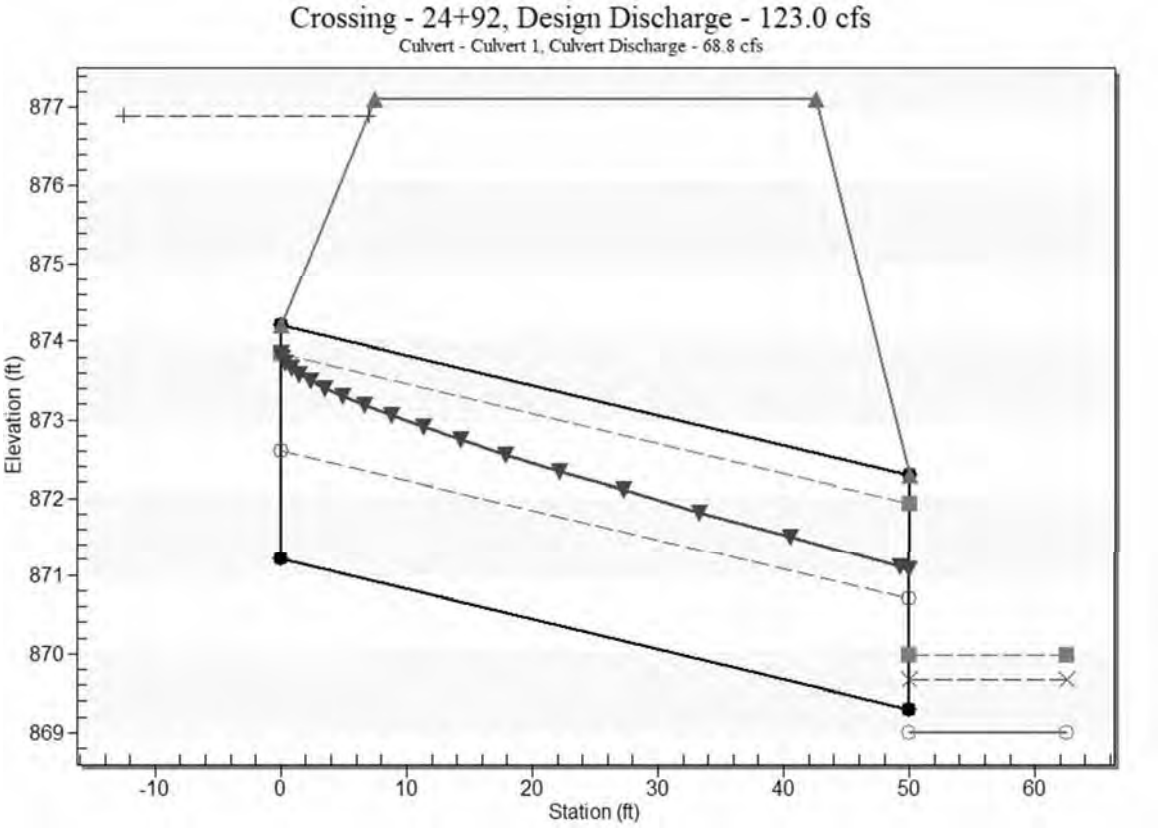
Culvert Length: 50.04 ft,

Culvert Slope: 0.0382

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.20 ft

Outlet Station: 50.00 ft

Outlet Elevation: 869.29 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0110

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Culvert Data: Culvert 2

Table 3 - Culvert Summary Table: Culvert 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	2.07 cfs	873.24	0.58	0.0*	1-S2n	0.32	0.45	0.32	0.24	5.01	4.39
37.20 cfs	7.75 cfs	873.81	1.15	0.0*	1-S2n	0.62	0.88	0.62	0.33	7.39	5.34
52.40 cfs	14.74 cfs	874.30	1.64	0.0*	1-S2n	0.85	1.22	0.85	0.40	8.90	6.06
67.60 cfs	22.45 cfs	874.79	2.13	0.0*	1-S2n	1.06	1.52	1.06	0.46	10.02	6.66
82.80 cfs	30.92 cfs	875.29	2.63	0.0*	1-S2n	1.26	1.80	1.29	0.52	10.62	7.16
98.00 cfs	39.73 cfs	875.84	3.18	0.730	5-S2n	1.46	2.05	1.49	0.58	11.34	7.60
113.20 cfs	48.57 cfs	876.45	3.79	1.974	5-S2n	1.64	2.27	1.67	0.63	12.00	8.00
123.00 cfs	54.18 cfs	876.89	4.23	2.523	5-S2n	1.76	2.39	1.79	0.66	12.29	8.24
143.60 cfs	60.17 cfs	877.40	4.74	3.161	5-S2n	1.89	2.50	1.93	0.72	12.53	8.69
158.80 cfs	62.29 cfs	877.60	4.94	3.399	5-S2n	1.93	2.54	1.98	0.77	12.61	9.00
174.00 cfs	64.07 cfs	877.77	5.11	3.604	5-S2	1.97	2.57	2.01	0.81	12.70	9.29

n

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

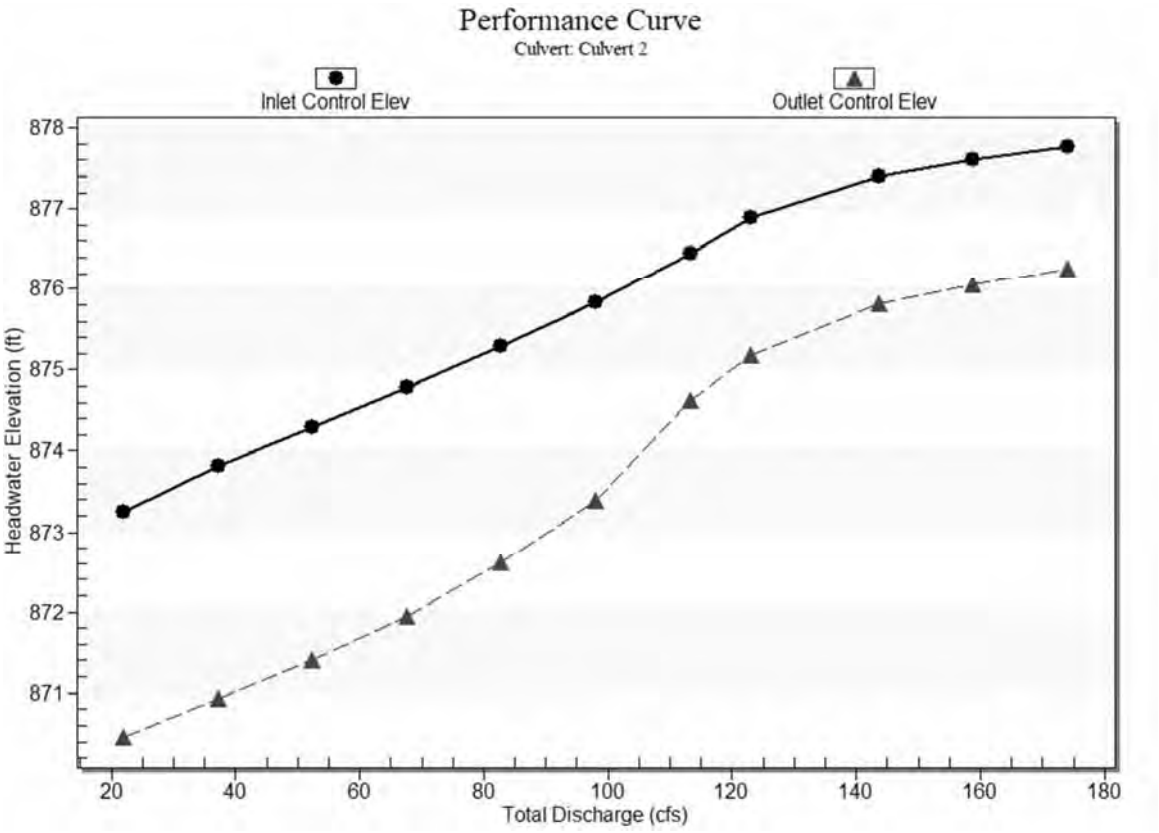
Inlet Elevation (invert): 872.66 ft,

Outlet Elevation (invert): 870.00 ft

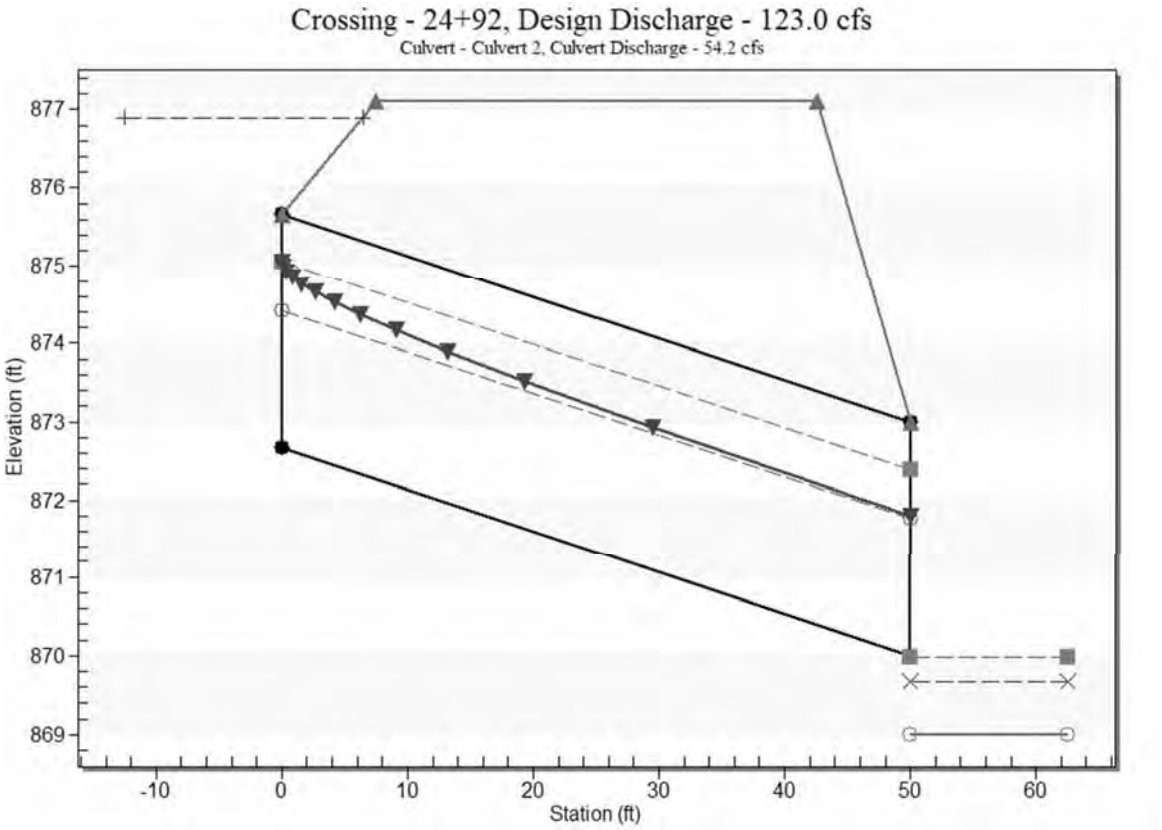
Culvert Length: 50.07 ft,

Culvert Slope: 0.0532

Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 872.66 ft

Outlet Station: 50.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 24+92

Table 4 - Downstream Channel Rating Curve (Crossing: 24+92)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
22.00	869.24	0.24	4.39	1.49	1.62
37.20	869.33	0.33	5.34	2.04	1.70
52.40	869.40	0.40	6.06	2.50	1.75
67.60	869.46	0.46	6.66	2.90	1.79
82.80	869.52	0.52	7.16	3.27	1.82
98.00	869.58	0.58	7.60	3.61	1.85
113.20	869.63	0.63	8.00	3.92	1.87
123.00	869.66	0.66	8.24	4.12	1.89
143.60	869.72	0.72	8.69	4.50	1.91
158.80	869.77	0.77	9.00	4.77	1.93
174.00	869.81	0.81	9.29	5.03	1.94

Tailwater Channel Data - 24+92

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.00 ft

Roadway Data for Crossing: 24+92

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 877.10 ft

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

STA 43+76 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

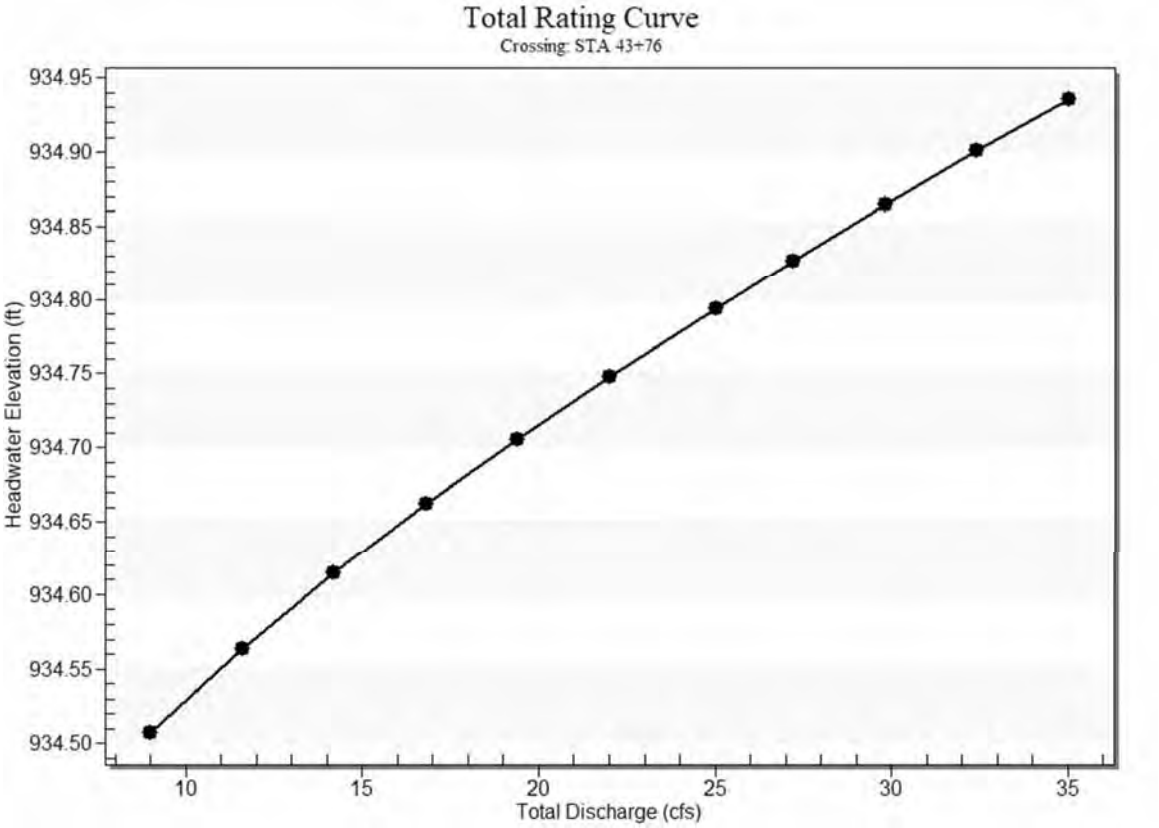
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.51	9.00	3.33	5.63	8
934.56	11.60	3.46	8.09	4
934.61	14.20	3.58	10.60	4
934.66	16.80	3.68	13.11	4
934.71	19.40	3.77	15.58	3
934.75	22.00	3.86	18.11	3
934.79	25.00	3.95	21.02	3
934.83	27.20	4.02	23.17	3
934.86	29.80	4.09	25.70	3
934.90	32.40	4.16	28.24	3
934.94	35.00	4.22	30.72	2
934.30	2.78	2.78	0.00	Overtopping

Rating Curve Plot for Crossing: STA 43+76



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	3.33 cfs	934.51	1.37	0.0*	5-S2n	0.50	0.78	0.50	0.27	8.41	1.44
11.60 cfs	3.46 cfs	934.56	1.42	0.0*	5-S2n	0.51	0.79	0.52	0.31	8.45	1.58
14.20 cfs	3.58 cfs	934.61	1.47	0.040	5-S2n	0.52	0.81	0.53	0.35	8.51	1.69
16.80 cfs	3.68 cfs	934.66	1.52	0.105	5-S2n	0.53	0.82	0.54	0.38	8.56	1.79

19.40 cfs	3.77 cfs	934.71	1.57	0.164	5-S2n	0.53	0.83	0.55	0.42	8.62	1.88
22.00 cfs	3.86 cfs	934.75	1.61	0.220	5-S2n	0.54	0.83	0.55	0.45	8.66	1.96
25.00 cfs	3.95 cfs	934.79	1.65	0.282	5-S2n	0.55	0.84	0.56	0.48	8.71	2.05
27.20 cfs	4.02 cfs	934.83	1.69	0.325	5-S2n	0.56	0.85	0.57	0.50	8.74	2.11
29.80 cfs	4.09 cfs	934.86	1.72	0.375	5-S2n	0.56	0.86	0.57	0.53	8.78	2.17
32.40 cfs	4.16 cfs	934.90	1.76	0.423	5-S2n	0.57	0.86	0.58	0.56	8.81	2.23
35.00 cfs	4.22 cfs	934.94	1.80	0.468	5-S2n	0.57	0.87	0.59	0.58	8.84	2.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

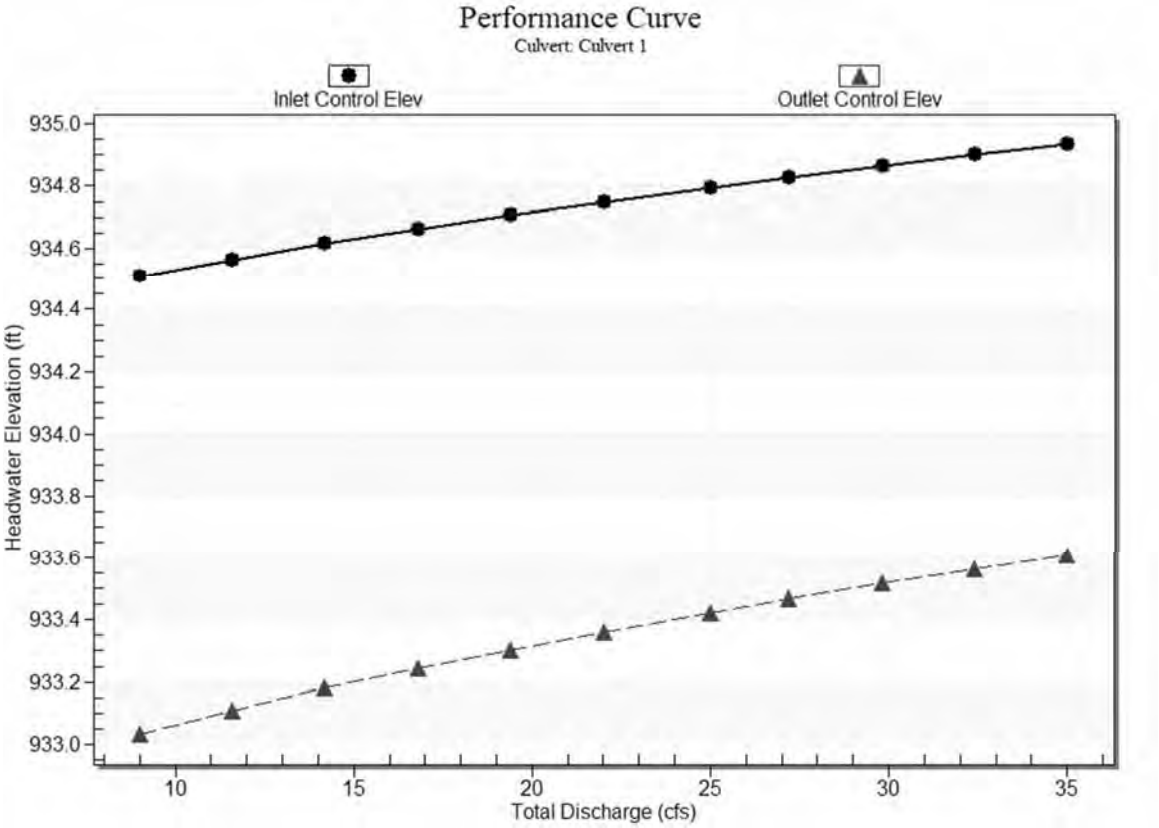
Inlet Elevation (invert): 933.14 ft,

Outlet Elevation (invert): 931.27 ft

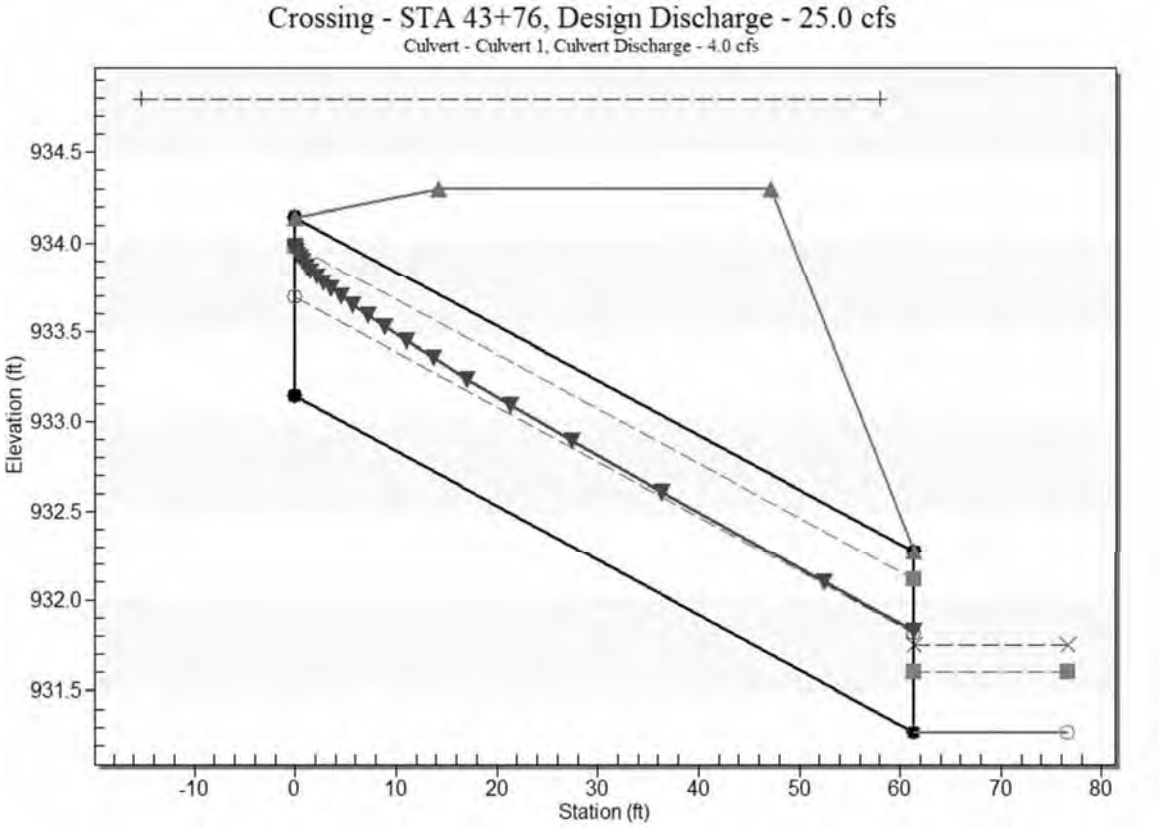
Culvert Length: 61.37 ft,

Culvert Slope: 0.0305

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 933.14 ft

Outlet Station: 61.34 ft

Outlet Elevation: 931.27 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: STA 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.54	0.27	1.44	0.17	0.52
11.60	931.58	0.31	1.58	0.19	0.53
14.20	931.62	0.35	1.69	0.22	0.54
16.80	931.65	0.38	1.79	0.24	0.55
19.40	931.69	0.42	1.88	0.26	0.55
22.00	931.72	0.45	1.96	0.28	0.56
25.00	931.75	0.48	2.05	0.30	0.56
27.20	931.77	0.50	2.11	0.32	0.57
29.80	931.80	0.53	2.17	0.33	0.57
32.40	931.83	0.56	2.23	0.35	0.58
35.00	931.85	0.58	2.29	0.36	0.58

Tailwater Channel Data - STA 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 931.27 ft

Roadway Data for Crossing: STA 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 934.30 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 50+72 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 40.00 cfs

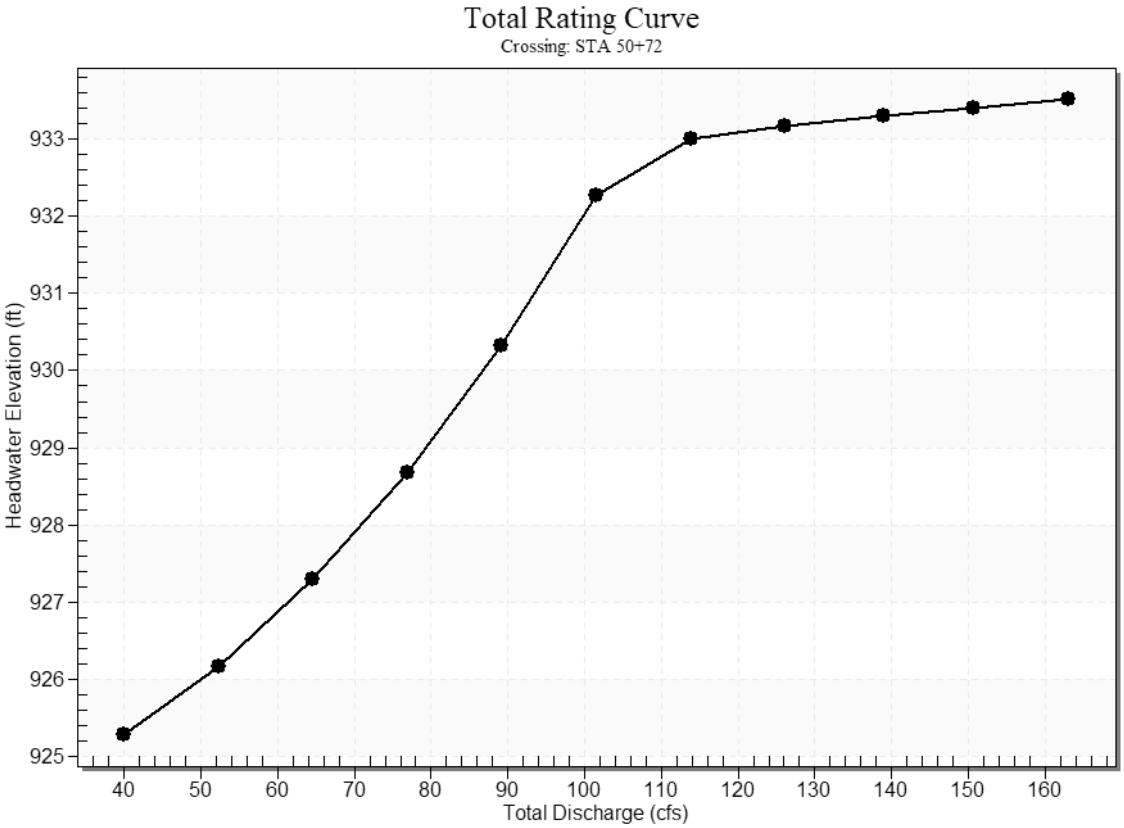
Design Flow: 139.00 cfs

Maximum Flow: 163.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 50+72

Headwater Elevation (ft)	Total Discharge (cfs)	36 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
925.29	40.00	40.00	0.00	1
926.17	52.30	52.30	0.00	1
927.29	64.60	64.60	0.00	1
928.68	76.90	76.90	0.00	1
930.32	89.20	89.20	0.00	1
932.27	101.50	101.50	0.00	1
933.00	113.80	105.69	8.07	7
933.16	126.10	106.57	19.49	6
933.29	139.00	107.32	31.62	5
933.40	150.70	107.91	42.65	4
933.51	163.00	108.49	54.42	4
932.80	104.55	104.55	0.00	Overtopping

Rating Curve Plot for Crossing: STA 50+72



Culvert Data: 36

Table 2 - Culvert Summary Table: 36

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00 cfs	40.00 cfs	925.29	3.25	0.908	5-S2n	0.97	2.06	1.25	0.66	14.38	4.32
52.30 cfs	52.30 cfs	926.17	4.13	2.126	5-S2n	1.12	2.35	1.47	0.77	15.13	4.68
64.60 cfs	64.60 cfs	927.29	5.25	3.003	5-S2n	1.26	2.58	1.68	0.86	15.88	4.98
76.90 cfs	76.90 cfs	928.68	6.64	4.007	5-S2n	1.39	2.74	1.87	0.94	16.64	5.24

89.20 cfs	89.20 cfs	930.32	8.28	5.141	5-S2n	1.51	2.84	2.03	1.01	17.49	5.47
101.50 cfs	101.50 cfs	932.27	10.23	6.363	5-S2n	1.63	2.80	2.18	1.08	18.46	5.68
113.80 cfs	105.69 cfs	933.00	10.96	6.926	5-S2n	1.67	3.00	2.26	1.15	18.48	5.86
126.10 cfs	106.57 cfs	933.16	11.12	7.025	5-S2n	1.68	3.00	2.27	1.21	18.56	6.03
139.00 cfs	107.32 cfs	933.29	11.25	7.109	5-S2n	1.69	3.00	2.28	1.27	18.62	6.20
150.70 cfs	107.91 cfs	933.40	11.36	7.177	5-S2n	1.70	3.00	2.29	1.32	18.68	6.34
163.00 cfs	108.49 cfs	933.51	11.47	7.244	5-S2n	1.70	3.00	2.29	1.38	18.73	6.48

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

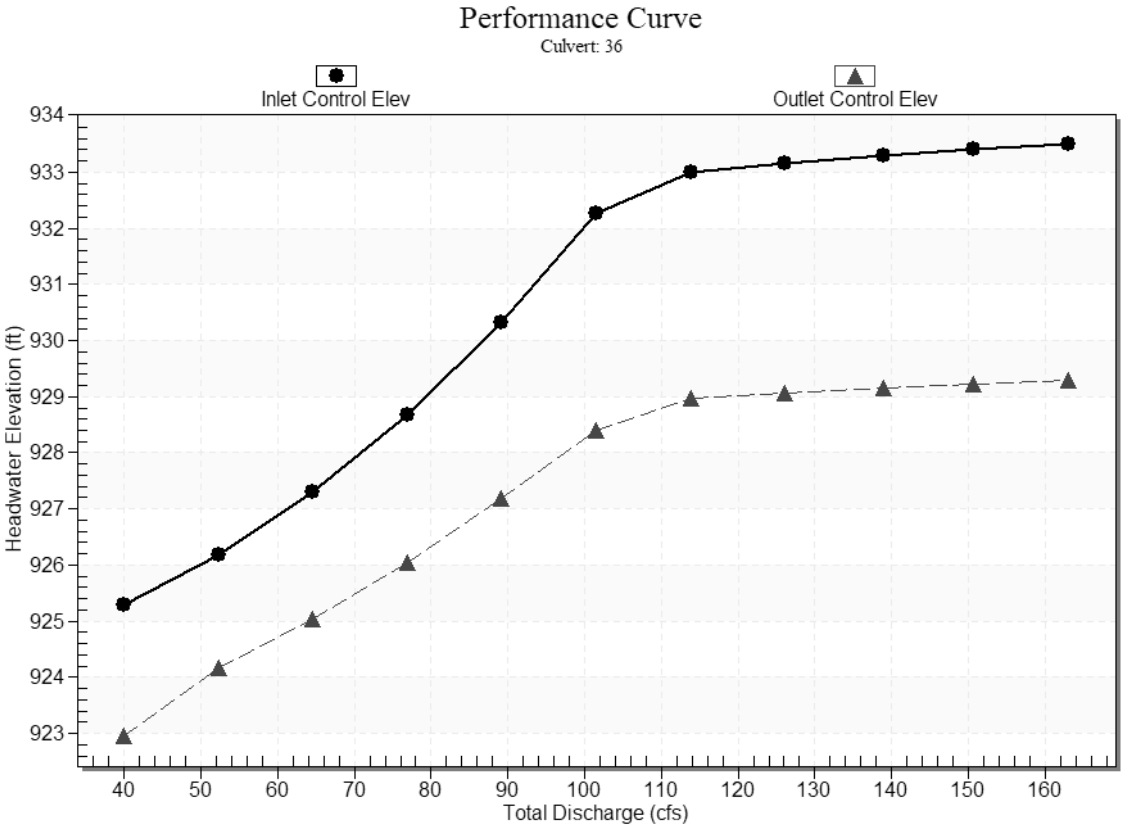
Inlet Elevation (invert): 922.04 ft,

Outlet Elevation (invert): 920.04 ft

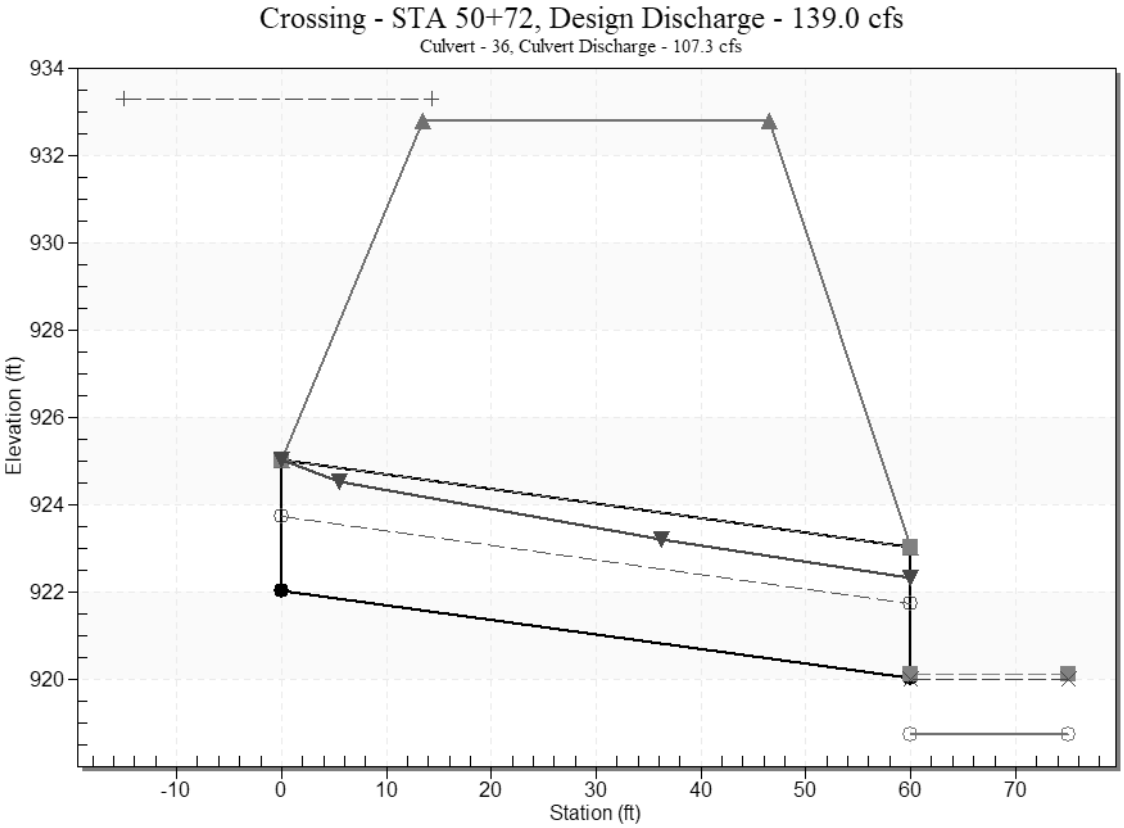
Culvert Length: 60.03 ft,

Culvert Slope: 0.0333

Culvert Performance Curve Plot: 36



Water Surface Profile Plot for Culvert: 36



Site Data - 36

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 922.04 ft

Outlet Station: 60.00 ft

Outlet Elevation: 920.04 ft

Number of Barrels: 1

Culvert Data Summary - 36

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0090

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 50+72

Table 3 - Downstream Channel Rating Curve (Crossing: STA 50+72)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
40.00	919.41	0.66	4.32	1.36	1.06
52.30	919.52	0.77	4.68	1.58	1.08
64.60	919.61	0.86	4.98	1.76	1.10
76.90	919.69	0.94	5.24	1.93	1.11
89.20	919.76	1.01	5.47	2.09	1.12
101.50	919.83	1.08	5.68	2.23	1.13
113.80	919.90	1.15	5.86	2.37	1.14
126.10	919.96	1.21	6.03	2.49	1.15
139.00	920.02	1.27	6.20	2.62	1.16
150.70	920.07	1.32	6.34	2.73	1.17
163.00	920.13	1.38	6.48	2.84	1.17

Tailwater Channel Data - STA 50+72

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0330

Channel Manning's n: 0.0400

Channel Invert Elevation: 918.75 ft

Roadway Data for Crossing: STA 50+72

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 932.80 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 82+07 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

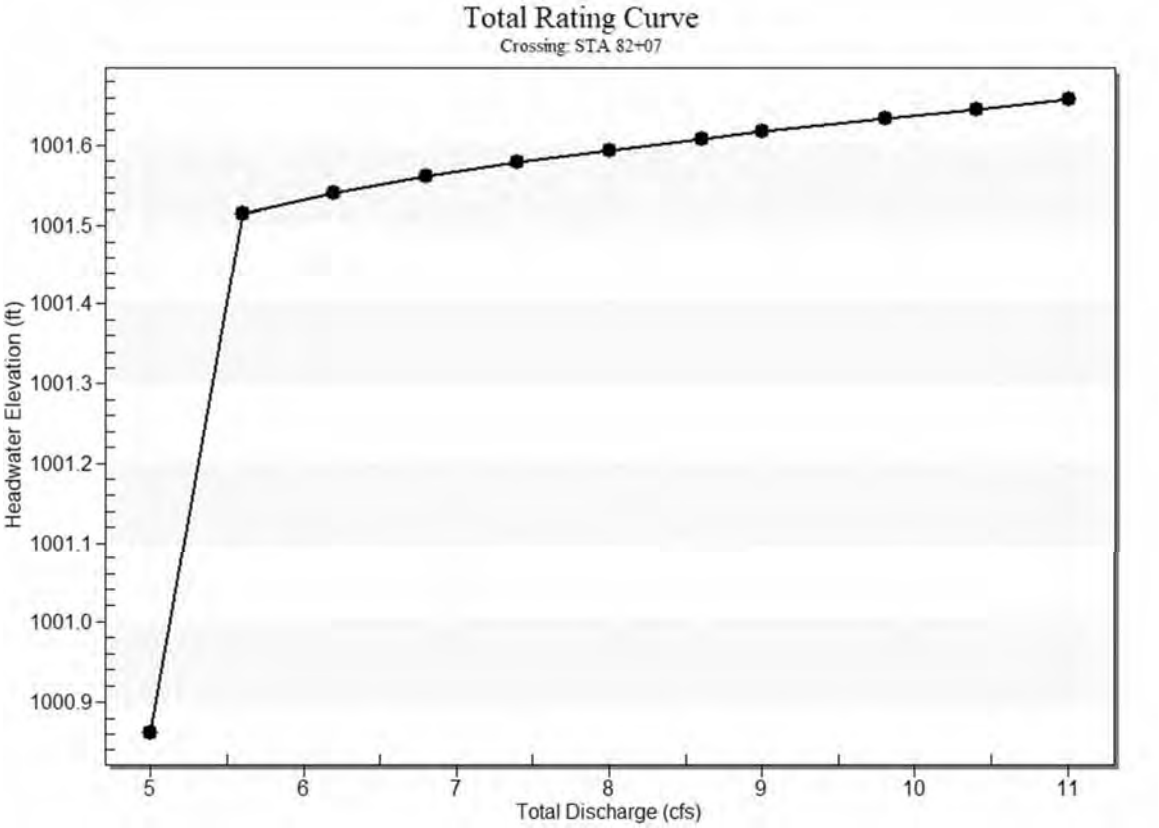
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1000.86	5.00	5.00	0.00	1
1001.51	5.60	5.41	0.15	49
1001.54	6.20	5.42	0.73	5
1001.56	6.80	5.43	1.32	4
1001.58	7.40	5.44	1.93	4
1001.59	8.00	5.45	2.50	3
1001.61	8.60	5.46	3.10	3
1001.62	9.00	5.47	3.51	3
1001.63	9.80	5.48	4.30	3
1001.65	10.40	5.48	4.90	3
1001.66	11.00	5.49	5.50	3
1001.50	5.40	5.40	0.00	Overtopping

Rating Curve Plot for Crossing: STA 82+07



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	1000.86	2.23	4.182	7-M2c	1.00	0.92	0.92	0.10	6.63	2.00
5.60 cfs	5.41 cfs	1001.51	2.49	4.834	7-M2c	1.00	0.94	0.94	0.11	7.08	2.09
6.20 cfs	5.42 cfs	1001.54	2.50	4.861	7-M2c	1.00	0.94	0.94	0.11	7.09	2.18
6.80 cfs	5.43 cfs	1001.56	2.51	4.881	7-M2c	1.00	0.94	0.94	0.12	7.11	2.26

7.40 cfs	5.44 cfs	1001.58	2.52	4.898	7-M2c	1.00	0.94	0.94	0.13	7.12	2.34
8.00 cfs	5.45 cfs	1001.59	2.52	4.913	7-M2c	1.00	0.94	0.94	0.13	7.13	2.41
8.60 cfs	5.46 cfs	1001.61	2.53	4.928	7-M2c	1.00	0.94	0.94	0.14	7.14	2.48
9.00 cfs	5.47 cfs	1001.62	2.53	4.937	7-M2c	1.00	0.94	0.94	0.14	7.15	2.52
9.80 cfs	5.48 cfs	1001.63	2.54	4.953	7-M2c	1.00	0.94	0.94	0.15	7.16	2.61
10.40 cfs	5.48 cfs	1001.65	2.54	4.965	7-M2c	1.00	0.94	0.94	0.15	7.16	2.67
11.00 cfs	5.49 cfs	1001.66	2.55	4.977	7-M2c	1.00	0.94	0.94	0.16	7.17	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

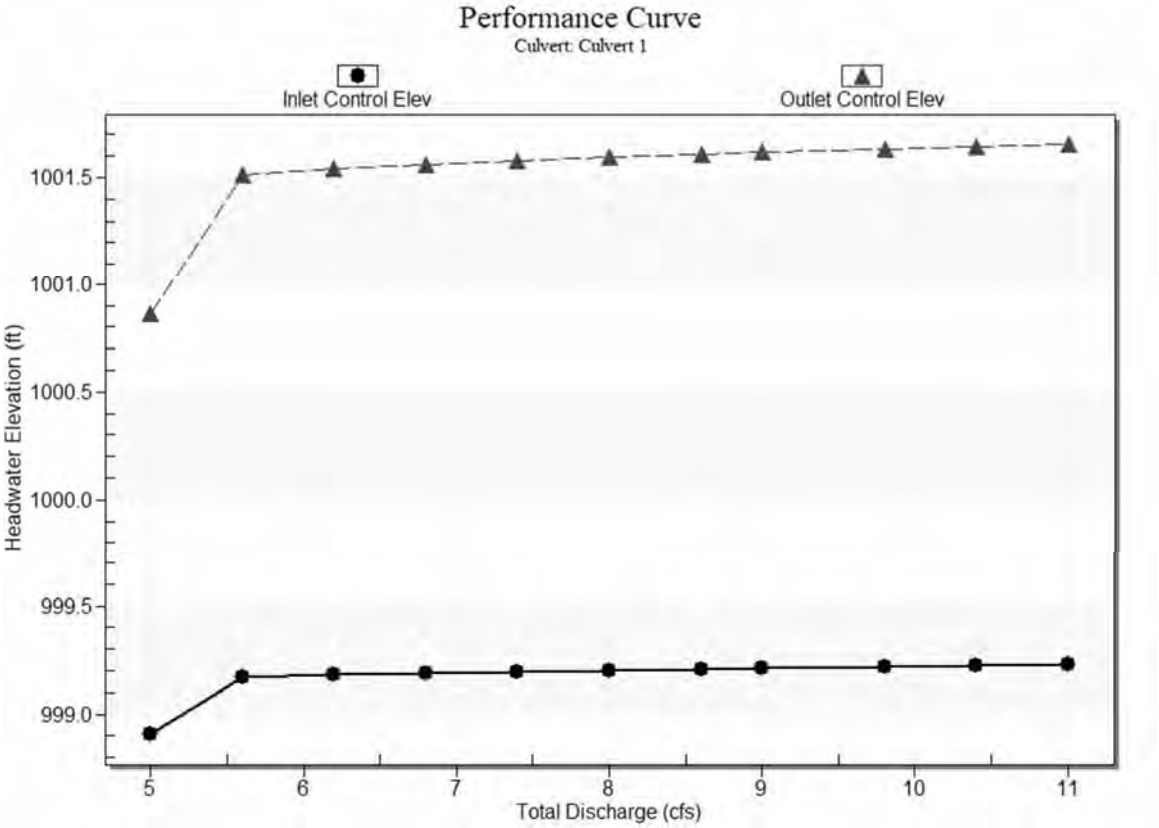
Inlet Elevation (invert): 996.68 ft,

Outlet Elevation (invert): 996.08 ft

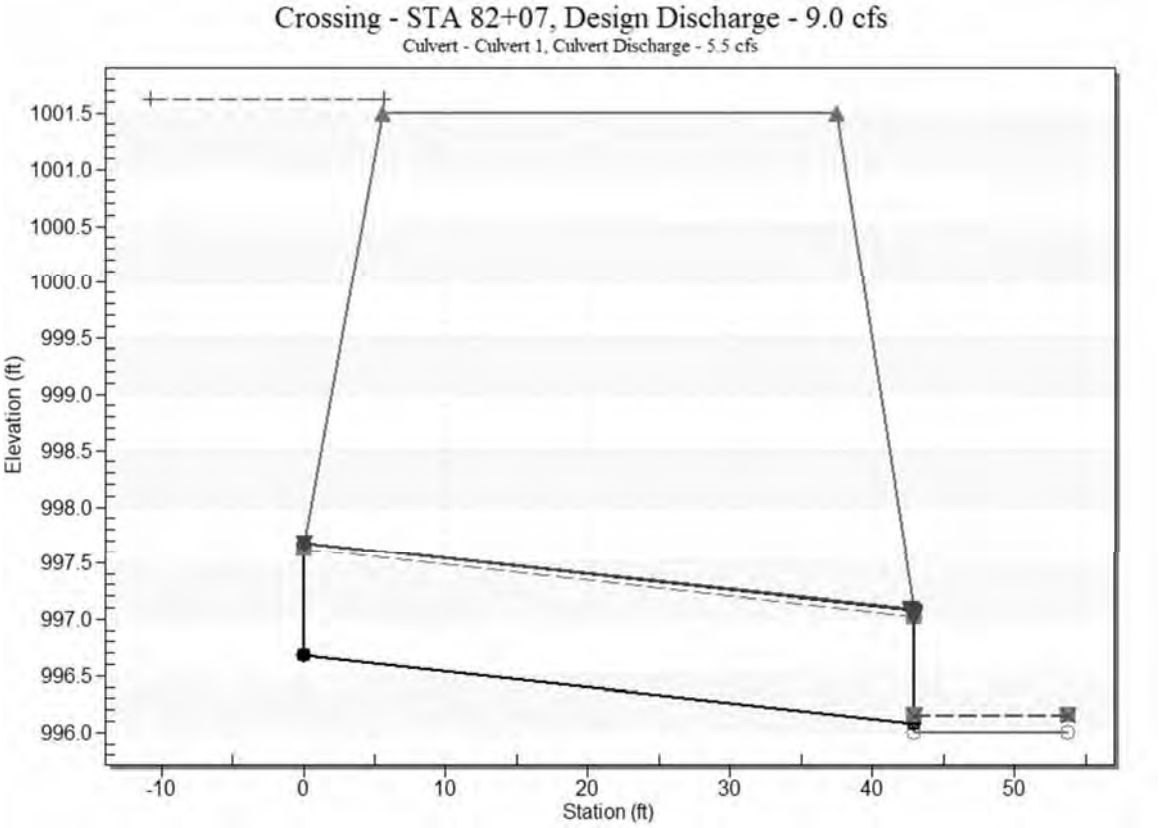
Culvert Length: 43.00 ft,

Culvert Slope: 0.0140

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.68 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.08 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: STA 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - STA 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: STA 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 1001.50 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

STA 85+60 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 26.00 cfs

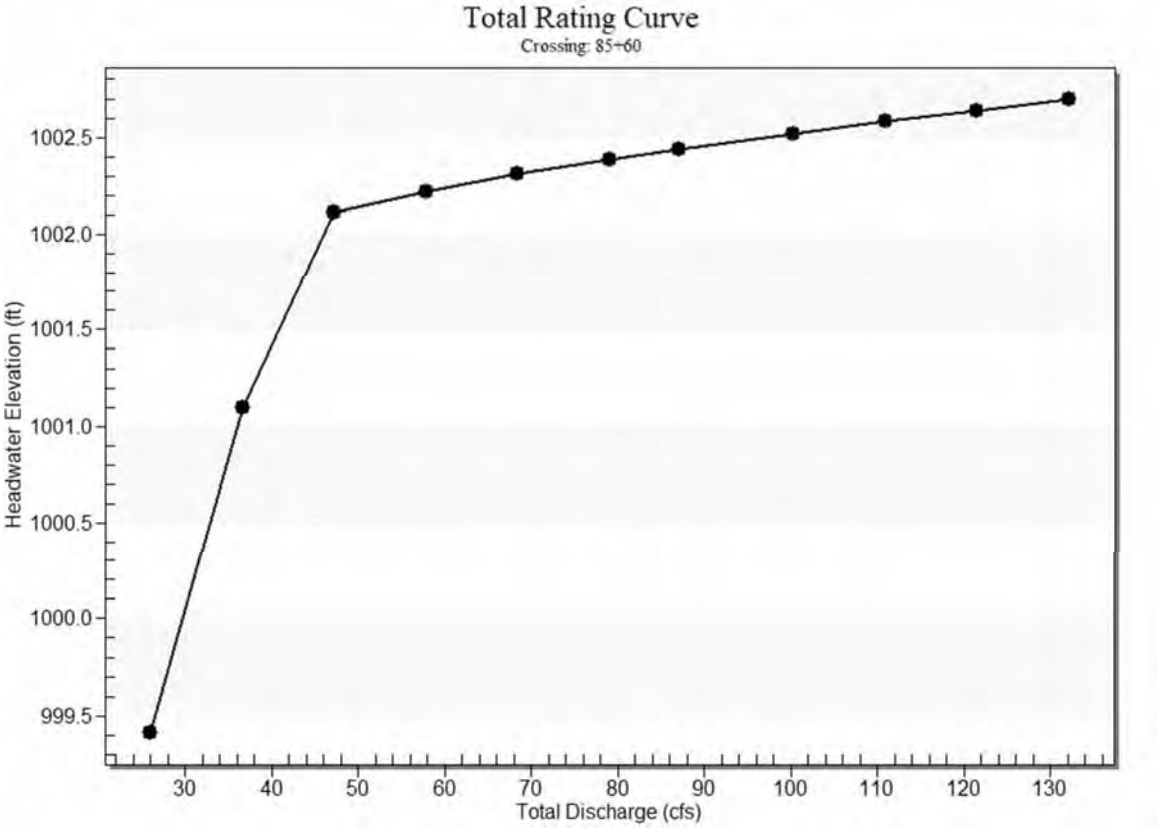
Design Flow: 87.00 cfs

Maximum Flow: 132.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 85+60

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.41	26.00	26.00	0.00	1
1001.10	36.60	36.60	0.00	1
1002.11	47.20	41.63	5.48	6
1002.22	57.80	42.11	15.60	6
1002.31	68.40	42.47	25.85	5
1002.39	79.00	42.79	36.09	4
1002.44	87.00	43.00	43.95	4
1002.52	100.20	43.33	56.83	4
1002.58	110.80	43.58	67.08	3
1002.64	121.40	43.81	77.50	3
1002.70	132.00	44.03	87.91	3
1002.00	41.10	41.10	0.00	Overtopping

Rating Curve Plot for Crossing: 85+60



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
26.00 cfs	26.00 cfs	999.41	3.25	2.849	5-S2n	1.71	1.74	1.71	0.57	7.62	4.30
36.60 cfs	36.60 cfs	1001.10	4.94	4.305	6-FFc	2.00	2.00	2.00	0.70	9.15	4.87
47.20 cfs	41.63 cfs	1002.11	5.95	5.090	6-FFc	2.00	2.00	2.00	0.82	10.41	5.33
57.80 cfs	42.11 cfs	1002.22	6.06	5.171	6-FFc	2.00	2.00	2.00	0.92	10.53	5.73

68.40 cfs	42.47 cfs	1002.31	6.15	5.233	6-FFc	2.00	2.00	2.00	1.02	10.62	6.07
79.00 cfs	42.79 cfs	1002.39	6.23	5.286	6-FFc	2.00	2.00	2.00	1.11	10.70	6.38
87.00 cfs	43.00 cfs	1002.44	6.28	5.323	6-FFc	2.00	2.00	2.00	1.18	10.75	6.60
100.20 cfs	43.33 cfs	1002.52	6.36	5.380	6-FFc	2.00	2.00	2.00	1.28	10.83	6.92
110.80 cfs	43.58 cfs	1002.58	6.42	5.422	6-FFc	2.00	2.00	2.00	1.36	10.89	7.16
121.40 cfs	43.81 cfs	1002.64	6.48	5.463	6-FFc	2.00	2.00	2.00	1.44	10.95	7.38
132.00 cfs	44.03 cfs	1002.70	6.54	5.502	6-FFc	2.00	2.00	2.00	1.51	11.01	7.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

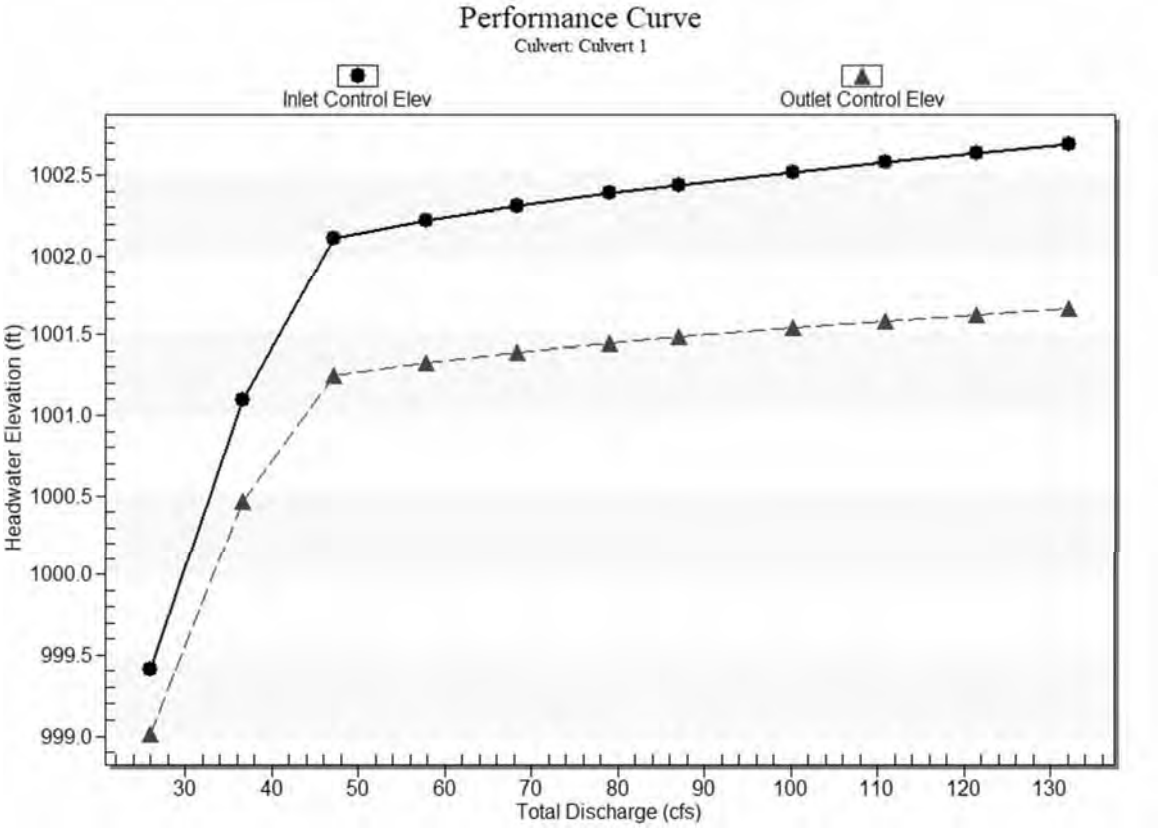
Inlet Elevation (invert): 996.16 ft,

Outlet Elevation (invert): 995.79 ft

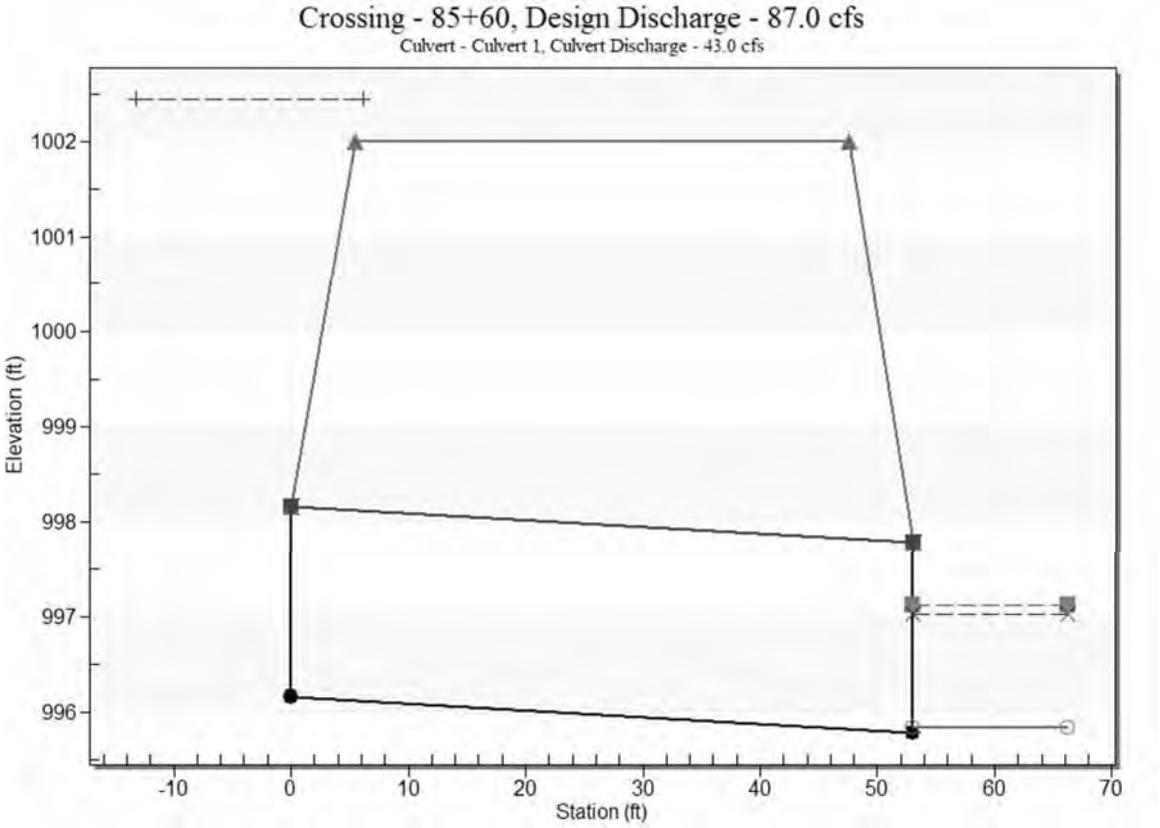
Culvert Length: 53.00 ft,

Culvert Slope: 0.0070

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.16 ft

Outlet Station: 53.00 ft

Outlet Elevation: 995.79 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 2.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: 85+60

Table 3 - Downstream Channel Rating Curve (Crossing: 85+60)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
26.00	996.41	0.57	4.30	1.78	1.03
36.60	996.54	0.70	4.87	2.19	1.06
47.20	996.66	0.82	5.33	2.55	1.08
57.80	996.76	0.92	5.73	2.88	1.09
68.40	996.86	1.02	6.07	3.19	1.11
79.00	996.95	1.11	6.38	3.47	1.12
87.00	997.02	1.18	6.60	3.68	1.13
100.20	997.12	1.28	6.92	4.00	1.14
110.80	997.20	1.36	7.16	4.25	1.14
121.40	997.28	1.44	7.38	4.49	1.15
132.00	997.35	1.51	7.58	4.72	1.16

Tailwater Channel Data - 85+60

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0500

Channel Invert Elevation: 995.84 ft

Roadway Data for Crossing: 85+60

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1002.00 ft

Roadway Surface: Paved

Roadway Top Width: 42.00 ft

DRAINAGE REPORT

Proposed

HY-8 Reports

Proposed STA 1+50
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.50 cfs

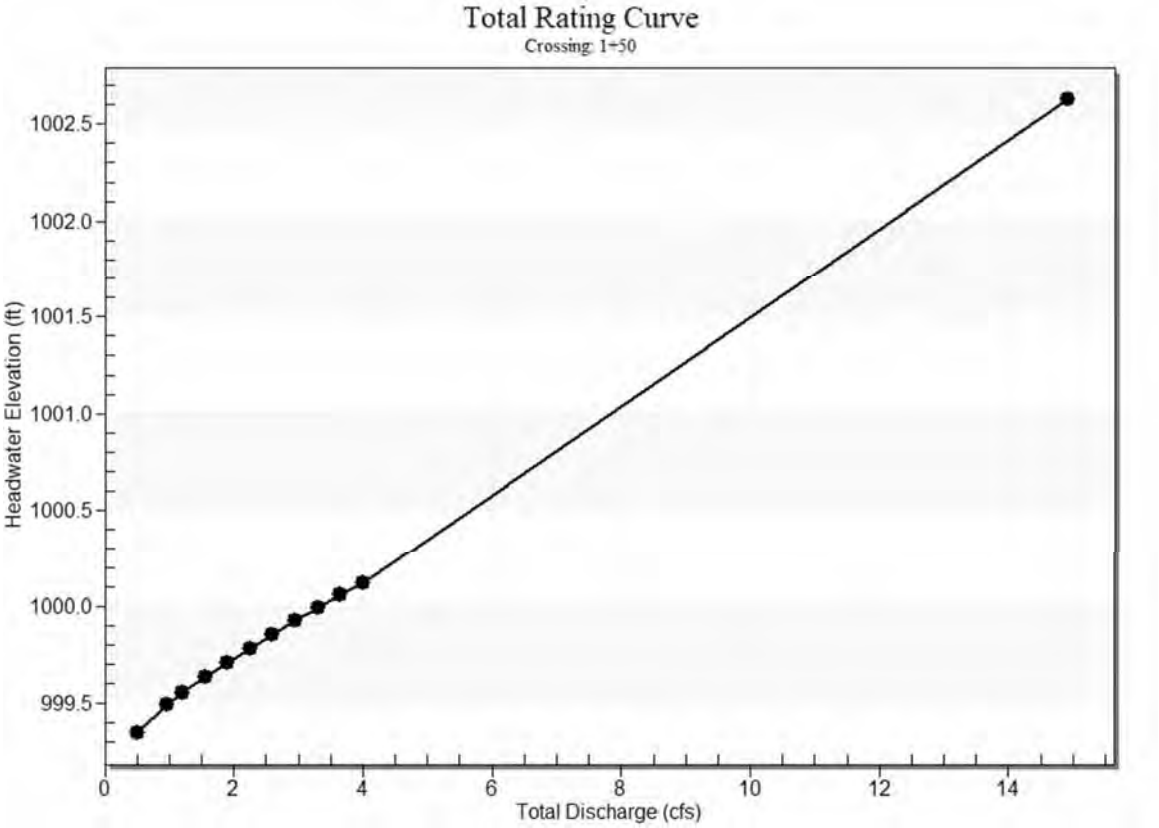
Design Flow: 0.97 cfs

Maximum Flow: 4.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 1+50

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.35	0.50	0.50	0.00	1
999.50	0.97	0.97	0.00	1
999.55	1.20	1.20	0.00	1
999.63	1.55	1.55	0.00	1
999.71	1.90	1.90	0.00	1
999.78	2.25	2.25	0.00	1
999.86	2.60	2.60	0.00	1
999.93	2.95	2.95	0.00	1
999.99	3.30	3.30	0.00	1
1000.06	3.65	3.65	0.00	1
1000.12	4.00	4.00	0.00	1
1002.60	14.34	14.34	0.00	Overtopping

Rating Curve Plot for Crossing: 1+50



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.50 cfs	0.50 cfs	999.35	0.35	0.0*	1-S2n	0.18	0.26	0.18	0.10	4.08	0.79
0.97 cfs	0.97 cfs	999.50	0.50	0.0*	1-S2n	0.25	0.37	0.25	0.15	4.96	1.02
1.20 cfs	1.20 cfs	999.55	0.55	0.0*	1-S2n	0.28	0.41	0.28	0.17	5.28	1.10
1.55 cfs	1.55 cfs	999.63	0.63	0.0*	1-S2n	0.32	0.47	0.32	0.20	5.69	1.21

1.90 cfs	1.90 cfs	999.71	0.71	0.0*	1-S2n	0.35	0.52	0.35	0.23	6.03	1.30
2.25 cfs	2.25 cfs	999.78	0.78	0.0*	1-S2n	0.38	0.57	0.38	0.25	6.32	1.39
2.60 cfs	2.60 cfs	999.86	0.86	0.0*	1-S2n	0.41	0.61	0.41	0.27	6.60	1.46
2.95 cfs	2.95 cfs	999.93	0.93	0.0*	1-S2n	0.44	0.65	0.44	0.29	6.85	1.53
3.30 cfs	3.30 cfs	999.99	0.99	0.0*	1-S2n	0.47	0.69	0.47	0.31	7.06	1.59
3.65 cfs	3.65 cfs	1000.06	1.06	0.0*	1-S2n	0.49	0.73	0.49	0.33	7.20	1.65
4.00 cfs	4.00 cfs	1000.12	1.12	0.0*	1-S2n	0.51	0.77	0.51	0.35	7.46	1.70

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

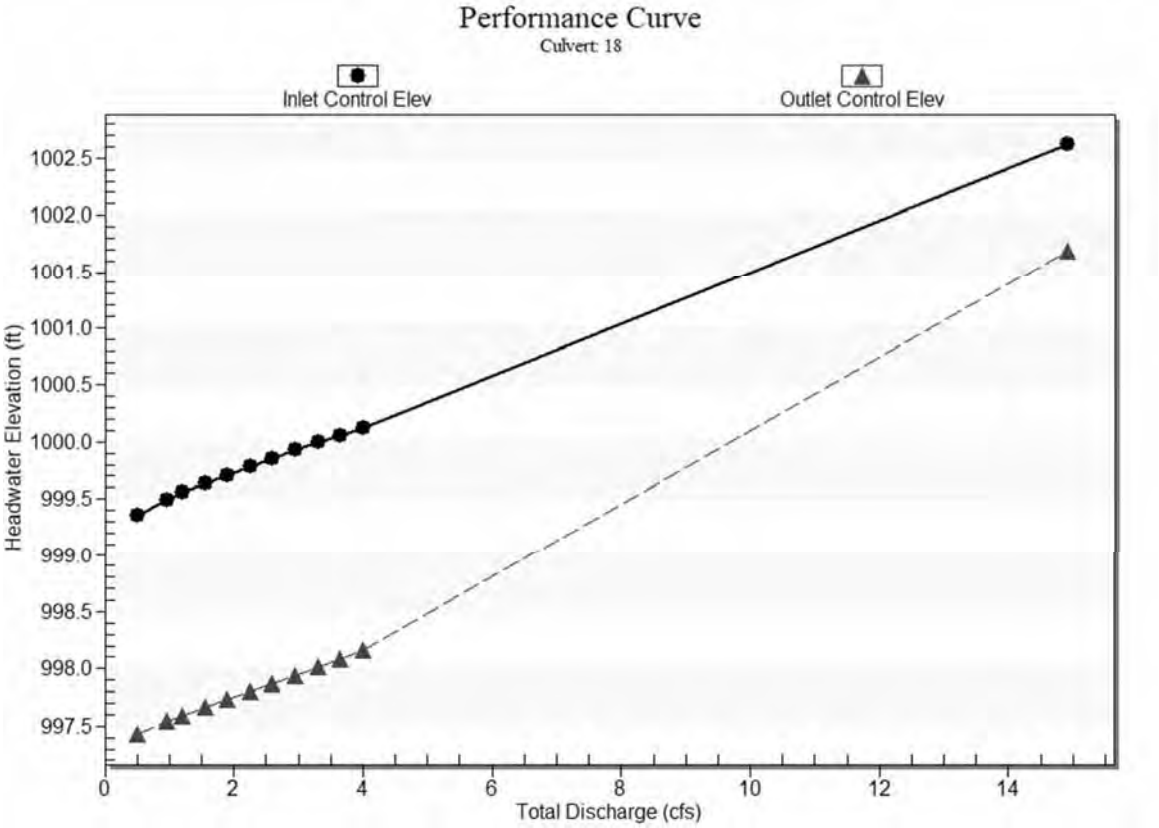
Inlet Elevation (invert): 999.00 ft,

Outlet Elevation (invert): 997.16 ft

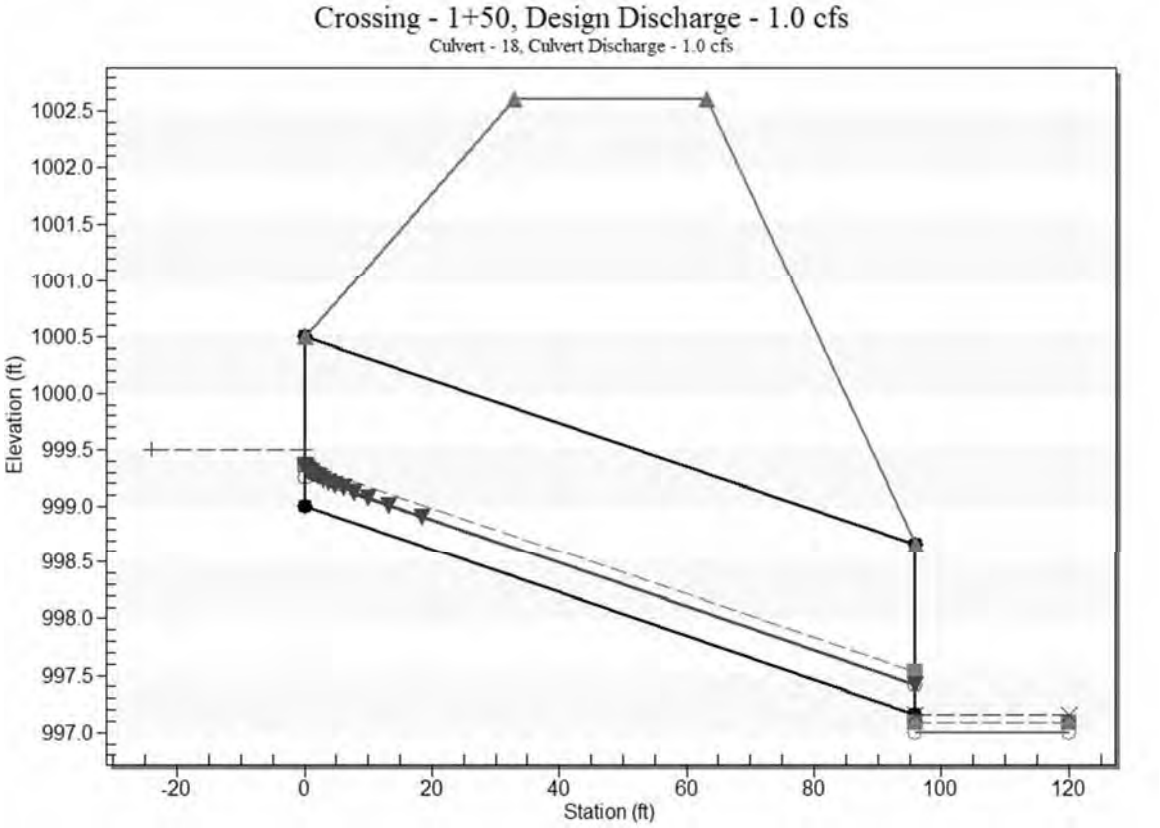
Culvert Length: 96.02 ft,

Culvert Slope: 0.0192

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 999.00 ft

Outlet Station: 96.00 ft

Outlet Elevation: 997.16 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 1+50

Table 3 - Downstream Channel Rating Curve (Crossing: 1+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.50	997.10	0.10	0.79	0.06	0.44
0.97	997.15	0.15	1.02	0.09	0.47
1.20	997.17	0.17	1.10	0.11	0.48
1.55	997.20	0.20	1.21	0.12	0.49
1.90	997.23	0.23	1.30	0.14	0.50
2.25	997.25	0.25	1.39	0.16	0.51
2.60	997.27	0.27	1.46	0.17	0.51
2.95	997.29	0.29	1.53	0.18	0.52
3.30	997.31	0.31	1.59	0.20	0.52
3.65	997.33	0.33	1.65	0.21	0.53
4.00	997.35	0.35	1.70	0.22	0.53

Tailwater Channel Data - 1+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 997.00 ft

Roadway Data for Crossing: 1+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 ft

Crest Elevation: 1002.60 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

STA 15+33
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

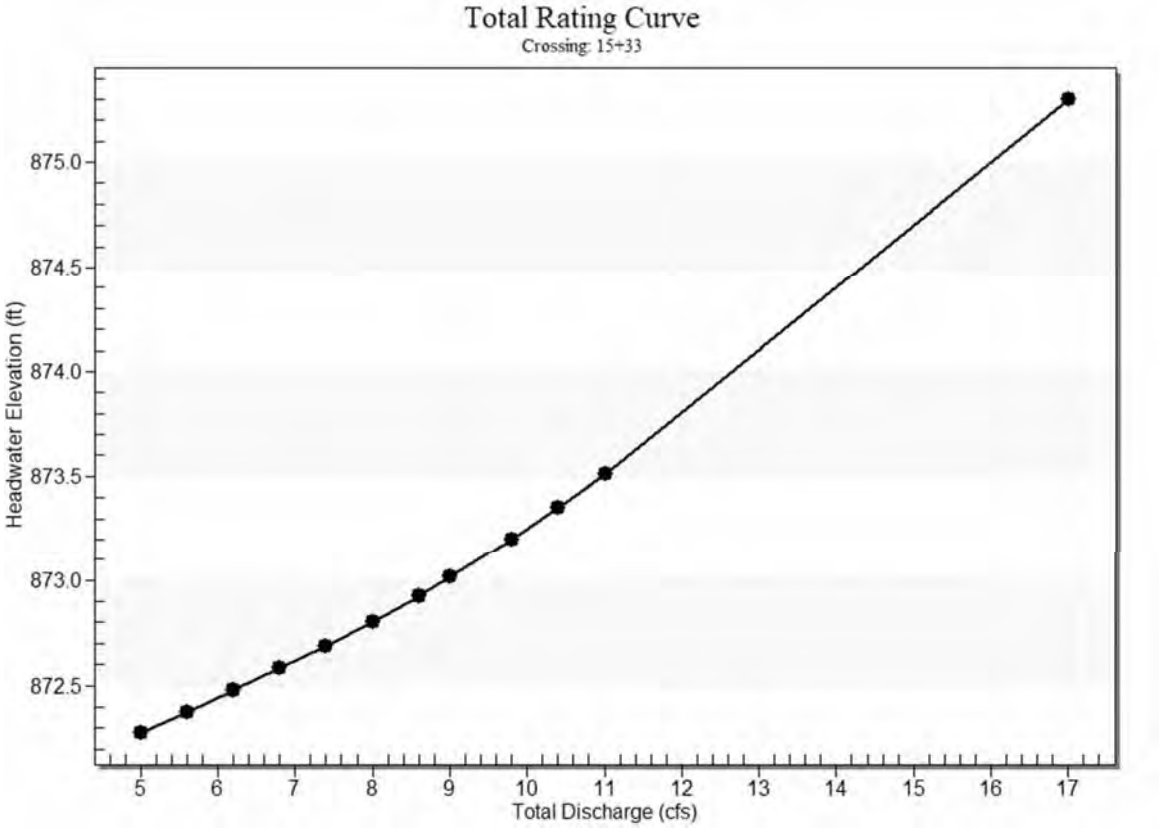
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 15+33

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
872.28	5.00	5.00	0.00	1
872.38	5.60	5.60	0.00	1
872.48	6.20	6.20	0.00	1
872.58	6.80	6.80	0.00	1
872.69	7.40	7.40	0.00	1
872.80	8.00	8.00	0.00	1
872.93	8.60	8.60	0.00	1
873.01	9.00	9.00	0.00	1
873.20	9.80	9.80	0.00	1
873.35	10.40	10.40	0.00	1
873.51	11.00	11.00	0.00	1
875.23	15.98	15.98	0.00	Overtopping

Rating Curve Plot for Crossing: 15+33



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	872.28	1.28	0.0*	1-S2n	0.52	0.86	0.54	0.21	8.68	2.73
5.60 cfs	5.60 cfs	872.38	1.38	0.0*	1-S2n	0.55	0.91	0.58	0.22	8.90	2.84
6.20 cfs	6.20 cfs	872.48	1.48	0.079	1-S2n	0.58	0.96	0.62	0.24	9.09	2.95
6.80 cfs	6.80 cfs	872.58	1.58	0.210	5-S2n	0.61	1.01	0.65	0.25	9.28	3.05

7.40 cfs	7.40 cfs	872.69	1.69	0.347	5-S2n	0.64	1.05	0.68	0.26	9.45	3.14
8.00 cfs	8.00 cfs	872.80	1.80	0.489	5-S2n	0.67	1.10	0.72	0.27	9.61	3.22
8.60 cfs	8.60 cfs	872.93	1.93	0.819	5-S2n	0.70	1.14	0.75	0.28	9.76	3.31
9.00 cfs	9.00 cfs	873.01	2.01	0.908	5-S2n	0.71	1.16	0.77	0.29	9.86	3.36
9.80 cfs	9.80 cfs	873.20	2.20	1.095	5-S2n	0.75	1.21	0.81	0.31	10.04	3.46
10.40 cfs	10.40 cfs	873.35	2.35	1.242	5-S2n	0.78	1.24	0.84	0.32	10.18	3.53
11.00 cfs	11.00 cfs	873.51	2.51	1.396	5-S2n	0.80	1.27	0.87	0.33	10.31	3.60

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

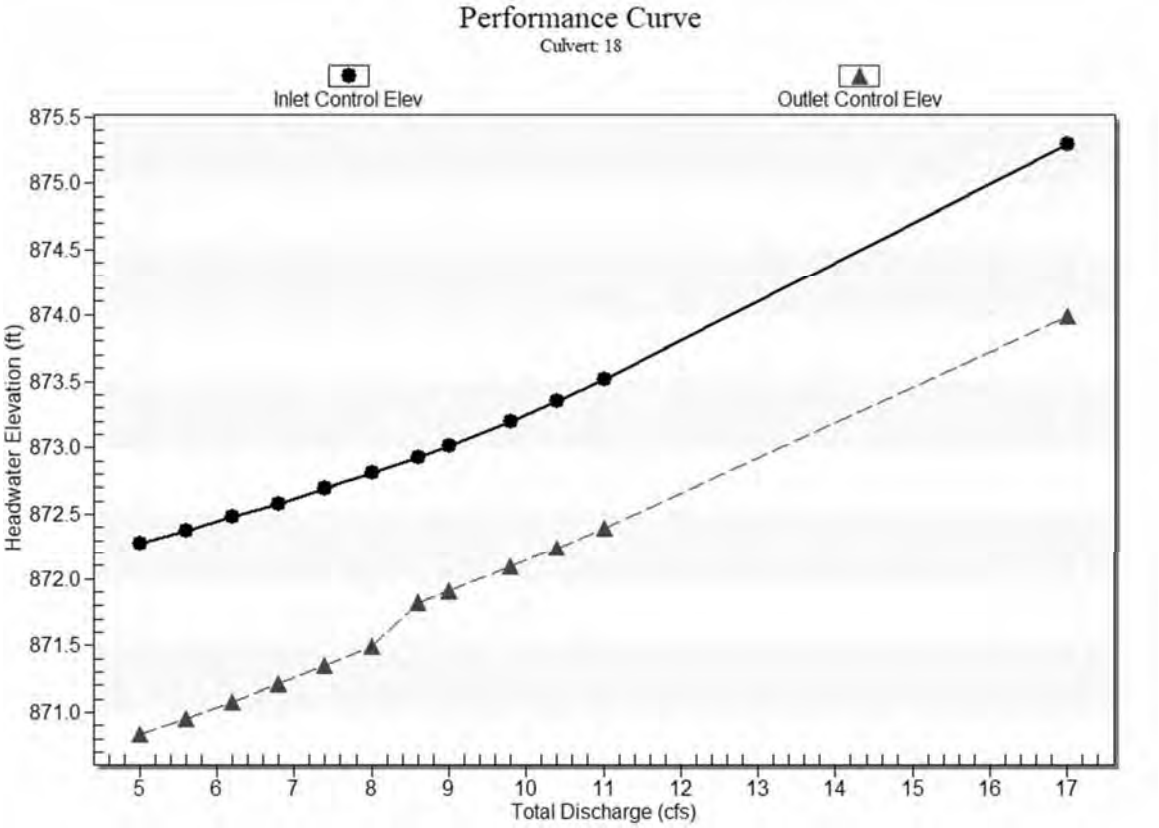
Inlet Elevation (invert): 871.00 ft,

Outlet Elevation (invert): 869.70 ft

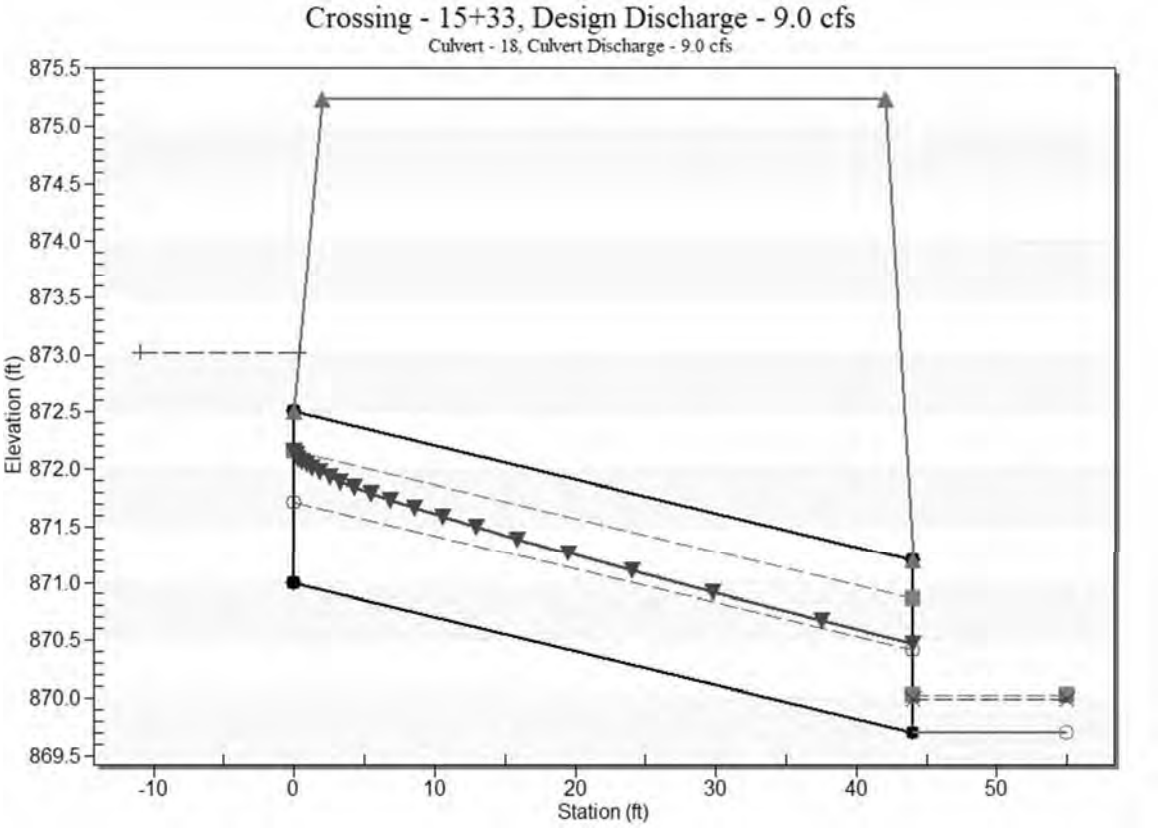
Culvert Length: 44.02 ft,

Culvert Slope: 0.0295

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.00 ft

Outlet Station: 44.00 ft

Outlet Elevation: 869.70 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 15+33

Table 3 - Downstream Channel Rating Curve (Crossing: 15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.91	0.21	2.73	0.65	1.11
5.60	869.92	0.22	2.84	0.69	1.12
6.20	869.94	0.24	2.95	0.73	1.13
6.80	869.95	0.25	3.05	0.77	1.14
7.40	869.96	0.26	3.14	0.81	1.14
8.00	869.97	0.27	3.22	0.85	1.15
8.60	869.98	0.28	3.31	0.89	1.16
9.00	869.99	0.29	3.36	0.91	1.16
9.80	870.01	0.31	3.46	0.96	1.17
10.40	870.02	0.32	3.53	0.99	1.18
11.00	870.03	0.33	3.60	1.02	1.18

Tailwater Channel Data - 15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.70 ft

Roadway Data for Crossing: 15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 875.23 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Sta. 43+76 (Split Flow w/ 46+65) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

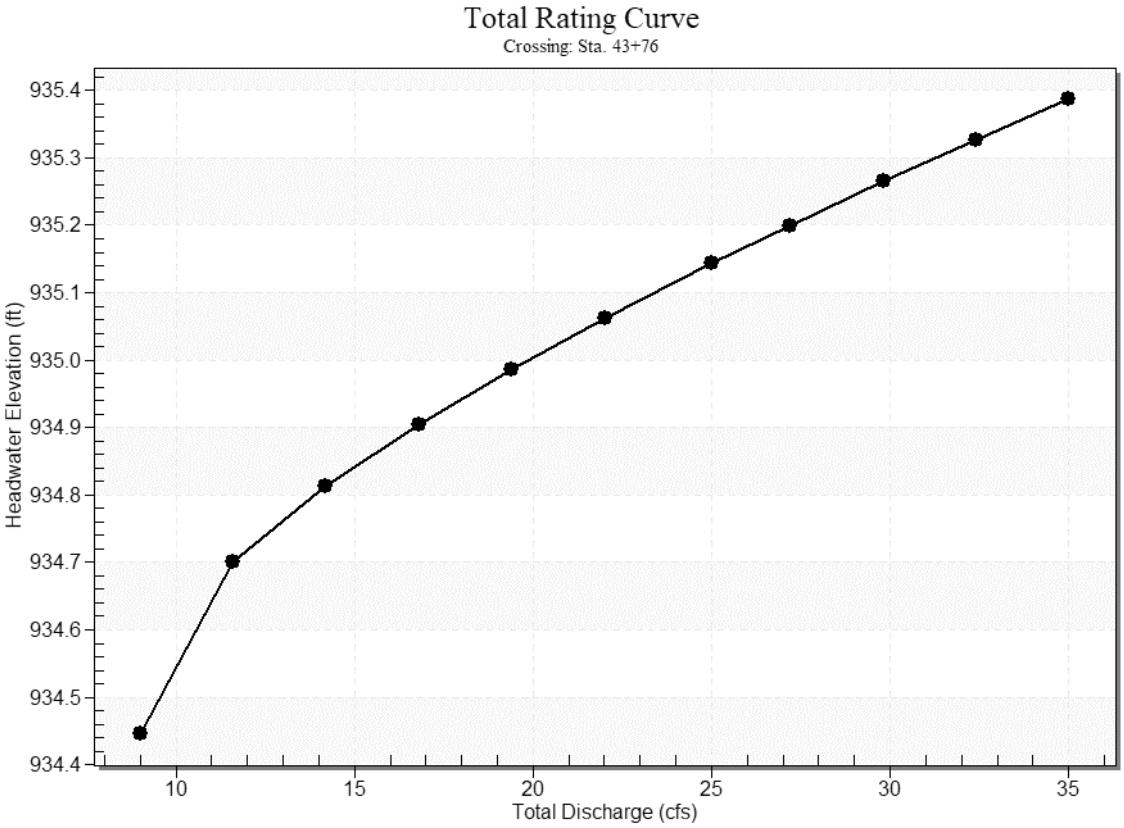
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.45	9.00	9.00	0.00	1
934.70	11.60	9.83	1.74	8
934.81	14.20	10.18	4.01	6
934.90	16.80	10.45	6.33	5
934.99	19.40	10.69	8.69	4
935.06	22.00	10.90	11.08	4
935.14	25.00	11.13	13.86	4
935.20	27.20	11.28	15.88	3
935.26	29.80	11.46	18.31	3
935.33	32.40	11.63	20.76	3
935.39	35.00	11.78	23.21	3
934.55	9.35	9.35	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 43+76



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	9.00 cfs	934.45	1.95	0.819	5-S2n	0.59	0.89	0.61	0.27	9.00	1.44
11.60 cfs	9.83 cfs	934.70	2.20	1.106	5-S2n	0.62	0.91	0.65	0.31	9.17	1.58
14.20 cfs	10.18 cfs	934.81	2.31	1.230	5-S2n	0.64	0.92	0.66	0.35	9.25	1.69
16.80 cfs	10.45 cfs	934.90	2.40	1.332	5-S2n	0.65	0.93	0.67	0.38	9.31	1.79

19.40 cfs	10.69 cfs	934.99	2.49	1.422	5-S2n	0.66	0.93	0.68	0.42	9.34	1.88
22.00 cfs	10.90 cfs	935.06	2.56	1.505	5-S2n	0.67	0.94	0.69	0.45	9.38	1.96
25.00 cfs	11.13 cfs	935.14	2.64	1.596	5-S2n	0.68	0.94	0.70	0.48	9.43	2.05
27.20 cfs	11.28 cfs	935.20	2.70	1.657	5-S2n	0.69	0.94	0.71	0.50	9.45	2.11
29.80 cfs	11.46 cfs	935.26	2.76	1.728	5-S2n	0.69	0.95	0.72	0.53	9.48	2.17
32.40 cfs	11.63 cfs	935.33	2.83	1.797	5-S2n	0.70	0.95	0.73	0.56	9.51	2.23
35.00 cfs	11.78 cfs	935.39	2.89	1.862	5-S2n	0.71	0.95	0.73	0.58	9.53	2.29

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

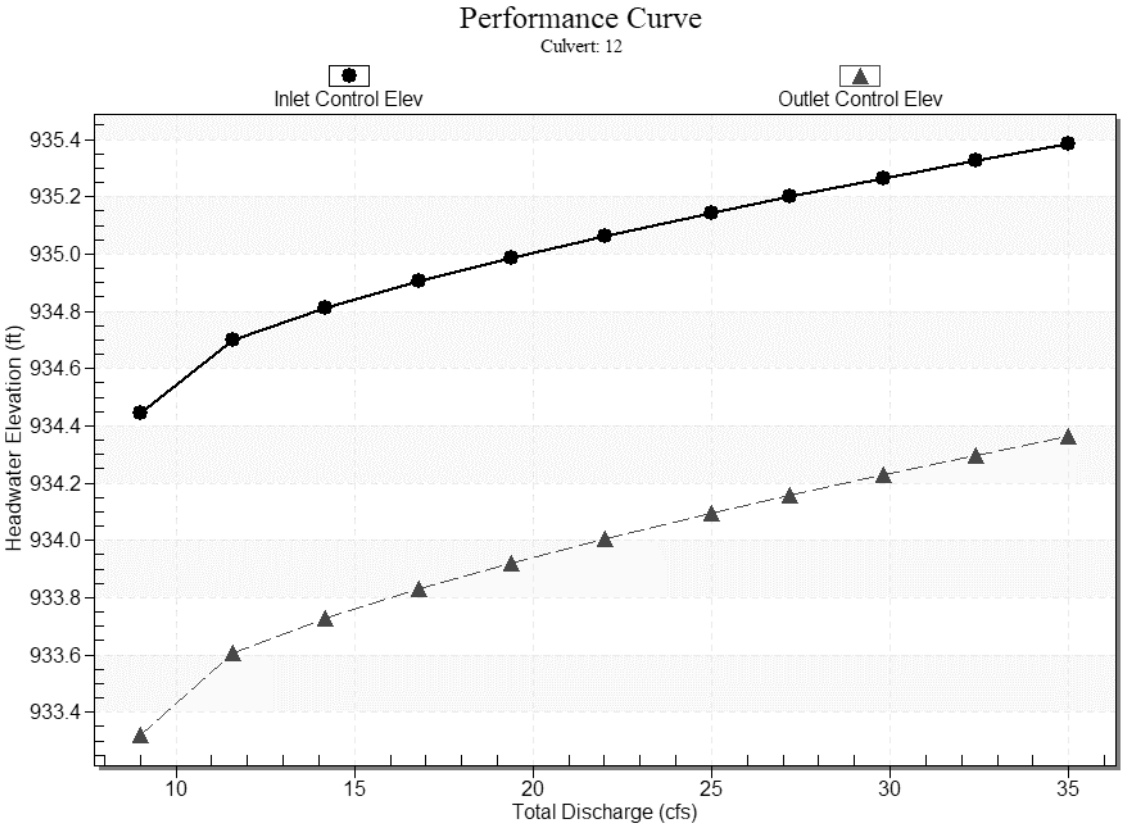
Inlet Elevation (invert): 932.50 ft,

Outlet Elevation (invert): 930.96 ft

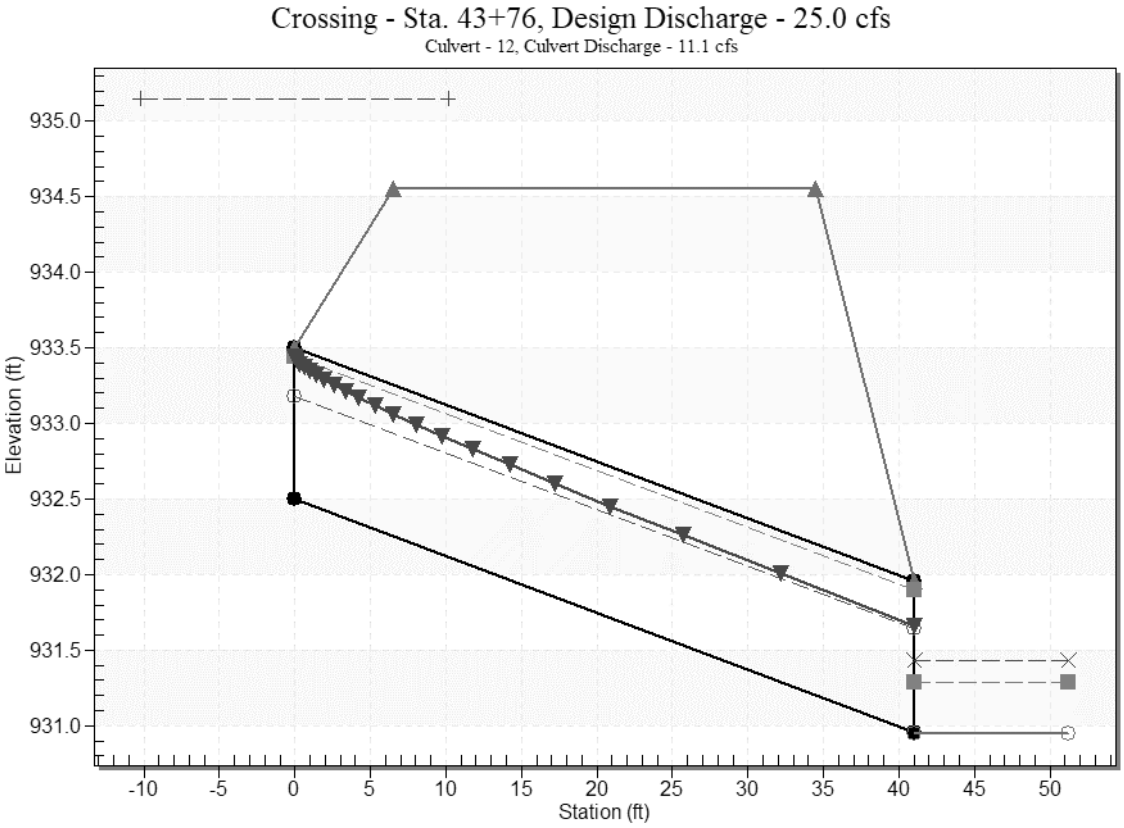
Culvert Length: 41.03 ft,

Culvert Slope: 0.0376

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 932.50 ft

Outlet Station: 41.00 ft

Outlet Elevation: 930.96 ft

Number of Barrels: 2

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.22	0.27	1.44	0.17	0.52
11.60	931.26	0.31	1.58	0.19	0.53
14.20	931.30	0.35	1.69	0.22	0.54
16.80	931.33	0.38	1.79	0.24	0.55
19.40	931.37	0.42	1.88	0.26	0.55
22.00	931.40	0.45	1.96	0.28	0.56
25.00	931.43	0.48	2.05	0.30	0.56
27.20	931.45	0.50	2.11	0.32	0.57
29.80	931.48	0.53	2.17	0.33	0.57
32.40	931.51	0.56	2.23	0.35	0.58
35.00	931.53	0.58	2.29	0.36	0.58

Tailwater Channel Data - Sta. 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 930.95 ft

Roadway Data for Crossing: Sta. 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 934.55 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Sta 46+65 (Split Flow w/ Sta 43+76) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

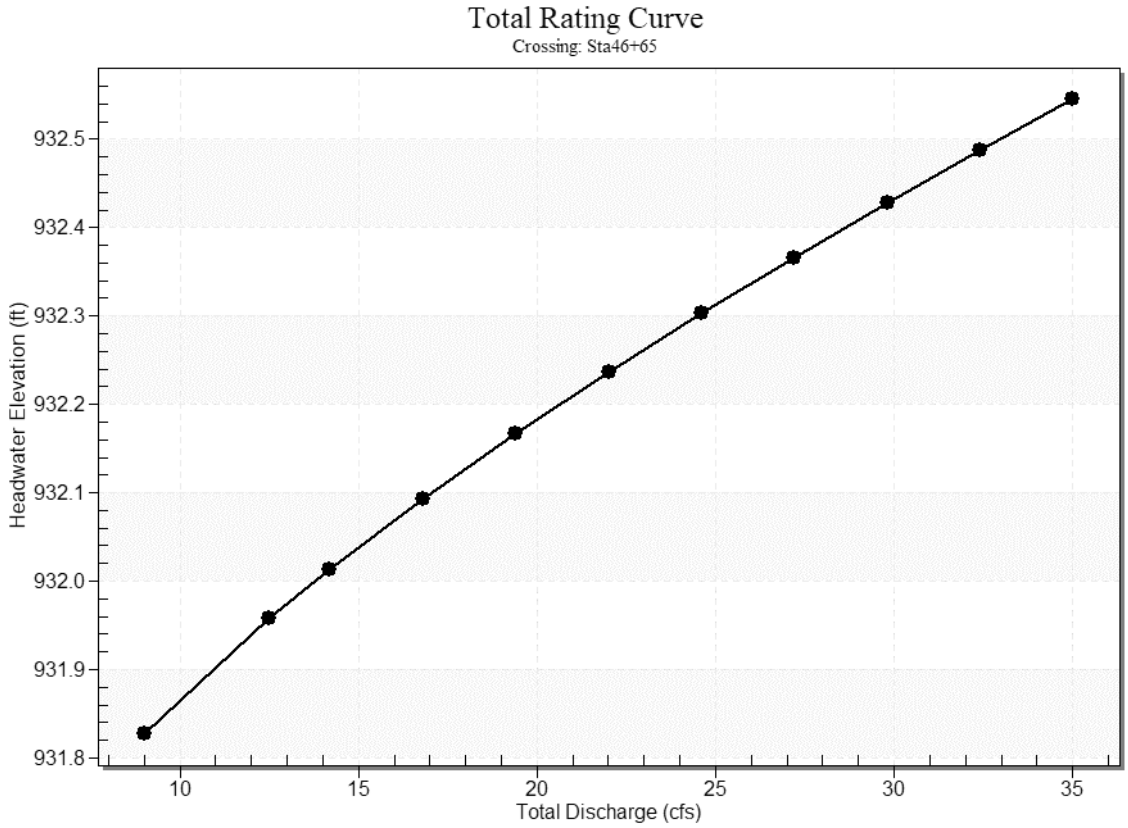
Design Flow: 12.50 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta46+65

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
931.83	9.00	5.29	3.68	9
931.96	12.50	5.48	7.00	5
932.01	14.20	5.55	8.62	4
932.09	16.80	5.66	11.12	4
932.17	19.40	5.76	13.63	4
932.24	22.00	5.86	16.14	4
932.30	24.60	5.94	18.63	3
932.37	27.20	6.02	21.16	3
932.43	29.80	6.10	23.69	3
932.49	32.40	6.17	26.22	3
932.55	35.00	6.24	28.76	3
931.58	4.92	4.92	0.00	Overtopping

Rating Curve Plot for Crossing: Sta46+65



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	5.29 cfs	931.83	2.43	0.0*	5-S2n	0.51	0.93	0.53	0.79	12.39	1.78
12.50 cfs	5.48 cfs	931.96	2.56	0.0*	5-S2n	0.52	0.94	0.55	0.94	12.49	1.96
14.20 cfs	5.55 cfs	932.01	2.61	0.0*	5-S2n	0.52	0.94	0.55	1.00	12.53	2.03
16.80 cfs	5.66 cfs	932.09	2.69	0.0*	5-S2n	0.53	0.95	0.56	1.09	12.59	2.12

19.40 cfs	5.76 cfs	932.17	2.77	0.083	5-S2n	0.54	0.95	0.56	1.17	12.65	2.21
22.00 cfs	5.86 cfs	932.24	2.84	0.233	5-S2n	0.54	0.95	0.57	1.24	12.70	2.28
24.60 cfs	5.94 cfs	932.30	2.90	0.374	5-S2n	0.55	0.95	0.57	1.32	12.75	2.35
27.20 cfs	6.02 cfs	932.37	2.97	0.509	5-S2n	0.55	0.95	0.58	1.38	12.79	2.42
29.80 cfs	6.10 cfs	932.43	3.03	0.638	5-S2n	0.55	0.94	0.58	1.44	12.79	2.48
32.40 cfs	6.17 cfs	932.49	3.09	0.759	5-S2n	0.56	0.92	0.59	1.50	12.85	2.53
35.00 cfs	6.24 cfs	932.55	3.15	0.875	5-S2n	0.56	0.92	0.59	1.56	12.88	2.59

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

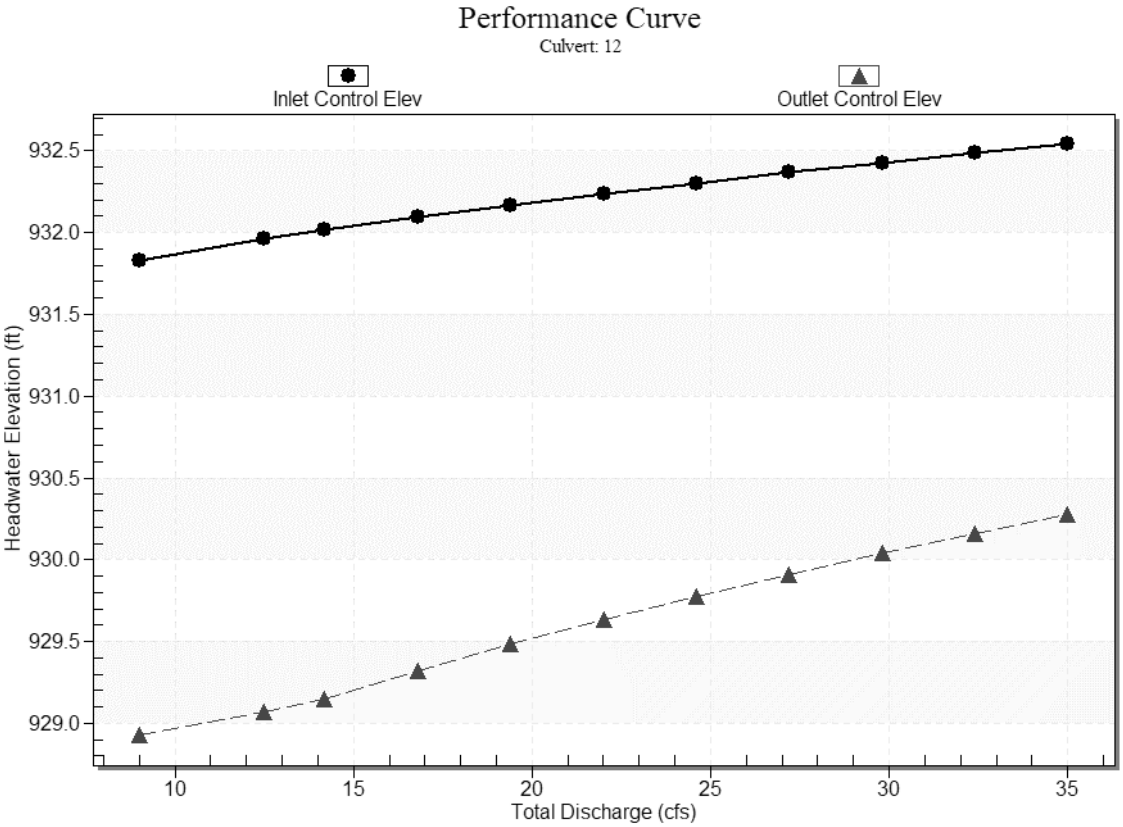
Inlet Elevation (invert): 929.40 ft,

Outlet Elevation (invert): 926.00 ft

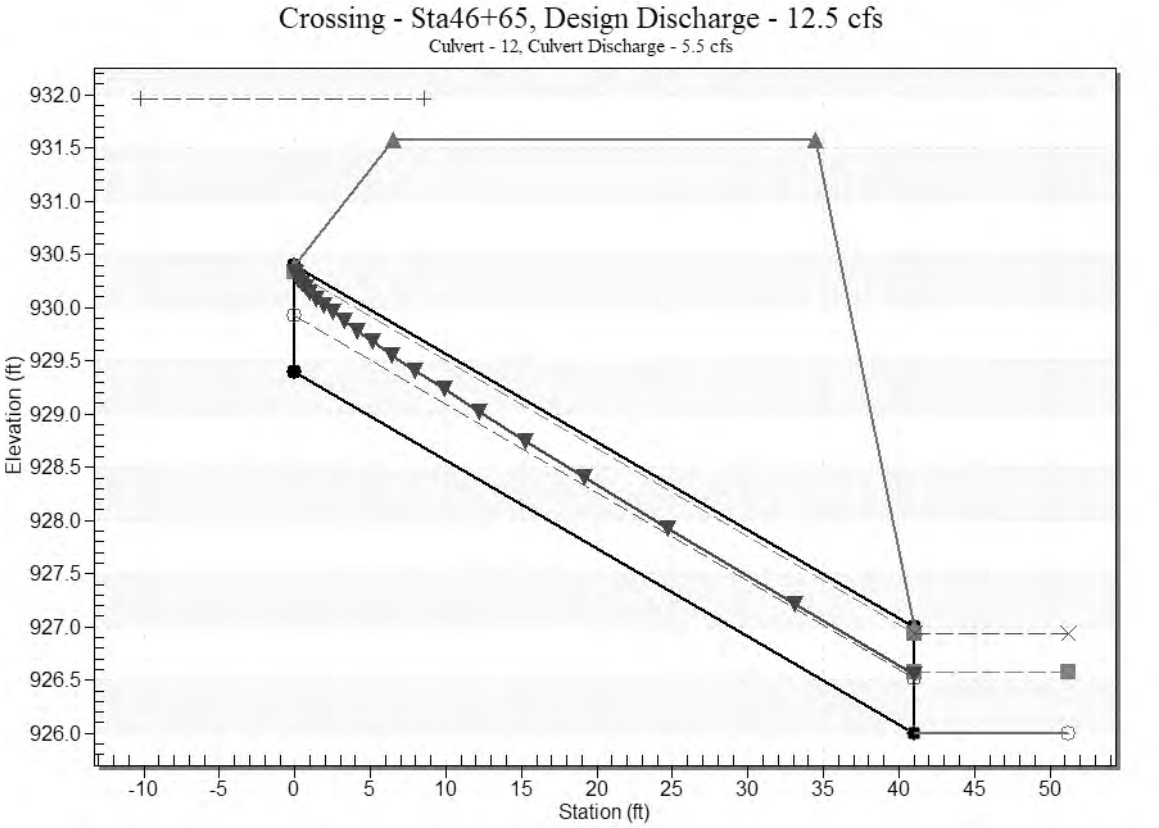
Culvert Length: 41.14 ft,

Culvert Slope: 0.0829

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 929.40 ft

Outlet Station: 41.00 ft

Outlet Elevation: 926.00 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta46+65

Table 3 - Downstream Channel Rating Curve (Crossing: Sta46+65)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	926.79	0.79	1.78	0.25	0.41
12.50	926.94	0.94	1.96	0.29	0.42
14.20	927.00	1.00	2.03	0.31	0.43
16.80	927.09	1.09	2.12	0.34	0.43
19.40	927.17	1.17	2.21	0.36	0.44
22.00	927.24	1.24	2.28	0.39	0.44
24.60	927.32	1.32	2.35	0.41	0.44
27.20	927.38	1.38	2.42	0.43	0.45
29.80	927.44	1.44	2.48	0.45	0.45
32.40	927.50	1.50	2.53	0.47	0.45
35.00	927.56	1.56	2.59	0.49	0.45

Tailwater Channel Data - Sta46+65

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0400

Channel Invert Elevation: 926.00 ft

Roadway Data for Crossing: Sta46+65

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 931.58 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Proposed STA 82+07
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

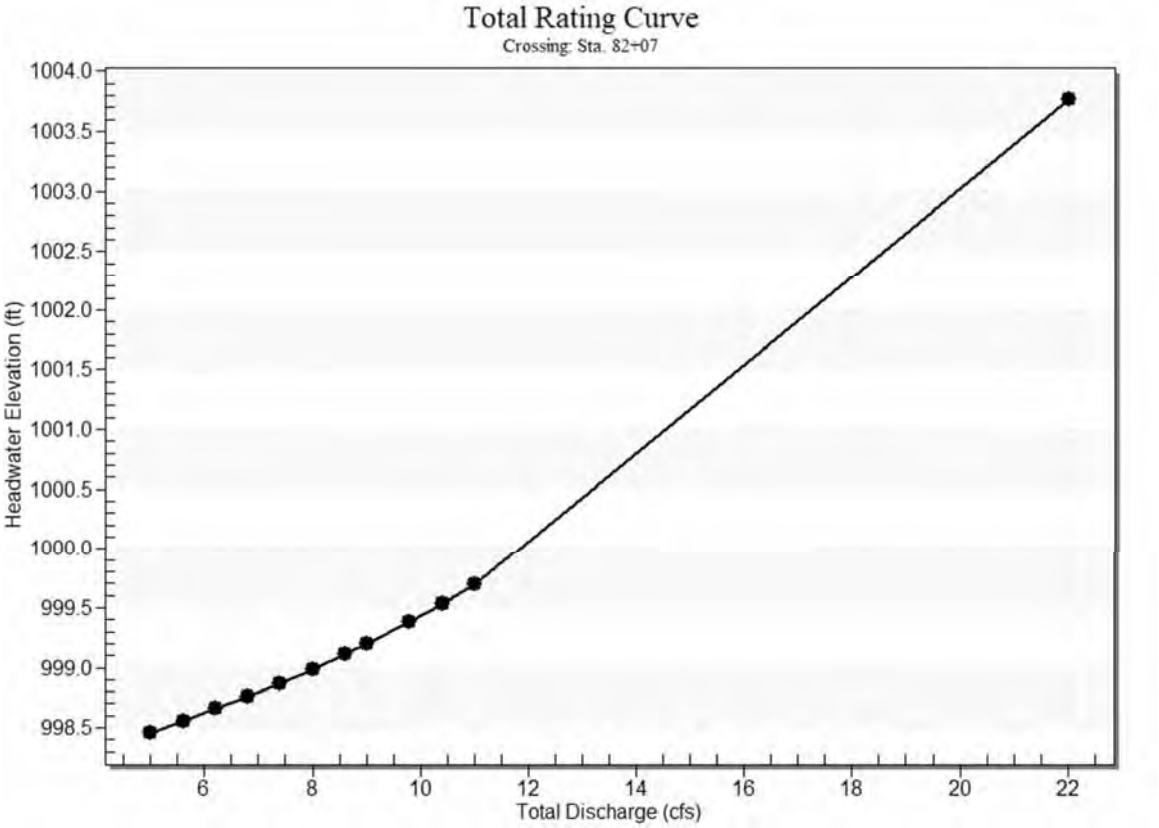
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
998.46	5.00	5.00	0.00	1
998.56	5.60	5.60	0.00	1
998.66	6.20	6.20	0.00	1
998.76	6.80	6.80	0.00	1
998.87	7.40	7.40	0.00	1
998.99	8.00	8.00	0.00	1
999.11	8.60	8.60	0.00	1
999.20	9.00	9.00	0.00	1
999.38	9.80	9.80	0.00	1
999.53	10.40	10.40	0.00	1
999.69	11.00	11.00	0.00	1
1003.70	20.61	20.61	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 82+07



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	998.46	1.29	0.549	1-S2n	0.64	0.86	0.66	0.10	6.70	2.00
5.60 cfs	5.60 cfs	998.56	1.39	0.670	1-S2n	0.68	0.91	0.70	0.11	6.89	2.09
6.20 cfs	6.20 cfs	998.66	1.49	0.796	1-S2n	0.72	0.96	0.75	0.11	7.06	2.18
6.80 cfs	6.80 cfs	998.76	1.59	0.927	5-S2n	0.76	1.01	0.79	0.12	7.22	2.26

7.40 cfs	7.40 cfs	998.87	1.70	1.063	5-S2n	0.80	1.05	0.83	0.13	7.37	2.34
8.00 cfs	8.00 cfs	998.99	1.82	1.204	5-S2n	0.84	1.10	0.87	0.13	7.51	2.41
8.60 cfs	8.60 cfs	999.11	1.94	1.534	5-S2n	0.88	1.14	0.91	0.14	7.64	2.48
9.00 cfs	9.00 cfs	999.20	2.03	1.622	5-S2n	0.91	1.16	0.94	0.14	7.72	2.52
9.80 cfs	9.80 cfs	999.38	2.21	1.807	5-S2n	0.96	1.21	0.99	0.15	7.88	2.61
10.40 cfs	10.40 cfs	999.53	2.36	1.954	5-S2n	1.00	1.24	1.03	0.15	8.00	2.67
11.00 cfs	11.00 cfs	999.69	2.52	2.107	5-S2n	1.04	1.27	1.08	0.16	8.10	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

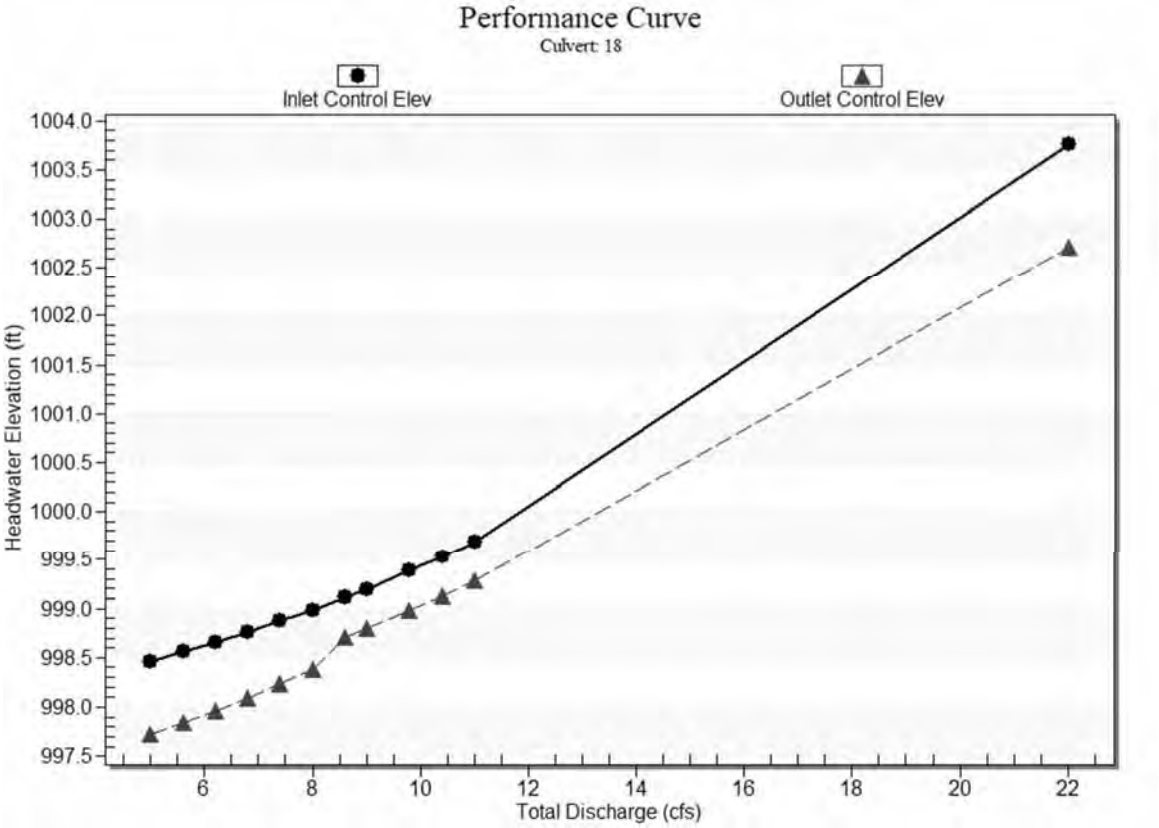
Inlet Elevation (invert): 997.17 ft,

Outlet Elevation (invert): 996.59 ft

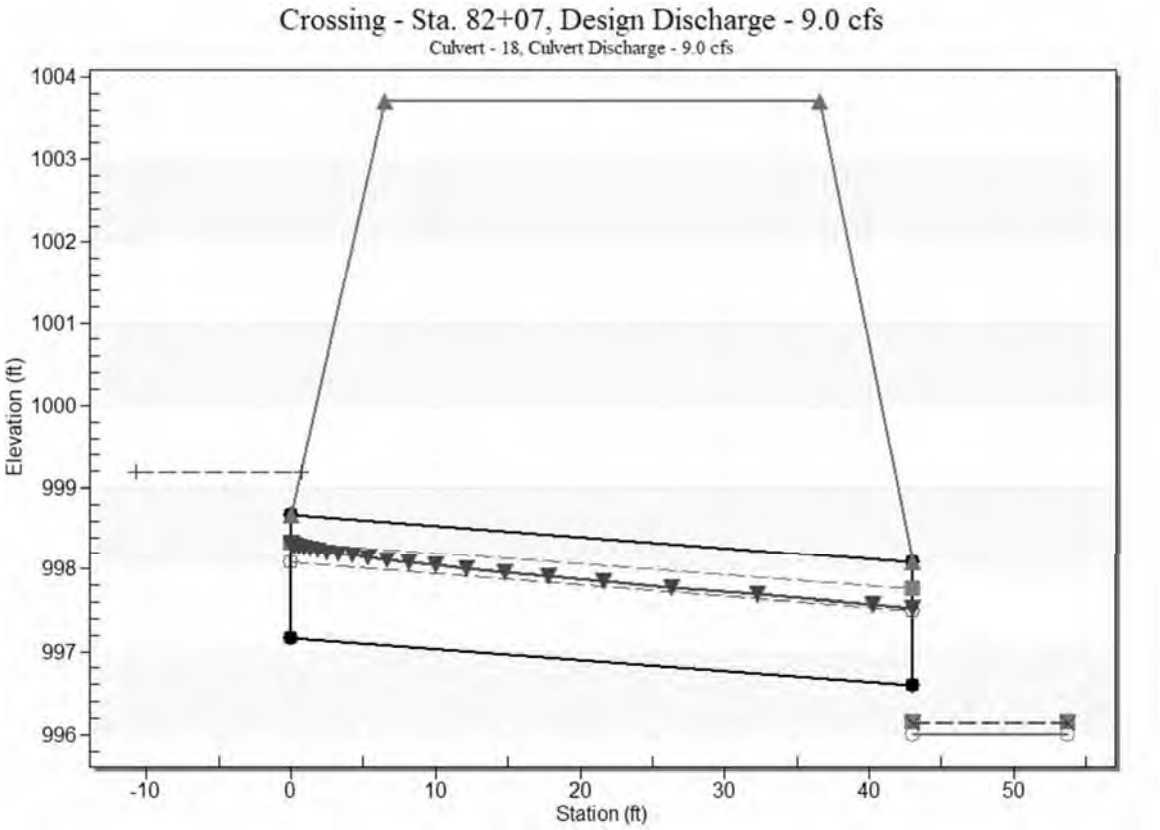
Culvert Length: 43.00 ft,

Culvert Slope: 0.0135

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 997.17 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.59 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - Sta. 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: Sta. 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 25.00 ft

Crest Elevation: 1003.70 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

APPENDIX E

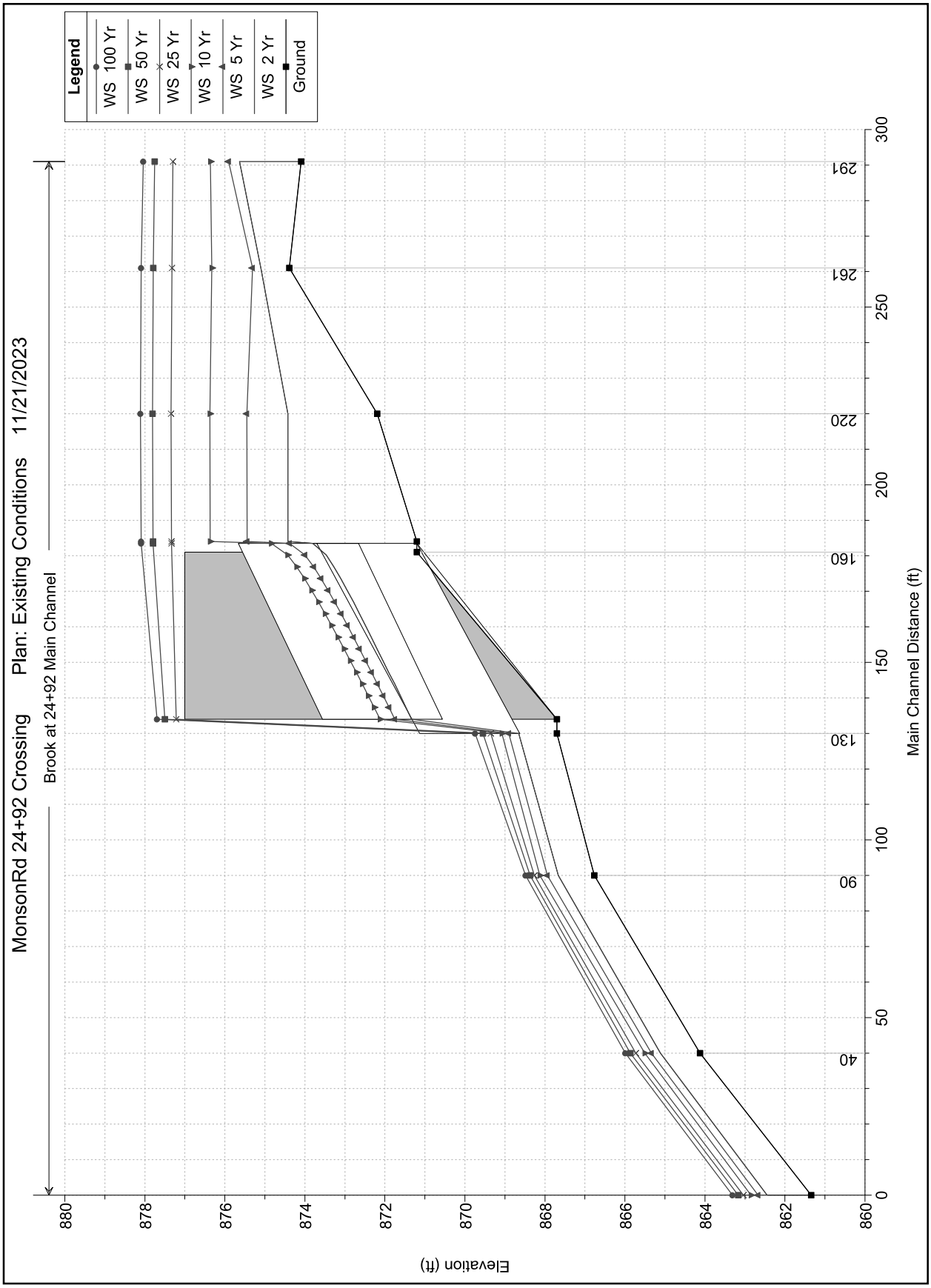
HEC-RAS

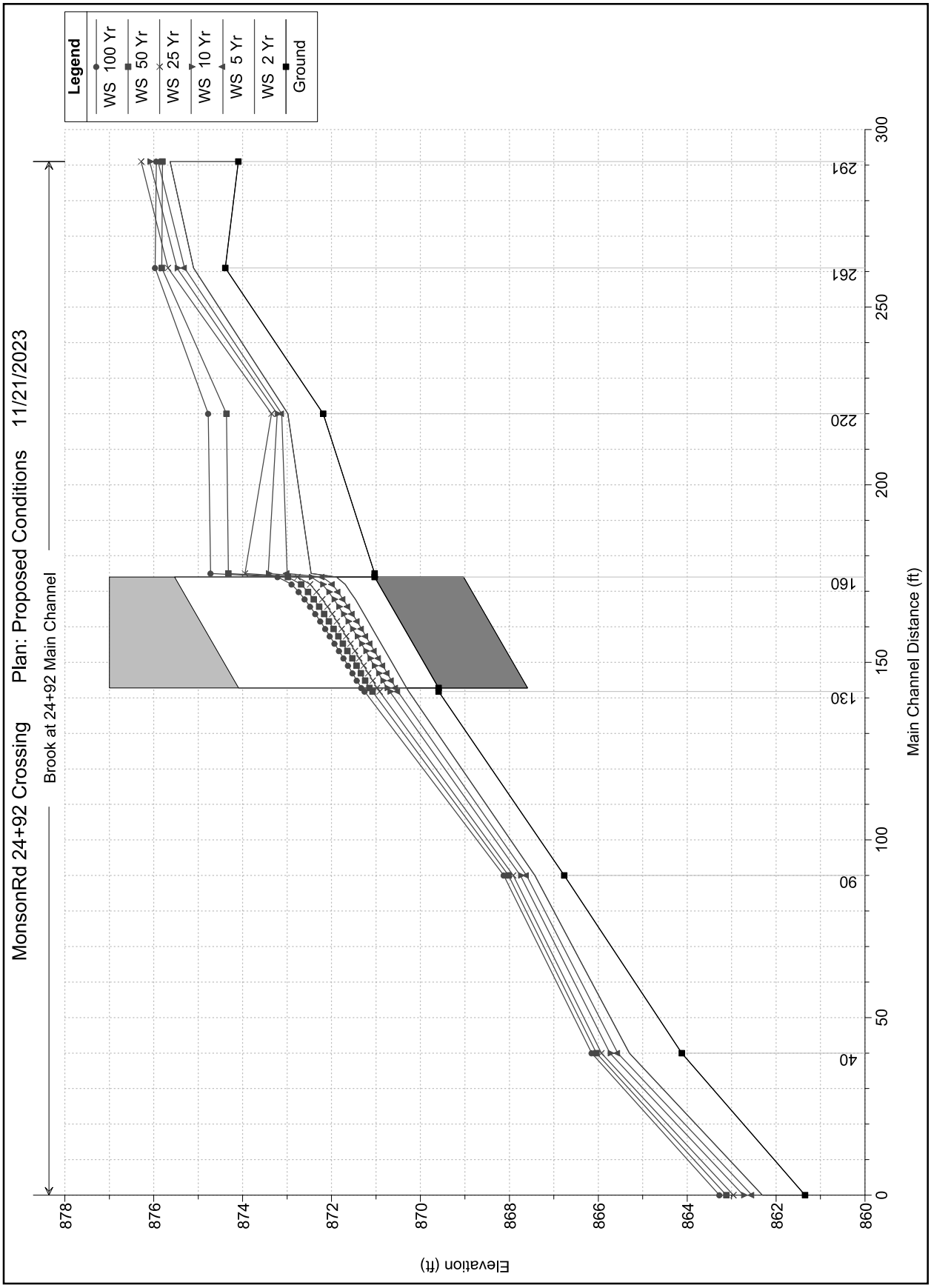
HEC-RAS Computed Results for crossing 24+92 proposed

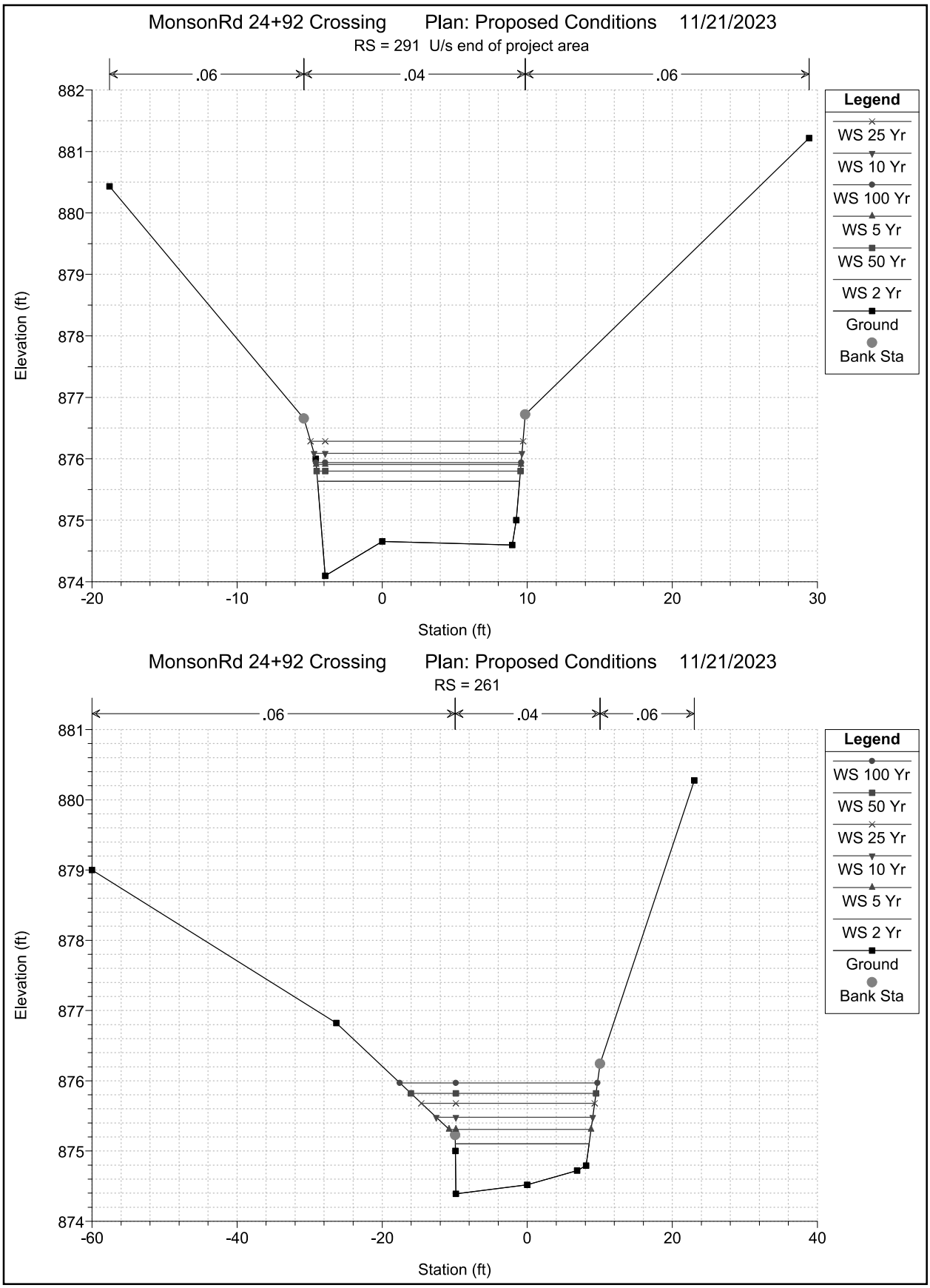
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

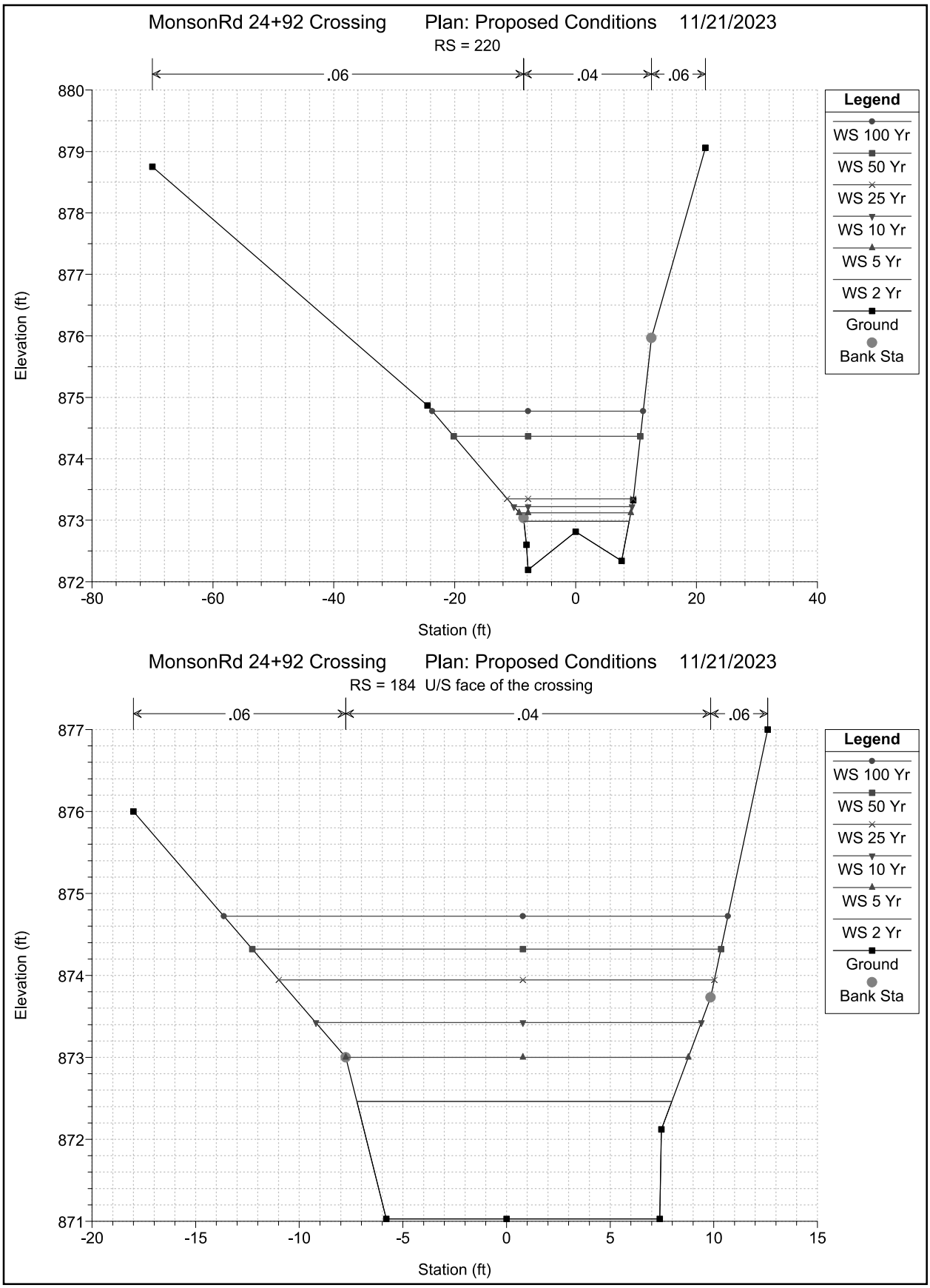
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	5.23
DESIGN FLOOD ELEVATION (FEET,NAVD)	876.1

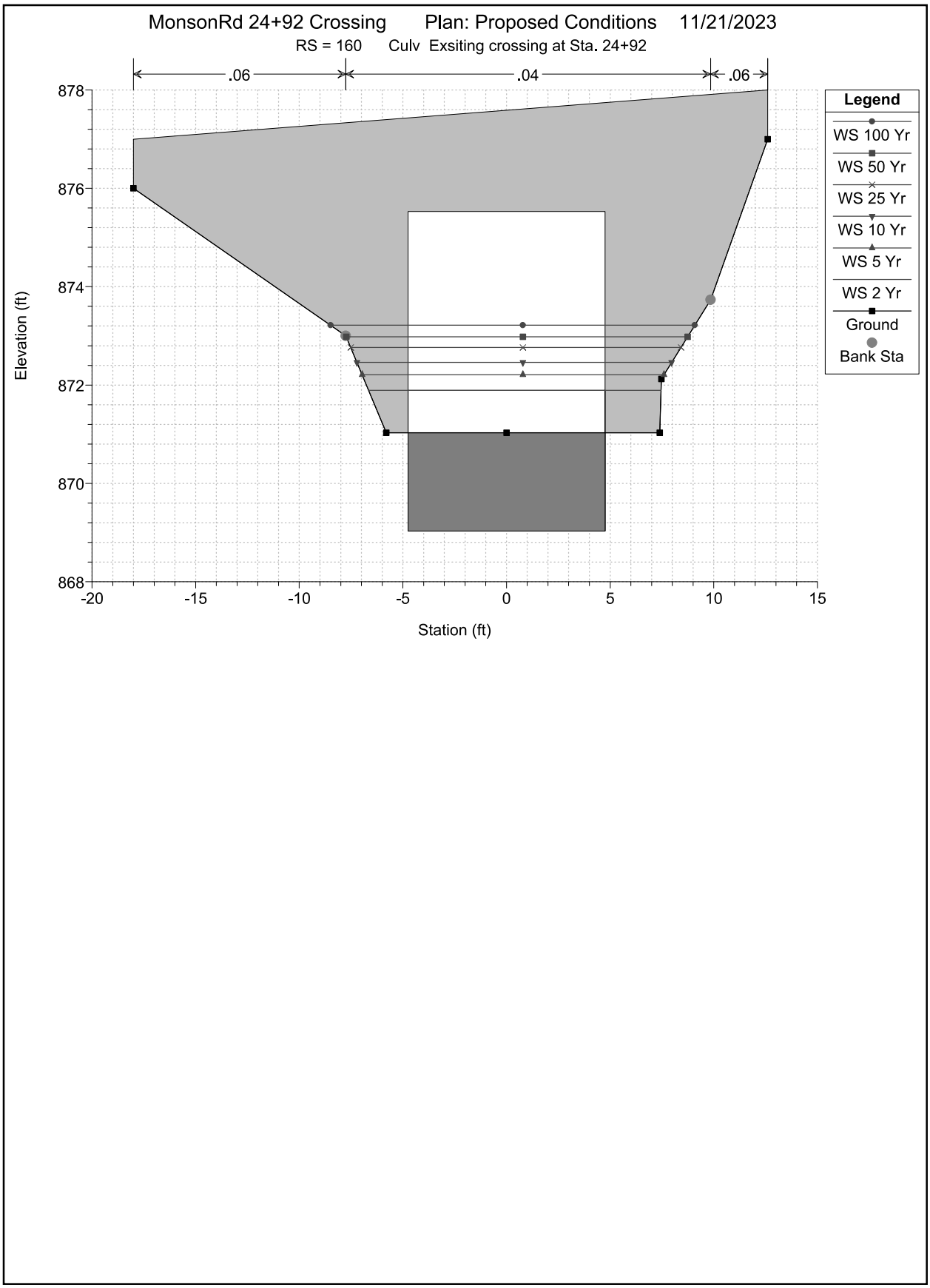
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	31.21	9.5	6.5	871.03	869.59

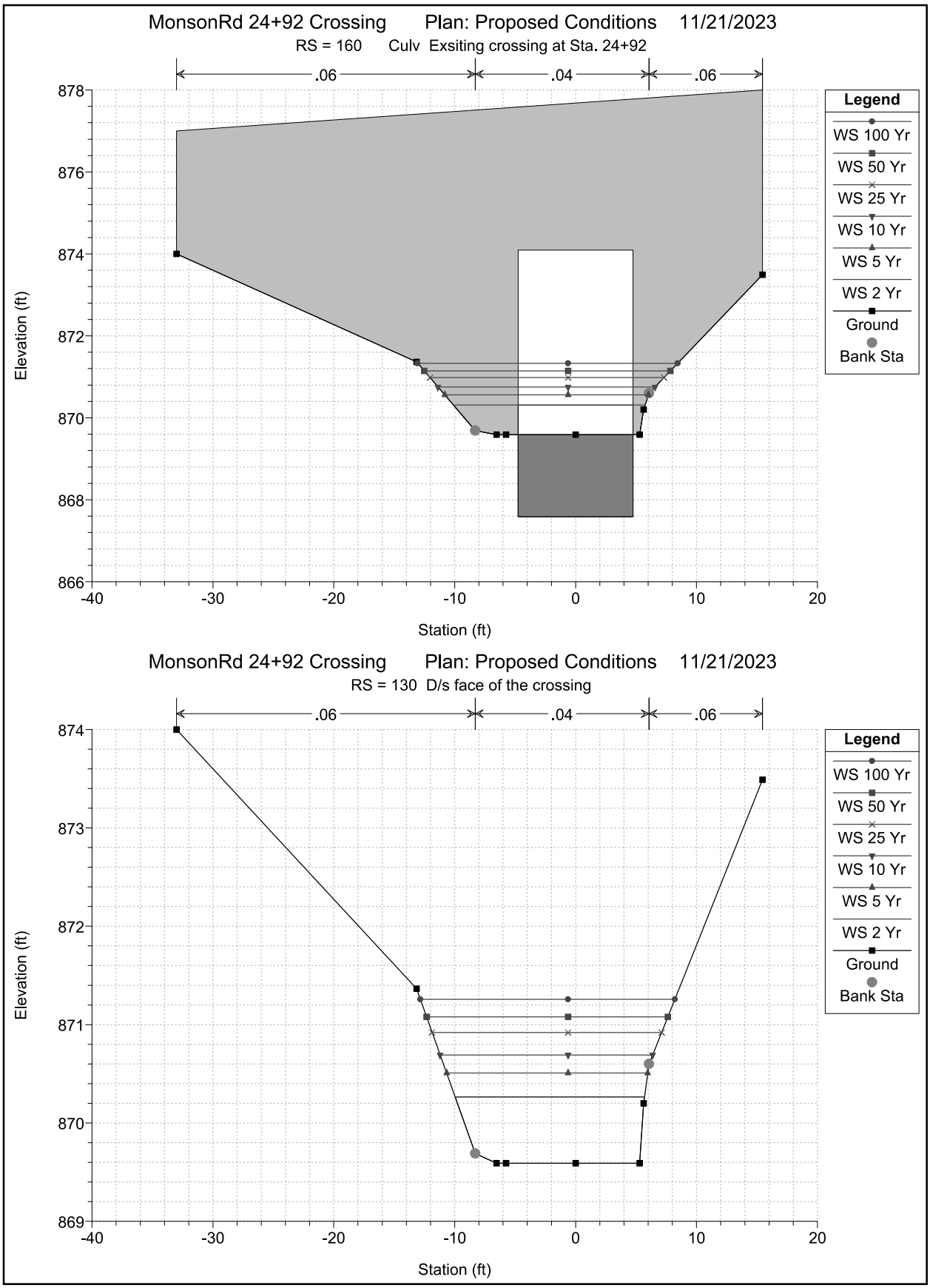

MonsonRd 24+92 Crossing
Plan: Existing Conditions 11/21/2023
Brook at 24+92 Main Channel
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
860
862
864
866
868
870
872
874
876
878
880
0
50
100
150
200
250
300
40
90
130
160
220
261
291

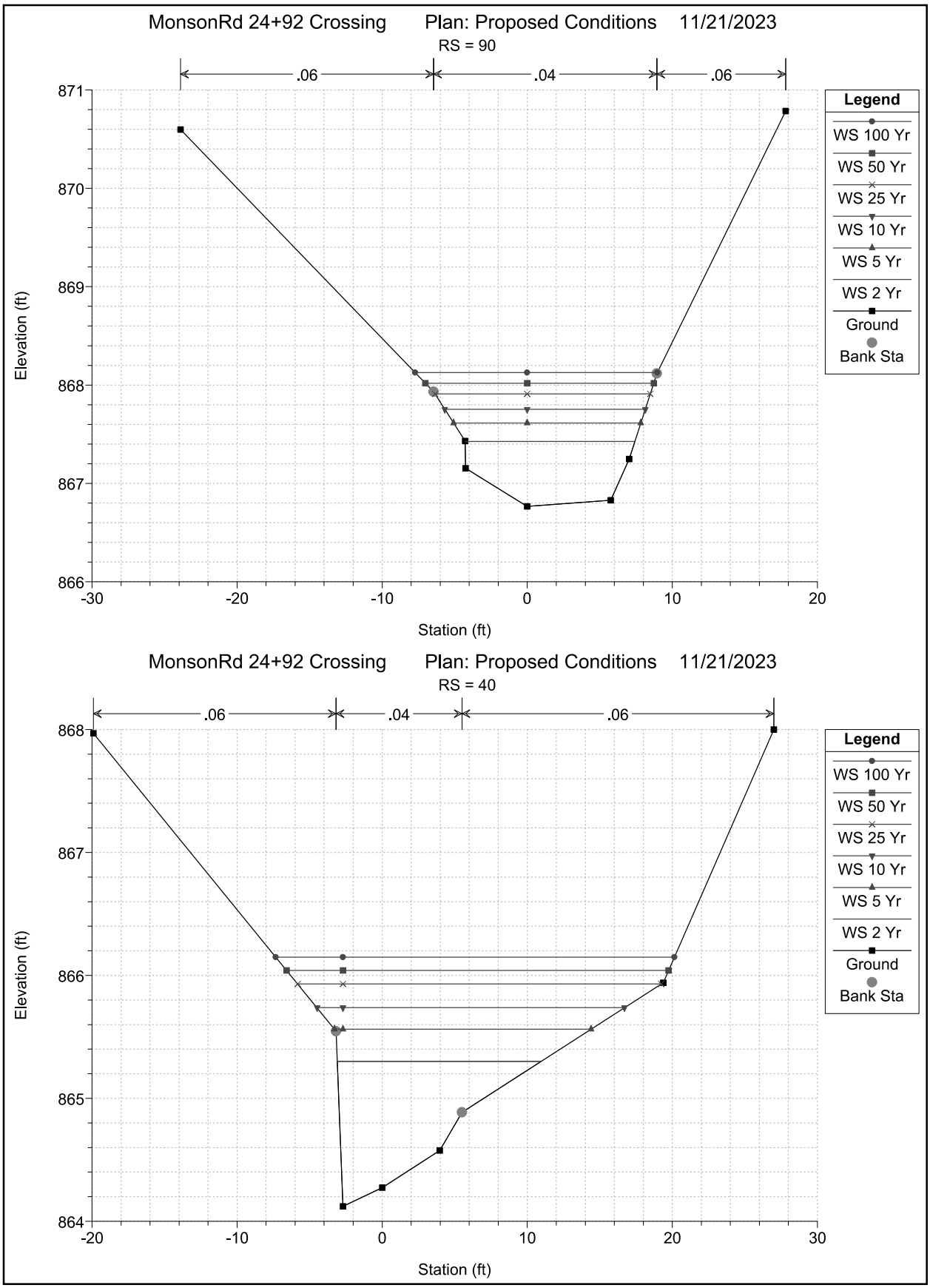

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
Brook at 24+92 Main Channel
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
860
862
864
866
868
870
872
874
876
878
0
40
50
90
100
130
150
160
200
220
250
261
291
300

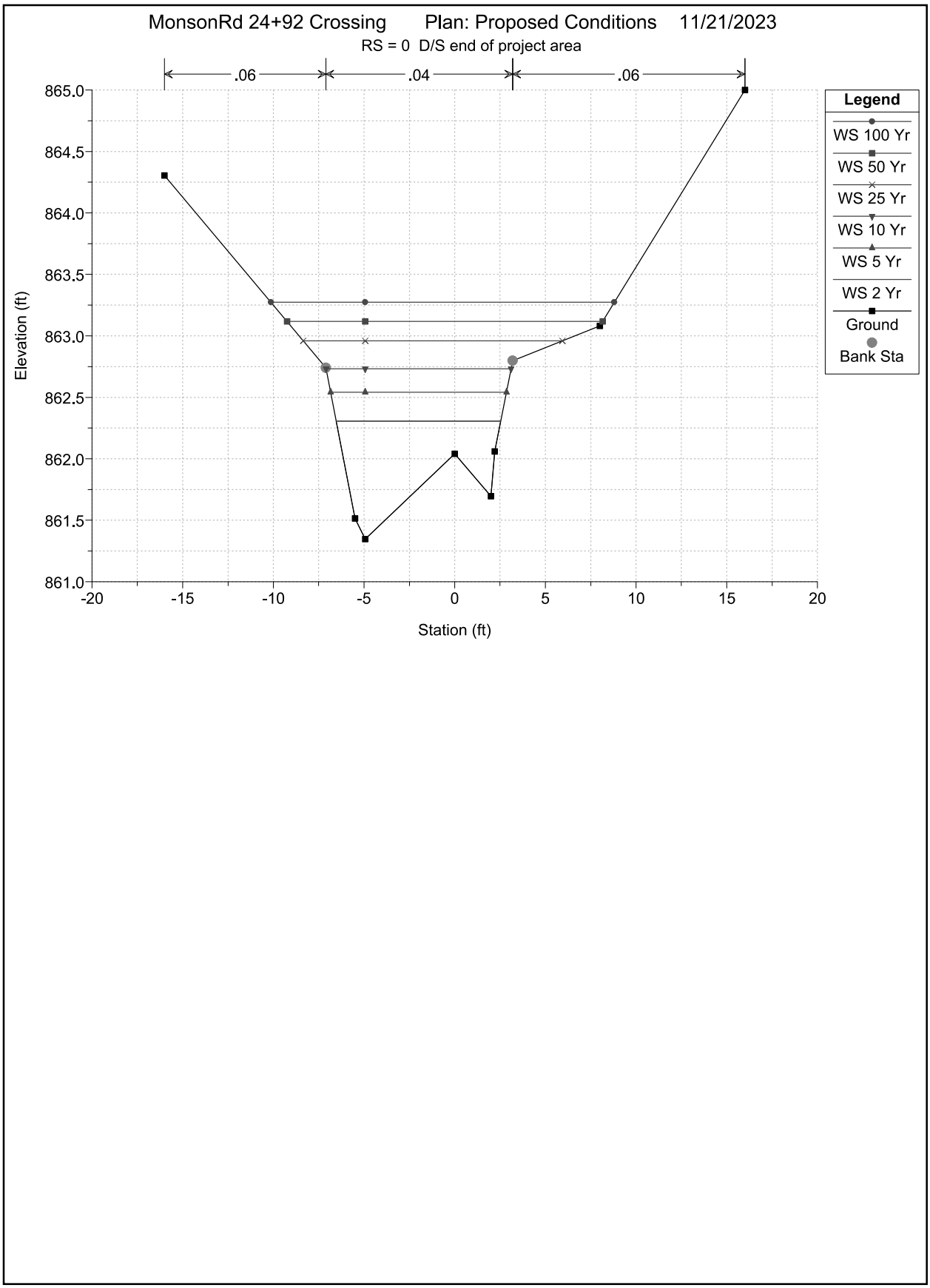

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 291 U/s end of project area
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 25 Yr
WS 10 Yr
WS 100 Yr
WS 5 Yr
WS 50 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 261
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 220
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 184 U/S face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 160
Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
878
876
874
872
870
868
-20
-15
-10
-5
0
5
10
15
Station (ft)


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 160 Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 130 D/s face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 90
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 40
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Elevation (ft)
Station (ft)
865.0
864.5
864.0
863.5
863.0
862.5
862.0
861.5
861.0
-20
-15
-10
-5
0
5
10
15
20
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006791	2.93	14.70	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008508	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.36	875.68	876.57	0.006020	3.67	25.08	14.77	0.50
Main Channel	291	25 Yr	123.00	874.10	877.30	875.92	877.45	0.002536	3.11	40.73	20.05	0.34
Main Channel	291	50 Yr	147.00	874.10	877.75	876.10	877.90	0.002041	3.11	50.68	23.65	0.32
Main Channel	291	100 Yr	174.00	874.10	878.04	876.28	878.21	0.002053	3.32	57.84	25.93	0.32
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	876.33		876.43	0.002553	2.56	40.10	31.59	0.35
Main Channel	261	25 Yr	123.00	874.39	877.32		877.38	0.000818	1.97	78.88	47.62	0.21
Main Channel	261	50 Yr	147.00	874.39	877.79		877.84	0.000619	1.91	103.13	56.34	0.19
Main Channel	261	100 Yr	174.00	874.39	878.09		878.14	0.000598	2.00	120.89	61.94	0.19
Main Channel	220	2 Yr	43.00	872.19	874.43	873.12	874.45	0.000483	1.15	42.65	31.46	0.15
Main Channel	220	5 Yr	69.00	872.19	875.45	873.35	875.46	0.000244	1.06	80.46	43.27	0.12
Main Channel	220	10 Yr	92.00	872.19	876.37		876.38	0.000141	0.97	126.10	55.86	0.09
Main Channel	220	25 Yr	123.00	872.19	877.35		877.36	0.000094	0.93	187.38	70.07	0.08
Main Channel	220	50 Yr	147.00	872.19	877.81		877.82	0.000090	0.97	221.42	76.84	0.08
Main Channel	220	100 Yr	174.00	872.19	878.11		878.12	0.000098	1.05	245.16	81.22	0.08
Main Channel	184	2 Yr	43.00	871.20	874.42	871.96	874.43	0.000149	0.85	53.33	23.04	0.09
Main Channel	184	5 Yr	69.00	871.20	875.44	872.21	875.46	0.000129	0.97	79.06	27.39	0.09
Main Channel	184	10 Yr	92.00	871.20	876.37	872.41	876.38	0.000104	1.01	105.91	30.07	0.08
Main Channel	184	25 Yr	123.00	871.20	877.34	872.65	877.35	0.000094	1.08	135.44	30.60	0.08
Main Channel	184	50 Yr	147.00	871.20	877.80	872.81	877.82	0.000101	1.18	149.53	30.60	0.08
Main Channel	184	100 Yr	174.00	871.20	878.09	872.99	878.12	0.000119	1.32	158.61	30.60	0.09
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	867.70	868.66	868.57	868.96	0.020428	4.43	9.71	11.70	0.86
Main Channel	130	5 Yr	69.00	867.70	868.90	868.85	869.37	0.023223	5.47	12.63	11.91	0.94
Main Channel	130	10 Yr	92.00	867.70	869.08	869.08	869.68	0.026087	6.26	14.71	12.20	1.00
Main Channel	130	25 Yr	123.00	867.70	869.35	869.35	870.06	0.025316	6.77	18.18	12.94	1.01
Main Channel	130	50 Yr	147.00	867.70	869.55	869.55	870.33	0.024776	7.08	20.76	13.47	1.01
Main Channel	130	100 Yr	174.00	867.70	869.75	869.75	870.60	0.024193	7.41	23.49	14.02	1.00
Main Channel	90	2 Yr	43.00	866.77	867.67	867.67	868.01	0.027657	4.71	9.13	13.26	1.00
Main Channel	90	5 Yr	69.00	866.77	867.94	867.94	868.38	0.025952	5.31	12.99	15.06	1.01
Main Channel	90	10 Yr	92.00	866.77	868.13	868.13	868.65	0.024492	5.79	16.00	16.73	1.01

Proposal No. 608163-128112

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	868.26	868.37	868.99	0.028912	6.83	18.34	18.05	1.12
Main Channel	90	50 Yr	147.00	866.77	868.37	868.54	869.23	0.030415	7.43	20.37	19.13	1.16
Main Channel	90	100 Yr	174.00	866.77	868.48	868.71	869.48	0.032139	8.07	22.50	20.20	1.21
Main Channel	40	2 Yr	43.00	864.12	865.11	865.36	865.90	0.067632	7.16	6.26	11.48	1.51
Main Channel	40	5 Yr	69.00	864.12	865.34	865.68	866.38	0.064742	8.34	9.25	14.57	1.53
Main Channel	40	10 Yr	92.00	864.12	865.50	865.93	866.71	0.063759	9.12	11.81	16.78	1.55
Main Channel	40	25 Yr	123.00	864.12	865.73	866.15	866.99	0.054635	9.56	16.05	21.03	1.48
Main Channel	40	50 Yr	147.00	864.12	865.86	866.29	867.21	0.052564	10.01	19.05	23.72	1.47
Main Channel	40	100 Yr	174.00	864.12	865.99	866.44	867.43	0.051739	10.50	22.16	25.77	1.48
Main Channel	0	2 Yr	43.00	861.35	862.45	862.65	863.19	0.066836	6.91	6.22	9.44	1.50
Main Channel	0	5 Yr	69.00	861.35	862.67	863.00	863.71	0.068697	8.18	8.44	10.04	1.57
Main Channel	0	10 Yr	92.00	861.35	862.85	863.27	864.10	0.066222	8.97	10.31	11.83	1.59
Main Channel	0	25 Yr	123.00	861.35	863.04	863.54	864.58	0.065444	10.00	12.92	16.08	1.62
Main Channel	0	50 Yr	147.00	861.35	863.17	863.72	864.87	0.063441	10.58	15.21	17.93	1.63
Main Channel	0	100 Yr	174.00	861.35	863.31	863.90	865.14	0.061000	11.09	17.79	19.30	1.62

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006822	2.93	14.67	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008494	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.09	875.68	876.38	0.010123	4.36	21.10	14.33	0.63
Main Channel	291	25 Yr	123.00	874.10	876.28	875.92	876.69	0.012395	5.14	23.92	14.65	0.71
Main Channel	291	50 Yr	147.00	874.10	875.80	876.09	876.96	0.050095	8.64	17.02	14.05	1.38
Main Channel	291	100 Yr	174.00	874.10	875.94	876.28	877.25	0.050078	9.17	18.97	14.14	1.40
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	875.48	875.48	875.92	0.024916	5.32	17.56	21.56	0.98
Main Channel	261	25 Yr	123.00	874.39	875.68	875.68	876.19	0.022903	5.77	22.12	23.89	0.97
Main Channel	261	50 Yr	147.00	874.39	875.82	875.82	876.38	0.021751	6.05	25.62	25.53	0.96
Main Channel	261	100 Yr	174.00	874.39	875.97	875.97	876.57	0.020640	6.32	29.57	27.26	0.95
Main Channel	220	2 Yr	43.00	872.19	872.98	873.12	873.49	0.076775	5.74	7.49	17.42	1.54
Main Channel	220	5 Yr	69.00	872.19	873.12	873.35	873.87	0.078410	6.92	10.00	18.48	1.63
Main Channel	220	10 Yr	92.00	872.19	873.22	873.51	874.17	0.082184	7.83	11.86	19.52	1.71
Main Channel	220	25 Yr	123.00	872.19	873.35	873.71	874.52	0.080896	8.69	14.48	20.87	1.74
Main Channel	220	50 Yr	147.00	872.19	874.37	873.85	874.61	0.006361	4.09	40.77	30.86	0.55
Main Channel	220	100 Yr	174.00	872.19	874.77	873.99	874.97	0.004204	3.77	54.21	34.89	0.46
Main Channel	184	2 Yr	43.00	871.03	872.46	871.71	872.53	0.002652	2.14	20.06	15.19	0.33
Main Channel	184	5 Yr	69.00	871.03	873.00	871.96	873.09	0.002383	2.41	28.59	16.52	0.32
Main Channel	184	10 Yr	92.00	871.03	873.42	872.16	873.53	0.002121	2.57	36.03	18.60	0.31
Main Channel	184	25 Yr	123.00	871.03	873.95	872.40	874.06	0.001820	2.72	46.40	21.01	0.30
Main Channel	184	50 Yr	147.00	871.03	874.32	872.57	874.44	0.001618	2.81	54.60	22.61	0.29
Main Channel	184	100 Yr	174.00	871.03	874.72	872.75	874.85	0.001449	2.90	63.98	24.32	0.28
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	869.59	870.26	870.26	870.59	0.027595	4.58	9.68	15.66	1.00
Main Channel	130	5 Yr	69.00	869.59	870.51	870.51	870.93	0.025058	5.30	13.60	16.64	0.99
Main Channel	130	10 Yr	92.00	869.59	870.69	870.69	871.20	0.023566	5.80	16.75	17.58	0.99
Main Channel	130	25 Yr	123.00	869.59	870.92	870.92	871.52	0.021537	6.32	20.93	18.98	0.98
Main Channel	130	50 Yr	147.00	869.59	871.08	871.08	871.74	0.020548	6.66	24.03	19.96	0.98
Main Channel	130	100 Yr	174.00	869.59	871.26	871.26	871.97	0.019231	6.96	27.66	21.05	0.96
Main Channel	90	2 Yr	43.00	866.77	867.43	867.66	868.19	0.087757	7.01	6.13	11.71	1.71
Main Channel	90	5 Yr	69.00	866.77	867.61	867.94	868.65	0.088978	8.17	8.45	12.92	1.78
Main Channel	90	10 Yr	92.00	866.77	867.75	868.13	868.99	0.089077	8.92	10.32	13.83	1.82

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel (Continued)

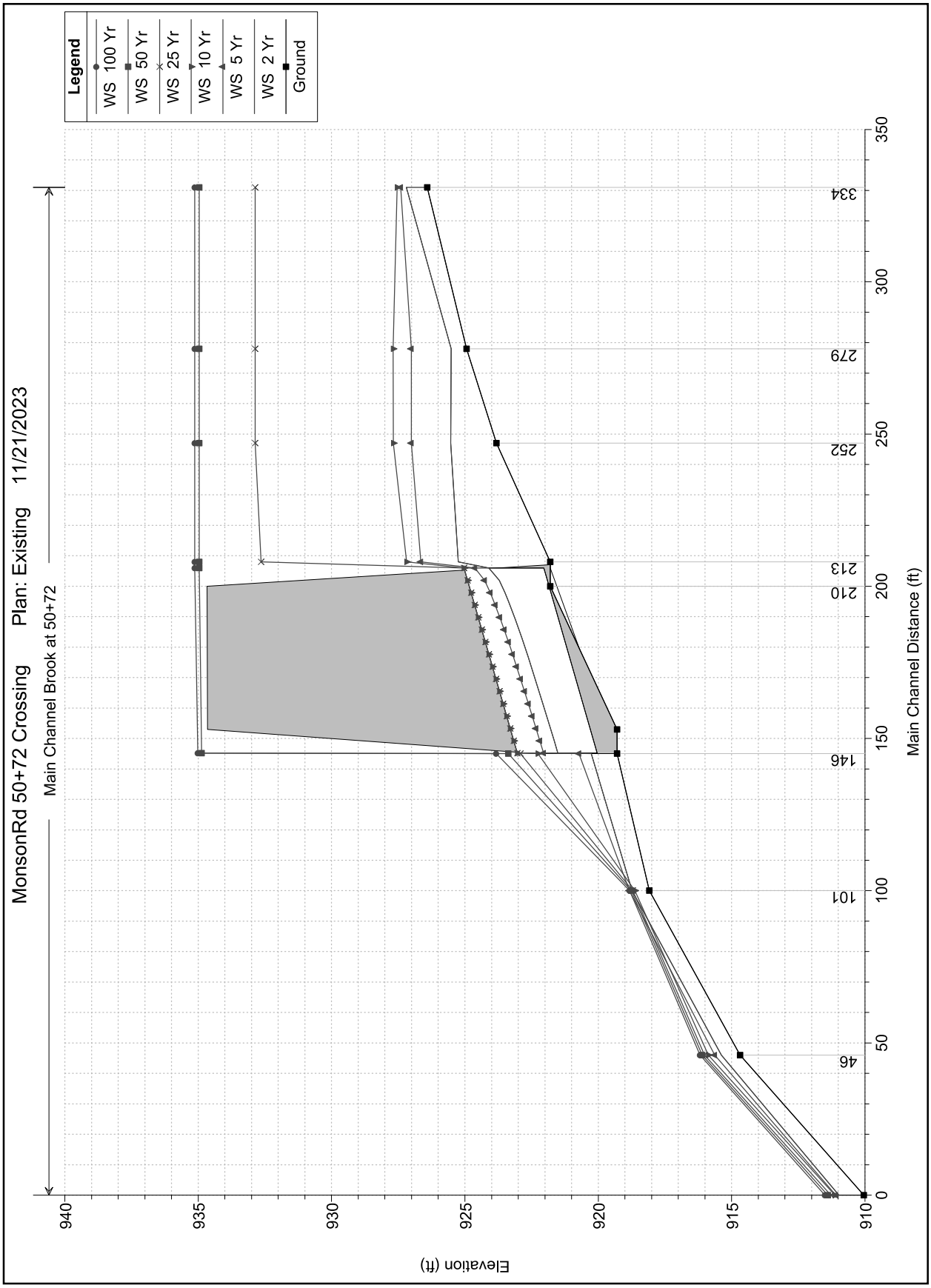
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	867.91	868.37	869.40	0.091293	9.80	12.54	14.84	1.88
Main Channel	90	50 Yr	147.00	866.77	868.02	868.54	869.69	0.089500	10.37	14.20	15.74	1.89
Main Channel	90	100 Yr	174.00	866.77	868.13	868.71	870.00	0.088274	10.98	15.96	16.70	1.91
Main Channel	40	2 Yr	43.00	864.12	865.30	865.36	865.75	0.029337	5.47	8.69	14.04	1.03
Main Channel	40	5 Yr	69.00	864.12	865.56	865.68	866.15	0.029358	6.40	12.83	17.69	1.06
Main Channel	40	10 Yr	92.00	864.12	865.74	865.93	866.43	0.029868	7.10	16.21	21.18	1.09
Main Channel	40	25 Yr	123.00	864.12	865.93	866.15	866.75	0.030526	7.86	20.67	25.06	1.13
Main Channel	40	50 Yr	147.00	864.12	866.04	866.29	866.96	0.031932	8.44	23.53	26.33	1.17
Main Channel	40	100 Yr	174.00	864.12	866.15	866.44	867.17	0.033594	9.04	26.45	27.48	1.22
Main Channel	0	2 Yr	43.00	861.35	862.31	862.65	863.49	0.135916	8.71	4.94	9.07	2.08
Main Channel	0	5 Yr	69.00	861.35	862.54	863.00	863.99	0.113529	9.67	7.14	9.69	1.99
Main Channel	0	10 Yr	92.00	861.35	862.73	863.27	864.34	0.099306	10.18	9.04	10.20	1.91
Main Channel	0	25 Yr	123.00	861.35	862.96	863.54	864.76	0.083177	10.77	11.73	14.30	1.81
Main Channel	0	50 Yr	147.00	861.35	863.12	863.72	865.00	0.073977	11.11	14.26	17.40	1.74
Main Channel	0	100 Yr	174.00	861.35	863.27	863.90	865.23	0.067208	11.44	17.09	18.94	1.69

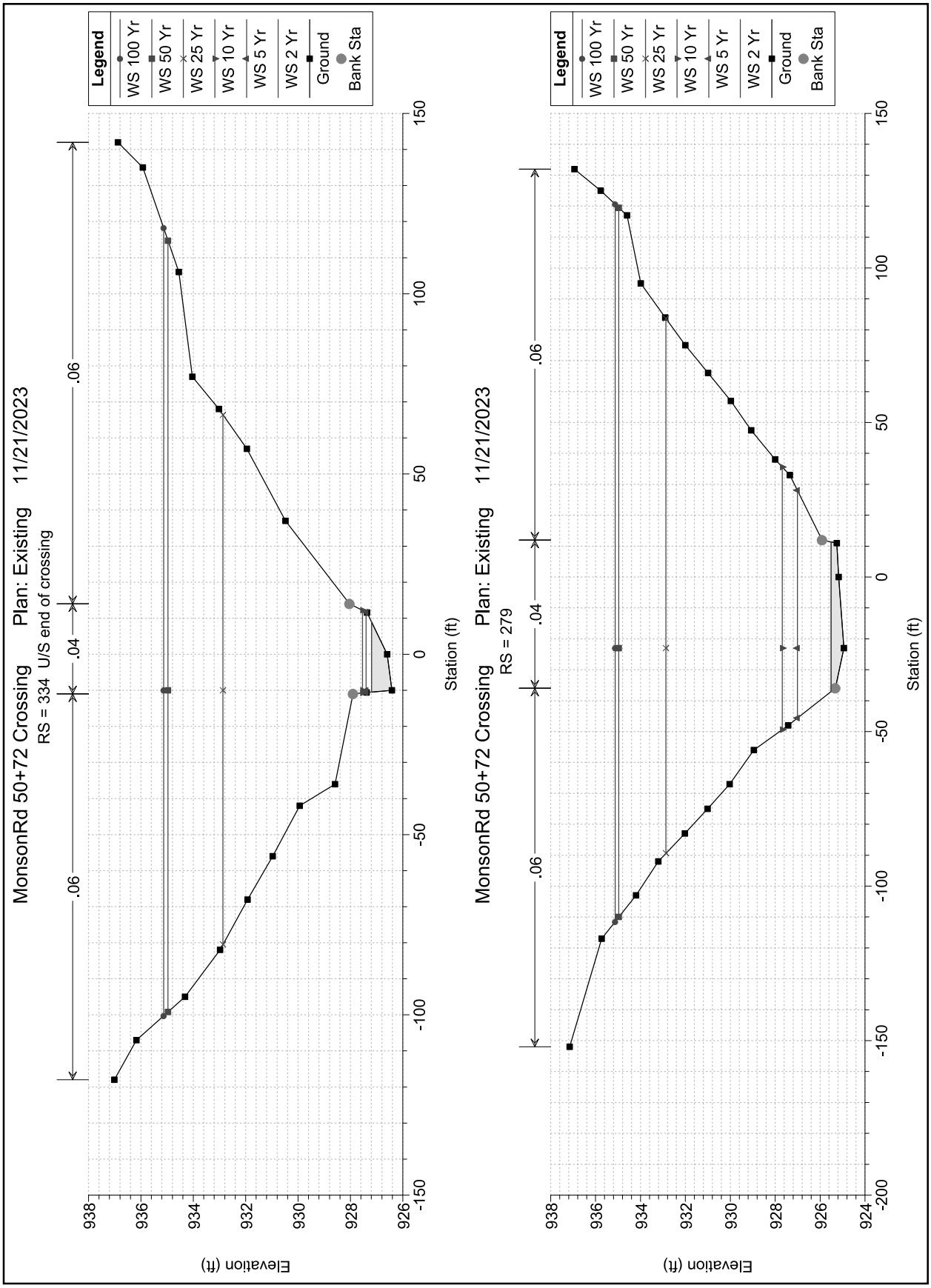
HEC-RAS Computed Results for crossing 50+72 proposed

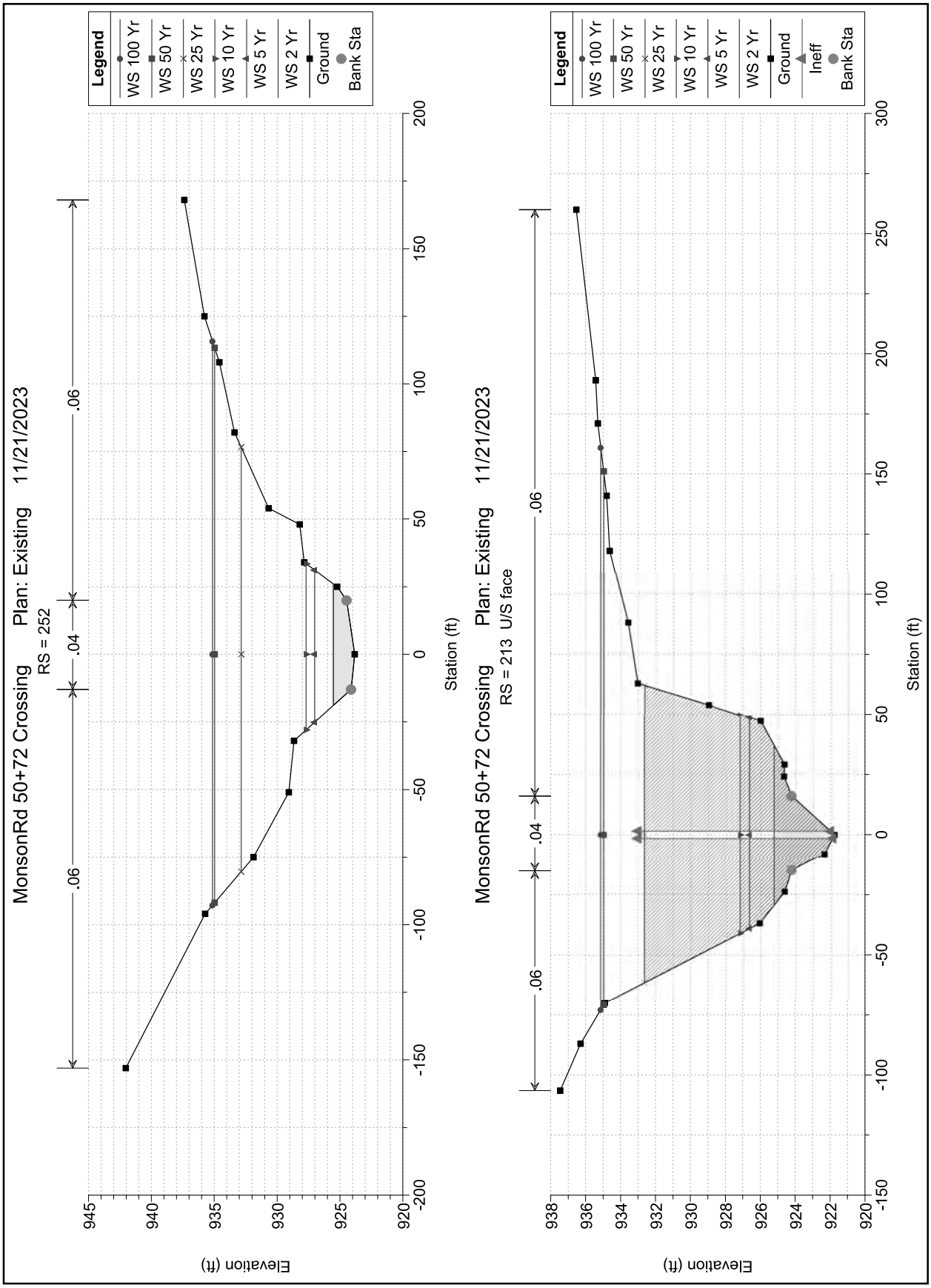
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	
DESIGN FLOOD DISCHARGE (C.F.S)	116
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	10.75
DESIGN FLOOD ELEVATION (FEET, NAVD)	932.64
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	163
BASE FLOOD ELEVATION (FEET, NAVD)	933.34
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

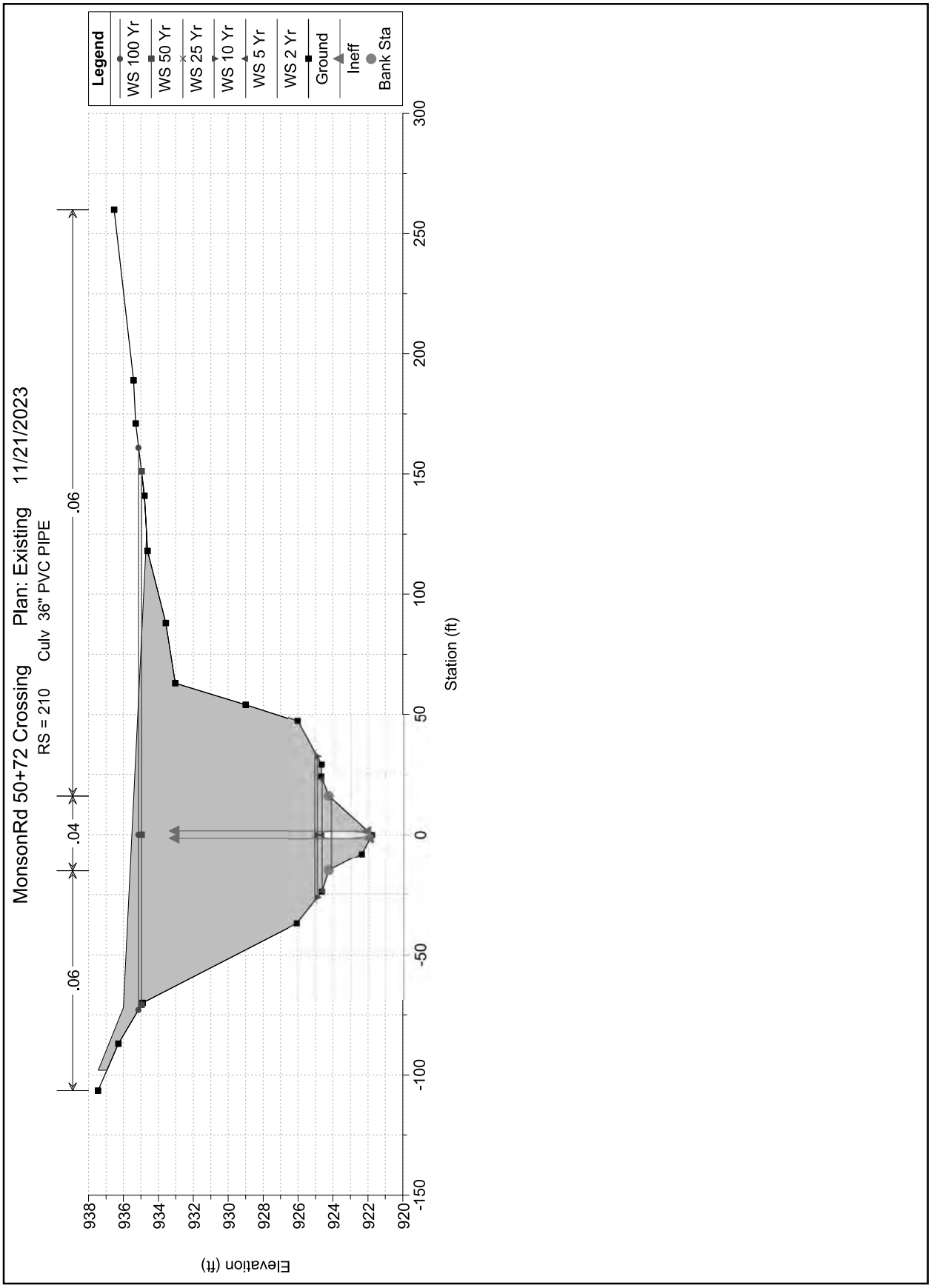
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	40
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	
DESIGN FLOOD ELEVATION (FEET,NAVD)	

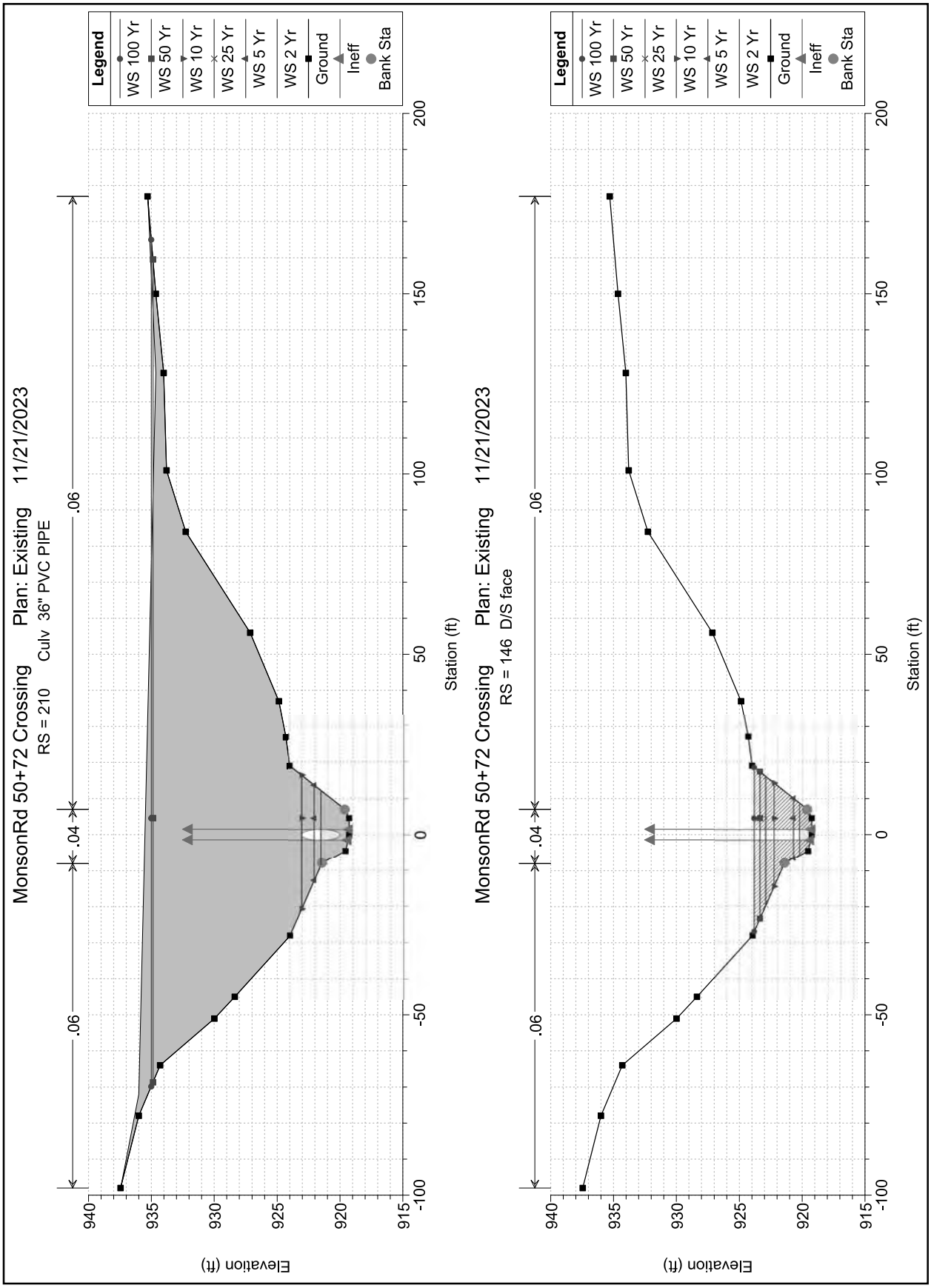
Section	Length (ft)	Span (ft)	Diameter (ft)	Invert (u/s)	Invert (d/s)
Circular Culvert	60.8	3	3	922.04	920.04

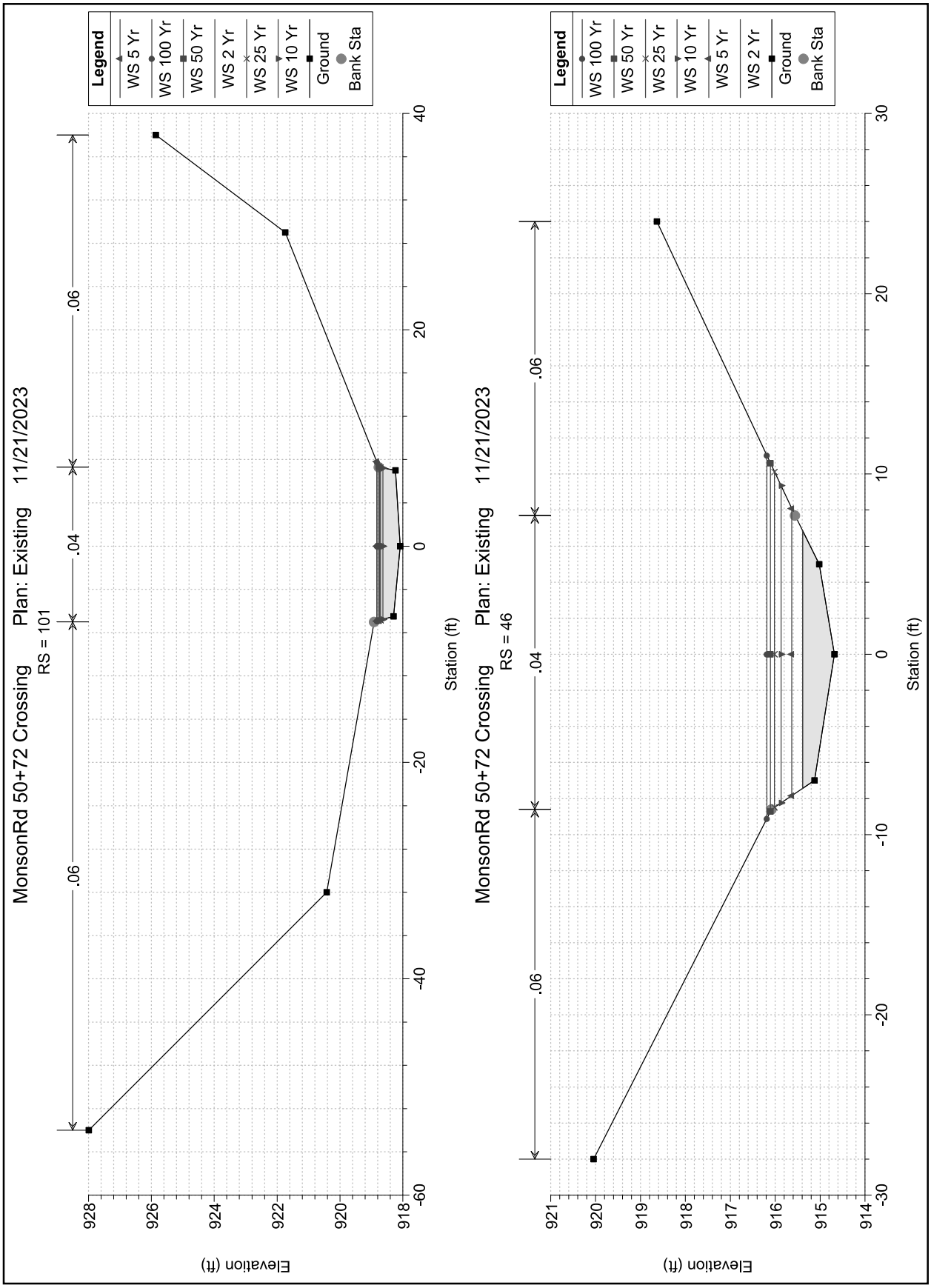

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
Main Channel Brook at 50+72
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
940
935
930
925
920
915
910
0
50
100
150
200
250
300
350
46
101
146
210
213
252
279
334

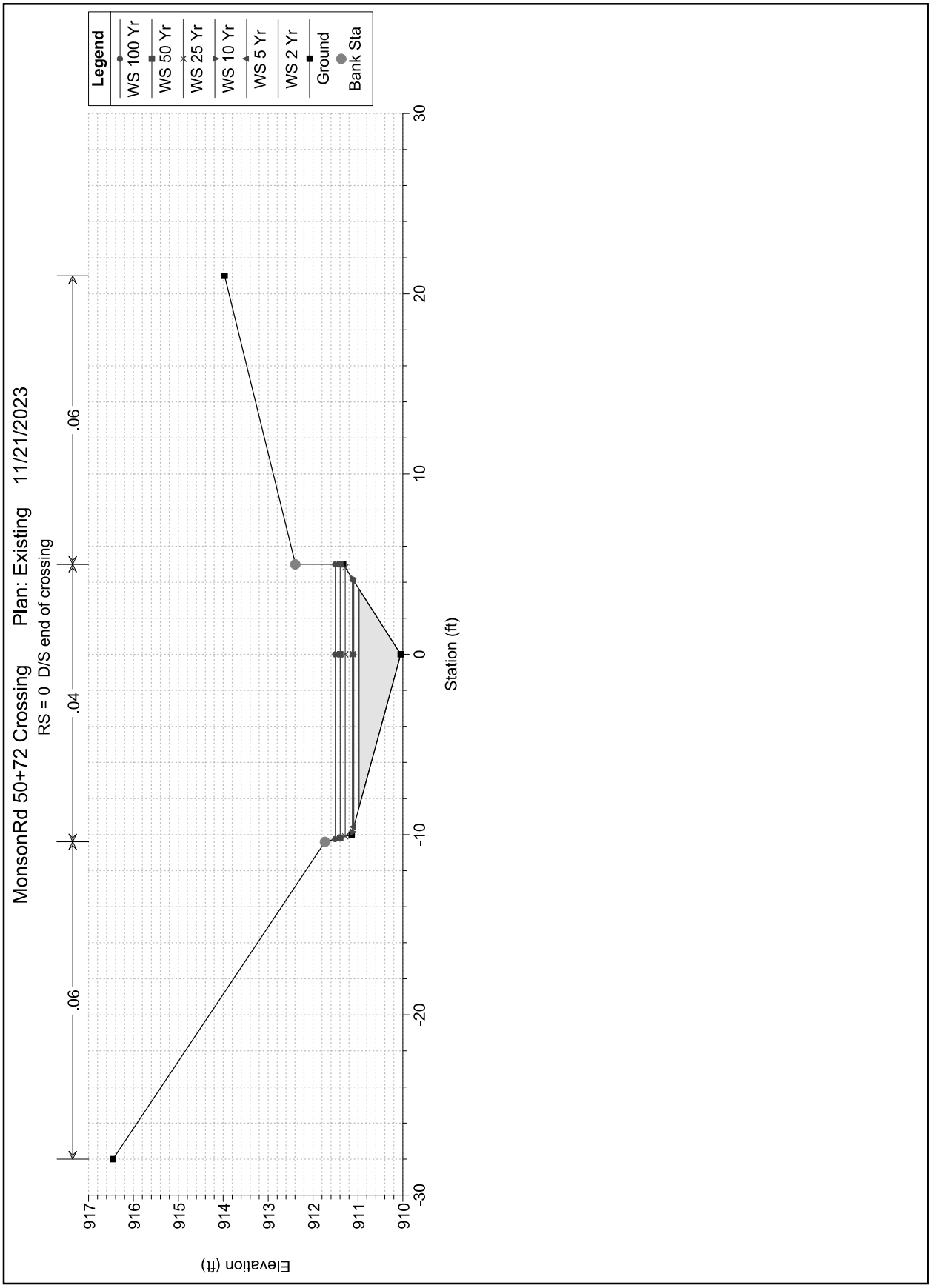

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 334 U/S end of crossing
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
150
100
50
0
-50
-100
-150
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 279
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
924
150
100
50
0
-50
-100
-150
-200


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 252
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 213 U/S face
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
938
936
934
932
930
928
926
924
922
920
Station (ft)
-150
-100
-50
0
50
100
150
200
250
300


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 10 Yr
WS 25 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
940
935
930
925
920
915
-100
-50
0
50
100
150
200
Station (ft)
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 146 D/S face
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
940
935
930
925
920
915
-100
-50
0
50
100
150
200
Station (ft)


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 101
Legend
WS 5 Yr
WS 100 Yr
WS 50 Yr
WS 2 Yr
WS 25 Yr
WS 10 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
928
926
924
922
920
918
40
20
0
-20
-40
-60
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 46
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
921
920
919
918
917
916
915
914
30
20
10
0
-10
-20
-30


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 0 D/S end of crossing
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
917
916
915
914
913
912
911
910
Station (ft)
30
20
10
0
-10
-20
-30

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	334	2 Yr	40.00	926.41	927.20	927.20	927.46	0.030832	4.07	9.83	19.51	1.01
Brook at 50+72	334	5 Yr	65.00	926.41	927.41	927.41	927.73	0.028816	4.58	14.19	22.34	1.01
Brook at 50+72	334	10 Yr	86.00	926.41	927.54	927.54	927.93	0.027344	4.98	17.25	22.94	1.01
Brook at 50+72	334	25 Yr	116.00	926.41	932.86	927.72	932.87	0.000013	0.43	463.57	146.85	0.03
Brook at 50+72	334	50 Yr	139.00	926.41	934.96	927.84	934.97	0.000005	0.31	831.05	213.91	0.02
Brook at 50+72	334	100 Yr	163.00	926.41	935.13	927.96	935.13	0.000006	0.35	867.47	218.55	0.02
Brook at 50+72	279	2 Yr	40.00	924.94	925.51	925.40	925.58	0.011315	2.13	18.87	48.50	0.60
Brook at 50+72	279	5 Yr	65.00	924.94	927.01	925.50	927.01	0.000144	0.68	107.26	73.71	0.09
Brook at 50+72	279	10 Yr	86.00	924.94	927.69	925.58	927.69	0.000081	0.63	161.79	85.03	0.07
Brook at 50+72	279	25 Yr	116.00	924.94	932.86		932.87	0.000002	0.21	823.56	173.02	0.01
Brook at 50+72	279	50 Yr	139.00	924.94	934.96		934.97	0.000001	0.18	1241.22	229.51	0.01
Brook at 50+72	279	100 Yr	163.00	924.94	935.13		935.13	0.000001	0.21	1280.14	232.20	0.01
Brook at 50+72	252	2 Yr	40.00	923.82	925.53		925.54	0.000268	0.78	55.96	44.97	0.11
Brook at 50+72	252	5 Yr	65.00	923.82	927.01		927.01	0.000060	0.59	130.59	56.23	0.06
Brook at 50+72	252	10 Yr	86.00	923.82	927.69		927.69	0.000049	0.61	170.66	61.43	0.06
Brook at 50+72	252	25 Yr	116.00	923.82	932.86		932.87	0.000002	0.25	759.54	157.00	0.01
Brook at 50+72	252	50 Yr	139.00	923.82	934.96		934.97	0.000001	0.21	1137.50	205.18	0.01
Brook at 50+72	252	100 Yr	163.00	923.82	935.13		935.13	0.000002	0.24	1172.36	208.53	0.01
Brook at 50+72	213	2 Yr	40.00	921.80	925.25	923.65	925.49	0.002277	3.96	10.10	66.47	0.38
Brook at 50+72	213	5 Yr	65.00	921.80	926.65	924.33	926.97	0.001884	4.55	14.30	87.66	0.37
Brook at 50+72	213	10 Yr	86.00	921.80	927.19	924.83	927.64	0.002312	5.41	15.91	90.93	0.41
Brook at 50+72	213	25 Yr	116.00	921.80	932.64	925.49	932.85	0.000398	3.59	32.28	123.70	0.19
Brook at 50+72	213	50 Yr	139.00	921.80	934.96	925.94	934.97	0.000001	0.21	1214.13	221.92	0.01
Brook at 50+72	213	100 Yr	163.00	921.80	935.13	926.41	935.13	0.000001	0.24	1252.53	233.86	0.01
Brook at 50+72	210		Culvert									
Brook at 50+72	146	2 Yr	40.00	919.29	920.26	921.08	923.38	0.157973	14.17	2.82	14.54	2.58
Brook at 50+72	146	5 Yr	65.00	919.29	920.73	921.77	924.42	0.109571	15.42	4.22	16.69	2.29
Brook at 50+72	146	10 Yr	86.00	919.29	922.26	922.26	923.74	0.016438	9.76	8.81	28.77	1.00
Brook at 50+72	146	25 Yr	116.00	919.29	922.92	922.92	924.72	0.015232	10.75	10.79	35.79	1.00
Brook at 50+72	146	50 Yr	139.00	919.29	923.38	923.38	925.41	0.014659	11.43	12.16	40.68	1.00
Brook at 50+72	146	100 Yr	163.00	919.29	923.83	923.83	926.09	0.014206	12.07	13.51	45.47	1.00
Brook at 50+72	101	2 Yr	40.00	918.08	918.74	918.82	919.15	0.044569	5.14	7.78	14.15	1.22
Brook at 50+72	101	5 Yr	65.00	918.08	918.83	919.07	919.62	0.071050	7.15	9.10	14.75	1.58

Proposal No. 608163-128112

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72 (Continued)

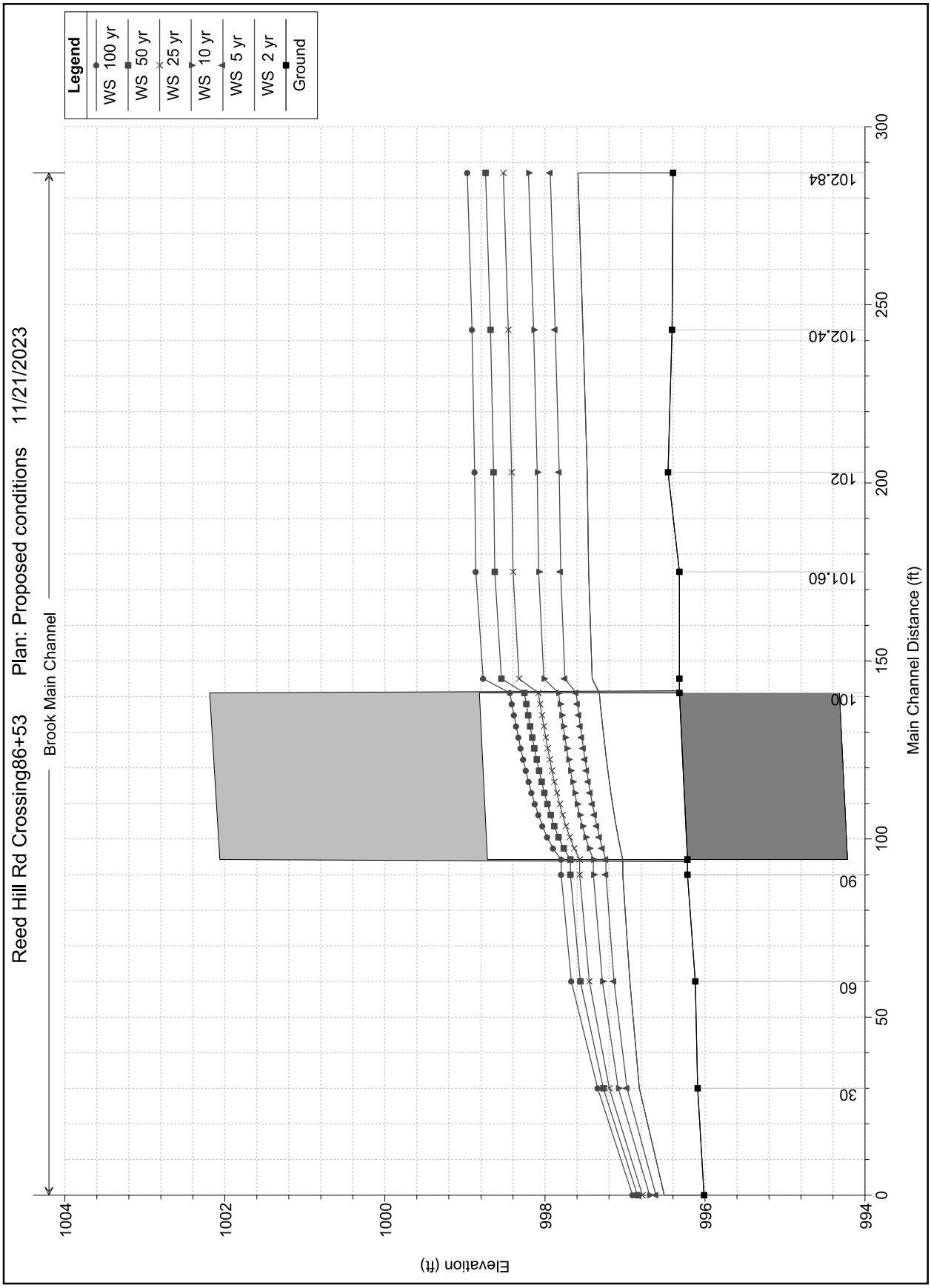
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	101	10 Yr	86.00	918.08	918.63	919.27	921.55	0.410756	13.69	6.28	14.00	3.60
Brook at 50+72	101	25 Yr	116.00	918.08	918.71	919.50	922.56	0.445820	15.74	7.37	14.11	3.84
Brook at 50+72	101	50 Yr	139.00	918.08	918.77	919.65	923.26	0.459074	17.01	8.17	14.23	3.95
Brook at 50+72	101	100 Yr	163.00	918.08	918.82	919.79	923.95	0.465437	18.16	8.99	14.69	4.03
Brook at 50+72	46	2 Yr	40.00	914.68	915.39	915.56	915.98	0.079859	6.16	6.49	14.29	1.61
Brook at 50+72	46	5 Yr	65.00	914.68	915.63	915.80	916.27	0.053473	6.40	10.16	15.93	1.40
Brook at 50+72	46	10 Yr	86.00	914.68	915.87	915.97	916.46	0.033671	6.15	14.18	17.60	1.16
Brook at 50+72	46	25 Yr	116.00	914.68	916.01	916.19	916.79	0.037296	7.09	16.77	18.60	1.25
Brook at 50+72	46	50 Yr	139.00	914.68	916.11	916.34	917.03	0.040066	7.75	18.51	19.32	1.31
Brook at 50+72	46	100 Yr	163.00	914.68	916.19	916.49	917.28	0.042985	8.43	20.12	20.15	1.37
Brook at 50+72	0	2 Yr	40.00	910.05	910.97	911.22	911.77	0.105045	7.14	5.60	12.10	1.85
Brook at 50+72	0	5 Yr	65.00	910.05	911.09	911.45	912.39	0.145922	9.12	7.13	13.65	2.22
Brook at 50+72	0	10 Yr	86.00	910.05	911.12	911.62	913.13	0.217622	11.36	7.57	14.06	2.73
Brook at 50+72	0	25 Yr	116.00	910.05	911.28	911.85	913.43	0.177670	11.74	9.88	14.92	2.54
Brook at 50+72	0	50 Yr	139.00	910.05	911.39	912.01	913.64	0.156288	12.03	11.56	15.17	2.43
Brook at 50+72	0	100 Yr	163.00	910.05	911.50	912.16	913.87	0.140339	12.34	13.21	15.25	2.34

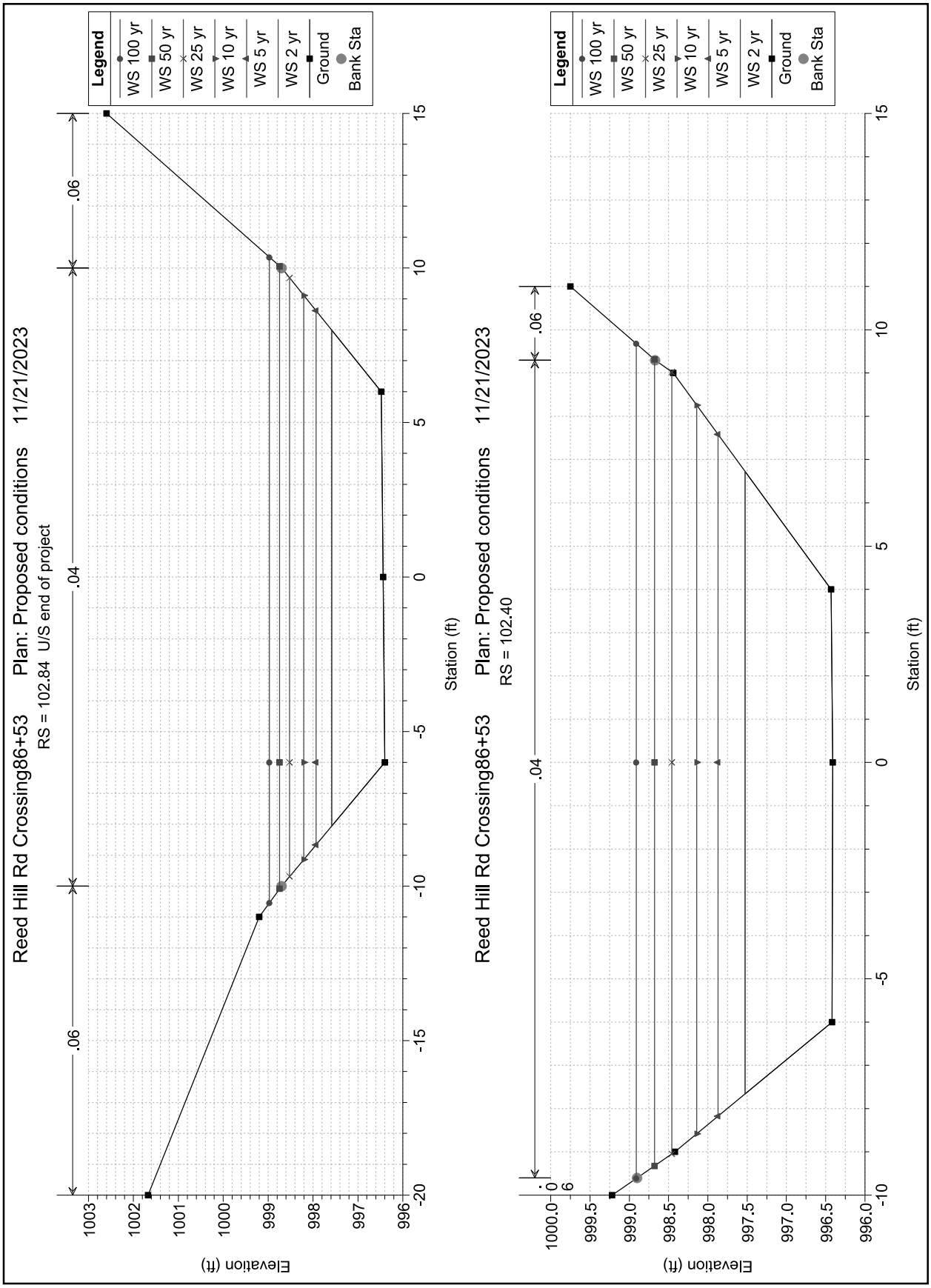
HEC-RAS Computed Results for crossing 86+53 proposed

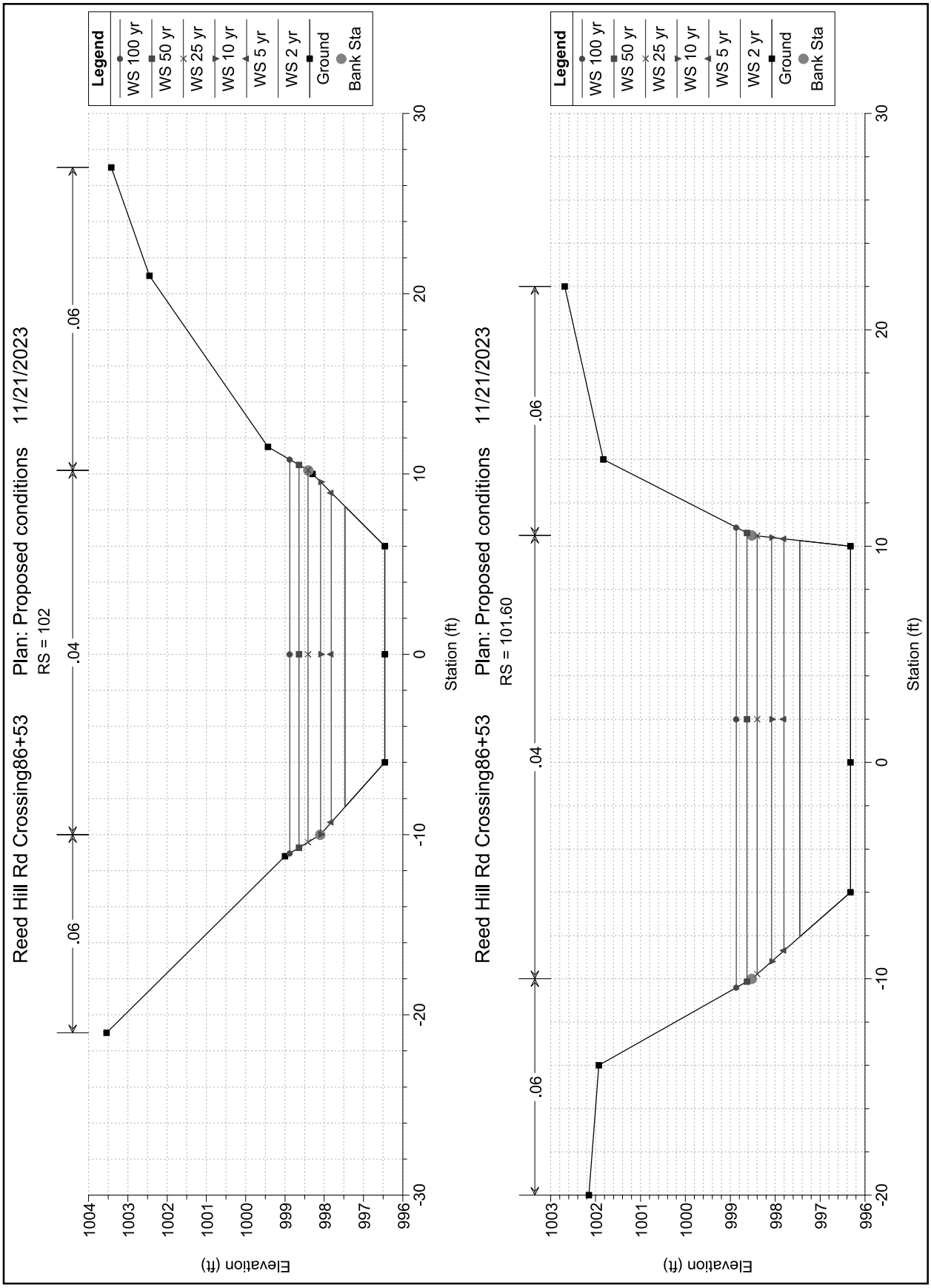
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.32
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

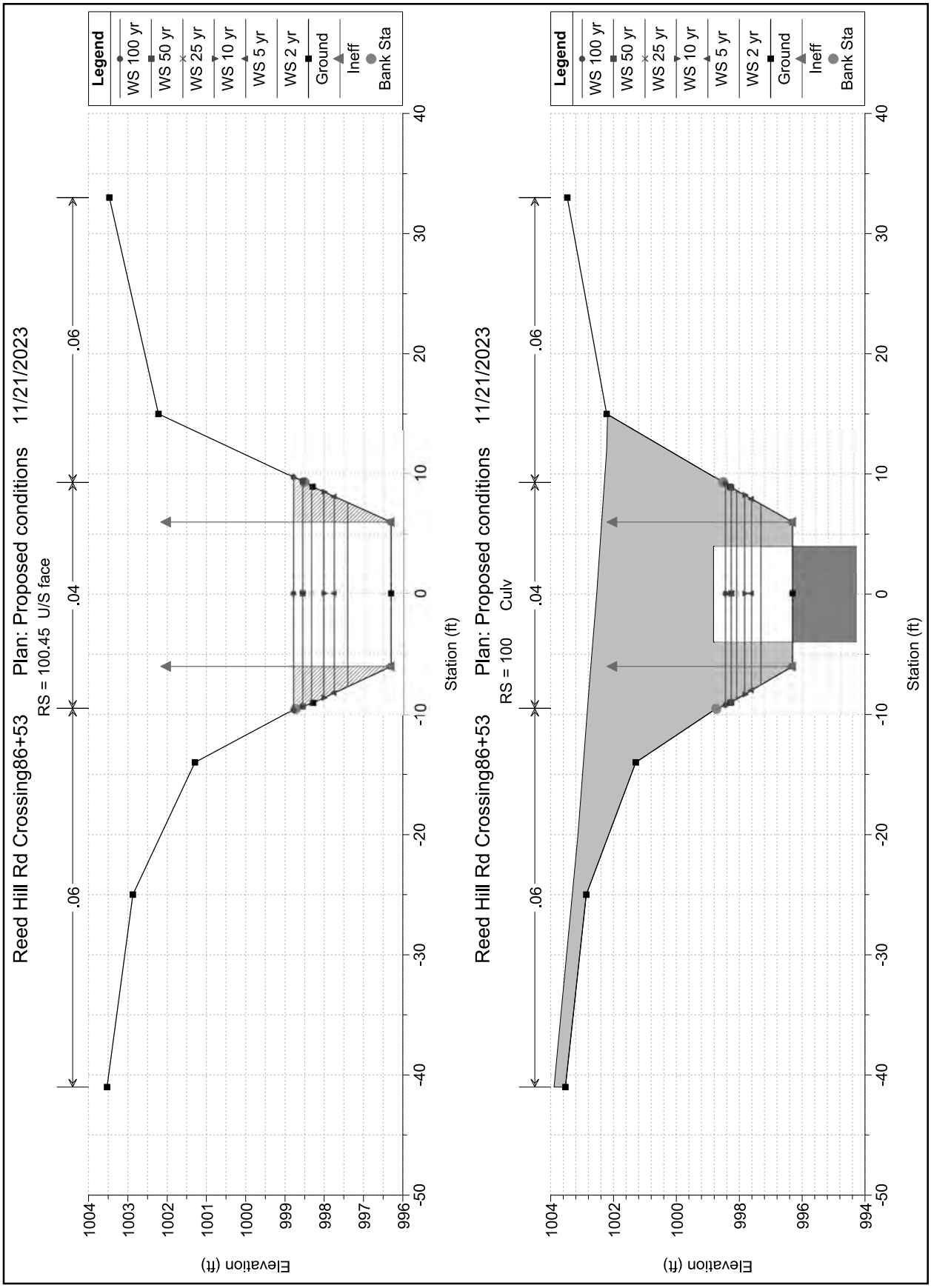
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	8.91
DESIGN FLOOD ELEVATION (FEET,NAVD)	1001.42

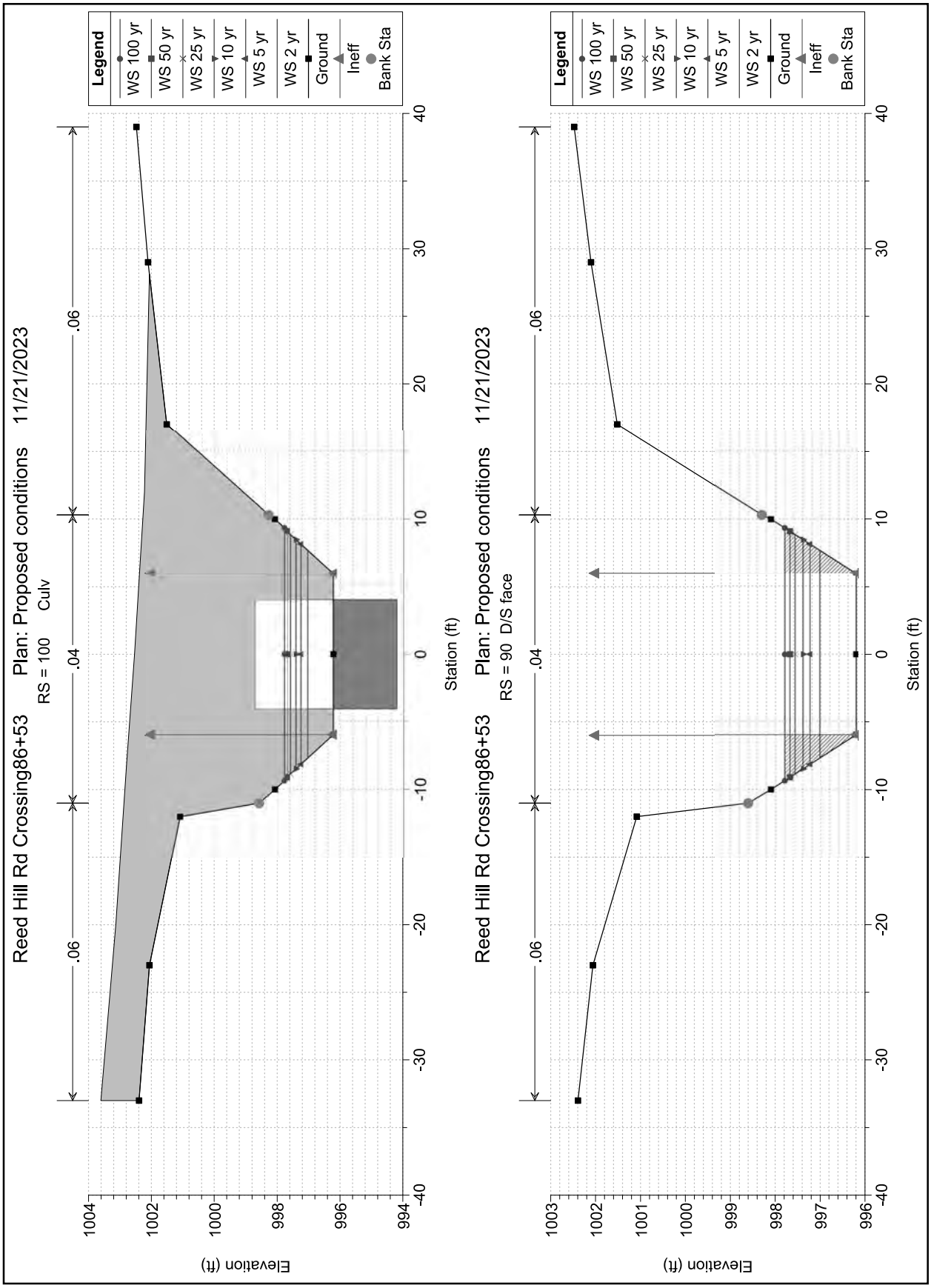
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	50	8	4.5	994.32	994.22

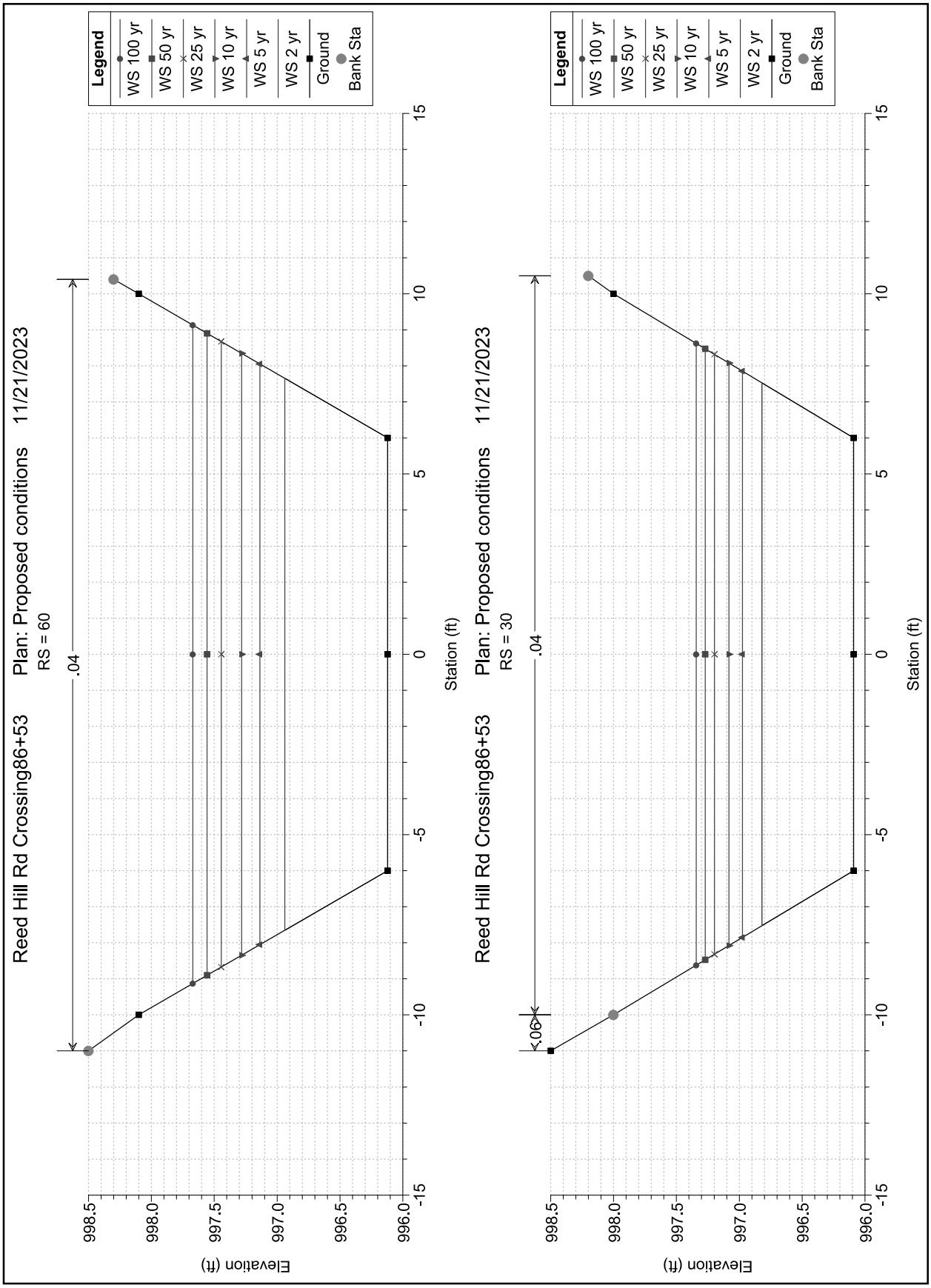

Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
Brook Main Channel
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Elevation (ft)
Main Channel Distance (ft)
994
996
998
1000
1002
1004
0
50
100
150
200
250
300
30
60
90
100
101.60
102
102.40
102.84

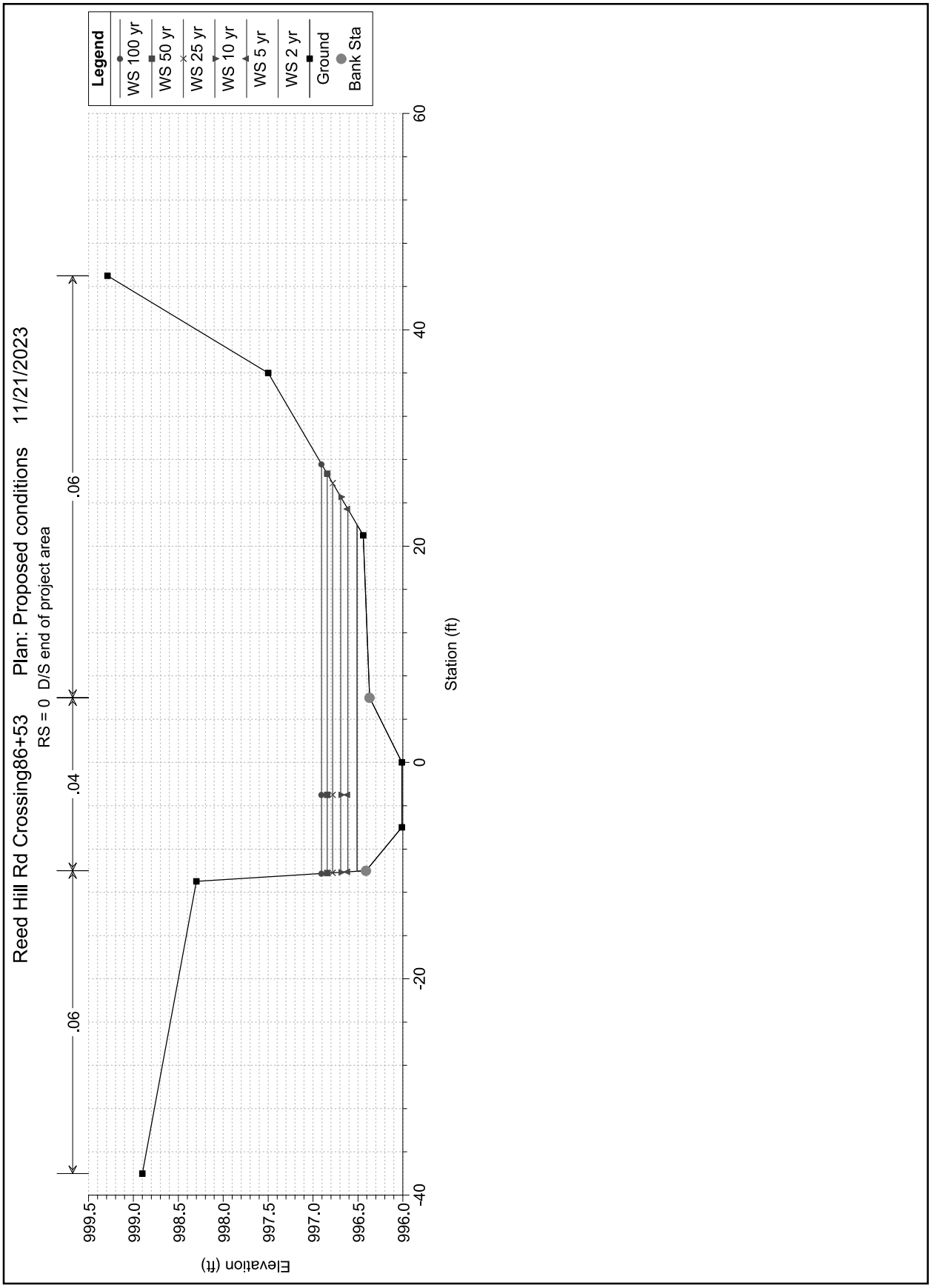

Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.84 U/S end of project
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
.06
.04
.06
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.40
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
.04
.06


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 101.60
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100.45 U/S face
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100 Culv
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100
Culv
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 90
D/S face
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 60
.04
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
998.5
998.0
997.5
997.0
996.5
996.0
15
10
5
0
-5
-10
-15
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 30
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
999.5
999.0
998.5
998.0
997.5
997.0
996.5
996.0
-40
-20
0
20
40
60
Station (ft)

HEC-RAS Plan: prop River: Brook Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	102.84	2 yr	18.00	996.40	997.59	996.84	997.61	0.000952	1.12	16.08	16.06	0.20
Main Channel	102.84	5 yr	29.00	996.40	997.93	996.99	997.96	0.000986	1.33	21.88	17.29	0.21
Main Channel	102.84	10 yr	39.00	996.40	998.21	997.10	998.24	0.000992	1.46	26.72	18.25	0.21
Main Channel	102.84	25 yr	52.00	996.40	998.52	997.24	998.56	0.000986	1.59	32.64	19.37	0.22
Main Channel	102.84	50 yr	62.00	996.40	998.74	997.33	998.79	0.000966	1.67	37.02	20.14	0.22
Main Channel	102.84	100 yr	73.00	996.40	998.97	997.43	999.02	0.000908	1.75	41.71	20.89	0.21
Main Channel	102.40	2 yr	18.00	996.41	997.53		997.55	0.001475	1.33	13.50	14.38	0.24
Main Channel	102.40	5 yr	29.00	996.41	997.87		997.91	0.001473	1.55	18.70	15.76	0.25
Main Channel	102.40	10 yr	39.00	996.41	998.14		998.19	0.001444	1.69	23.12	16.84	0.25
Main Channel	102.40	25 yr	52.00	996.41	998.46		998.51	0.001393	1.82	28.63	18.07	0.25
Main Channel	102.40	50 yr	62.00	996.41	998.68		998.74	0.001332	1.90	32.71	18.64	0.25
Main Channel	102.40	100 yr	73.00	996.41	998.91		998.97	0.001248	1.97	37.10	19.29	0.25
Main Channel	102	2 yr	18.00	996.46	997.47		997.49	0.001395	1.24	14.48	16.66	0.24
Main Channel	102	5 yr	29.00	996.46	997.82		997.85	0.001276	1.41	20.59	18.28	0.23
Main Channel	102	10 yr	39.00	996.46	998.10		998.13	0.001197	1.51	25.80	19.54	0.23
Main Channel	102	25 yr	52.00	996.46	998.42		998.46	0.001068	1.62	32.24	20.64	0.23
Main Channel	102	50 yr	62.00	996.46	998.64		998.69	0.000972	1.69	36.99	21.23	0.22
Main Channel	102	100 yr	73.00	996.46	998.88		998.93	0.000897	1.75	42.05	21.84	0.22
Main Channel	101.60	2 yr	18.00	996.32	997.45		997.47	0.000625	0.93	19.44	18.32	0.16
Main Channel	101.60	5 yr	29.00	996.32	997.80		997.82	0.000662	1.12	25.98	19.03	0.17
Main Channel	101.60	10 yr	39.00	996.32	998.08		998.10	0.000680	1.25	31.30	19.60	0.17
Main Channel	101.60	25 yr	52.00	996.32	998.40		998.43	0.000690	1.38	37.71	20.25	0.18
Main Channel	101.60	50 yr	62.00	996.32	998.63		998.66	0.000680	1.46	42.37	20.74	0.18
Main Channel	101.60	100 yr	73.00	996.32	998.86		998.90	0.000657	1.55	47.33	21.27	0.18
Main Channel	100.45	2 yr	18.00	996.32	997.41	996.73	997.44	0.001225	1.38	13.08	15.27	0.23
Main Channel	100.45	5 yr	29.00	996.32	997.75	996.88	997.79	0.001288	1.69	17.15	16.29	0.25
Main Channel	100.45	10 yr	39.00	996.32	998.01	997.01	998.07	0.001319	1.92	20.34	17.09	0.26
Main Channel	100.45	25 yr	52.00	996.32	998.32	997.16	998.40	0.001340	2.16	24.06	18.02	0.27
Main Channel	100.45	50 yr	62.00	996.32	998.54	997.26	998.63	0.001347	2.32	26.69	18.67	0.27
Main Channel	100.45	100 yr	73.00	996.32	998.77	997.37	998.87	0.001349	2.48	29.43	19.31	0.28
Main Channel	100		Culvert									
Main Channel	90	2 yr	18.00	996.22	997.03	996.63	997.08	0.003347	1.86	9.67	15.43	0.37
Main Channel	90	5 yr	29.00	996.22	997.24	996.79	997.33	0.003986	2.37	12.22	16.33	0.41
Main Channel	90	10 yr	39.00	996.22	997.39	996.91	997.51	0.004479	2.77	14.09	17.00	0.45

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 yr	52.00	996.22	997.57	997.06	997.73	0.005057	3.22	16.15	17.73	0.49
Main Channel	90	50 yr	62.00	996.22	997.68	997.17	997.88	0.005461	3.54	17.54	18.22	0.52
Main Channel	90	100 yr	73.00	996.22	997.80	997.28	998.03	0.005871	3.86	18.93	18.71	0.54
Main Channel	60	2 yr	18.00	996.12	996.94		996.98	0.002948	1.61	11.18	15.31	0.33
Main Channel	60	5 yr	29.00	996.12	997.14		997.20	0.003645	2.03	14.28	16.11	0.38
Main Channel	60	10 yr	39.00	996.12	997.28		997.37	0.004144	2.34	16.67	16.70	0.41
Main Channel	60	25 yr	52.00	996.12	997.45		997.56	0.004663	2.67	19.45	17.35	0.45
Main Channel	60	50 yr	62.00	996.12	997.56		997.69	0.004990	2.90	21.41	17.81	0.47
Main Channel	60	100 yr	73.00	996.12	997.67		997.82	0.005291	3.11	23.46	18.26	0.48
Main Channel	30	2 yr	18.00	996.09	996.82		996.87	0.004345	1.82	9.88	15.06	0.40
Main Channel	30	5 yr	29.00	996.09	996.97		997.06	0.005849	2.37	12.25	15.70	0.47
Main Channel	30	10 yr	39.00	996.09	997.08	996.75	997.20	0.007099	2.79	13.98	16.16	0.53
Main Channel	30	25 yr	52.00	996.09	997.20	996.88	997.36	0.008642	3.28	15.86	16.64	0.59
Main Channel	30	50 yr	62.00	996.09	997.27	996.98	997.48	0.009811	3.63	17.10	16.95	0.64
Main Channel	30	100 yr	73.00	996.09	997.34	997.07	997.59	0.011118	3.99	18.30	17.24	0.68
Main Channel	0	2 yr	18.00	996.01	996.51	996.49	996.62	0.020035	2.76	7.67	32.01	0.79
Main Channel	0	5 yr	29.00	996.01	996.61	996.59	996.76	0.020008	3.24	11.09	33.54	0.82
Main Channel	0	10 yr	39.00	996.01	996.69	996.66	996.86	0.020010	3.58	13.78	34.70	0.84
Main Channel	0	25 yr	52.00	996.01	996.78	996.75	996.98	0.020022	3.95	16.93	36.01	0.86
Main Channel	0	50 yr	62.00	996.01	996.84	996.81	997.07	0.020016	4.20	19.19	36.92	0.88
Main Channel	0	100 yr	73.00	996.01	996.91	996.87	997.15	0.020015	4.44	21.54	37.84	0.89

APPENDIX F

Drainage Swales

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 11+50 Lt to STA 13+50 Lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.41	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.031	ft/ft	
	τ		0.79	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA14+50 to 17+00 LT

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon d S$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow From Express Calcs	0.63	ft	(10 year)
S	avg. bed slope	0.035	ft/ft	

τ	1.38	lb/ft^2

Rock Riprap (6" diameter) (Permissible Unit Shear Stress 2.00 lb/ft^2)

D50 bottom	5	in

$D50_{sides} = K_1/K_2 * (D50)_{bottom}$

K1 Ratio of shear streese on sides and bottom
Side slope of 2:1
B/d 1.59

K1	0.87

K2 Ratio of tractive force on the sides and bootm using Fig. 7-10
Angle of repose is 42°

K2	0.77

$D50_{sides}$	5.65	in

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA31+65 Lt to STA40+40

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon dS$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow From Express Calcs	0.57	ft	(10 year)
S	avg. bed slope	0.047	ft/ft	

τ	1.67	lb/ft^2

Rock Riprap (6" diameter) (Permissible Unit Shear Stress 2.00 lb/ft^2)

D50 bottom	5	in

$D50_{sides} = K_1/K_2 * (D50)_{bottom}$

K1 Ratio of shear streese on sides and bottom
Side slope of 2:1
B/d 1.75

K1	0.87

K2 Ratio of tractive force on the sides and bootm using Fig. 7-10
Angle of repose is 42°

K2	0.77

$D50_{sides}$	5.65	in

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA40+40 Lt to STA 46+50 lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.35	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.016	ft/ft	
	τ		0.35	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 70+50 TO 72+75

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.46	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.03	ft/ft	
	τ		0.86	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Proposing modified rockfill to comply with MassDOT PDDG standards for a swale with 3% slope

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 11+50 to 13+50

Trapezoidal

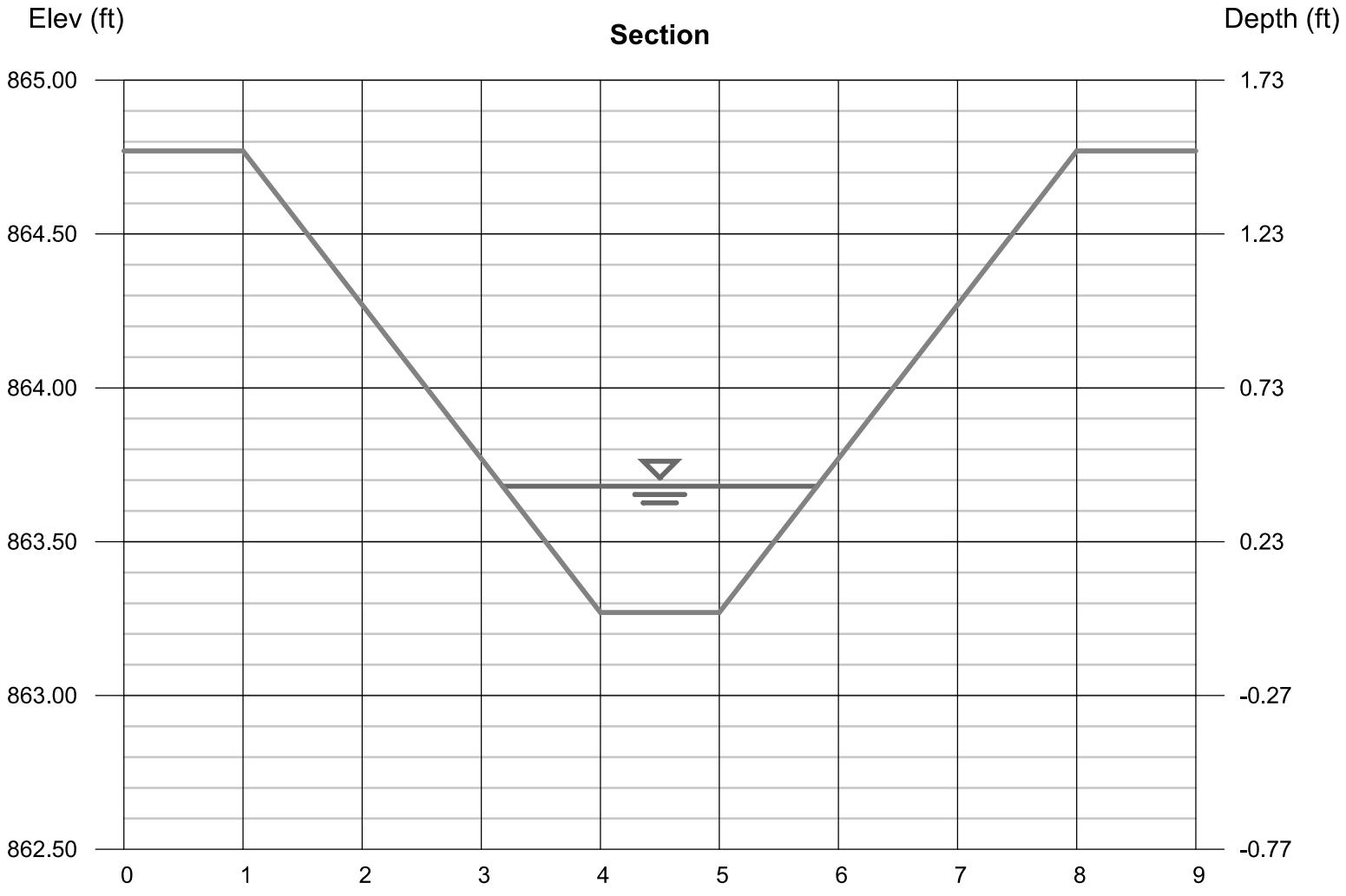
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 863.27
Slope (%)	= 3.10
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.38

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 2.380
Area (sqft)	= 0.75
Velocity (ft/s)	= 3.19
Wetted Perim (ft)	= 2.83
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 2.64
EGL (ft)	= 0.57



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 14+50 to 17+00

Trapezoidal

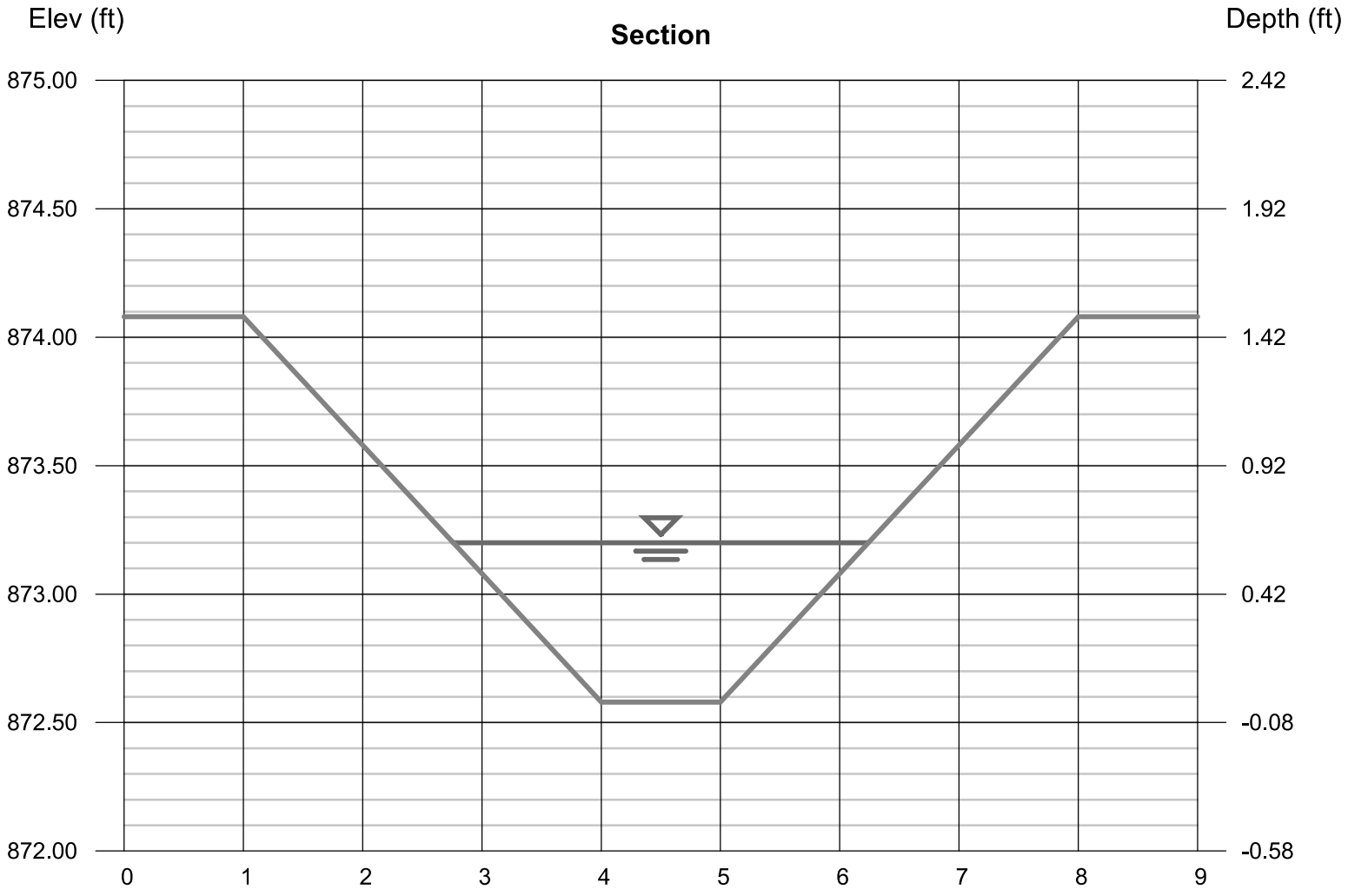
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 872.58
Slope (%)	= 3.90
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.14

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 6.140
Area (sqft)	= 1.39
Velocity (ft/s)	= 4.42
Wetted Perim (ft)	= 3.77
Crit Depth, Yc (ft)	= 0.69
Top Width (ft)	= 3.48
EGL (ft)	= 0.92



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 31+65

Trapezoidal

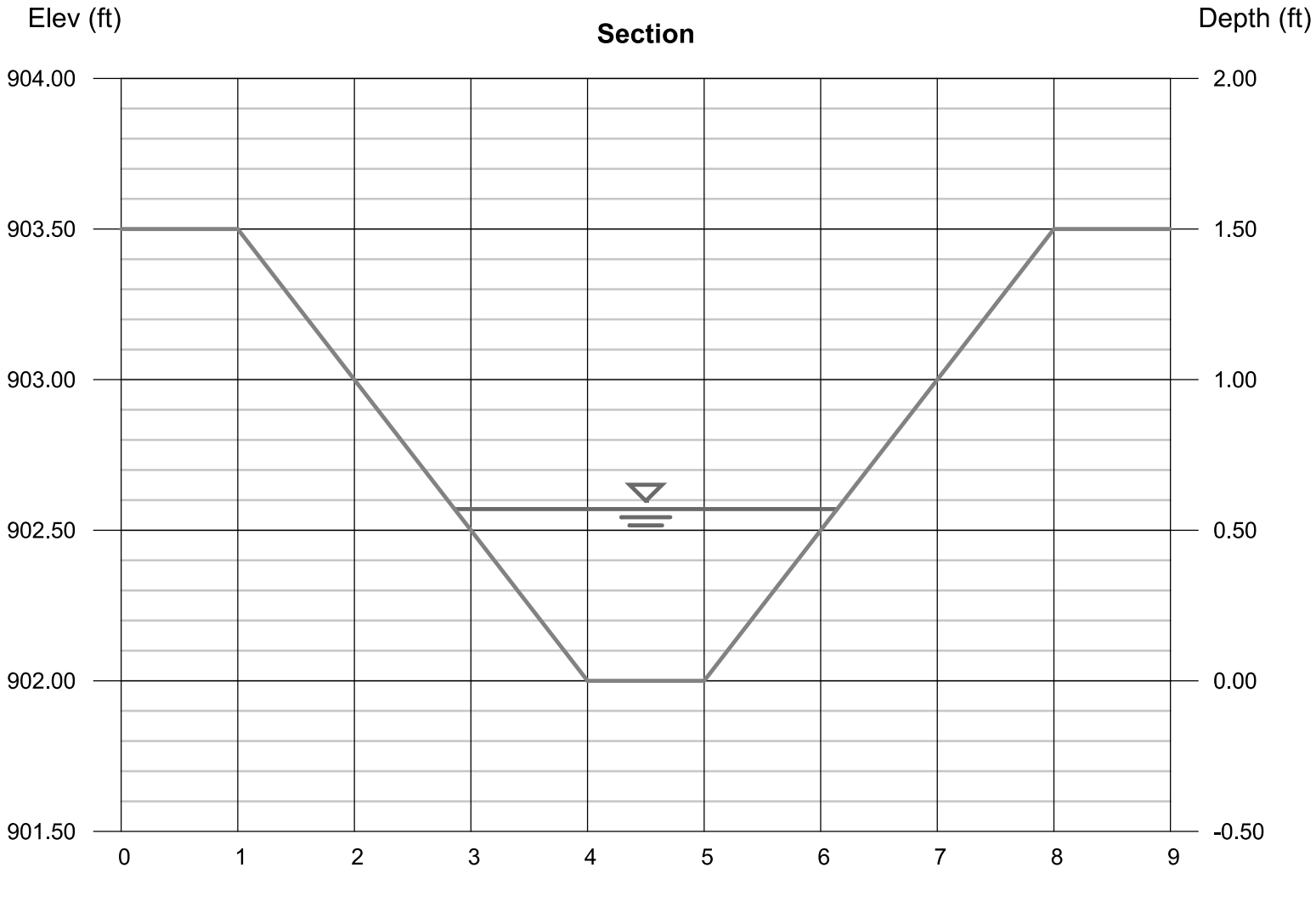
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 902.00
Slope (%)	= 4.70
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.66

Highlighted

Depth (ft)	= 0.57
Q (cfs)	= 5.660
Area (sqft)	= 1.22
Velocity (ft/s)	= 4.64
Wetted Perim (ft)	= 3.55
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 3.28
EGL (ft)	= 0.90



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 43+70

Trapezoidal

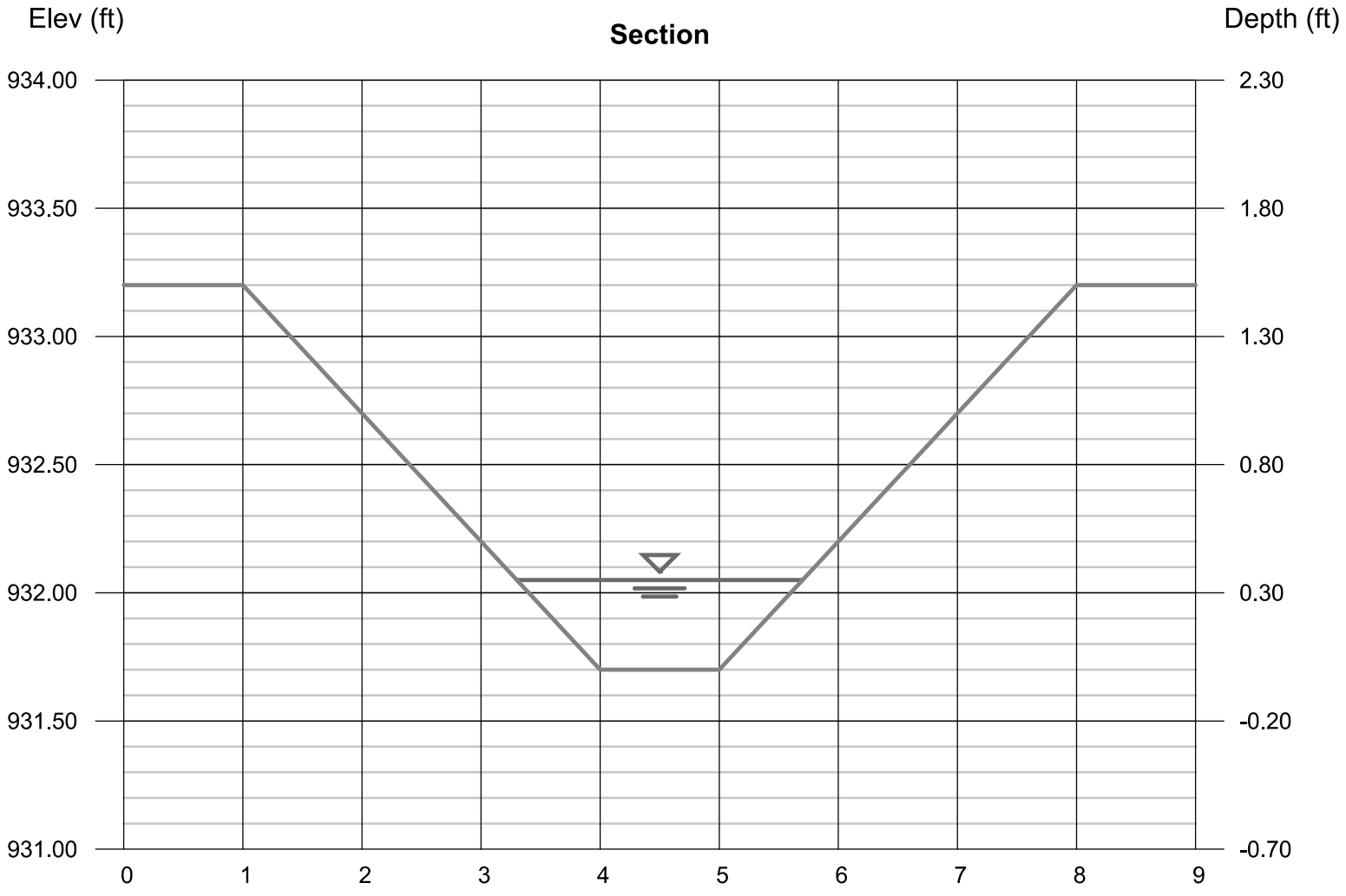
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 931.70
Slope (%)	= 1.60
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.23

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 1.230
Area (sqft)	= 0.59
Velocity (ft/s)	= 2.07
Wetted Perim (ft)	= 2.57
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 2.40
EGL (ft)	= 0.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 30 2023

Sta. 46+65

Triangular

Side Slopes (z:1)	= 6.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 930.00
Slope (%)	= 0.66
N-Value	= 0.033

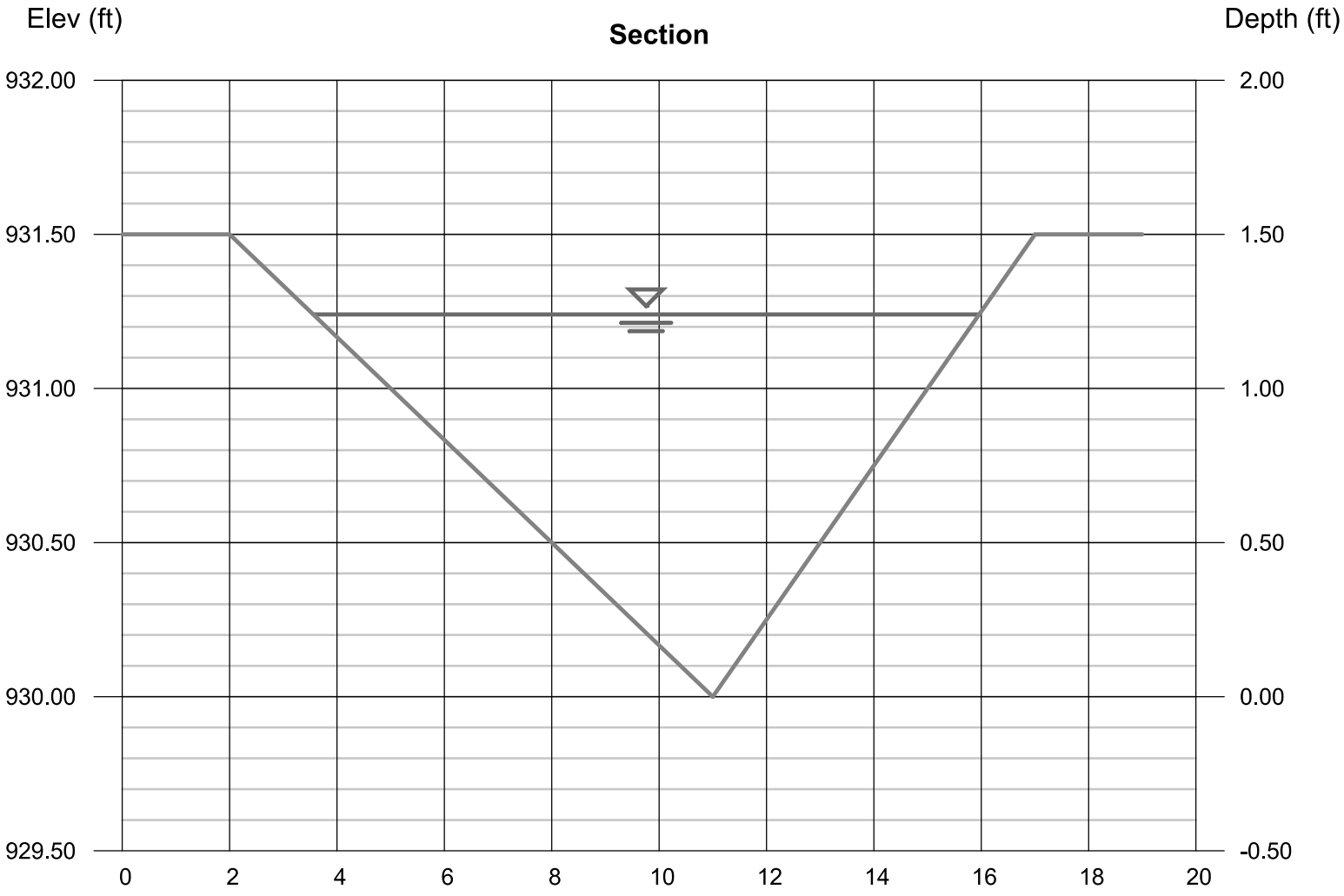
Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 20.00
Area (sqft)	= 7.69
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 12.66
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 12.40
EGL (ft)	= 1.35

Assuming diverted flow from Sta. 43+76 crossing - normal flow without diversion is 1.60 cfs



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

STA 72+75

Trapezoidal

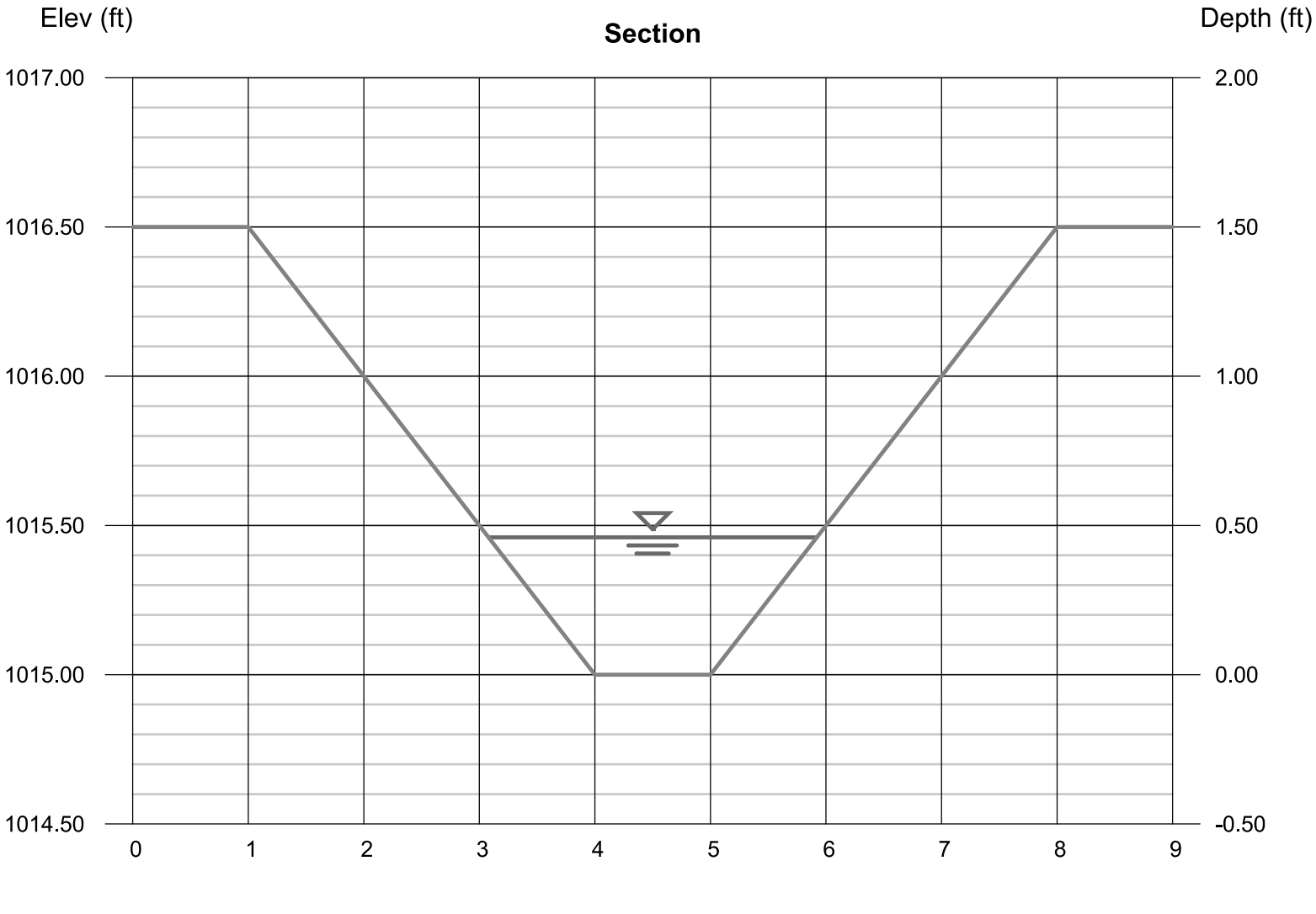
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1015.00
Slope (%)	= 3.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.94

Highlighted

Depth (ft)	= 0.46
Q (cfs)	= 2.940
Area (sqft)	= 0.88
Velocity (ft/s)	= 3.33
Wetted Perim (ft)	= 3.06
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 2.84
EGL (ft)	= 0.63



Monson Road Reconstruction
Wales, MA

Weston&Sampson ENGINEERS, INC.

Date: 4/8/2024
By: NSD
Checked By: RSV

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

i = 7.21 for 5 min
i = 4.00 for 15 min. Tc
10-yr Storm

Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)	Q=CiA
Proposed Drainage System									
	STA 11+50								
Swale		146,424	**3.361**	5,227	141,197		0.32	15	4.32
	STA 15+30								
Swale		263,398	**6.047**	14,906	88,478	160,014	0.27	15	6.61
	STA 31+65								
Swale		261,651	**6.007**	16,212	18,800	226,639	0.25	15	6.02
	STA 43+70								
Swale		33,770	**0.775**	9,772	6,265	17,733	0.42	15	1.31
	STA 46+65								
Swale		48,946	**1.124**	2,570	13,201	33,175	0.26	8	1.76
	STA 72+75								
Swale		161,325	**3.704**	5,642	6,630	149,053	0.23	15	3.39

NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover		C
Impervious		0.9
Grass		0.3
Unimproved (Woods)		0.2

APPENDIX G

Outlet Protection

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 15+33					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.29	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	9.86			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.74	ft	8.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT
Depth=	$3.3D_{50}$	2.45	FT
W1= 3Wo	(min.)	4.5	FT
W2=3Wo + 2/3L		11.17	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	4	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 22+25					
Wo	pipe diameter or span	(ft)	1.25			Input
Q	pipe(design) discharge	(cfs)	5.55	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1.25			
	Velocity	(ft/s)	5.36			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.44	ft	17.31	in

Calculated Riprap Apron Dimensions

L=	4D	5.00	FT
Depth=	$3.3D_{50}$	4.76	FT
W1= 3Wo	(min.)	3.75	FT
W2=3Wo + 2/3L		7.08	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 25+00					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.22	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	4.53			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.26	ft	3.09	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	0.85	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	7.5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 43+76	Twin 12" diameter pipes				
Wo	pipe diameter or span	(ft)	2			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.32	(HY-8)		
D	pipe rise	(ft)	2			

Velocity	(ft/s)	6.27

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.71	ft	8.54	in

Calculated Riprap Apron Dimensions

L=	4D	8.00	FT
Depth=	$3.3D_{50}$	2.35	FT
W1= 3Wo	(min.)	6	FT
W2=3Wo + 2/3L		12.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	16	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 46+65					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.94	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	6.75			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.61	ft	7.32	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.01	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	3	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 50+55					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	2.05	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	3.5			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.51	ft	6.18	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	1.70	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 51+20					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.75	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	5.83			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.15	ft	13.82	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.80	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 73+25					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.58	10-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	3.38			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.73	ft	8.73	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.40	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	9.5	FT
Depth	1.5	FT
W1	10	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 81+97					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.31	10-yr storm		Output
TW	tailwater depth	(ft)	0.1			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	6.12

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.98	ft	11.70	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.22	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 82+07					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.14	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	7.72			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.54	ft	18.48	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	5.08	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	2	FT
W1	5	FT
W2	14	FT

Project	Monson Road	Date:	4/8/2024
Project Number:	ENG23-0621	By:	NSD
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels
Chapter 10 Riprap Basins and Aprons

Location	Sta 85+72					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.78	25-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	3.96

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.85	ft	10.24	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	2.81	FT			
W1= 3Wo	(min.)	3	FT			
W2=3Wo + 2/3L		9.67	FT			

Proposed Modified Rockfill Scour Hole

Ls	8	FT
Depth	2	FT
W1	4.5	FT
W2	7	FT

Dimensions based on site conditions and proposed headwall configuration

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 1+50					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	1	25-yr storm		Output
TW	tailwater depth	(ft)	0.15	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	4.96			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.08	ft	0.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	0.25	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed

Existing Wetlands to Remain. Velocity is under 5 ft/s.

ATTACHMENT D

Operation and Maintenance Plan

LONG-TERM POLLUTION PREVENTION PLAN/
OPERATION AND MAINTENANCE PLAN
Town of Wales

I. Purpose and Scope

The purpose of this plan is to provide the maintenance staff of the Town of Wales guidelines and procedures for the operation and maintenance of the drainage systems for the Monson Road Transportation Improvement Project. Checklists will be utilized during the inspection and cleaning process and kept on file in the maintenance office.

The proposed site plan includes the following stormwater structures:

- Catch Basins
- Drainage Manholes
- Drainage Swales
- Discharge Points

II. Ownership

The Town of Wales Highway Department operates and maintains Town-wide roadways and drainage systems.

III. Responsible Party

The following individual is the primary contact for the implementation of this plan.

Name: Christopher Ryan, Highway Superintendent

Phone #: (413) 245-7494

IV. Schedule for Inspection and Maintenance Activities

A. Inspection

i. Structures, swales, and outfalls will be inspected annually for excess accumulation of sediment and debris, erosion or other problems.

B. Routine and Non-Routine Maintenance

i. Structures, swales, and outfalls shall be cleaned at least once a year, at a minimum, after the snow and ice removal

season and before spring rainfall events or as required due to conditions noted during inspections.

ii. Street sweeping: The roadways shall be swept once a year after the snow and ice removal season has ended and prior to spring rains.

iii. Erosion repairs will be completed on an as-needed basis.

V. Access to System

The drainage system is located within the Town right-of-way.

VI. Funding

The Highway Department maintains a budget as required to complete all highway related services. Inspection and maintenance of the systems is part of this yearly budget process.

VII. Illicit Discharges

No illicit discharges to watercourses or drainage structures are permitted in the Town of Wales.

VIII. Operation and Maintenance Log Forms

See attached sheets.

STORMWATER MANAGEMENT SYSTEM INSPECTION CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
STRUCTURES				

STRUCTURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

ATTACHMENT E

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

For Construction Activities At:

Monson Road Transportation Improvement Project
Wales, MA

Prepared For:

Town of Wales
3 Hegan Street
Wales, MA
(413) 245-7494– Christopher Ryan

Prepared By:

Weston & Sampson Engineers, Inc.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
(860) 513-1473

Site Contractor:

To Be Determined

1. Narrative

The purpose of this plan is to provide general guidelines and operation and maintenance procedures to the contractor during construction specifically with regards to erosion and sediment control.

The proposed project includes construction activities in, or close to, the limit of work includes bordering vegetated wetlands, mean annual high water and top of bank to perennial and intermittent stream). Activities includes excavation within existing pavement limits for the installation of storm drainage systems and the reconstruction of the existing paved roadways. Soils in the project area per the NRCS Web Soil Survey include:

- 307C – Paxton fine sandy loam, 8 to 15 percent slopes –Hydrologic Soil Group C
- 316B – Scituate fine sandy loam , 3 to 8 percent slopes, very stony – Hydrologic Soil Group C/D

Imported fill material will likely be limited to new road base and pipe bedding material unless excessive unsuitable materials are encountered within the paving limit.

2. Operation and Maintenance

A. The work covered by this plan consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this plan apply to all land disturbing activities required for this project

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as all other stated requirements.

D. The proposed erosion and sediment control measures that are to be installed are located on the construction drawings.

E. A rain gauge shall be placed at the project in a workable location and monitored during rainfall periods until all disturbed areas are stabilized. In the event, there is a rainfall greater than 1/2" in a 12 hour period, all erosion control measures shall be checked and repaired as required. If no rain gauge is used, all erosion control measures shall be checked after all rainfall events. A checklist (sample provided at the end of this plan) will be filled out by the contractor each week. The contractor shall designate a party to be responsible for the maintenance of all erosion and sediment control measures for the duration of the project. Inspections shall be completed weekly or

within 24 hours of a rain event as described above. When maintenance is required it shall be completed within 24 hours of being identified.

Designated Party: _____

F. All soil erosion and sediment control measures shall be installed, maintained, and implemented as shown on the construction drawings. It is the intent of this plan that soil erosion control measures are the first to be installed and the last to be removed. Surface waters on and adjacent to the site and abutting properties are to be protected from degradation and sedimentation. If other watercourses, streams, drainage-ways or abutting properties are jeopardized by construction, it shall be the contractor's responsibility to protect those waters and properties.

G. Make all necessary repairs to erosion control facilities as soon as possible. Silt fences and straw bale barriers, temporary sediment traps, and inlet protection which accumulate sediment and debris shall be cleaned and re-set as needed.

3. Notification

The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions. The Contractor shall, after receipt of such notice, 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 to act promptly, the Engineer may order stoppage of all or part of the work until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

4. Implementation

A. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer and the Conservation Commission to develop mutual understandings relative to compliance of the environmental protection program.

B. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands and 200 feet of watercourses.

C. Once a construction schedule has been established a person shall be named and will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials,

installation, and maintenance of erosion and sediment structures, the communication and detailed explanation to all people involved in the site work of the requirements and objective of the erosion and sediment control measures.

D. The Engineer shall be notified of any proposed alteration to the erosion and sediment control plan, prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

5. Area of Construction Activity

Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

6. Protection of Water Resources

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

7. Location of Storage Areas

A. The location of the Contractor's storage areas for equipment and/or materials shall be as negotiated with the Owner. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled hay or straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

8. Spill Prevention Measures

A. Vehicle Maintenance: Vehicles and equipment maintenance shall occur at the off-site staging area over a spill containment pallet or sufficiently impervious surface. Only minor maintenance shall be conducted. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets inside a materials storage container. Fluids shall be removed from the site and dispose of in accordance with applicable regulations as soon as feasible. All vehicles and equipment including subcontractor vehicles shall be checked for leaking oil and fluids. Vehicles leaking fluid shall not be allowed onsite.

B. Spill Kits: Spill kits will be stored within the designated fueling area and concrete washout areas. Spill kits shall be readily available during all fueling operations. Spill kits must contain absorbent pads or other sorbent materials. Spill kits shall be inspected weekly to insure that adequate cleanup materials are on site at all times.

C. Spills: All spills will be cleaned up immediately upon discovery. Spent absorbent materials and rags will be hauled offsite immediately after the spill is cleaned up for disposal at an approved location. Spills large enough to discharge to surface water will be reported to the National Response Center at 1-800-424-8802.

D. Material safety data sheets: A material inventory and emergency contact information shall be maintained onsite.

9. Vehicle Fueling Operations

A. Several types of vehicles and equipment will be used on-site throughout the project, including graders, excavators, loaders, concrete equipment, rollers, trucks and trailers, backhoes, and forklifts. Equipment/vehicle fueling will be performed onsite. Fueling activities are to be situated so that drainage facilities or watercourses located in the area are not at risk from potential infiltration. Fueling shall take place on an impervious surface and shall be conducted at least 100 feet from a drainage structure, wetland or watercourse. Absorbent, spill-cleanup materials and spill kits will be available at the designated fueling areas. Fuel will be delivered to the site on an as needed basis by a fuel delivery service.

B. Maintenance and Inspection: Inspect equipment/vehicle storage areas and fueling area weekly. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately or the problem vehicle(s) or

equipment will be removed from the project site. Keep ample supply of spill-cleanup materials onsite and immediately clean up spills and dispose of materials properly.

10. Washing of Equipment and Vehicles

Washing of equipment and vehicles is prohibited. Vehicle and equipment washing shall occur off-site at a permitted facility.

11. Materials Storage and Staging Area

A. Construction equipment and maintenance materials will be stored at a designated staging area and materials storage areas. A watertight shipping container will be used to store hand tools, small parts, and other construction materials. All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the storage container, until such time they can be properly disposed of. Very large items, such as piping, valves, and structures, will be stored in the open in the materials storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

B. The storage areas will be inspected weekly. The storage areas will be kept clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners will be repaired or replaced as needed to maintain proper function.

C. It is not anticipated that pesticides, herbicides, insecticides, fertilizers and landscape materials will be stored on site. These materials will be delivered as needed during the installation of the limited landscaping features. If it is determined that these materials are required to be stored on site they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

D. It is not anticipated that diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals will be stored on site. These materials will be delivered as needed over the course of construction. If it is determined that these materials are required to be stored on site, they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

E. All hazardous waste materials including oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers, within a hazardous materials storage area in a designated staging area. Hazardous waste materials will be stored in appropriate and clearly marked containers and segregated from other non-

waste materials. Secondary containment will be provided for all waste materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous waste materials will be disposed of in accordance with federal, state, and local regulations. Hazardous waste materials will not be disposed of into the on-site dumpsters. The hazardous waste materials area will be inspected weekly and after storm events. The storage area will be kept clean, well-organized and equipped with ample cleanup supplies as appropriate for the materials being stored. Material safety datasheets, material inventory, and emergency contact numbers will be maintained on site.

F. All waste materials will be collected and disposed of into a dumpster in the designated staging area. Dumpsters will have a secure tight lid, be placed away from stormwater drains and structures, and will meet all federal, state, and local regulations. Only trash and construction debris will be placed in the dumpsters. Construction materials will not be buried on site. The dumpsters will be inspected weekly and immediately after storm events. The dumpsters will be emptied weekly, or more frequently if needed, and taken to the appropriate disposal facility.

12. Sanitary Waste

Portable toilets, located in the staging area, will be provided at the site throughout all the phases. The toilets will be located away from concentrated drainage flow paths. Sanitary waste will be collected a minimum of once a week and shall be inspected weekly for evidence of leaking holding tanks.

13. Concrete Truck Washout Procedures

A. A designated temporary, above-grade concrete washout area will be constructed at an approved onsite location. The washout area shall be constructed in a location approved by the engineer. The temporary concrete washout area will be constructed using staked hay bales with a recommended minimum length and minimum width of 10 feet, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. The washout area will be lined with plastic sheeting at least 10 mils thick and free of holes or tears.

B. Concrete pours will not be conducted during or before an anticipated storm event. Concrete mixer trucks and chutes will be washed in the designated area or concrete wastes will be properly disposed of offsite. When the temporary washout area is no longer needed for the construction project, the hardened concrete and materials used to construct the area will be removed and disposed as described below and the area will be stabilized.

C. The washout areas will be inspected weekly and each day of use to ensure that all concrete washing is being discharged into the washout area, no leaks

or tears are present and to identify when concrete wastes need to be removed. The washout areas will be cleaned out once the area is filled to 75 percent of the holding capacity. Once the area's holding capacity has been reached, the concrete wastes will be allowed to harden, the concrete will be broken up, removed, and taken to the appropriate landfill for disposal. The plastic sheeting will be replaced if tears occur during removal of concrete wastes from the washout area.

14. Recycling Practices

Wood pallets, cardboard boxes, and other recyclable construction scraps will be disposed of in a separate designated dumpster for recycling. The dumpster will have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all local and state solid waste management regulations. Only solid recyclable construction scraps from the site will be deposited in the dumpster. The recycling dumpster will be inspected weekly. The recycling dumpster will be emptied when full and taken to an approved recycling center by the contractor. If recyclable construction wastes are exceeding the dumpster's capacity, the dumpsters will be emptied more frequently.

15. Construction in Areas Designated as Wetland Resources on the Drawings

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetland resources. Total construction widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetland resources shall not be unduly disturbed by the Contractor's operations. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

16. Protecting and Minimizing Exposed Areas

A. The Contractor shall limit the area of land which is exposed and erodible during construction. In areas where the period of exposure will be greater than two (2) months, temporary stabilization or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

17. Protection of Landscape

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as required.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. 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.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled, and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

18. Clearing and Grubbing

A. The Contractor shall clear and grub only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.

B. The Contractor shall not remove trees without permission of the Engineer.

19. Discharge of Dewatering Operations

A. Any water that is pumped and discharged as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to an approved filtration method before discharging to the nearest drainage system, stream, or waterway.

C. The pumped water shall be filtered through baled hay, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

20. 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 streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as required.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

21. Separation and Replacement of Topsoil

Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

22. Compost Filter tubes

To trap sediment and to prevent sediment from discharging downhill, compost filter tubes shall be used where shown on the drawings. The tubes should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

23. Sediment Fence

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

B. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a 22-foot wide, continuous length support netting, and stapled to pre-weathered oak posts installed as shown on the drawings. The oak posts shall be 1½-inches by 1½-inches (Minimum Dimension) by 48 inches and shall be tapered. The support netting shall be industrial strength polypropylene. The bottom edge of the sediment control fabric shall be buried as shown on the drawings. The sediment control fabric shall conform to the following properties:

Property	Value	Test Method
1. Grab Strength (lbs.)	124	ASTM D-4632
2. Elongation (%)	15%	ASTM D-4632
3. Puncture Strength (lbs.)	65	ASTM D-4833
4. Burst Strength (psi)	300	ASTM D-3786
5. Trapezoid Tear (lbs.)	60	ASTM D-4533
6. Equivalent Opening Size (U.S. Sieve)	No. 30	ASTM D-4571
7. Permittivity (sec^{-1})	0.10	ASTM D-4491
8. Water Flow Rate (gal/min/sf.)	10	ASTM D-4491
9. UV Resistance (%)	70	ASTM D-4355

C. The silt fence shall be Mirafi Envirofence manufactured by Mirafi, Inc. or approved equal.

24. Inlet Protection

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall install and maintain inlet protection. At a minimum inlet protection is required on all drainage structures in the project area. The inlet protection shall be SiltSack or approved equal. The inlet protection shall be cleaned or replaced as needed to insure proper operation for the duration of construction.

EROSION CONTROL MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Sediment Barriers				
Inlet Protection				
Discharge Points				

POLLUTION PREVENTION MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Trash Dumpster with Cover				
Recycling Dumpster with Cover				
Staging Area				
Bulk Material Storage Area				
Material Storage Containers				
Fueling Area				
Equipment Storage Area				
Sanitary Facilities				
Concrete Washout Area				
Spill Kits				

Appendix I

Wetland Delineation Report

Weston & Sampson

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Wetland Delineation Report

October 2023
Updated May 2024

Monson Road
Wales, MA

Wetland Delineation Conducted By:
Devin Herrick, CWS on 10/31/2023

Delineation Report Reviewed By:
Megan Kearns, PWS

TABLE OF CONTENTS

Page

1.0 SITE DESCRIPTION 1-1

2.0 DELINEATION OF WETLAND RESOURCES 2-1
2.1 Site Observations 2-1
2.2 Wetland Delineation Methodology 2-1
2.3 Bordering Vegetated Wetlands (BVW) 2-2
2.4 Isolated Vegetated Wetland (IW) 2-3
2.4 Bank 2-4
2.5 Other Protected Areas 2-7

3.0 SUMMARY 3-1

4.0 REFERENCES 4-1

FIGURES

Figure 1.1-1.6 ..... Wetlands Field Map
Figure 2 ..... USGS Topographic Map
Figure 3.1-3.4 ..... FEMA FIRM Map
Figure 4 ..... Environmental Resources Map

APPENDICES

Appendix A ..... ACOE Wetland Determination Data Forms

1.0 SITE DESCRIPTION

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA on a section of road approximately 1.5 miles in length. The western limit of investigation terminated at the intersection with Lynch Road while the eastern limit terminated at the intersection with Reed Hill Road. The area under consideration is in a rural community within a topographically variable landscape composed of glacial till transected by numerous streams running with north/south trajectories. Please see Figure 1.1-1.6 (Wetlands Field Map) and Figure 2 (USGS Topographic Map) attached to this report for the investigation area.

Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field using pink flagging by a Weston & Sampson employee who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) and the US Army Corps of Engineers methodologies. A further description of these wetland resource areas is presented in the following sections.

2.0 DELINEATION OF WETLAND RESOURCES

2.1 Site Observations

The Weston & Sampson wetland scientist, trained in the ACOE Wetland Delineation Manual and Massachusetts Department of Environmental Protection (MassDEP) Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetland Protection Act guidance document, observed the following protected wetland resources at the site:

- Bordering Vegetated Wetlands (BVW)
- Isolated Vegetated Wetland (IW)
- Bank – Perennial Stream
- Bank – Intermittent Stream
- Bank – Non-Jurisdictional Intermittent Stream

Field data were recorded on U.S. Army Corps of Engineers (ACOE) Wetland Determination Data Forms which are included in Appendix A.

2.2 Wetland Delineation Methodology

A wetland delineation assessment was conducted in accordance with the Massachusetts Wetland Protection Act Regulations (310 CMR 10.55(2)(c)), Massachusetts Department of Environmental Protection (MassDEP) Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands (Second Edition, September 2022), and ACOE Wetland Manual (Technical Report Y-87-1).

The bordering vegetated wetlands (BVW) delineation methodology included the characterization of vegetation, hydrologic conditions, and soil in both wetland and upland areas to identify the transitional area, which was used as the wetland limit. Pink flags with distinct flag numbers were left in the field to show wetland resource area limits.

Vegetation, hydrology and soils were assessed in both wetland and upland areas to accurately place the wetland limits at each site. The percentage of vegetative species was estimated by creating sample plots. Sample plot radius for trees, saplings, shrubs, groundcover and woody vine strata was 30', 15', 15', 5' and 30', respectively. After creating the sample plot areas, the percent basal area coverage of

each species within the monitoring plot was recorded. Using these field observations, the percent dominance of each species within its stratum was calculated. The 50/20 Rule was then used to determine dominance. Dominant species were considered the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceeds 50% of the total dominance measure (basal area) for the stratum, plus any additional species comprising 20% or more of the total dominance measure for the stratum. Once the dominant species were determined, they were treated equally to determine the presence of hydrophytic vegetation. If the number of dominant species with a Wetland Indicator Status of FAC (excluding FAC-), FACW or OBL is greater than, or equal to, the number of remaining dominant species, the area was considered a jurisdictional wetland resource area based on vegetation.

A soil sample from each wetland sample plot were also taken. Each soil sample goes to a depth of at least 12-24 inches. The soil was characterized to determine if the soil sample was considered a hydric (wetland) soil. Soil samples, including mottles, were characterized based on color using Munsell Soil-Color charts as a color reference.

The general area was then assessed for hydrologic conditions, including, but not limited to, site inundation, depth to free water, depth of soil saturation, water marks, drift lines, sediment deposits, water stained leaves.

2.3 Bordering Vegetated Wetlands (BVW)

A total of sixteen BVW series were delineated at the site. The limits of the BVW resource areas were determined by locating the transitional areas between wetlands and uplands vegetation, soils and hydrologic conditions. Wetland flags left in the field included:

- BVW-A1 through BVW-A6 (Bordering Vegetated Wetland “A” Series)
- BVW-B1 through BVW-B10 (Bordering Vegetated Wetland “B” Series)
- BVW-C1 through BVW-C6 (Bordering Vegetated Wetland “C” Series)
- BVW-D1 through BVW-D4 (Bordering Vegetated Wetland “D” Series)
- BVW-E1 through BVW-E6 (Bordering Vegetated Wetland “E” Series)
- BVW-F1 through BVW-F3 (Bordering Vegetated Wetland “F” Series)
- BVW-G1 through BVW-G11 (Bordering Vegetated Wetland “G” Series)

- BVW-H1 through BVW-H12 (Bordering Vegetated Wetland "H" Series)
- BVW-I1 through BVW-I10 (Bordering Vegetated Wetland "I" Series)
- BVW-J1 through BVW-J13 (Bordering Vegetated Wetland "J" Series)
- BVW-K1 through BVW-K4 (Bordering Vegetated Wetland "K" Series)
- BVW-L1 through BVW-L15 (Bordering Vegetated Wetland "L" Series)
- BVW-M1 through BVW-M10 (Bordering Vegetated Wetland "M" Series)
- BVW-O1 through BVW-O3 (Bordering Vegetated Wetland "O" Series)
- BVW-AA1 through BVW-AA4 (Bordering Vegetated Wetland "AA" Series)
- BVW-BB1 through BVW-BB4 (Bordering Vegetated Wetland "BB" Series)

Dominant vegetation within this resource area included red maple (*Acer rubrum*), winterberry (*Ilex verticillate*), crested fern (*Dryopteris cristata*), sensitive fern (*Onoclea sensibilis*), and riverbank grape (*Vitis riparia*), all species that thrive in wet conditions. Soils within the BVW were considered sandy mucky mineral. Other indicators of wetland hydrology included surface water, water-stained leaves, drainage patterns, highwater table and saturation.

Dominant upland vegetation next to this BVW included red oak (*Quercus rubra*) and Japanese barberry (*Berberis thunbergii*). Soil in the upland area consisted of dry sandy loam, with no evidence of mottling or hydrology within the top 12 inches.

BVWs are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.4 Isolated Vegetated Wetland (IW)

Two isolated wetlands were delineated at the site. The limit of the IW resource area was determined by locating the transitional area between wetland and upland vegetation, soils and hydrologic conditions. Vegetation, hydrology and soils were assessed in the same manner as described above for identifying BVW. Wetland flags left in the field included:

- WET-A1 through WET-A10 (Isolated Wetland "A" Series)
- WET-B1 through WET-B11 (Isolated Wetland "B" Series)

Dominant vegetation within this resource area included reed canary grass (*Phalaris arundinacea*), rough-leaved goldenrod (*Solidago patula*), and grass-leaved goldenrod (*Euthamia graminifolia*), all species that thrive in wet conditions. Soils within the wetland limits were considered sandy loam (sandy redox). Indicators of wetland hydrology included surface water, soil saturation, and oxidized rhizospheres.

Dominant upland vegetation next to this isolated wetland included red oak (*Quercus rubra*). Soil in the upland area consisted of dry sandy loam. No indicators of wetland hydrology were observed.

The Massachusetts Wetland Protection Act does not protect isolated vegetated wetlands.

2.4 Bank

Water bodies, including perennial streams, intermittent streams, ponds and lakes, have banks which are protected by the Massachusetts Wetland Protection Act. Bank is a wetland resource area defined by 310 CMR 10.54(2)(a) as "the portion of land surface which normally abuts and confines a water body. It occurs between a waterbody and a vegetated bordering wetland and adjacent floodplain, or, in absence of these, it occurs between a waterbody and an upland." Vegetated banks provide valuable functions such as flood control, stormwater prevention, fisheries protection, and water quality protection. The limit of this resource area is identified by Top of Bank (TOB) which is located at the first observable break in slope or the Mean Annual Flood Level (MAFL), whichever is lower. TOB is easily identified in the field so that indicator was utilized for this wetland delineation.

Perennial Stream Banks

Three perennial streams were identified within the investigation area. All three of these perennial streams are unnamed. These streams are shown as perennial on the current United States Geographical Survey (USGS) map which classifies them as perennial per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the perennial streams were identified by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-E1 through TOB-E8 (Perennial Stream Bank "E" Series)
- TOB-F1 through TOB-F9 (Perennial Stream Bank "F" Series)
- TOB-I1 through TOB-I17 (Perennial Stream Bank "I" Series)
- TOB-J1 through TOB-J18 (Perennial Stream Bank "J" Series)

- WET-C1 through WET-C8 (Perennial Stream Bank “C” Series)
- TOB-K1 through TOB-K6 (Perennial Stream Bank “K” Series)
- TOB-L1 through TOB-L6 (Perennial Stream Bank “L” Series)

Perennial streams are subject to a 200-foot Riverfront Area under the Massachusetts Wetland Protection Act per 301 CMR 10.58(2)(a)(2)(c).

Intermittent Stream Banks (Jurisdictional)

Five jurisdictional intermittent streams were identified within the investigation area. Four of these intermittent streams are unnamed and not shown on the current United States Geographical Survey (USGS) map. The easternmost intermittent stream is shown on the current United States Geographical Survey (USGS) map and called Vinica Brook. These intermittent streams have a watershed size less than 0.5 square miles in size according to USGS Stream Stats which classifies the streams as intermittent per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the intermittent streams were identified in the field by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-A1 through TOB-A5 (Intermittent Stream Bank “A” Series)
- TOB-B1 through TOB-B5 (Intermittent Stream Bank “B” Series)
- TOB-C1 through TOB-C5 (Intermittent Stream Bank “C” Series)
- TOB-D1 through TOB-D5 (Intermittent Stream Bank “D” Series)
- TOB-CC1 through TOB-CC3 (Intermittent Stream Bank “CC” Series)
- TOB-DD1 through TOB-DD3 (Intermittent Stream Bank “DD” Series)
- TOB-GG1 through TOB-GG2 (Intermittent Stream Bank “GG” Series)
- TOB-HH1 through TOB-HH2 (Intermittent Stream Bank “HH” Series)
- TOB-AA1 through TOB-AA3_March 2024 (Intermittent Stream Bank “AA” Series)
- TOB-BB1 through TOB-BB15_March 2024 (Intermittent Stream Bank “BB” Series)
- TOB-CC1 through TOB-CC16_March 2024 (Intermittent Stream Bank “CC” Series)
- TOB-KK1 through TOB-KK9 (Intermittent Stream Bank “KK” Series)
- TOB-LL1 through TOB-LL6 (Intermittent Stream Bank “LL” Series)
- TOB-EE1 through TOB-EE6 (Intermittent Stream Bank “EE” Series)
- TOB-FF1 through TOB-FF6 (Intermittent Stream Bank “FF” Series)
- TOB-M1 through TOB-M4 (Intermittent Stream Bank “M” Series)

- TOB-N1 through TOB-N4 (Intermittent Stream Bank "N" Series)
- TOB-AA1 through TOB-AA3 (Intermittent Stream Bank "AA" Series)
- TOB-BB1 through TOB-BB3 (Intermittent Stream Bank "BB" Series)
- TOB-JJ1 through TOB-JJ6 (Intermittent Stream Bank "JJ" Series)

Intermittent stream banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

Intermittent Stream Banks (Non-Jurisdictional)

Three intermittent streams were identified within the investigation area which do originate within a wetland resource area. Per 310 CMR 10.04 Stream means "*a body of running water, including brooks and creeks, which moves in a definite channel in the ground due to a hydraulic gradient, and which flows within, into or out of an Area Subject to Protection under M.G.L. c. 131, § 40. A portion of a stream may flow through a culvert or beneath a bridge. Such a body of running water which does not flow throughout the year (i.e., which is intermittent) is a stream except for that portion upgradient of all bogs, swamps, wet meadows and marshes*". Since these streams are located upgradient of any wetland there are non-jurisdictional. Wetland flags left in the field included:

- TOB-G1 through TOB-G2 (Intermittent Stream Bank "G" Series)
- TOB-H1 through TOB-H2 (Intermittent Stream Bank "H" Series)
- WET-N1 through WET-N8 (Intermittent Stream Bank "N" Series)
- TOB-DD1 through TOB-DD2_March 2024 (Intermittent Stream Bank "DD" Series)
- TOB-EE1 through TOB-EE2_March 2024 (Intermittent Stream Bank "EE" Series)

Pond Bank

A single unnamed pond was located within the investigation area. According to the Massachusetts Wetland Protection Act a pond is defined as "any body of fresh water with a surface area observed or recorded within the last ten years of at least 10,000 square feet". Based on aerial imagery the unnamed pond identified on site is approximately 14,000 SF. According to the Massachusetts Wetland Protection Act "ponds may be either naturally occurring or human made by impoundment, excavation or otherwise". Wetland flags left in the field included:

- TOB-II1 through TOB-II3 (Pond Bank "II" Series)

Pond banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.5 Other Protected Areas

Weston & Sampson created environmental resources maps (see Figure 4) of the site to determine the presence of other protected areas. The data source of these map layers was the Massachusetts Geographic Information System (MassGIS). These areas included:

- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Certified and Potential Vernal Pools
- Areas of Critical Environmental Concern (ACEC)
- Outstanding Resource Waters (ORW)
- Coldwater Fisheries
- Article 97 Land

Wetland resources identified in the field were also added to these maps. Based on the MassGIS information, a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

FEMA Flood Insurance Rate Maps (FIRM) were created online from the FEMA website to determine if there is a 100-year flood zone at the site. See Figure 3 for FIRM map. Based on FEMA flood maps the investigation area is not located within the 100-year flood zone.

3.0 SUMMARY

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA. Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field.

Additional environmental mapping was conducted using MassGIS data layers and FEMA FIRM mapping. This additional mapping indicates that a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

4.0 REFERENCES

Massachusetts Department of Environmental Protection. September 2022. "Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands – Second Edition".

Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. Massachusetts Natural Heritage Atlas, 13th Edition with 2017 web updates. Accessed on 1/23/2024.

Massachusetts Geographic Information System. January 2009. Outstanding Resource Waters. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Massachusetts Geographic Information System. December 2003. Areas of Critical Environmental Concern. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Newcomb, Lawrence. 1977. Newcomb's Wildflower Guide. Little, Brown and Company.

Web Soil Survey of Hampden County, Massachusetts. United States Department of Agriculture, Soil Conservation Service, in cooperation with Massachusetts Agricultural Experiment Station

United States Department of Agriculture, Natural Resources Conservation Service. *2018. Field Indicators of Hydric Soils in the United States, Version 8.2.* L. M. Vasilas, G. W. Hurt, and J.F. Berkowitz (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.

USACOE, January 1987, Corps of Engineers Wetlands Delineation Manuel, Wetlands Research Program Technical Report Y-87-1.

FEMA Flood Map Service Center, online at msc.fema.gov/portal Assessed on 1/23/2024.
Tiner, Jr., Ralph W., 2005, Field Guide to Nontidal Wetland Identification

Tiner, Jr., Ralph W, 2009, Field Guide to Tidal Wetland Plants of the Northeastern United States and Neighboring Canada.

Wojtec, Michael, Bard – A field Guide to Trees of the Northeast.

New England Hydric Soils Technical Committee, 2019, Version 4, *Field Indicator of Identifying Hydric Soils in New England*. New England Interstate Water Pollution Control Commission, Lowell, MA.

.

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.1

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.2.mxd User: Herrick.Devin Saved: 4/15/2024 3:59:52 AM Opened: 4/15/2024 4:00:36 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.2

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.3.mxd User: Herrick.Devin Saved: 4/15/2024 4:01:11 AM Opened: 4/15/2024 4:01:40 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.3

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

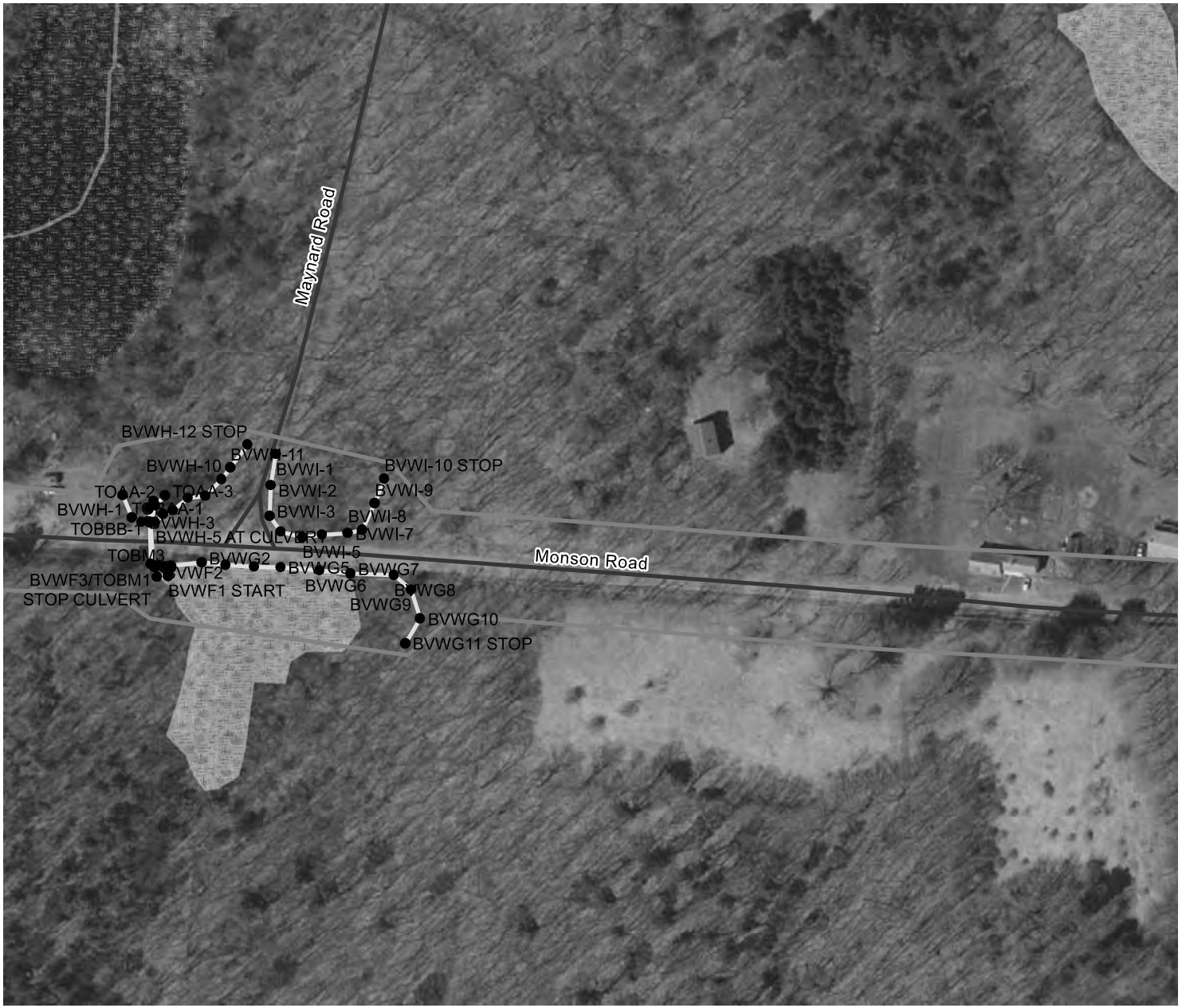
FIGURE 1.4

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.5.mxd User: Herrick.Devin Saved: 4/15/2024 4:03:43 AM Opened: 4/15/2024 4:04:34 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.5

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

N
W E
S

100 50 0 100
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

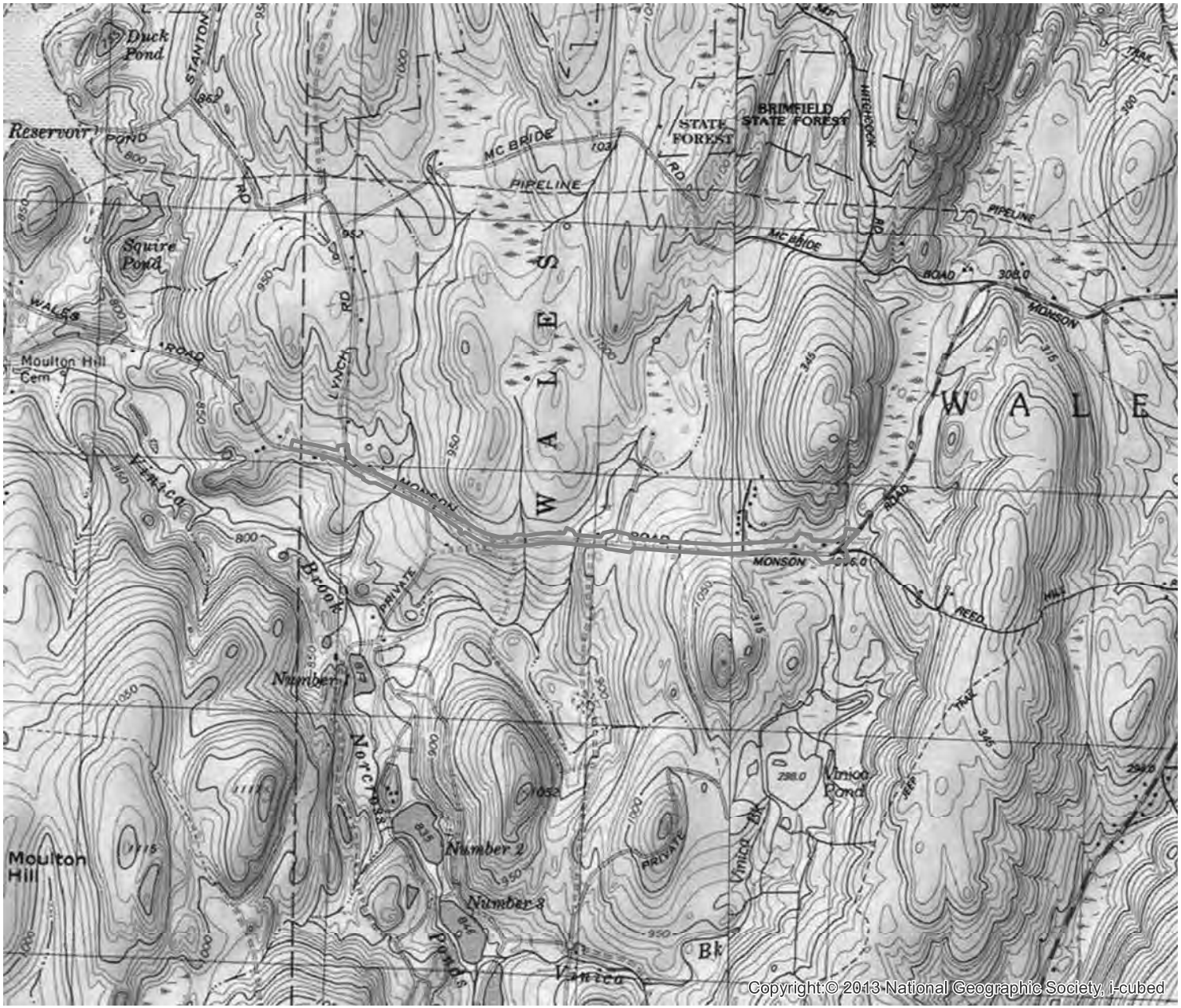
- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.6

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson



N
W E
S

1,000 500 0 1,000
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

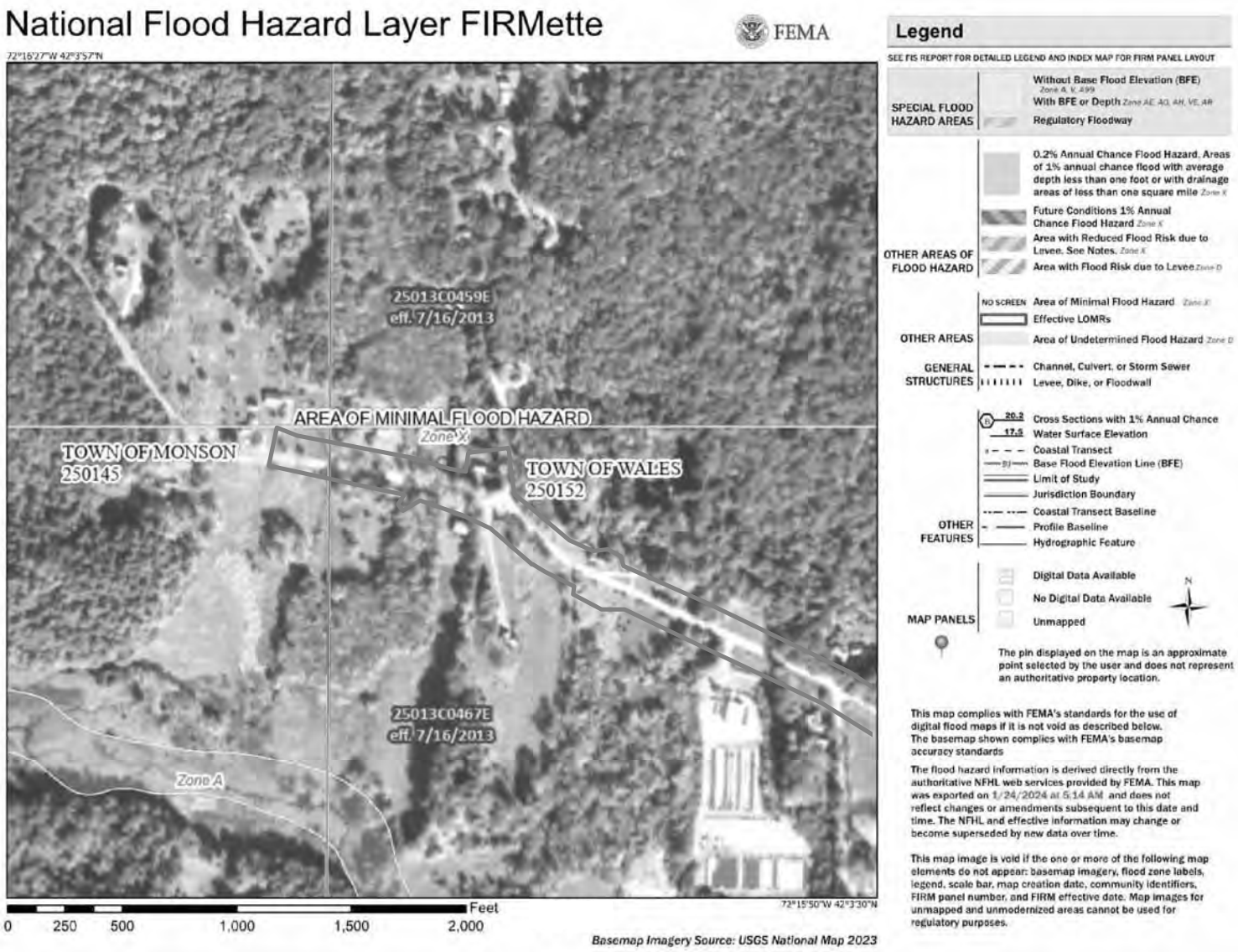
Investigation Area

FIGURE 2

MONSON ROAD
WALES MA

USGS TOPOGRAPHIC MAP

Weston & Sampson



Legend

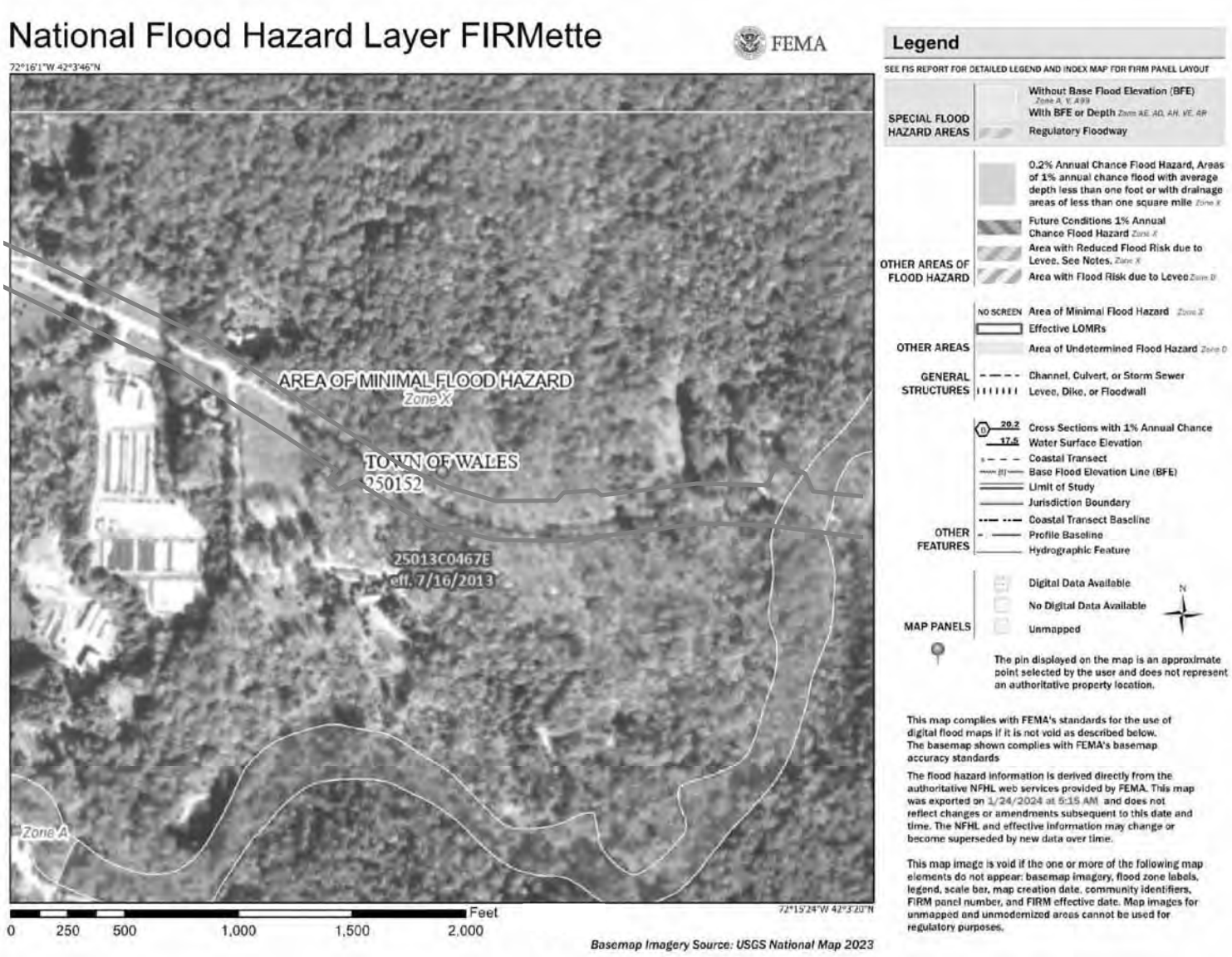
Investigation Area

FIGURE 3.1

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

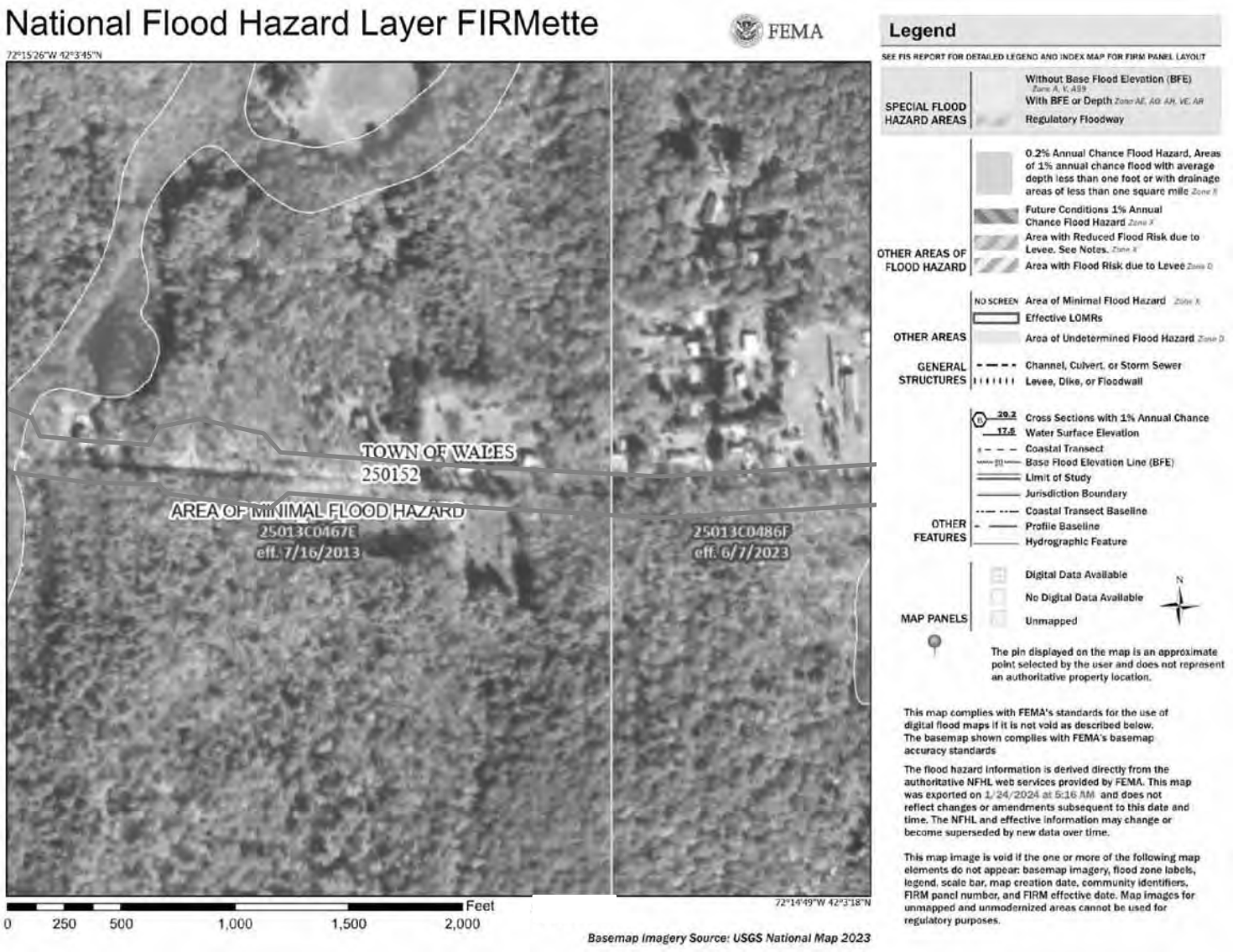
Investigation Area

FIGURE 3.2

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

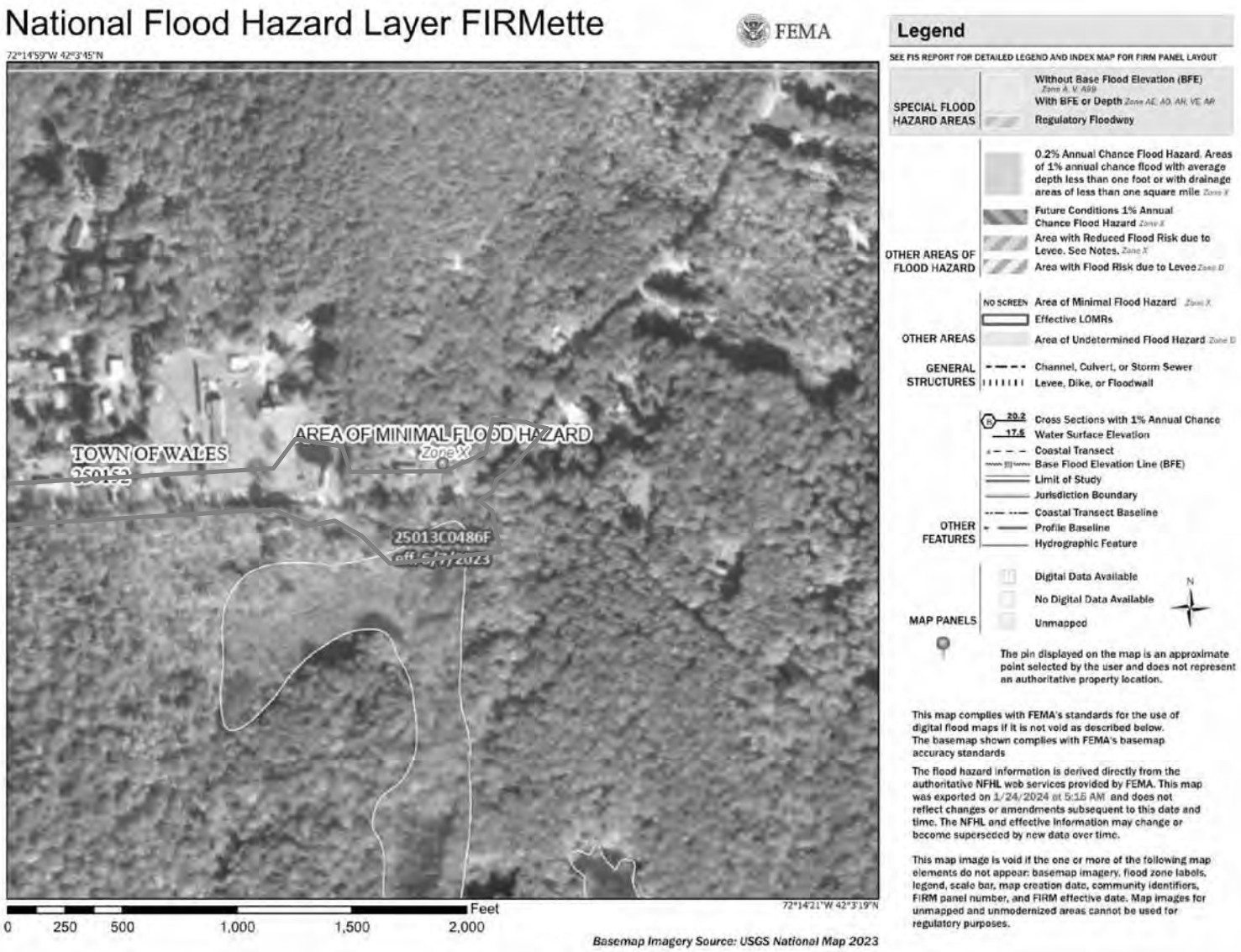
Investigation Area

FIGURE 3.3

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

Investigation Area

FIGURE 3.4

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Environmental Receptor.mxd User: Herrick.Devin Saved: 4/15/2024 4:07:31 AM Opened: 4/15/2024 4:07:54 AM

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- MassDOT Roads
- ACECs
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- Cold Water Fisheries
- Public Water Supply Contributor
- ORW for ACEC
- ORW for both Water Supply and Other
- Article 97 Land
- Community Groundwater Source

N W E S

1,000 500 0 1,000 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

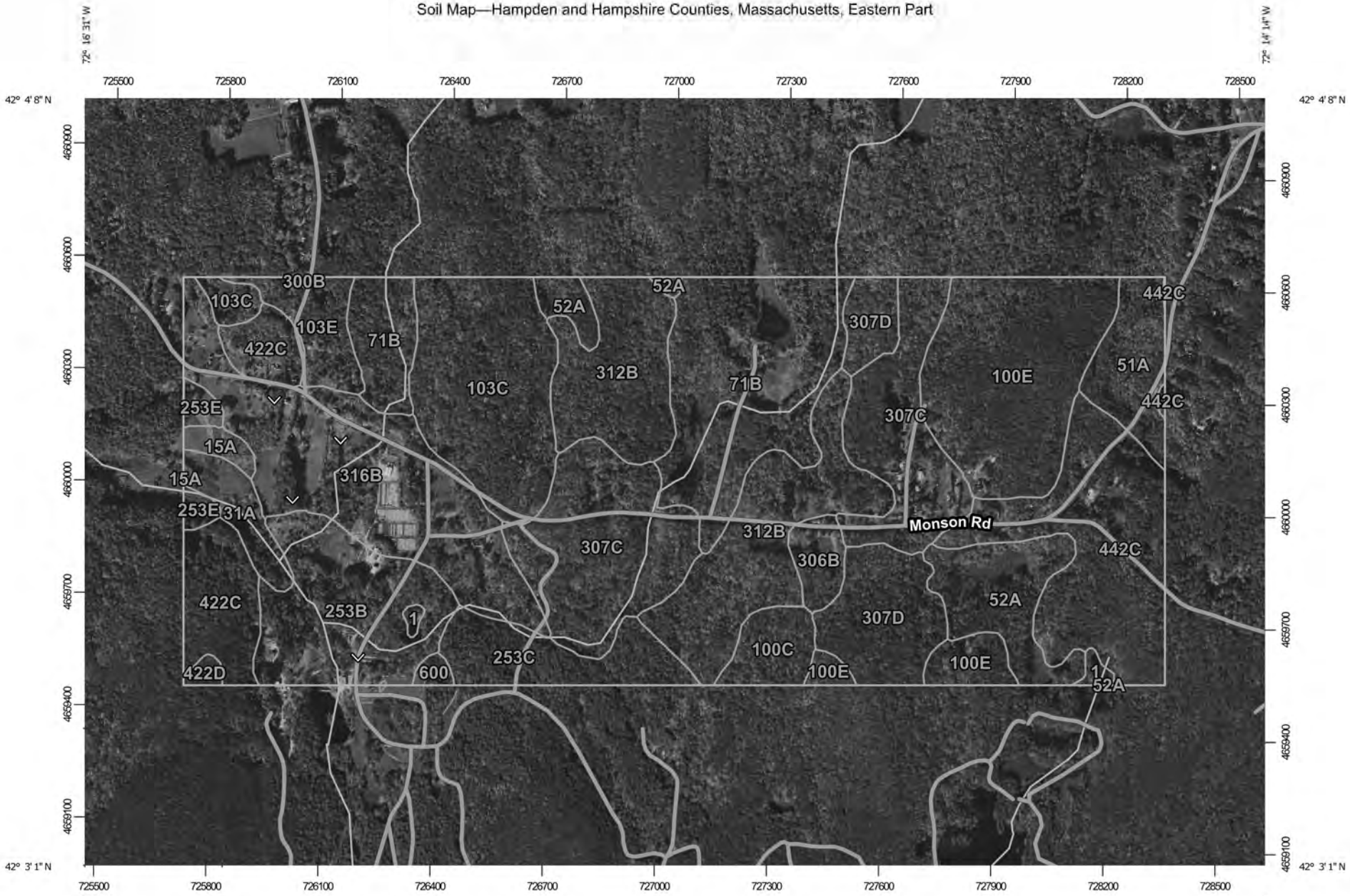
FIGURE 4

MONSON ROAD
WALES MA

ENVIRON. RESOURCES MAP

Weston & Sampson

Soil Map—Hampden and Hampshire Counties, Massachusetts, Eastern Part



Map Scale: 1:14,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hampden and Hampshire Counties, Massachusetts, Eastern Part
Survey Area Data: Version 18, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

A00840 - 423

Proposal No. 608163-128112

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	2.2	0.3%
15A	Scarboro-Rippowam complex, 0 to 2 percent slopes, frequently flooded	3.6	0.5%
31A	Walpole sandy loam, 0 to 3 percent slopes	10.2	1.4%
51A	Swansea muck, 0 to 1 percent slopes	17.8	2.5%
52A	Freetown muck, 0 to 1 percent slopes	29.2	4.1%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	74.9	10.5%
100C	Brookfield-Brimfield-Rock outcrop complex, strongly sloping	10.6	1.5%
100E	Brookfield-Brimfield-Rock outcrop complex, steep	66.3	9.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	55.2	7.8%
103E	Charlton-Hollis-Rock outcrop complex, steep	13.1	1.8%
253B	Hinckley loamy sand, 3 to 8 percent slopes	44.5	6.3%
253C	Hinckley loamy sand, 8 to 15 percent slopes	22.3	3.1%
253E	Hinckley loamy sand, 25 to 35 percent slopes	4.6	0.6%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	0.2	0.0%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	7.3	1.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	81.2	11.4%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	32.3	4.6%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	76.3	10.7%
316B	Scituate fine sandy loam, 3 to 8 percent slopes, very stony	71.3	10.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	27.2	3.8%
422D	Canton fine sandy loam, 15 to 35 percent slopes, extremely stony	1.6	0.2%
442C	Gloucester gravelly fine sandy loam, 8 to 15 percent slopes, extremely stony	56.5	8.0%
600	Pits, gravel	1.7	0.2%
Totals for Area of Interest		**710.0**	**100.0%**

APPENDIX A

ACOE Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	90	Yes	FAC
2. green ash (*Fraxinus pennsylvanica*)	10	No	FACW
3. white pine (*Pinus Strobus*)	10	No	FACU
4. shagbark hickory (*Carya ovata*)	10	No	FACU
5.			
6.			
7.			
	120	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. common winterberry (*Ilex verticillata*)	80	Yes	FACW
2. Japanese barberry (*Berberis thunbergii*)	15	No	FACU
3.			
4.			
5.			
6.			
7.			
	95	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1. crested fern (*Dryopteris cristata*)	30	Yes	FACW
2. sensitive fern (*Onoclea sensibilis*)	20	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50	= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1. riverbank grape (*Vitis riparia*)	10	Yes	FAC
2.			
3.			
4.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	140	x 2 =	280
FAC species	100	x 3 =	300
FACU species	35	x 4 =	140
UPL species		x 5 =	
Column Totals:	275 (A)		720 (B)

Prevalence Index = B/A = 2.61

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 8	10YR 2/1	90	10YR 5/2 & 2.5YR 2.5/4	10	C/D	M	sandy muck	could not get below 8" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 8 inches as materials were very stoney.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (Quercus rubra)	70	Yes	FACU
2. white pine (*Pinus Strobus*)	20	No	FACU
3. shagbark hickory (*Carya ovata*)	20	No	FACU
4.			
5.			
6.			
7.			
	110	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	125	x 4 =	500
UPL species		x 5 =	
Column Totals:	125 (A)		500 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 4/3	100					sandy loam	soils moist to dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Marshes, depressions, kettles, bogs, swamps Local relief (concave, convex, none): Concave

Slope (%): 0 - 1 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Freetown muck NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. common winterberry (*Ilex verticillata*)	30	Yes	FACW
2. highbush blueberry (*Vaccinium corymbosum*)	30	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. unidentified sedge	60	Yes	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	60	x 2 =	120
FAC species	70	x 3 =	210
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	130 (A)		330 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/1	100					muck	saturated soils

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer rubrum*)	60	Yes	FAC
2. shagbark hickory (*Carya ovata*)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	60	x 3 =	180
FACU species	55	x 4 =	220
UPL species		x 5 =	
Column Totals:	115 (A)		400 (B)

Prevalence Index = B/A = 3.47

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-C1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. mulitflora rose (Rosa multiflora)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. broad-leaved cattail (*Typha latifolia*)	10	Yes	OBL
2. sensitive fern (*Onoclea sensibilis*)	15	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1. riverbank grape (*Vitis riparia*)	10	Yes	FAC
2.			
3.			
4.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	15	x 2 =	30
FAC species	70	x 3 =	210
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	115 (A)		330 (B)

Prevalence Index = B/A = 2.87

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-C1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	30	Yes	FAC
2. red oak (*Quercus rubra*)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. manicured lawn	60		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 30	x 3 = 90
FACU species 40	x 4 = 160
UPL species	x 5 =
Column Totals: 70 (A)	250 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 6
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-D5 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. highbush blueberry (*Vaccinium corymbosum*)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. crested fern (*Dryopteris cristata*)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	30	x 2 =	60
FAC species	70	x 3 =	210
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		270 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					saturated loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-D5 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer rubrum*)	40	Yes	FAC
2. red oak (*Quercus rubra*)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	100	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	40	x 3 =	120
FACU species	160	x 4 =	640
UPL species		x 5 =	
Column Totals:	200 (A)		760 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/2	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-E1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. crested fern (*Dryopteris cristata*)	15	Yes	FACW
2. sensitive fern (*Onoclea sensibilis*)	10	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 25	x 2 = 50
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 95 (A)	260 (B)

Prevalence Index = B/A = 2.74

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/2	95	10YR 5/6	5	C/CS		sandy loam	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-E1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	30	Yes	FAC
2. red oak (*Quercus rubra*)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 30	x 3 = 90
FACU species 60	x 4 = 240
UPL species	x 5 =
Column Totals: 90 (A)	330 (B)

Prevalence Index = B/A = 3.67

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 16' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	50	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. silky dogwood (*Cornus amomum*)	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 40	x 2 = 80
FAC species 50	x 3 = 150
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 90 (A)	230 (B)

Prevalence Index = B/A = 2.56

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 2/2	100					sandy muck	could not get below 5" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 5 inches as materials were very stony.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 15' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. black cherry (*Prunus serotina*)	20	Yes	FACU
2. white pine (*Pinus Strobus*)	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	10	Yes	FACU
2. American red raspberry (*Rubus idaeus*)	15	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	25	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1. American bittersweet (*Celastrus scandens*)	15	Yes	FACU
2.			
3.			
4.			
	15	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 70	x 4 = 280
UPL species	x 5 =
Column Totals: 70 (A)	280 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Materials stony below 10 inches.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-C4 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	80	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	No	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	No	FAC
4. broadleaf cattail (*Typha latiifolia*)	20	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	140 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	80	x 2 =	160
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	140 (A)		260 (B)

Prevalence Index = B/A = 1.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-C4 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. white pine (*Pinus strobus*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	15	x 4 =	60
UPL species	90	x 5 =	450
Column Totals:	105 (A)		510 (B)

Prevalence Index = B/A = 4.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 44.81" N Long: 72° 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-A3 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	60	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	Yes	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 20	x 1 = 20
FACW species 60	x 2 = 120
FAC species 20	x 3 = 60
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 100 (A)	200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 44.81" N Long: 72° 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-A3 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (*Quercus rubra*)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 20	x 4 = 80
UPL species 90	x 5 = 450
Column Totals: 110 (A)	530 (B)

Prevalence Index = B/A = 4.82

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes X** **No _____**
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	X Water-Stained Leaves (B9)	X Drainage Patterns (B10)
___ High Water Table (A2)	___ Aquatic Fauna (B13)	___ Moss Trim Lines (B16)
___ Saturation (A3)	___ Marl Deposits (B15)	___ Dry-Season Water Table (C2)
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	___ Crayfish Burrows (C8)
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	___ Saturation Visible on Aerial Imagery (C9)
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	___ Stunted or Stressed Plants (D1)
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	___ Geomorphic Position (D2)
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	___ Microtopographic Relief (D4)
___ Sparsely Vegetated Concave Surface (B8)		___ FAC-Neutral Test (D5)

Secondary Indicators (minimum of two required)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: IW-B6 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	70	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	No	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	70	x 2 =	140
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	110 (A)		220 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: IW-B6 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species 90	x 5 = 450
Column Totals: 90 (A)	450 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Appendix J

Project Plans (provided under separate cover)

THIS PAGE IS INTENTIONALLY LEFT BLANK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE TOWN OF

WALES

HAMPDEN COUNTY

100% SUBMITTAL

401 ENVIRONMENTAL PERMIT PLAN SET

WALES
MONSON ROAD

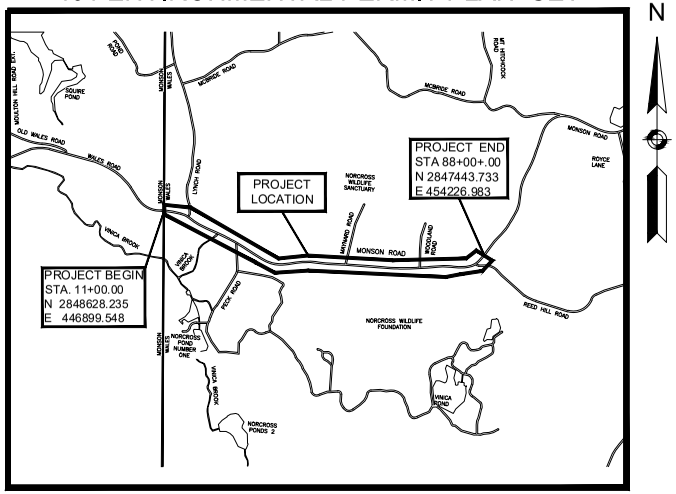
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	180
PROJECT FILE NO. 608163			

TITLE SHEET & INDEX

THESE PLANS ARE SUPPLEMENTED BY THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2024, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND, ABBREVIATIONS & GENERAL NOTES
4-6	BORING LOGS
7	TYPICAL SECTIONS
8-21	CONSTRUCTION PLANS
22-33	PROFILES
34-47	CURB TIE & GRADING PLANS
48-61	TRAFFIC SIGN AND PAVEMENT MARKING PLANS
62	TRAFFIC CONTROL SIGN SUMMARY
63-68	TEMPORARY TRAFFIC CONTROL DETAILS
69-82	UTILITY PLANS
83-85	CONSTRUCTION DETAILS
86-162	CROSS SECTIONS
163-174	STRUCTURAL PLANS
175	CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION
176-177	CULVERT 3 CHANNEL CROSS SECTIONS
178-179	TEMPORARY WATER HANDLING PLAN
180	WETLAND REPLICATION AREA DETAIL



2000 0 2000 4000

SCALE: 1" = 2000'

LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

June 2024

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

COMMONWEALTH OF MASSACHUSETTS
SCOTT R. BRUSO
STRUCTURAL
No. 48061
REGISTERED PROFESSIONAL ENGINEER

Weston & Sampson
712 Brook Street, Suite 103
Rocky Hill, CT 06067
860.513.1473
www.westonandsampson.com

DATE	DESCRIPTION	REV #

massDOT
Massachusetts Department of Transportation
Highway Division

APPROVED

CHIEF ENGINEER DATE

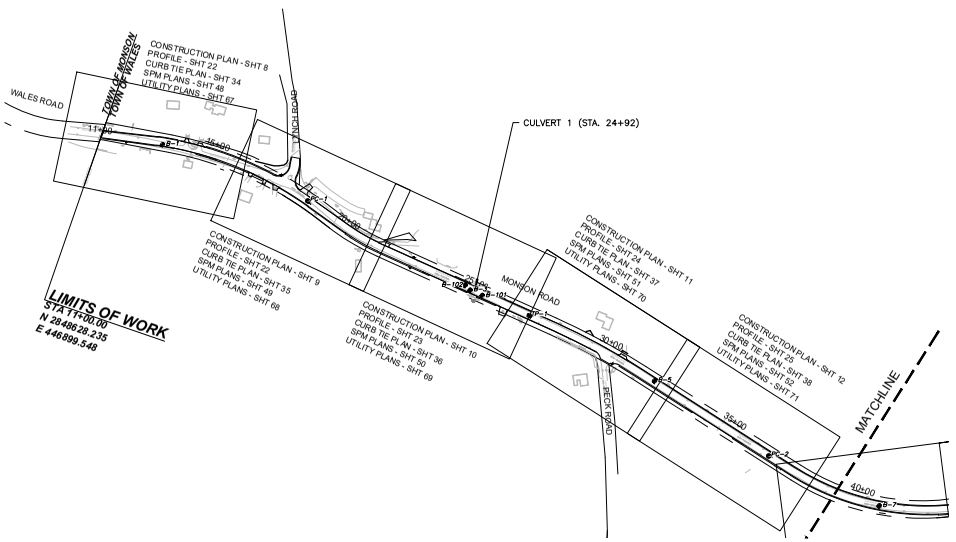
608163_HDI(TITLE, LEGEND, KEY & TYPICAL SECTIONS)401.DWG Plotted on 26-Jun-2024 8:22 AM

Project No. 608163.128121

A08840 - 401

NOTES:

1. BENCH MARK:
   MAGNAIL U.P.L. LOCATED EAST OF NORTH STREET AT STATION 12+79.94 AND EL. 869'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 21+37.43 AND EL. 877'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 29+56.65 AND EL 900'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 29+94.76 AND EL 902'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 38+22.13 AND EL 938'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 56+22.73 AND EL 957'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 65+94.25 AND EL 1007'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 74.95.16 AND EL 1022'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 81+31.62 AND EL 1006'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 87+05.97 AND EL 1008'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 87+15.35 AND EL 1001'



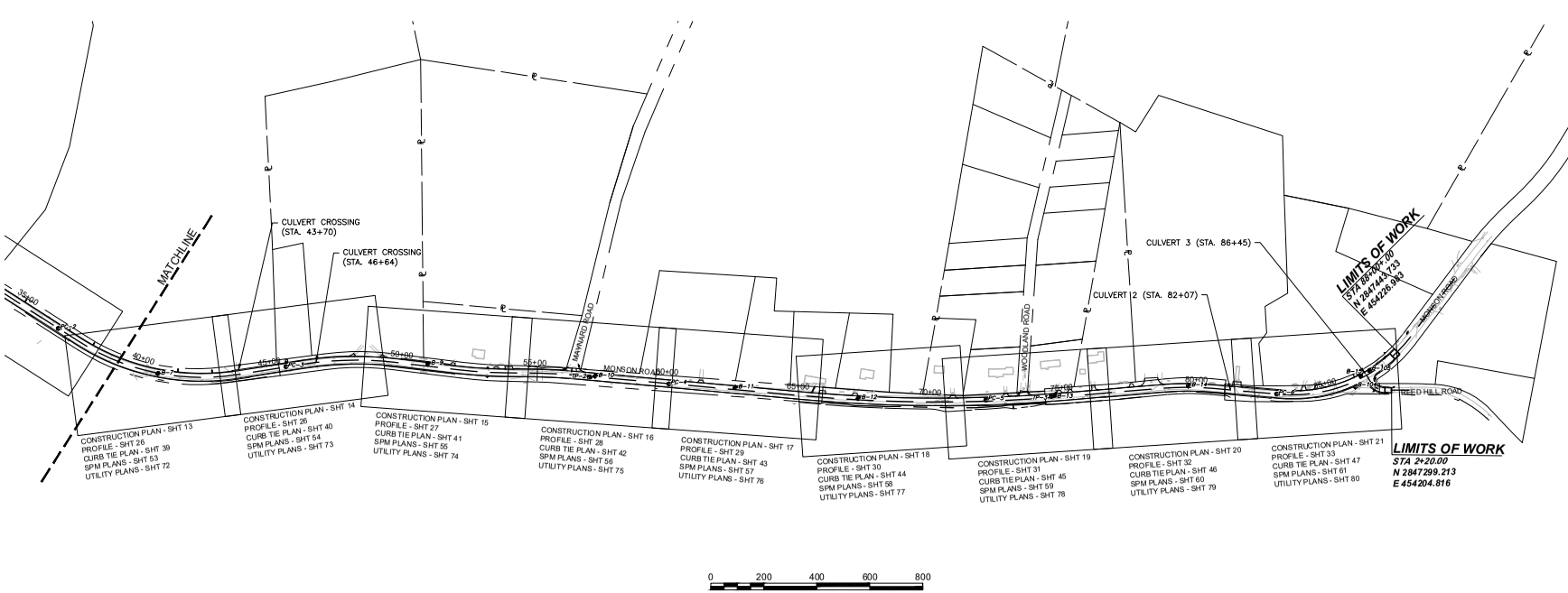
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	180
PROJECT FILE NO. 608163			

KEY PLAN

BORING LOCATIONS (FEET)

BORING	NORTHING	EASTING	STATION	OFFSET	SURFACE EL.	H.B.E.
B-1	2,848,584	447,074	12+80	22.4 RT	868.0	861.5
B-3	2,848,121	448,154	24+56	10.0 LT	877.0	865.2
B-5	2,847,789	448,792	31+89	10.8 LT	902.0	897.5
B-7	2,847,423	449,318	38+27	18.1 RT	941.0	937.0
B-9	2,847,397	450,584	51+05	9.6 LT	933.0	916.5
B-10	2,847,355	451,197	57+19	6.7 LT	956.0	951.5
B-11	2,847,315	451,727	62+51	14.1 LT	989.0	984.5
B-12	2,847,272	452,354	68+80	16.0 LT	1011.0	1007.0
B-13	2,847,294	452,969	74+98	19.4 LT	1019.0	1014.5
B-14	2,847,322	453,443	79+72	12.1 LT	1009.0	1004.5
B-15	2,847,355	454,092	86+37	9.1 LT	1002.0	999.1
B-101	2,848,098	448,155	24+80	4.2 RT	877.1	861.9
B-102	2,848,103	448,186	25+06	12.85 LT	877.5	849.0
B-104	2,847,316	454,080	86+09	20.6 RT	1002.4	974.4
B-105	2,847,367	454,110	85+59	11.0 RT	1001.8	987.7



608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 25-Jun-2024 3:33 PM
Proposal No. 608163-1.36.12
A08840 .sda

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
	CBCI	CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
OHU	OHU	OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		EROSION AND SEDIMENT CONTROL BARRIER
		TREE LINE
		LIMITS OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT AREA BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
		SIGN AND POST

ABBREVIATIONS

GENERAL	
AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CBCI-DB	DOUBLE GRATE CATCH BASIN W/ CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN

ABBREVIATIONS (cont.)

GENERAL	
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCCE	REINFORCED CONCRETE CULVERT END
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STA
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
SWTU	STORMWATER TREATMENT UNIT
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
	SL	12"-WIDE STOP LINE
	SWL	6"-WIDE SOLID WHITE LINE
	DBYL	DOUBLE YELLOW LINE (2 - 6"-WIDE YELLOW LINES)

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	180
PROJECT FILE NO.	608163		

LEGEND, ABBREVIATIONS & GENERAL NOTES

GENERAL NOTES:

1. TOPOGRAPHICAL INFORMATION BASED ON AN ON THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ON DECEMBER 2017 AND SUPPLEMENTED BY CHAPPELL ENGINEERING IN OCTOBER 2023. WETLAND FLAGGING WAS PERFORMED BY WESTON & SAMPSON IN NOVEMBER 2020 AND REFLAGGED IN SEPTEMBER OF 2023.
2. THE HORIZONTAL COORDINATES ARE BASED ON NAD 83, THE VERTICAL DATUM IS NAVD 88.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL DIG TEST PITS WITH THE LOCATIONS BEING APPROVED BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK TO EXACTLY LOCATE EXISTING UTILITIES.
4. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY OWNER. ANY ALTERATIONS SHALL BE INCIDENTAL TO THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY SUPPORT OF ALL UTILITIES TO REMAIN IN PLACE AND SHALL DESCRIBE IN WRITING, TO THE SATISFACTION OF THE ENGINEER, HIS METHOD OF TEMPORARY SUPPORT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. THE TERM "PROPOSED (PROP.)" INDICATES WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET (R&R)".
8. ALL EXISTING STATE, COUNTY AND TOWN LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
9. ALL EXCESS MATERIAL FROM ROADWAY RECONSTRUCTION OR THE EXCAVATION PROCESS SHALL BE REUSED ON SITE OR REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL AND PROPER MANNER.
10. THE CONTRACTOR SHALL CALL DIGSAFE AT 1-888-344-7233 AT LEAST 72 HOURS, SATURDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE TOWN PRIOR TO EXCAVATION.
11. JOINTS BETWEEN HOT MIX ASPHALT TRENCH PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.
12. IF DEEMED NECESSARY DUE TO THE WORK, THE CONTRACTOR SHALL COORDINATE WITH THE TOWN OF WALES HIGHWAY DEPARTMENT, THE WALES FIRE DEPARTMENT, AND THE ENGINEER FOR APPROVAL OF SHUTTING DOWN ANY EXISTING WATER MAINS AND SHALL ALSO OBTAIN APPROVAL FOR DISRUPTING ANY EXISTING SEWER FLOWS.
13. THE CONTRACTOR SHALL BE AWARE THAT ONLY TOWN PERSONNEL ARE ALLOWED TO OPERATE WATER GATES AND HYDRANTS. ANY REQUESTS TO OPERATE THE GATES SHALL BE COORDINATED THROUGH THE ENGINEER.
14. THE CONTRACTOR SHALL COORDINATE ANY WORK FOR THE PROJECT WITH ALL ADJACENT/CONCURRENT PROJECTS AND CONTRACTORS.
15. THE CONTRACTOR SHALL INSTALL PRIOR TO COMMENCEMENT OF WORK, MAINTAIN, AND REMOVE AT THE END OF THE PROJECT INLET SEDIMENT CONTROL BAGS IN ALL CATCH BASINS, WITHIN OR ADJACENT TO THE PROJECT LIMITS. THE CONTRACTOR SHALL ALSO MAINTAIN SILT FENCE AND COMPOST FILTER TUBES AS SHOWN ON THE PLANS THROUGHOUT THE DURATION OF THE PROJECT AND REMOVE AT THE END.
16. ANY GRASS AREAS DISTURBED BY THE WORK SHALL BE RESTORED WITH LOAM AND SEED.
17. ANY LANDSCAPED AREAS DISTURBED BY THE WORK SHALL BE RESTORED TO EXISTING CONDITIONS WITH EXISTING OR NEW GROUND COVER MATERIALS AS DIRECTED BY THE ENGINEER. ANY PLANTS, SHRUBS, OR FLOWERS DISTURBED BY THE WORK SHALL BE RESET TO EXISTING CONDITIONS OR REPLACED WITH NEW PLANTS, SHRUBS, OR FLOWERS AS DIRECTED BY THE ENGINEER. ALL WORK TO RESTORE LANDSCAPE AREAS, NEW GROUND COVER MATERIALS, NEW PLANTS, NEW SHRUBS, OR NEW FLOWERS REQUIRED BY THE ENGINEER SHALL BE INCIDENTAL TO THE PROJECT.
18. CONTRACTOR TO COORDINATE WITH UTILITY POLE OWNERS IN AREAS WHERE UNDERGROUND UTILITY WORK IS WITHIN CLOSE PROXIMITY AND POSSIBLE UTILITY POLE SHORING IS REQUIRED WHILE INSTALLING PROPOSED UTILITIES.
19. RAISE AND ADJUST FRAMES AND GRATES, FRAMES AND COVERS AND GATE BOXES PRIOR TO PAVEMENT OVERLAY, IF REQUIRED.
20. CONTRACTOR IS RESPONSIBLE FOR REPLACING ANY PROPERTY PINS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION, TO THEIR LOCATION JUST PRIOR TO CONSTRUCTION.
21. ALL TRAFFIC SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS OTHERWISE NOTED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
22. CONTRACTOR TO ESTABLISH TEMPORARY BENCHMARKS EVERY 1000 FEET BASED ON THE PERMANENT BENCHMARKS LOCATED AT STA 29+85.04, 24.73 LEFT AND STA 87+27.18, 41.17 LEFT OR AS REQUIRED BY THE ENGINEER.
23. CONTRACTOR TO PROVIDE ADDITIONAL TRAVERSE POINTS AND TRAVERSE LINES IN THE VICINITY OF EXISTING TRAVERSE POINTS WHERE THE EXISTING TRAVERSE POINT IS LOCATED IN "SOFT GROUND" OR AS REQUIRED BY THE ENGINEER.
24. ALL EXISTING STONE WALLS PROPOSED FOR RELOCATION SHALL NOT BE REMOVED FROM THE IMMEDIATE AREA SHOWN ON THE PLANS.

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 25-Jun-2024 3:33 PM
Project No. 608163.130212
A08840 -485

OBSERVED GROUNDWATER NOVEMBER 21, 2017 ELEV. = 954.00

OBSERVED GROUNDWATER NOVEMBER 21, 2017 ELEV. = 972.00

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	180
PROJECT FILE NO.	608163		

BORING LOGS
1 OF 3

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-#
   LOCATION OF TEST PITS SHOWN ON THE PLAN THUS: TP-#
   LOCATION OF PAVEMENT CORES SHOWN ON THE PLANS THUS: PC-#
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRCUTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL TO BE ENCOUNTERED DURING CONSTRCUTION.
4. FIGURES TO THE LEFT OF THE COLUMNS INDICATE DEPTH AND ELEVATION BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 2" O.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30 INCHES.
6. BORING SAMPLES MADE ON: 11/21/2017, 09/13/2023, 09/14/2023
   TEST PITS MADE ON :
   PAVEMENT CORES MADE ON:
7. BORINGS WERE MADE BY:
   SEABAORD DRILLING INC.
   649 MEADOW ST, CHICOPEE, MA 01013
8. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ORUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

608163_H02\BORING LOGS.DWG Plotted on 25-Jun-2024 3:35 PM
Proposal No. 608163-132121
A208.40 - 48i

WALES
MONSON ROAD

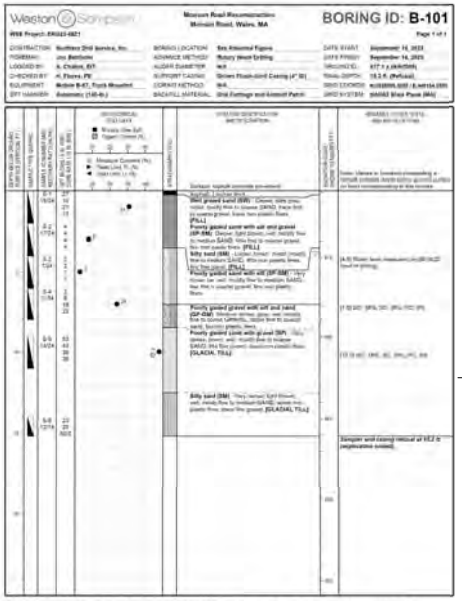
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	180
PROJECT FILE NO.	608163		

BORING LOGS
2 OF 3

NOTES:

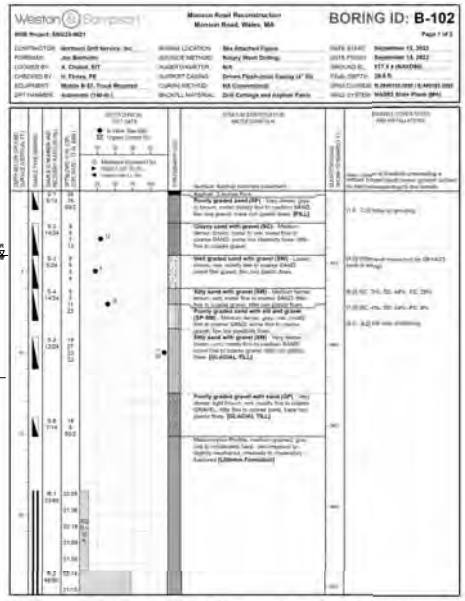
1. FOR BORING NOTES, SEE SHEET 4.

608163_H02(BORING LOGS).DWG Plotted on 25-Jun-2024 3:55 PM
Proposal No. 608163-182112
A0680.dgn



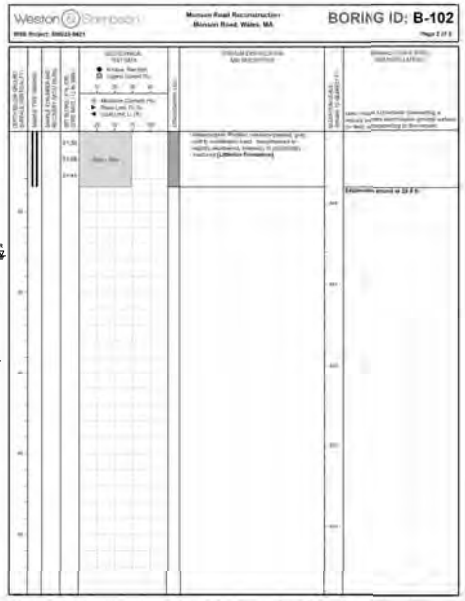
OBSERVED GROUNDWATER
SEPTEMBER 14, 2023
ELEV. = 973.20

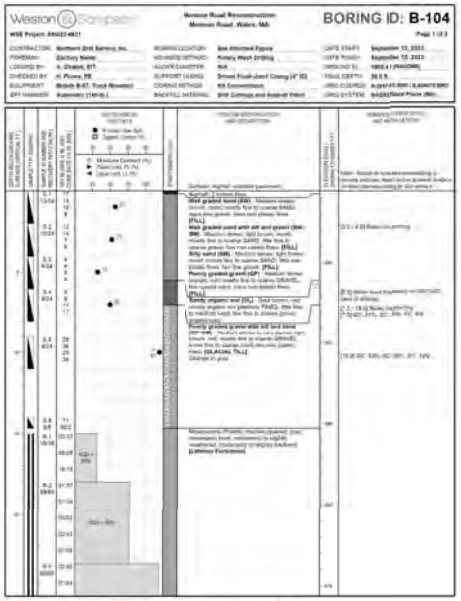
Culvert proposed
67.2' E 990.00'



OBSERVED GROUNDWATER
SEPTEMBER 13, 2023
ELEV. = 973.50

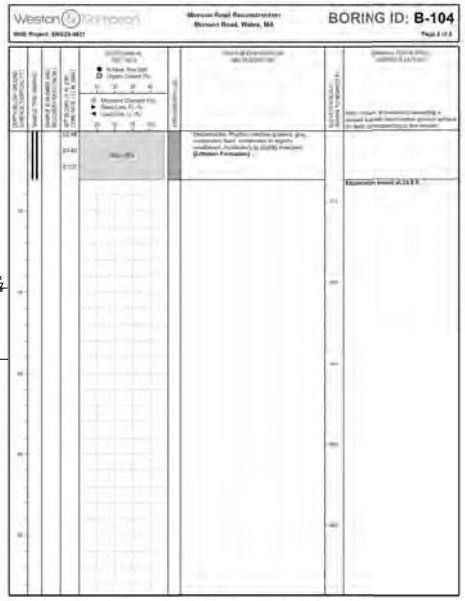
Culvert proposed
67.2' E 987.0'

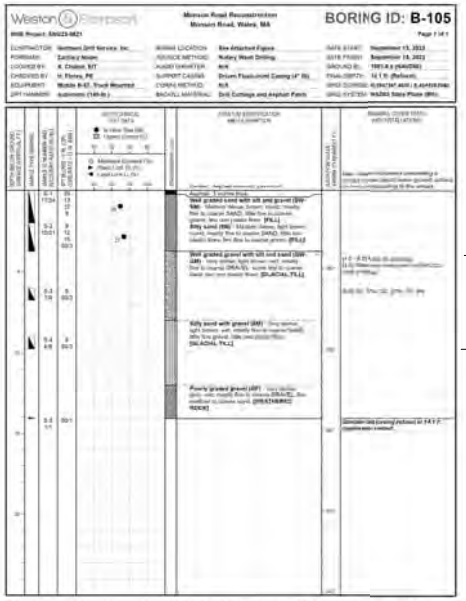




OBSERVED GROUNDWATER
SEPTEMBER 13, 2023
ELEV. = 956.30

Culvert proposed
67.2' E 992.0'





OBSERVED GROUNDWATER
SEPTEMBER 13, 2023
ELEV. = 991.90

Culvert proposed
67.2' E 992.0'

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	180
PROJECT FILE NO.	608163		

BORING LOGS
3 OF 3

NOTES:

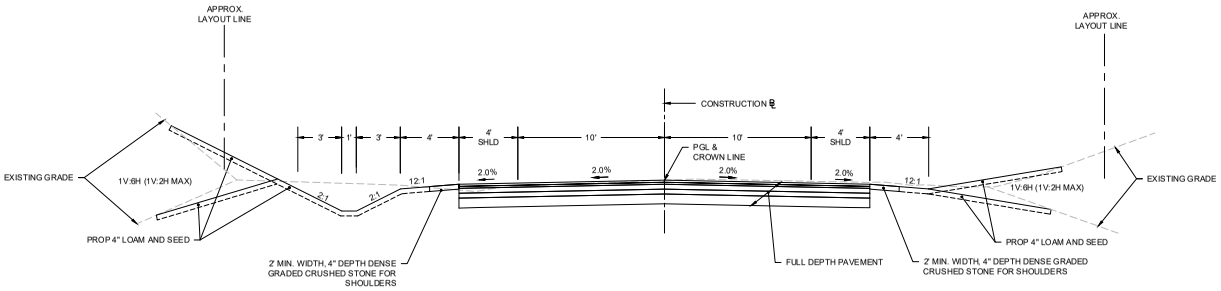
1. FOR BORING NOTES, SEE SHEET 4.

608163_HD2\BORING LOGS\.DWG Plotted on 25-Jun-2024 3:38 PM
Project No. 608163\1501212
A3080-48

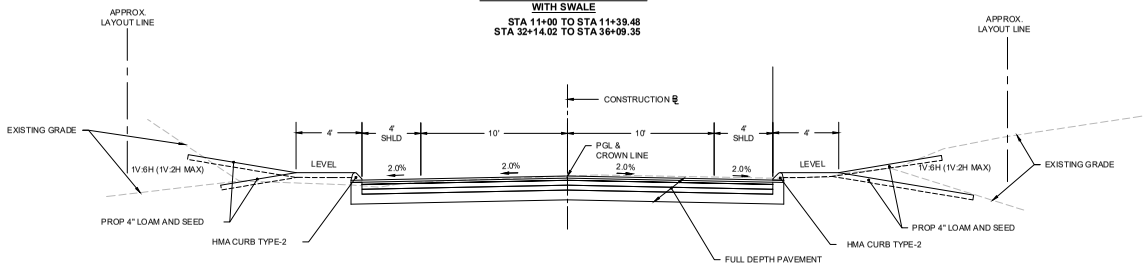
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	180
PROJECT FILE NO.	608163		

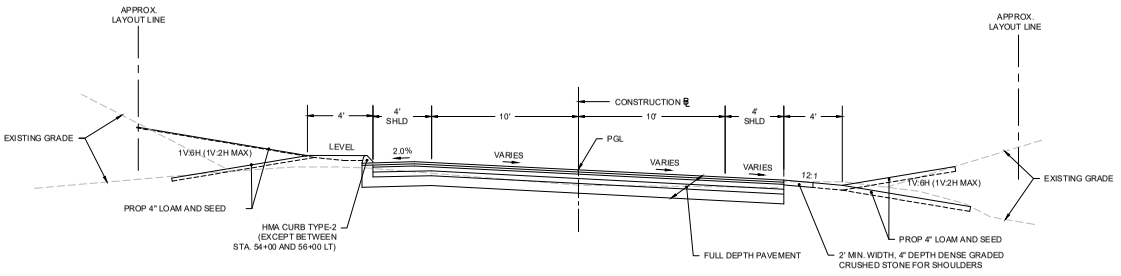
TYPICAL SECTIONS



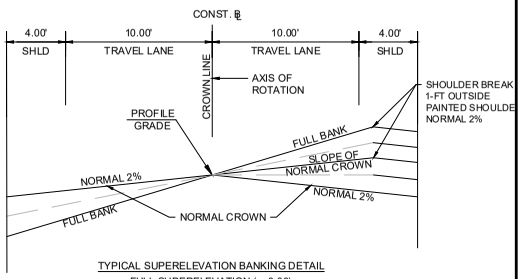
MONSON ROAD TYPICAL SECTION
WITH SWALE
STA 11+00 TO STA 11+39.48
STA 32+14.02 TO STA 36+09.35



MONSON ROAD TYPICAL SECTION
WITH CURBING
STA 22+70.43 TO STA 26+98.72
STA 57+46.79 TO STA 64+41.04
STA 75+70.50 TO STA 77+39.51



MONSON ROAD TYPICAL SECTION
FULL SUPERELEVATION AND TRANSITIONS
STA 11+39.48 TO STA 22+70.43
STA 26+98.72 TO STA 32+14.02
STA 36+09.35 TO STA 57+46.79
STA 64+41.04 TO STA 75+70.50
STA 77+39.51 TO STA 88+00



TYPICAL SUPERELEVATION BANKING DETAIL
FULL SUPERELEVATION (e=0.06)
N.T.S.

PAVEMENT NOTES

PROPOSED PAVEMENT MILLING AND OVERLAY:

1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.50" PAVEMENT MILLING

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).

BASE COURSE: 3.25" SUPERPAVE INTERMEDIATE COURSE 19 (SIC-19.0) PLACED IN ONE LAYER.

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT A RATE OF 0.07 TO 0.09 GAL/SY OVER MILLED SURFACES AND 0.06 TO 0.08 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY :

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2.50" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5)

FOUNDATION: 8" GRAVEL BORROW, TYPE B

PROPOSED GRAVEL DRIVEWAY:

8" GRAVEL BORROW, TYPE B

PROPOSED CEMENT CONCRETE WALK

4" CEMENT CONCRETE OVER

8" GRAVEL BORROW, TYPE B

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 25-Jun-2024 3:33 PM
Proposal No. 608163-132127
A08840 - 489

HIGHWAY GUARD DETAILS

STA 14+65 TO STA 14+78 LT TANGENT END TREATMENT TL-3
STA 14+78 TO STA 16+88 LT (TL-3)
STA 14+50 TO STA 14+63 RT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

401 PERMIT IMPACT NUMBERS

	L.U.W. IMPACT	B.V.W IMPACTS	BANK IMPACTS	DREDGE
PERMANENT IMPACTS	4454 SF	653SF	783 LF	90 CY
TEMPORARY IMPACTS	194 SF	199 SF	0 LF	N/A

PLANT SCHEDULE

TREES	QTY (PER SHEET)	QTY (MASTER TOTAL)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	13	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	25	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	13	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS

LIMITS OF WORK
STA 11+00.00
N 2846628.235
E 446899.548

TOWN OF MONSON
TOWN OF WALES

WALES ROAD
MONSON ROAD

PROP SAWCUT
PROP EOP
PROP FULL DEPTH CONSTRUCTION
PROP HMA CURB
PROP HMA DWY
PROP GRAV DWY
PROP CHECK DAM
PROP ROCKFILL
PROP LOAM & SEED (TYP.)
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PROP SEDIMENT CONTROL BARRIER (TYP.)
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
MODIFIED ROCKFILL DRAINAGE DITCH
GRASS DRAINAGE DITCH
R&R 20 FT STONE WALL
R&S 2 BOULDERS
R&D LANSCAPING
R&R 195 LF BALANCE STONE WALL (CONT. ON SHEET NO. 9)
R&S 85 LF BALANCE STONE WALL
REM 25 FT STONE WALL WITHIN DRAINAGE EASEMENT
RET BUSHES
R&R MAILBOX
REM TREE (3)
REM TREE (4)
REM TREE (14)
REM TREE
RET TREE W/ PROT
RET TREE W/ PROT (7)
TEMP CONST EASEMENT
PERM UTIL EASEMENT
DRAINAGE EASEMENT
WPA JURISDICTION
WQC JURISDICTION
MATCH EXISTING
1930 COUNTY LAYOUT
APPROX LIMIT OF CLEARING & GRUBBING
PERMANENT L.U.W. IMPACT = 591 SF
PERMANENT L.U.W. IMPACT= 40 SF
BANK IMPACT = 10 LF
PERMANENT L.U.W. IMPACT= 15 SF
DREDGE VOLUME = 1 CY
BANK IMPACT = 298 LF
S 83° 11' 15" E 157.78'
S 83° 11' 15" E 100.10'
PC +57.89
10+00
Δ=28°43'06"
R=120.00'
L=60.17'
T=30.75'

324 WALES RD
MONSON, MA
N/F
LYNNETTE M BIGGS
BK. 16452 PG. 495
MAP 159 LOT 002

167 MONSON ROAD
N/F
LYNNETTE M. BIGGS
BK. 16452 PG. 495
MAP 100 PG. 167

165 MONSON ROAD
N/F
LYNDA ST. GERMAIN
BK. 9539 PG. 79
MAP 100 LOT 165

163 MONSON ROAD
N/F
SHAWN M WHITE
BK. 20859 PG. 312
MAP 100 LOT 163

WALES ROAD, MONSON
N/F
THE NORCROSS WILDLIFE FOUNDATION INC
BK. 9529 PG. 478
MAP 159 PG. 02C

WALES ROAD, MONSON
N/F
THE NORCROSS WILDLIFE FOUNDATION INC
BK. 9529 PG. 478
MAP 159 PG. 02C

170 MONSON ROAD
N/F
MICHAEL P THIBEAULT
BK. 16309 PG. 348
MAP 100 PG. 170

162 MONSON RD
N/F
DONNA J. GILES
BK. 15046 PG. 116
MAP 100, LOT. 162

IMPACT LEGEND

L.U.W.= LAND UNDER WATER
B.V.W= BORDERING VEGETATED WETLANDS
WETLAND REPLICATION/RESTORATION AREA
T.O.B.= TOP OF BANK
—OHW— ORDINARY HIGH WATER

0 20 50 100

CONTINUED ON SHEET NO. 9

FOR PROFILE SEE SHEET NO. 22

Proposal No. 608163.121212

HIGHWAY GUARD DETAILS

STA 14+78 TO STA 16+88 LT (TL-3)
STA 16+88 TO STA 17+00 LT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)
STA 16+02 TO STA 16+14 RT TANGENT END TREATMENT TL-3
STA 20+25 TO STA 20+37 RT TANGENT END TREATMENT TL-3
STA 20+37 TO STA 23+10 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

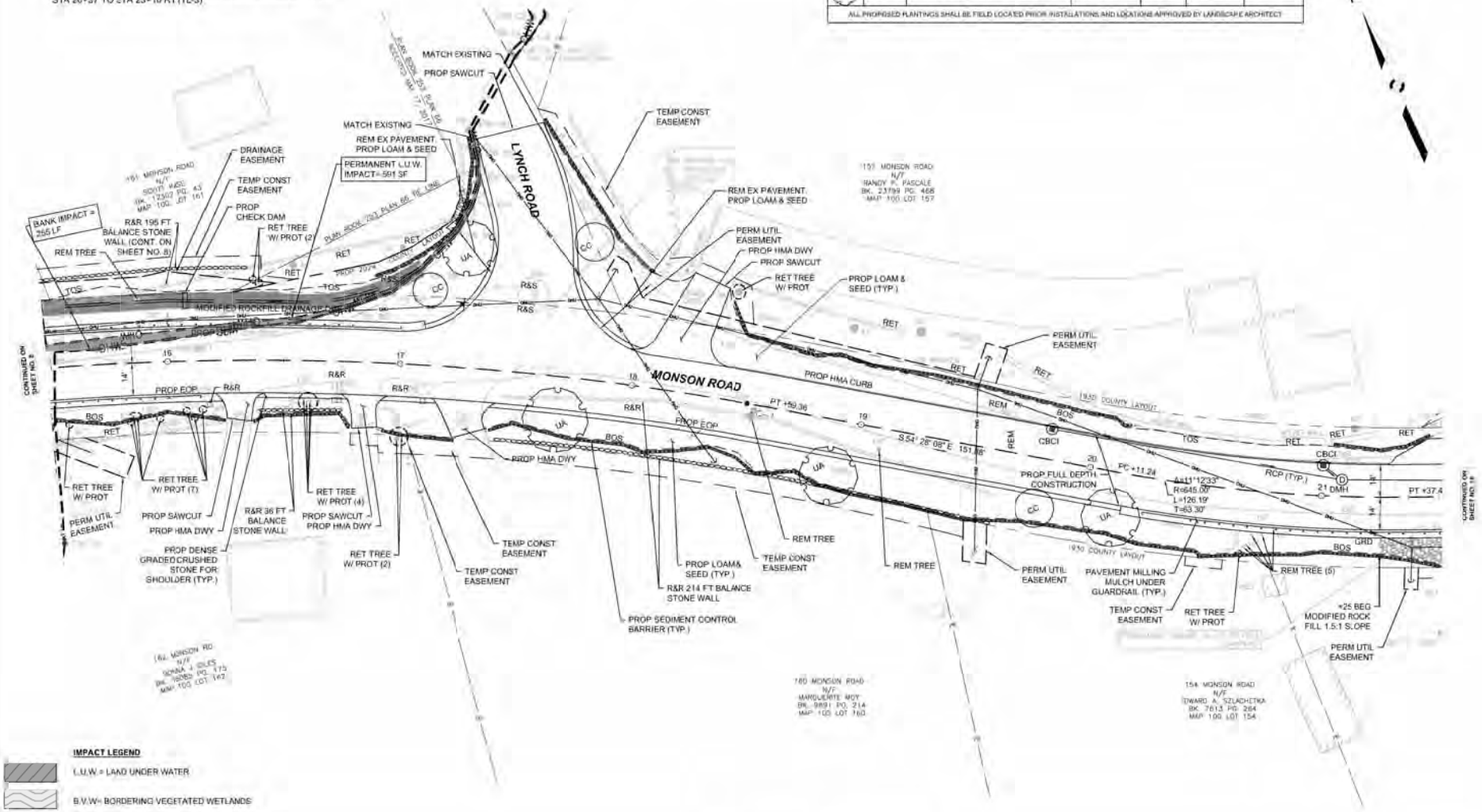
PLANT SCHEDULE

TREES	QTY (SEE SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	4	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS



IMPACT LEGEND

L.U.W.= LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B.= TOP OF BANK

—OHW— ORDINARY HIGH WATER

0 20 50 100

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 22

Proposal No. 688-163-12012

HIGHWAY GUARD DETAILS

STA 20+37 TO STA 23+10 RT (TL-3)
STA 23+10 TO STA 23+22 RT TANGENT END TREATMENT TL-3
STA 23+86 TO STA 23+98 RT TANGENT END TREATMENT TL-3
STA 23+98 TO STA 25+61 RT (TL-3)
STA 24+25 TO STA 24+37 RT TANGENT END TREATMENT TL-3
STA 24+25 TO STA 24+37 LT TANGENT END TREATMENT TL-3
STA 24+37 TO STA 24+77 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 24+37 TO STA 24+77 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+46 TO STA 25+60 RT (TL-3)
STA 25+46 TO STA 25+79 LT (TL-3)
STA 25+60 TO STA 25+72 RT TANGENT END TREATMENT TL-3
STA 25+79 TO STA 25+91 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

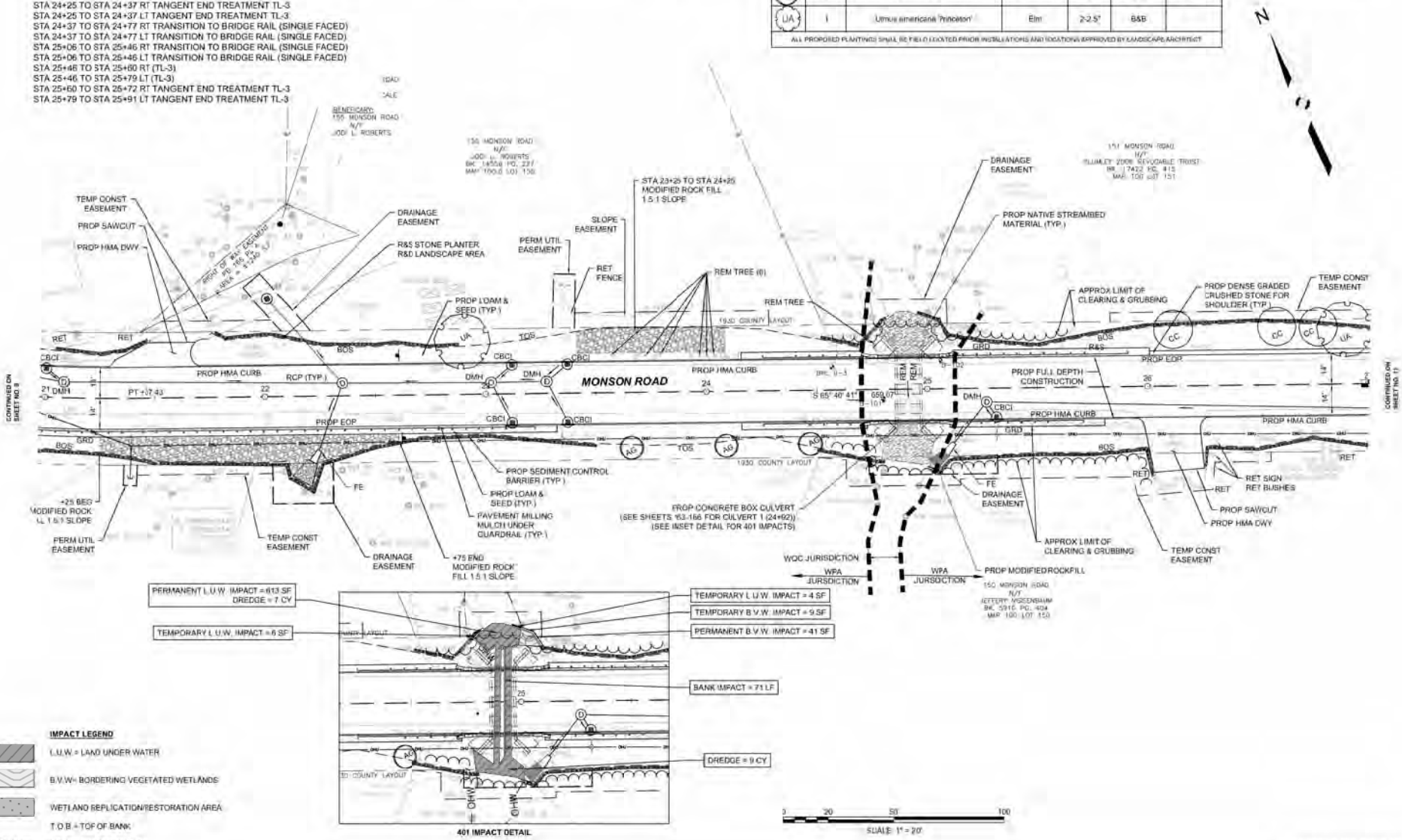
PLANT SCHEDULE

TREES	QTY. (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS



IMPACT LEGEND

L.U.W.= LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B.= TOP OF BANK

—OHW— ORDINARY HIGH WATER

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 23

HIGHWAY GUARD DETAILS
STA 30+62 TO STA 30+75 RT TANGENT END TREATMENT TL-3
STA 30+75 TO STA 33+25 RT (TL-3)

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

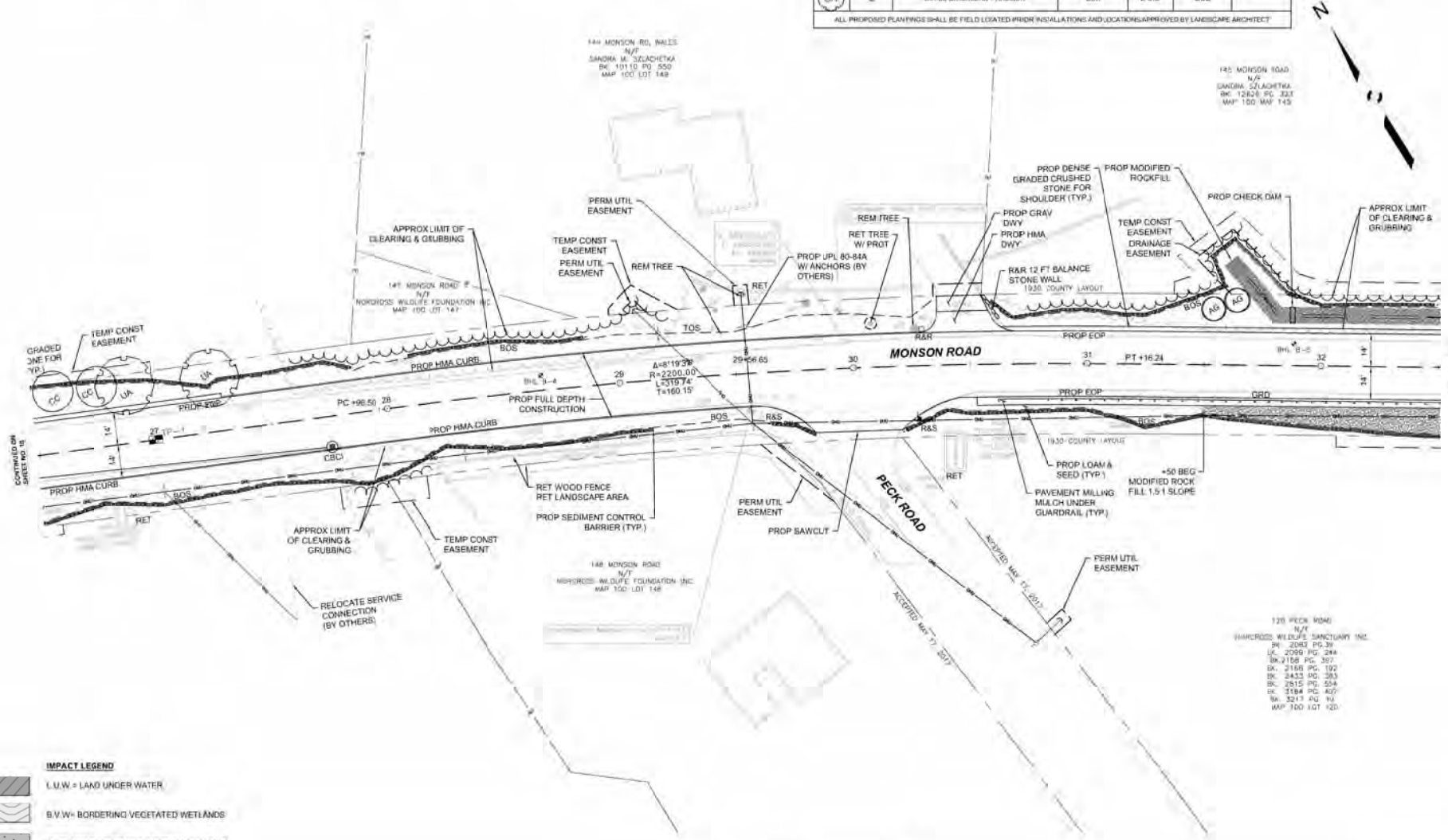
ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		11	

PROJECT FILE NO. 608163

CONSTRUCTION PLANS



IMPACT LEGEND

L.U.W.= LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B.= TOP OF BANK

—OHW— ORDINARY HIGH WATER

FOR PROFILE SEE SHEET NO. 24

A0680.483
Proposal No. 608163-128212

HIGHWAY GUARD DETAILS
STA 30+75 TO STA 33+25 RT (TL-3)
STA 33+25 TO STA 33+38 RT TANGENT END TREATMENT TL-3
STA 35+22 TO STA 35+34 RT TANGENT END TREATMENT TL-3
STA 35+34 TO STA 36+84 RT (TL-3)
STA 36+84 TO STA 36+97 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

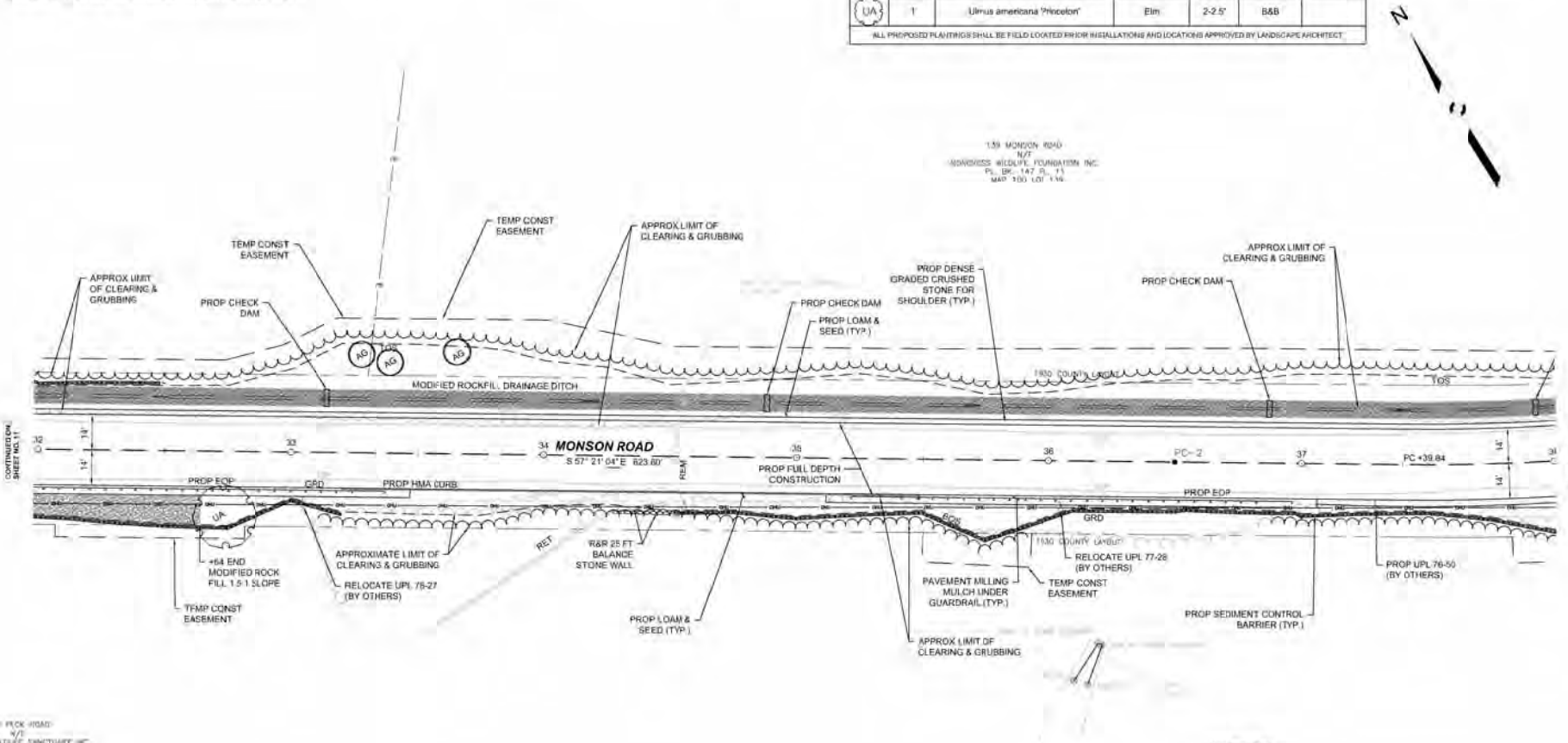
ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		12	151

PROJECT FILE NO. 608163

CONSTRUCTION PLANS



120 FCCX ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC
BK. 2082 PG.38
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 5217 PG. 19
MAP 100 LOT 120

120 FCCX ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC
BK. 2082 PG.38
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 5217 PG. 19
MAP 100 LOT 120

IMPACT LEGEND

L.U.W. = LAND UNDER WATER

B.V.W.= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B. = TOP OF BANK

—OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 25

Proposal No. 608163 (SU) 12/21

HIGHWAY GUARD DETAILS
STA 42+75 TO STA 42+87 RT TANGENT END TREATMENT TL-3
STA 42+87 TO STA 43+86 RT (TL-3)

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

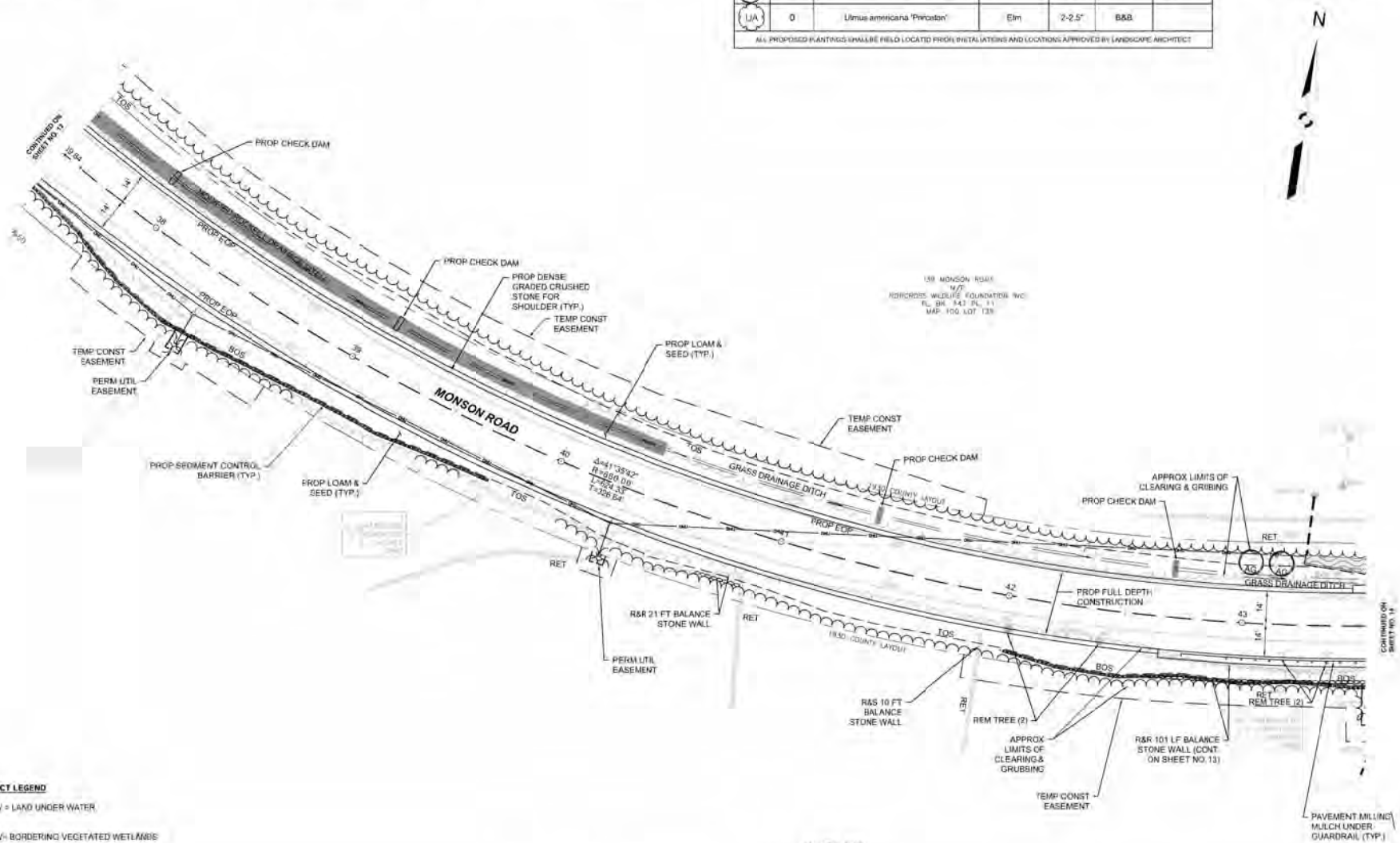
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR TO INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS



IMPACT LEGEND

L.U.W. = LAND UNDER WATER

B.V.W.= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B. = TOP OF BANK

—OHW— ORDINARY HIGH WATER

FOR PROFILE SEE SHEET NO. 26

Proposal No. 6916-19212

HIGHWAY GUARD DETAILS
STA 42+87 TO STA 43+86 RT (TL-3)
STA 43+86 TO STA 43+98 RT TANGENT END TREATMENT TL-3
STA 43+57 TO STA 43+70 LT TANGENT END TREATMENT TL-3
STA 43+70 TO STA 44+57 LT (TL-3)
STA 44+57 TO STA 44+70 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	6	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS

N

135 MONSON ROAD
N/F
NORCROSS WILDLIFE FOUNDATION INC
BK 9562 PG. 213
MAP 100 MAP 135

111 MONSON ROAD
N/F
BARBARA KUSTRA
BK. 5671 PG. 359
MAP 100 LOT 111

PERMANENT B.V.W. IMPACT = 243 SF
PERMANENT L.U.W. IMPACT = 35 SF
BANK IMPACT = 291 LF
PERMANENT L.U.W. IMPACT = 1275 SF
PROP LOAM & SEED (TYP.)
FE (2)
RET
AG
GRASS DRAINAGE DITCH
1930 COUNTY LAYOUT
1931 COUNTY LAYOUT
PROP EOP
TEMP CONST EASEMENT
12" RCP - CLASS V REM EXIST PIPE
PROP HMA DWY
APPROX LIMITS OF CLEARING & GRUBBING
FE
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP GRAV DWY
TEMP CONST EASEMENT
PROP GRAV DWY
PROP HMA DWY
RET
CONTINUED ON SHEET NO. 13
43
44
45
46
47
48
49
N 81° 02' 14" E 250.18'
PC=14.35
PROP FULL DEPTH CONSTRUCTION
MONSON ROAD
Δ=15°45'58"
R=1300.00'
L=357.70'
T=179.99'
CBCI
TOS
PROP HMA CURB
RCP (TYP.)
DMH
REM
RAS
BOS
REM TREE (2)
TEMP CONST EASEMENT
BANK IMPACT = 30 LF
PROP 12" RCP FLARED ENDS
TEMPORARY L.U.W. IMPACT= 46 SF
PERMANENT L.U.W. IMPACT = 166 SF
DRAINAGE EASEMENT
PROP MODIFIED ROCKFILL
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 101 FT BALANCE STONE WALL (CONT. ON SHEET NO. 12)
TEMPORARY L.U.W. IMPACT = 48 SF
R&R 103 LF BALANCE STONE WALL
APPROX LIMITS OF CLEARING & GRUBBING
PROP LOAM& SEED (TYP.)
R&S 12 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
TEMP CONST EASEMENT
DRAINAGE EASEMENT
PERMANENT B.V.W. IMPACT = 19 SF
PERMANENT L.U.W. IMPACT= 41 SF
BANK IMPACT = 12 LF
PROP MODIFIED ROCKFILL
PERMANENT B.V.W. IMPACT = 31 SF
PERMANENT L.U.W. IMPACT= 64 SF
TEMPORARY L.U.W. IMPACT= 5 SF
PROP SEDIMENT CONTROL BARRIER (TYP.)
TEMP CONST EASEMENT
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
CONTINUED ON SHEET NO. 15

120 DECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC
BK. 2052 PG.39
BK. 2099 PG. 244
BK.2158 PG. 387
BK. 2168 PG. 183
BK. 2433 PG. 263
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 130

IMPACT LEGEND
L.U.W.= LAND UNDER WATER
B.V.W= BORDERING VEGETATED WETLANDS
WETLAND REPLICATION/RESTORATION AREA
T.O.B.= TOP OF BANK
—OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 26

Proposal No. 68163-120112

HIGHWAY GUARD DETAILS
STA 49+96 TO STA 50+08 LT TANGENT END TREATMENT TL-3
STA 50+08 TO STA 51+46 LT (TL-3)
STA 51+46 TO STA 51+58 LT TANGENT END TREATMENT TL-3
STA 49+33 TO STA 49+46 RT TANGENT END TREATMENT TL-3
STA 49+46 TO STA 51+71 RT (TL-3)
STA 51+71 TO STA 51+84 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

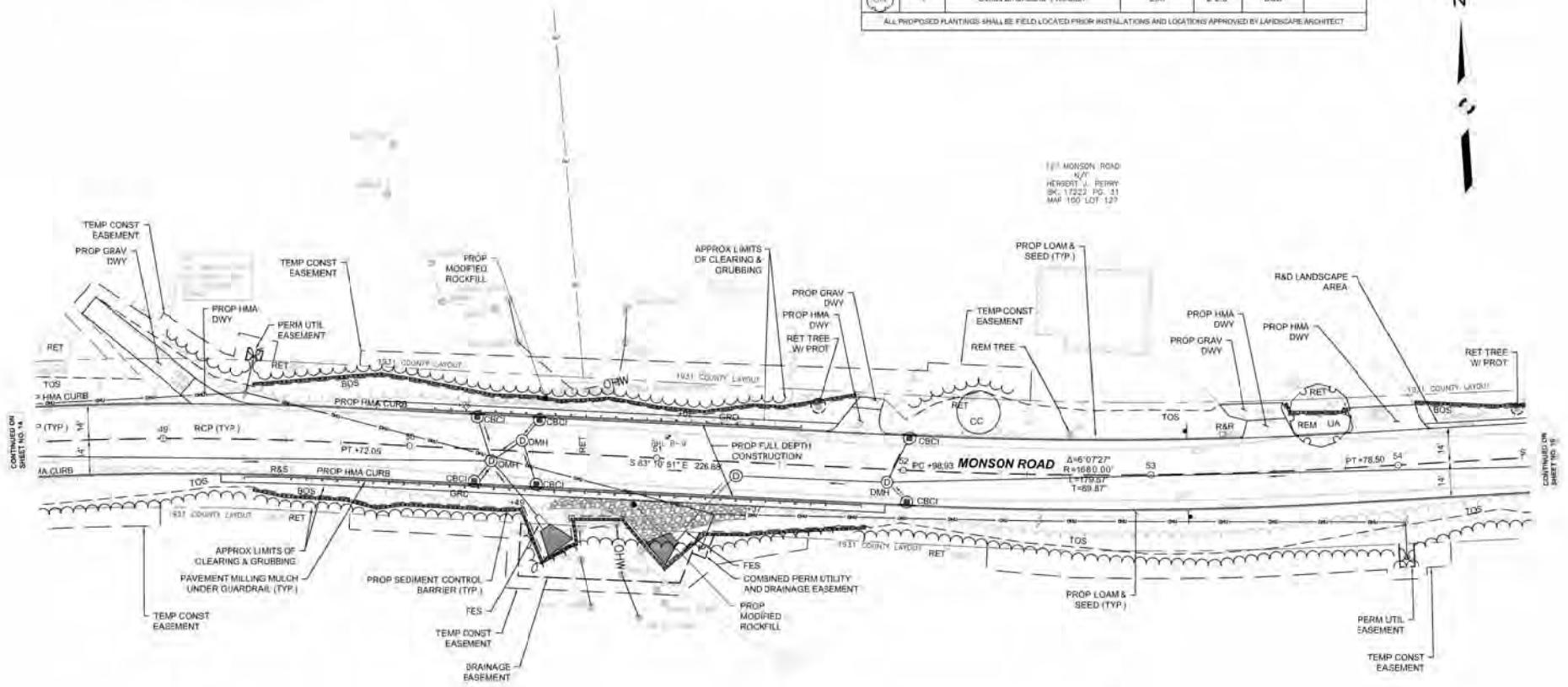
WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		15	

PROJECT FILE NO. ADM 163

CONSTRUCTION PLANS

N



IMPACT LEGEND

- L.U.W. = LAND UNDER WATER
- B.V.W= BORDERING VEGETATED WETLANDS
- WETLAND REPLICATION/RESTORATION AREA
- T.O.B. = TOP OF BANK
- —OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 27

Proposal No. 608153.1212

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

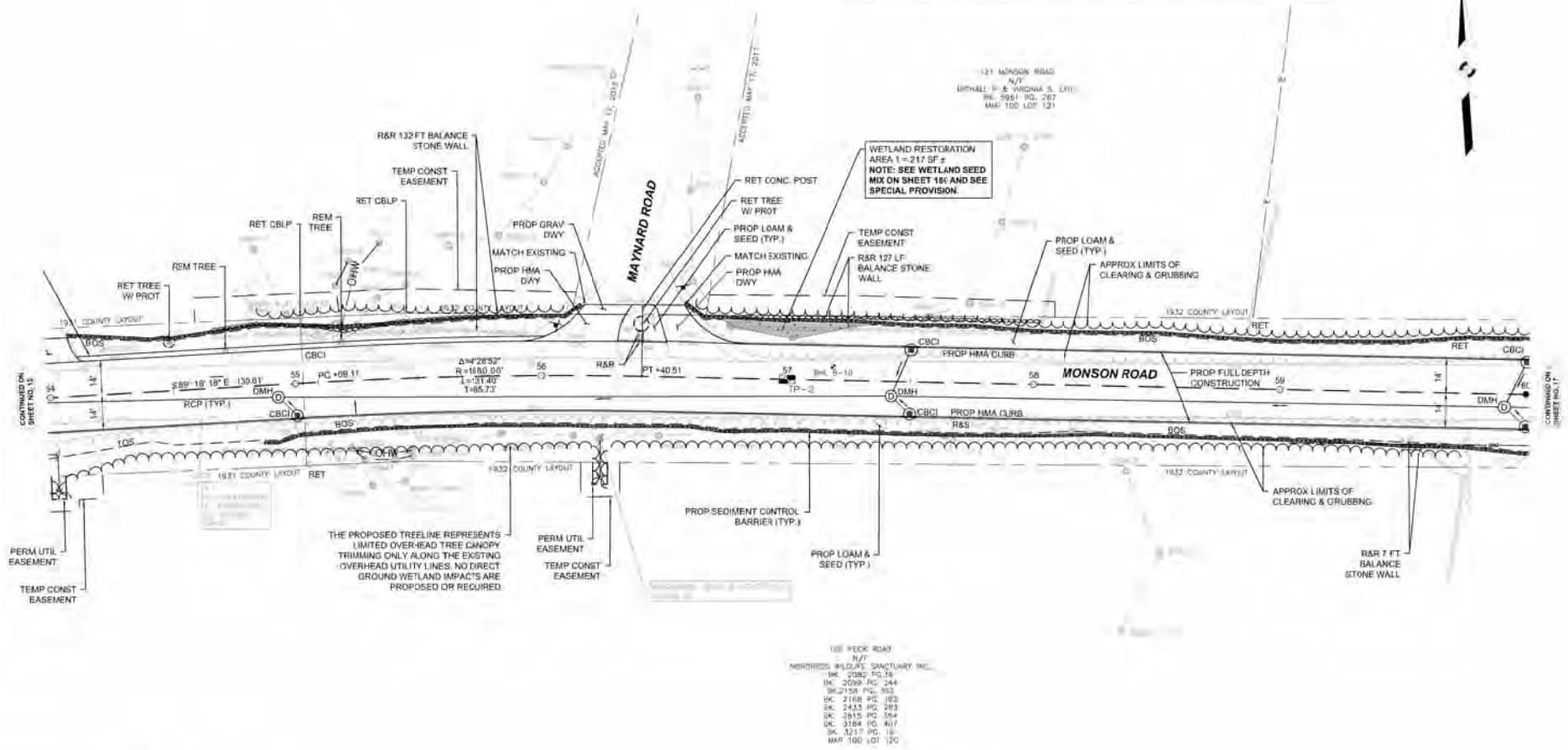
WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		19	

PROJECT FILE NO. 608163

CONSTRUCTION PLANS

N



IMPACT LEGEND

L.U.W.= LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B.= TOP OF BANK

—OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 28

Proposal No. 608163-182112

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

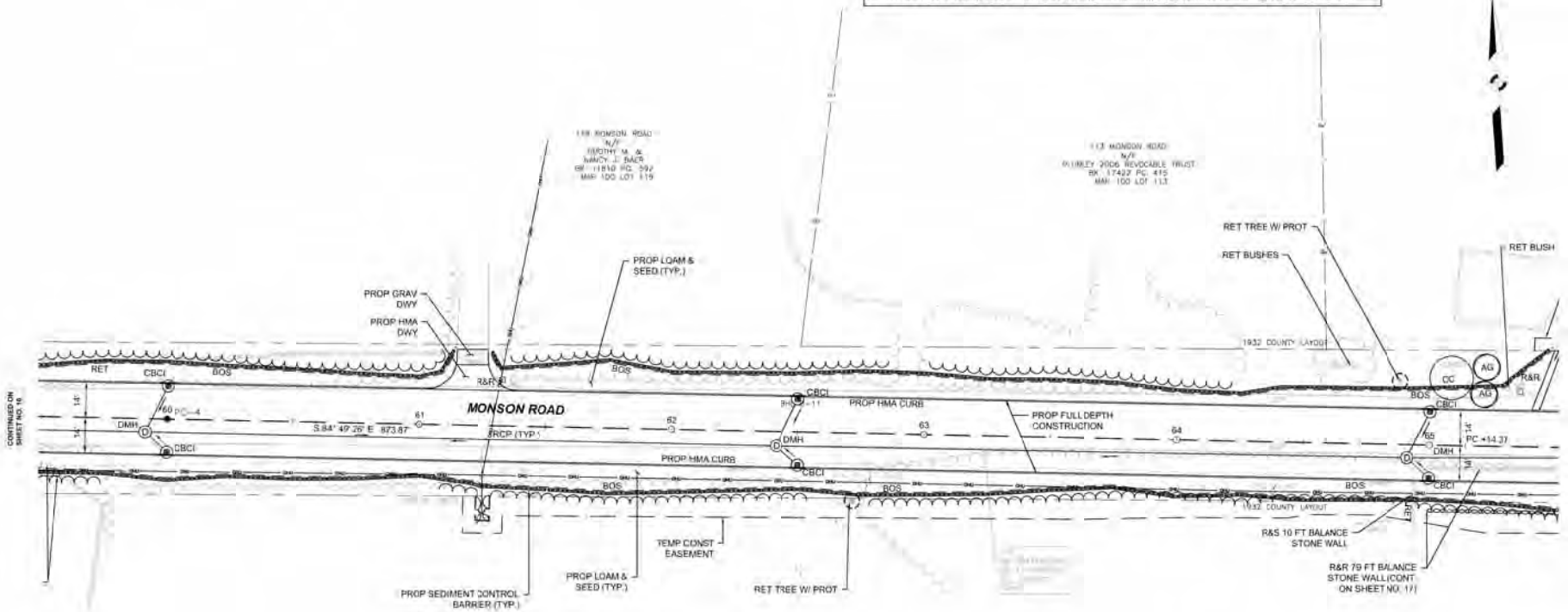
WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		17	

PROJECT FILE NO. 608163

CONSTRUCTION PLANS

N



IMPACT LEGEND

L.U.W. = LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B. = TOP OF BANK

—OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 29

A0680 .dgn
Proposal No. 608163 (3012)12

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

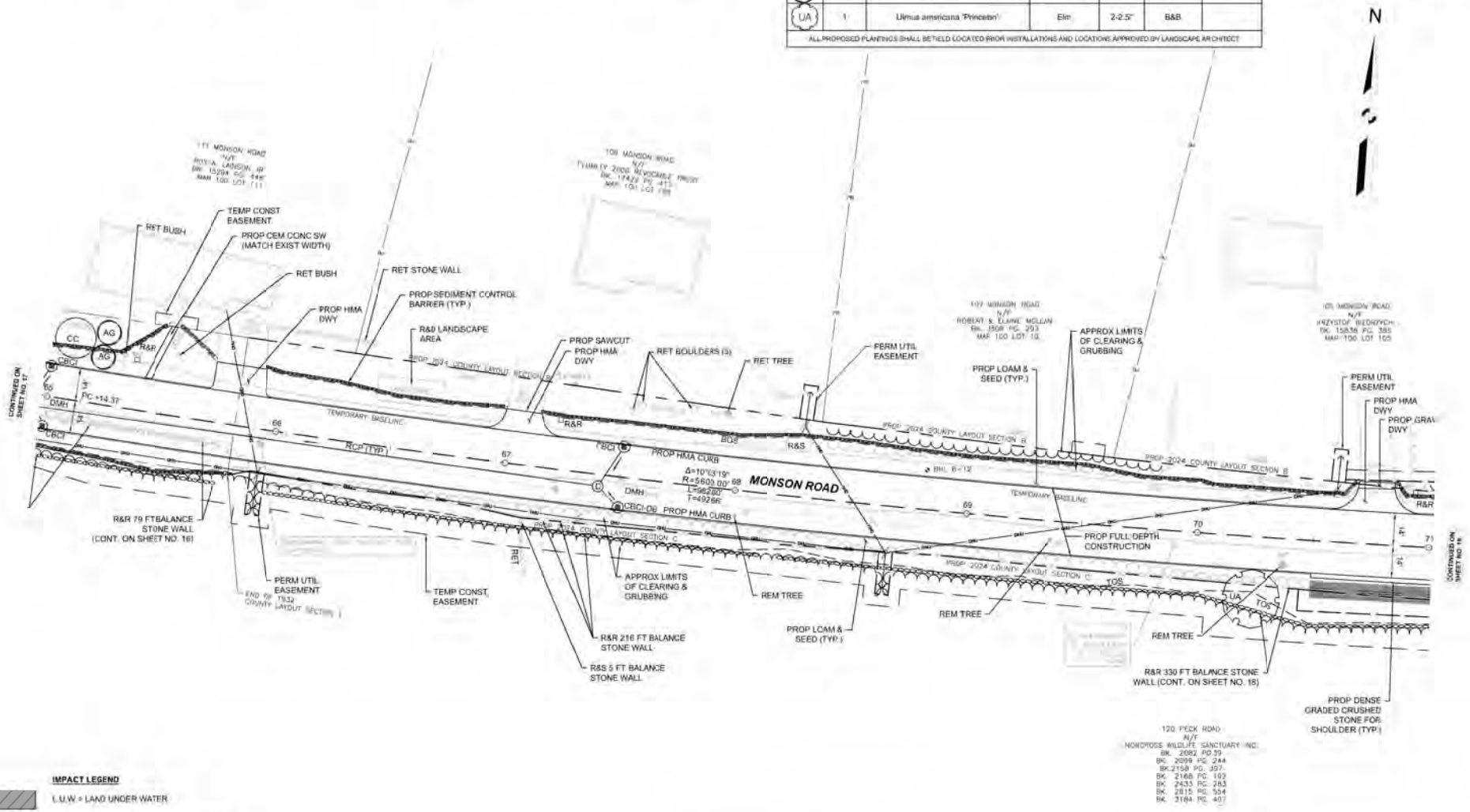
ALL PROPOSED PLANTINGS SHALL BE HELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		15	151

PROJECT FILE NO. 608163

CONSTRUCTION PLANS



IMPACT LEGEND

L.U.W.= LAND UNDER WATER

B.V.W= BORDERING VEGETATED WETLANDS

WETLAND REPLICATION/RESTORATION AREA

T.O.B.= TOP OF BANK

—OHW— ORDINARY HIGH WATER

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 30

HIGHWAY GUARD DETAILS

STA 71+83 TO STA 71+95 RT TANGENT END TREATMENT TL-3
STA 71+95 TO STA 74+07 RT (TL-3)
STA 74+07 TO STA 74+19 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	2	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

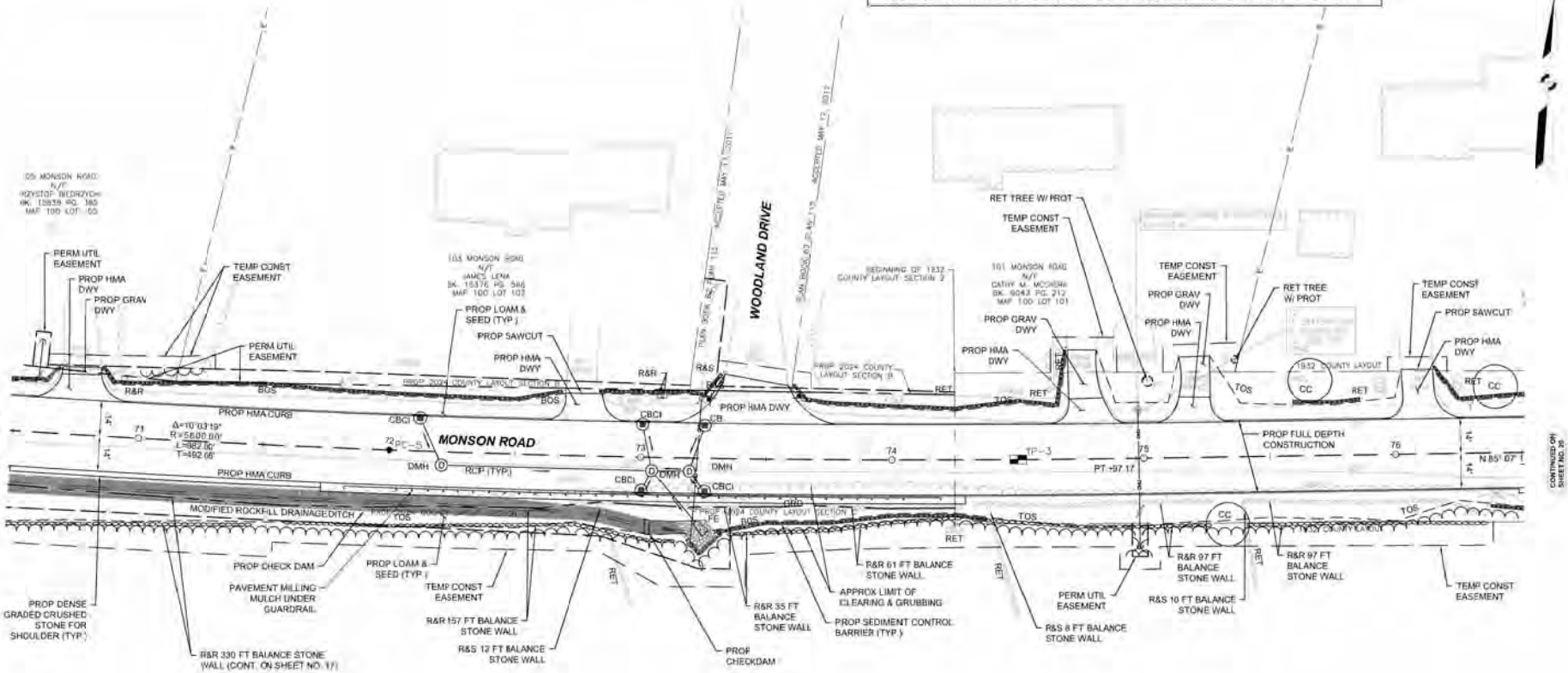
WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		16	151

PROJECT FILE NO. 608163

CONSTRUCTION PLANS

N



IMPACT LEGEND

- L.U.W.= LAND UNDER WATER
- B.V.W= BORDERING VEGETATED WETLANDS
- WETLAND REPLICATION/RESTORATION AREA
- T.O.B.= TOP OF BANK
- —OHW— ORDINARY HIGH WATER

SCALE: 1" = 20'

120 PECK ROAD
N/F
TORCROSS WILDLIFE SANCTUARY INC
BK. 2062 PG. 36
BK. 2098 PG. 244
BK.2159 PG. 387
BK. 2168 PG. 192
BK. 2433 PG. 263
BK. 2815 PG. 354
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

FOR PROFILE SEE SHEET NO. 31

HIGHWAY GUARD DETAILS

STA 80+08 TO STA 80+21 RT TANGENT END TREATMENT TL-3
STA 80+21 TO STA 82+59 RT (TL-3)
STA 81+79 TO STA 81+92 LT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	2	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	4	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

CONSTRUCTION PLANS

MONSON ROAD

TEMP CONST EASEMENT
PROP SAWCUT
PROP HMA DWY
PROP GRAV DWY
APPROX LIMITS OF CLEARING & GRUBBING
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP LOAM & SEED (TYP.)
RET TREE W/ PROT
PERM UTIL EASEMENT
RET TREE W/ PROT (2)
PROP HMA CURB
PROP EOP
R&R 82 FT BALANCE STONE WALL
PROP SEDIMENT CONTROL BARRIER (TYP.)
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 22 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
PROP CONCRETE HEADWALL
PERM DRAINAGE EASEMENT
PROP CROSSING (SEE SHEETS 167-168 CULVERT 2 (82+07))
SEE IN SET DETAIL FOR 401 IMPACTS
PROP FULL DEPTH CONSTRUCTION
PC +57.91
PT +65.84
Δ=9°56'08"
R=1200.00'
L=207.73'
T=104.13'
N 85° 07' 15" E 380.75'
RCP (TYP.)
CONTINUED ON SHEET NO. 19
CONTINUED ON SHEET NO. 21

401 IMPACT DETAIL

TEMPORARY B.V.W. IMPACT = 39 SF
PERMANENT B.V.W. IMPACT = 26 SF
BANK IMPACT 13 LF
PERMANENT B.V.W. IMPACT = 10 SF
TEMPORARY B.V.W. IMPACT = 15 SF
TEMPORARY B.V.W. IMPACT 18 SF
TEMPORARY L.U.W IMPACT = 29 SF
PERMANENT L.U.W IMPACT = 24 SF
DREDGE VOLUME = 3 CY
PERMANENT B.V.W. IMPACT = 33 SF
BANK IMPACT 10 LF
PERMANENT L.U.W IMPACT = 30 SF
PERMANENT B.V.W. IMPACT = 6 SF
TEMPORARY B.V.W. IMPACT = 7 SF
TEMPORARY L.U.W. IMPACT = 5 SF

IMPACT LEGEND

L.U.W. = LAND UNDER WATER
B.V.W= BORDERING VEGETATED WETLANDS
WETLAND REPLICATION/RESTORATION AREA
T.O.B. = TOP OF BANK
—OHW— ORDINARY HIGH WATER

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 32

Proposal No. 0016313012

HIGHWAY GUARD DETAILS

STA 80+21 TO STA 82+59 RT (TL-3)
STA 82+59 TO STA 82+72 RT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)
STA 82+92 TO STA 83+04 LT TANGENT END TREATMENT TL-3
STA 84+54 TO STA 84+66 RT TANGENT END TREATMENT TL-3
STA 84+66 TO STA 85+84 RT (TL-3)
STA 85+64 TO STA 86+04 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+43 TO STA 1+83 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+83 TO STA 2+07 RT (TL-3)
STA 02+07 TO STA 02+20 RT TANGENT END TREATMENT TL-3

STA 02+20 TO STA 02+07 LT TANGENT END TREATMENT TL-3
STA 02+07 TO STA 87+79 RT (TL-3)
STA 87+79 TO STA 87+92 RT TANGENT END TREATMENT TL-3
STA 87+02 TO STA 87+42 LT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 87+42 TO STA 87+87 LT (TL-3)
STA 87+87 TO STA 88+00 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	5	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

ALL PROPOSED PLANTING SHALL BE FIELD LOCATED PRIOR INSTALLATION AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

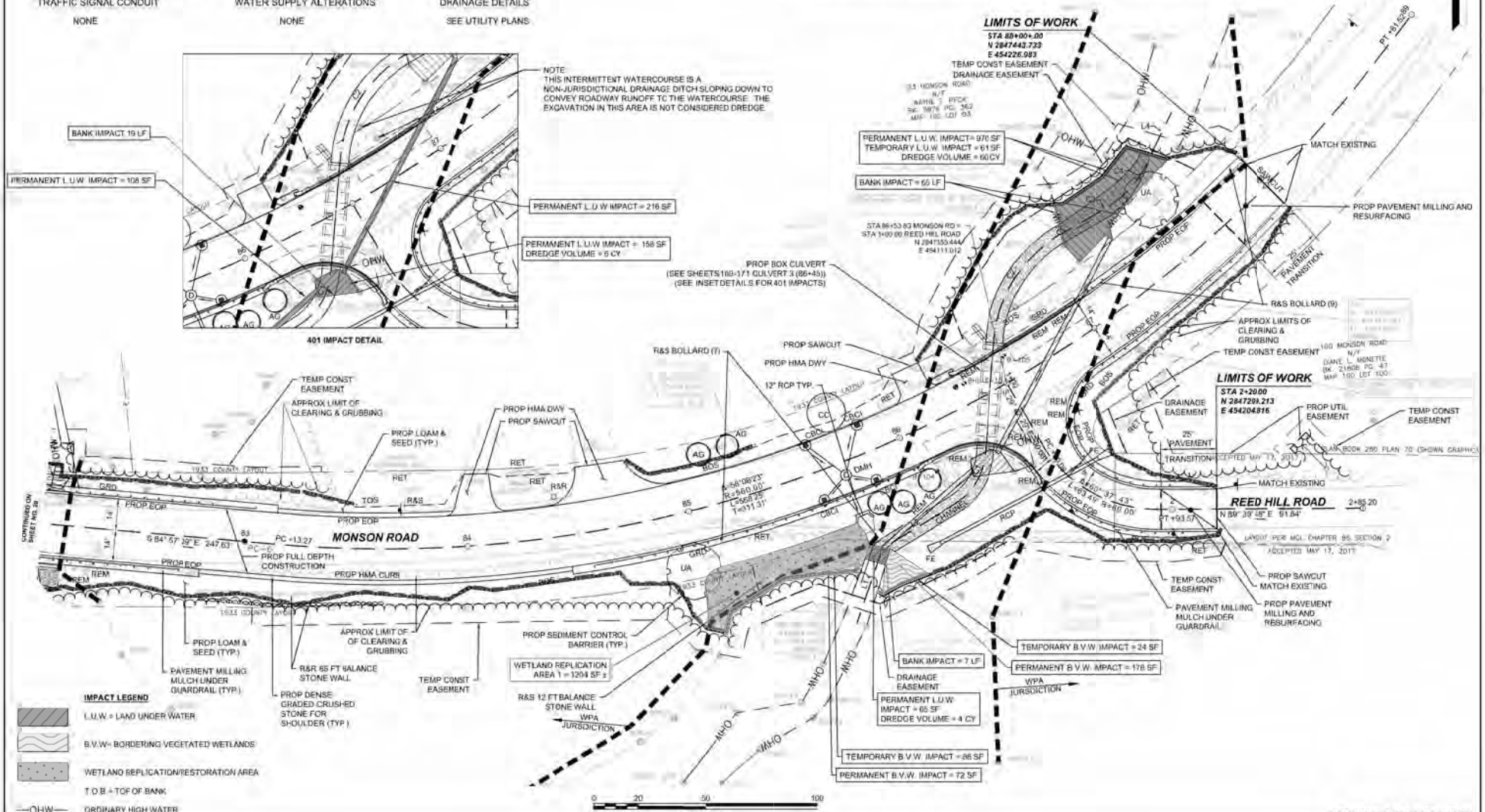
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA		21	180

PROJECT FILE NO. 608163

CONSTRUCTION PLANS

N

401 IMPACT DETAIL



FOR PROFILE SEE SHEET NO. 33

Proposal No. 608163-128212

608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:43 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NOS. 8 AND 9

TOWN OF MONSON

TOWN OF WALES

LIMIT OF WORK
STA. 11+00.00
N 2848862.235
E 446899.548
EL = 862.87

MONSON ROAD

MATCH EXISTING PROFILE

GRADE BREAK STA = 11+00.00
ELEV = 862.87

EXIST 12" STONE BOX CULVERT

NORMAL CROWN

+39

1.61%

GRADE BREAK STA = 11+52.00
ELEV = 863.71

SUPERELEVATION TRANSITION
NORMAL CROWN TO e=5.0%

FULL SUPERELEVATION RIGHT
e=5.0%

+95

EXISTING GRADE

PROPOSED GRADE

2.90%

PROPOSED 18" RCP

EXISTING 12" CPP

BENCHMARK
MAGNAIL IN UTILITY POLE
ELEV. = 868.98'
STA. 12+79.94
OFF 13.54' RT

CONTINUED BELOW

CONTINUED ON SHEET NO. 23

MONSON ROAD

PVC: 16+05
ELEV: 876.41

HIGH POINT ELEV = 880.20
HIGH POINT STA = 18+36.94
PVI STA = 17+75.00
PVI ELEV = 881.76
A.D.T. = 4,25%
K = 80.05
340' VC
424.1' SSD

LYNCH ROAD

-1.35%

PVT: 19+45
ELEV: 879.47

EXISTING GRADE

PROPOSED GRADE

FULL SUPERELEVATION RIGHT
e=5.0%

SUPERELEVATION TRANSITION
e=5.0% TO e=0%

+22

SUPERELEVATION TRANSITION
e=0% TO e=6.0%

+28

SUPERELEVATION TRANSITION
e=6.0% TO NORMAL CROWN

FULL SUPERELEVATION LEFT
e=6.0%

+56

+93

BENCHMARK
MAGNAIL IN UTILITY POLE
ELEV. = 877.63'
STA. 21+57.43
OFF 16.83' RT

CONTINUED ABOVE

HOR SCALE IN FEET
20 0 20 40

VER. SCALE IN FEET
4 0 4 8

NAVD 88
BASE ELEV
865.00

EXIST. ELEVATION
PROP. ELEVATION

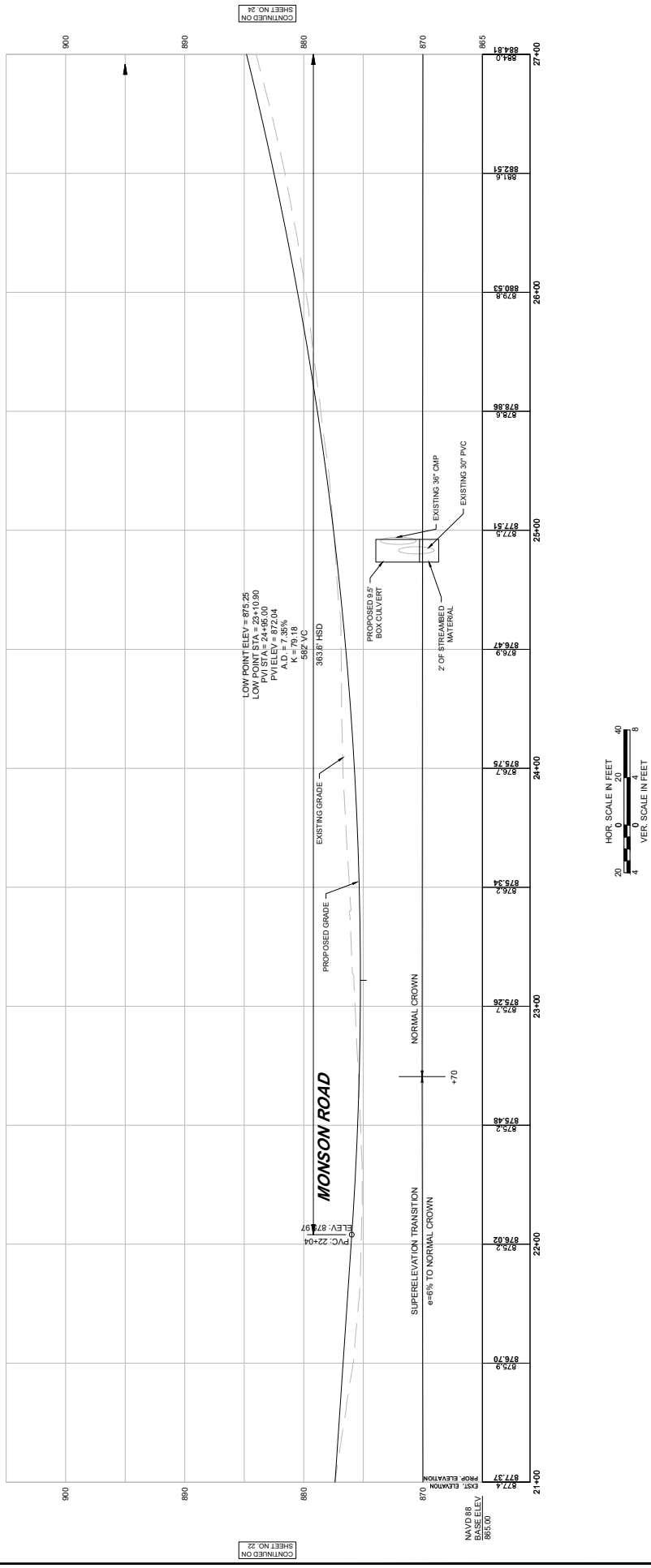
608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:43 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 10



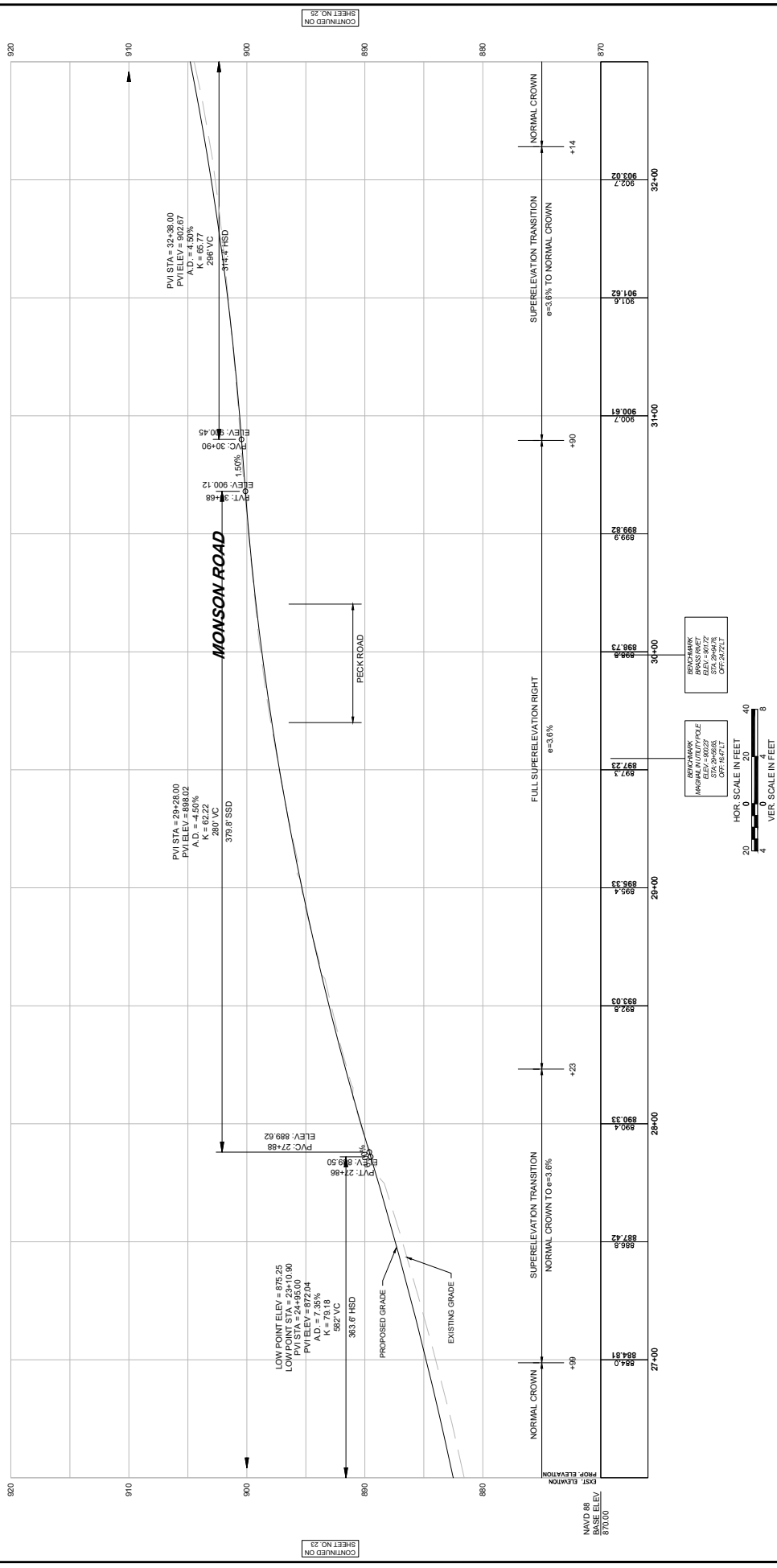
608163_HDAPROFILE.DWG Plotted on 25-Jun-2024 3:43 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 11



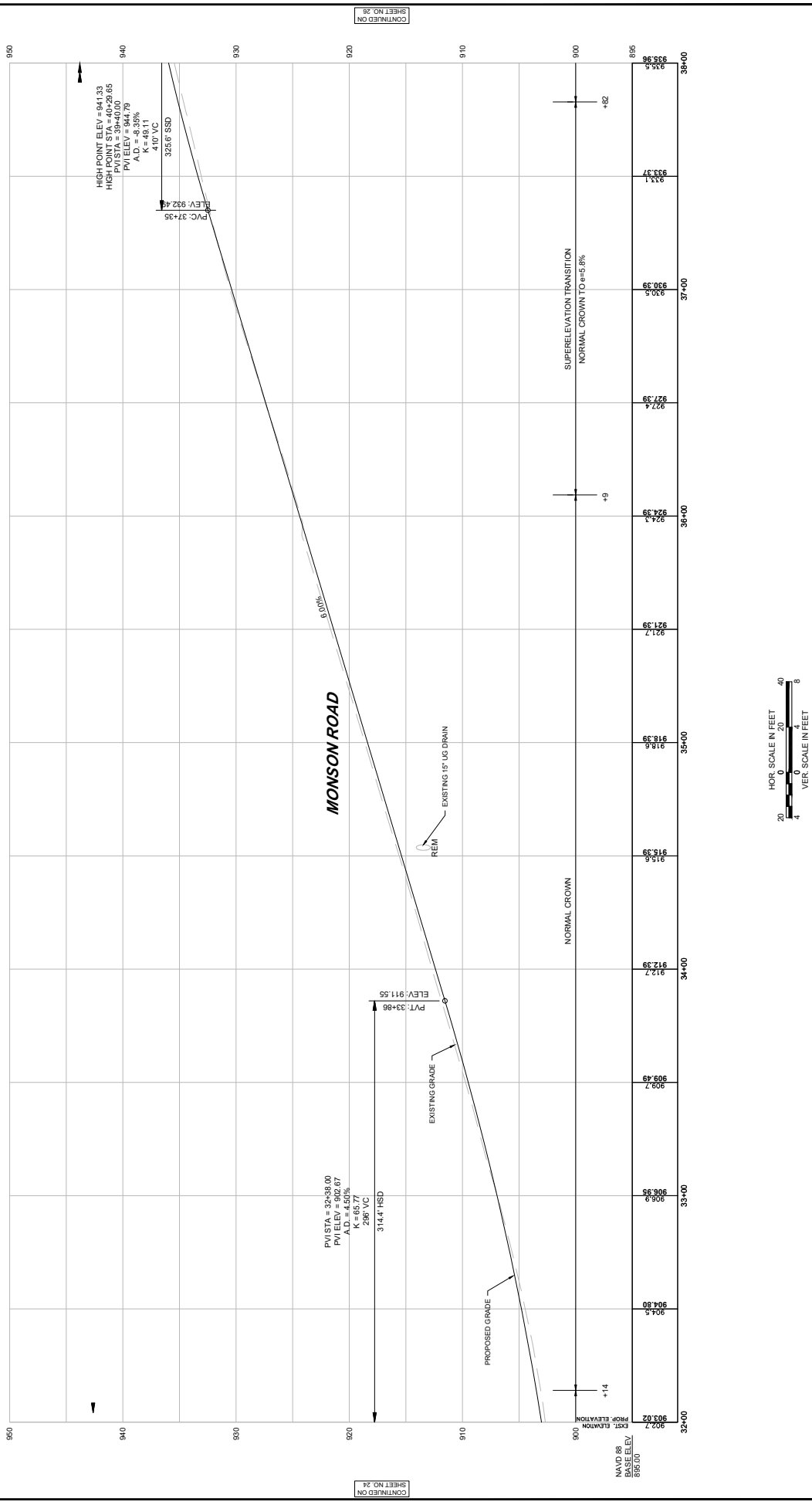
608163_HDAPROFILE.DWG Plotted on 25-Jun-2024 3:43 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	25	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 12

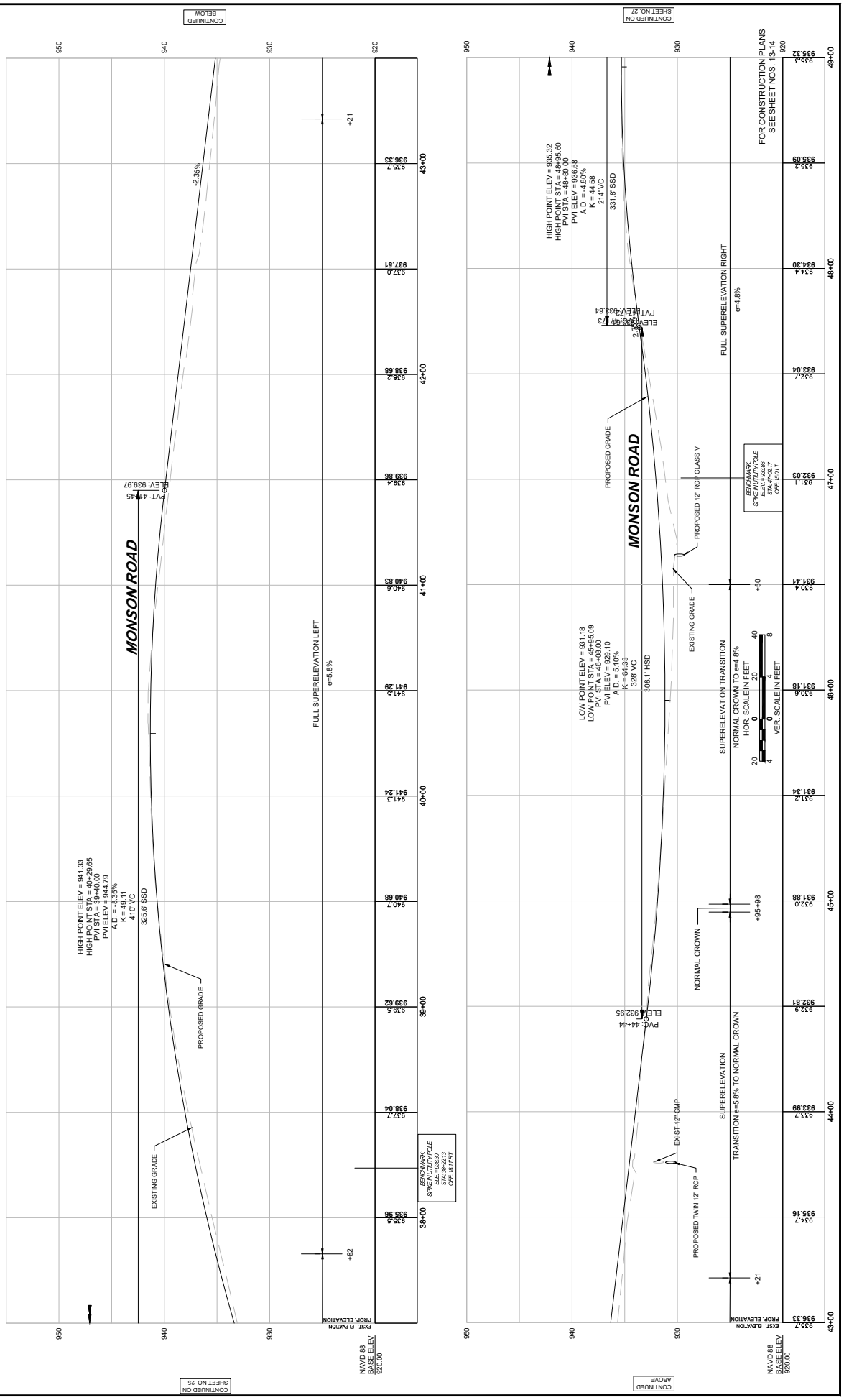


608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:44 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	26	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:44 PM

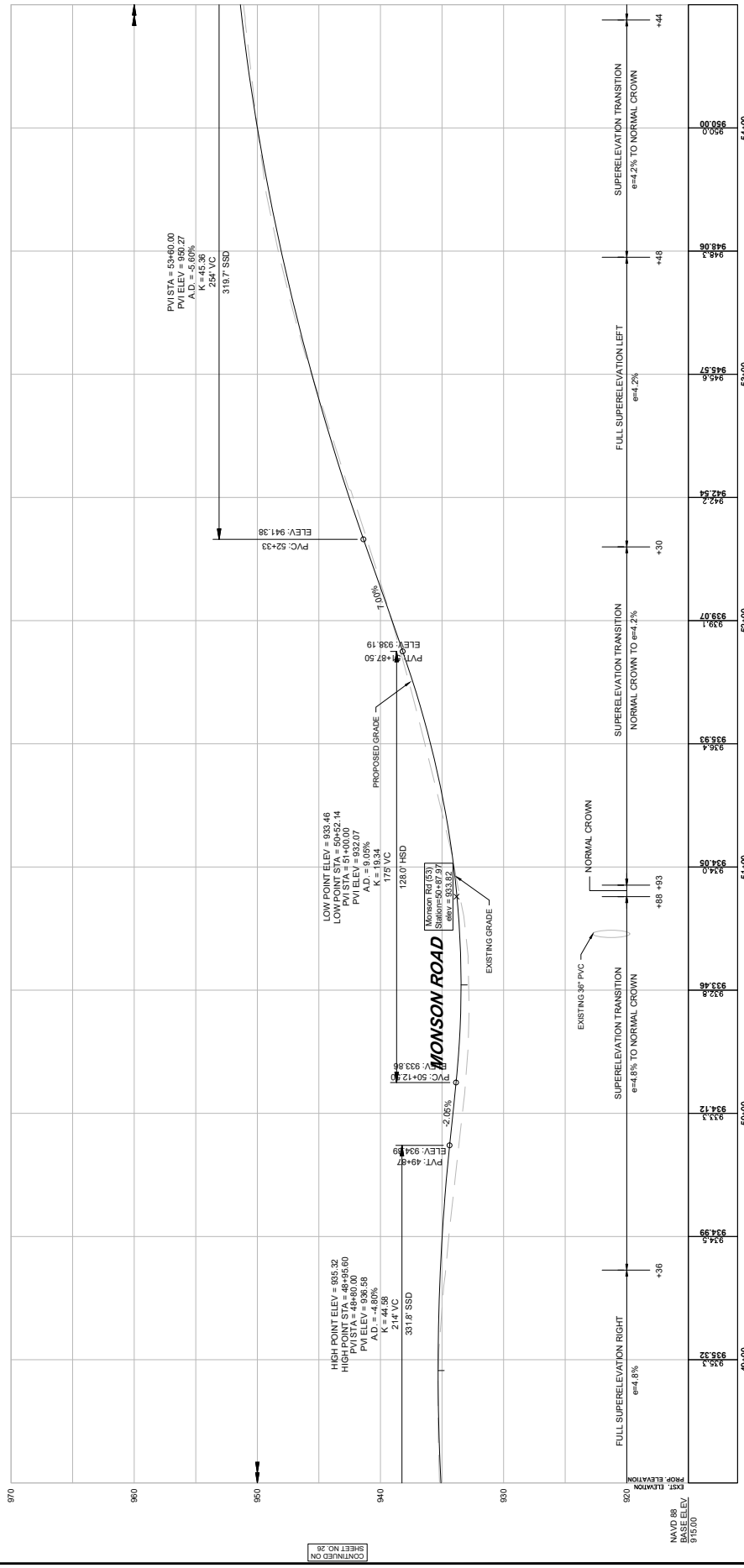
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	27	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 15

CONTINUED ON SHEET NO. 28

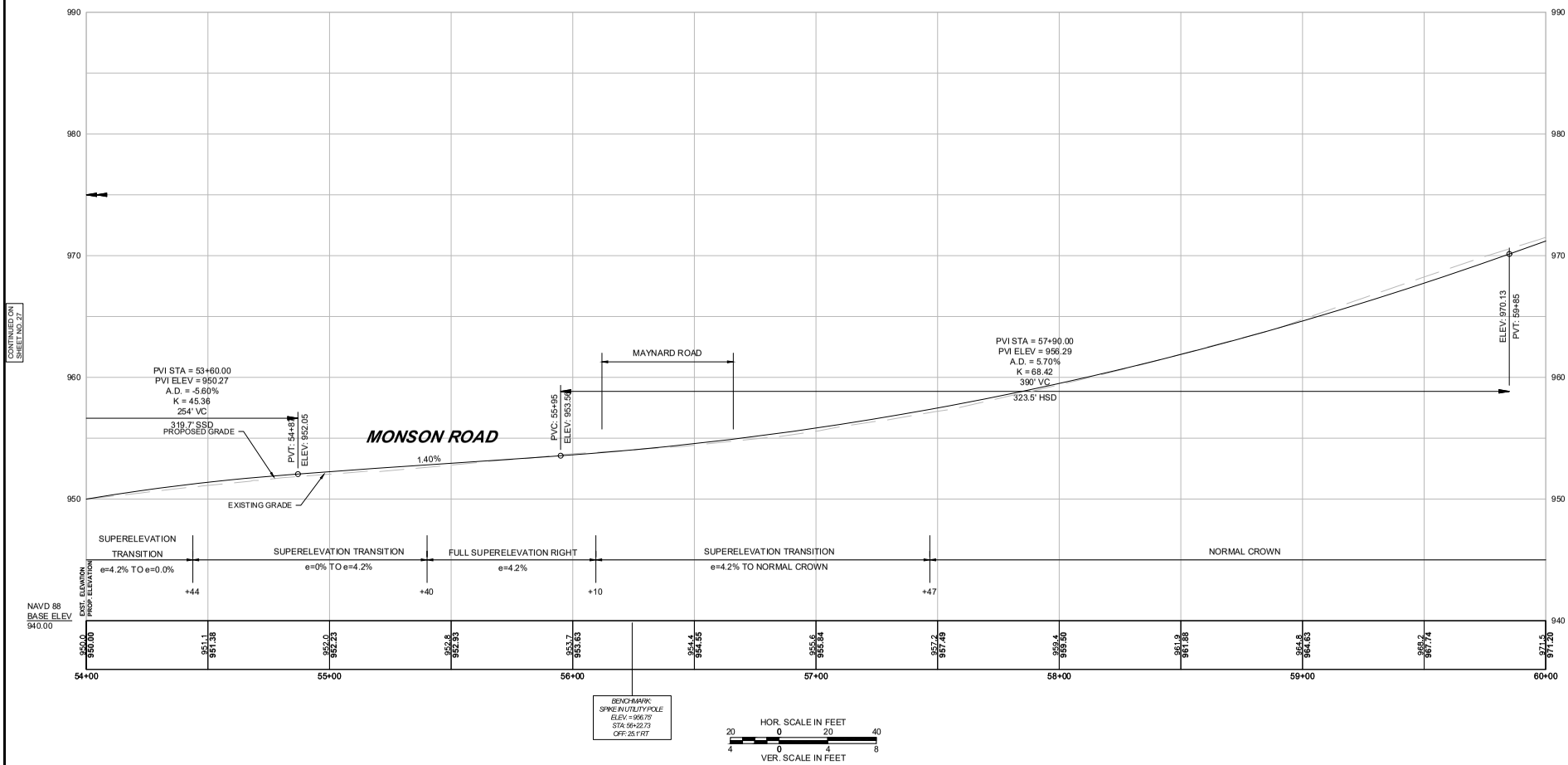


CONTINUED ON SHEET NO. 26

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	28	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 16

608163_H04PROFILE1.DWG Plotted on 25-Jun-2024 3:44 PM

Proposal No. 608163-138312

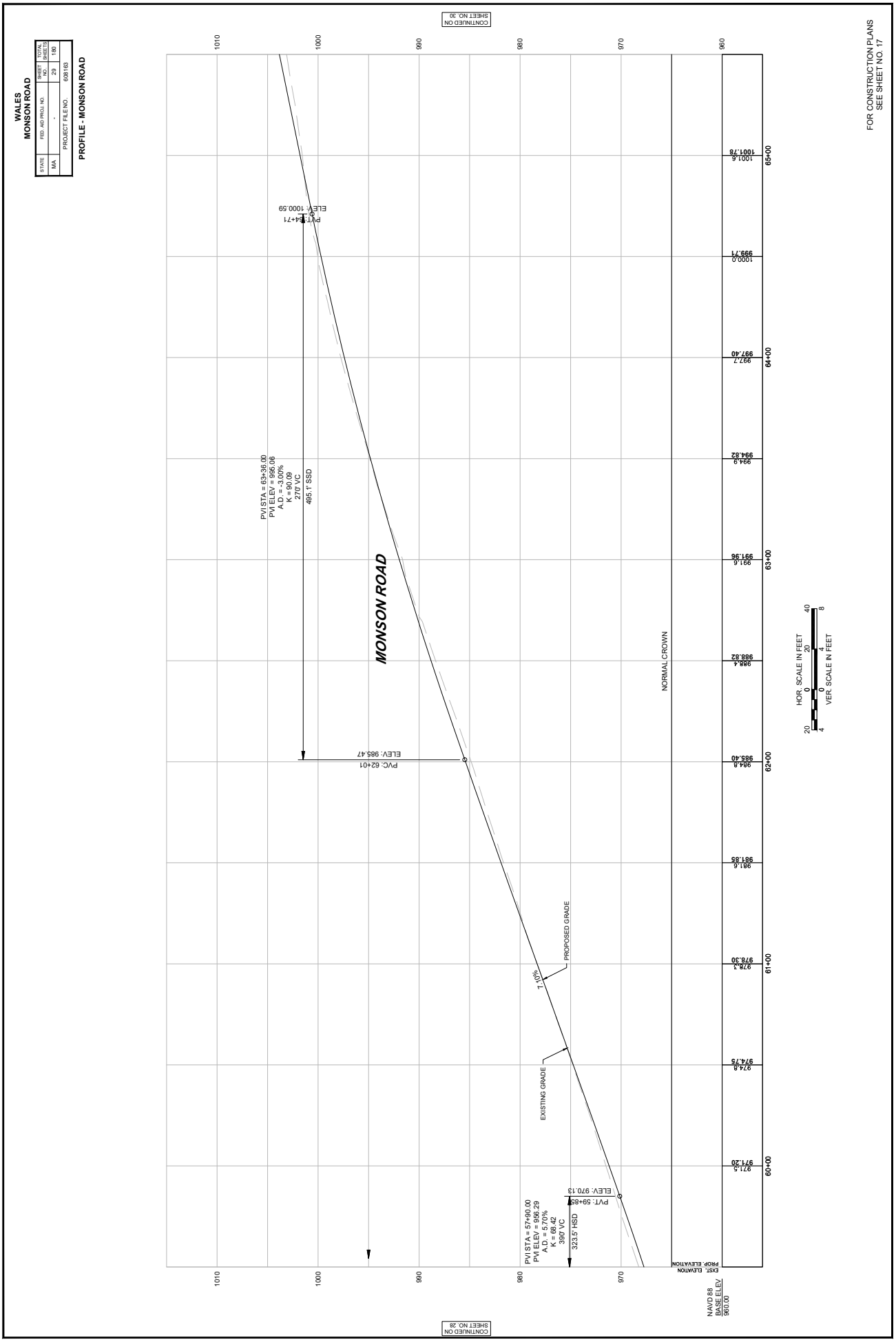
Addend. 5.10

608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:44 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	29	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



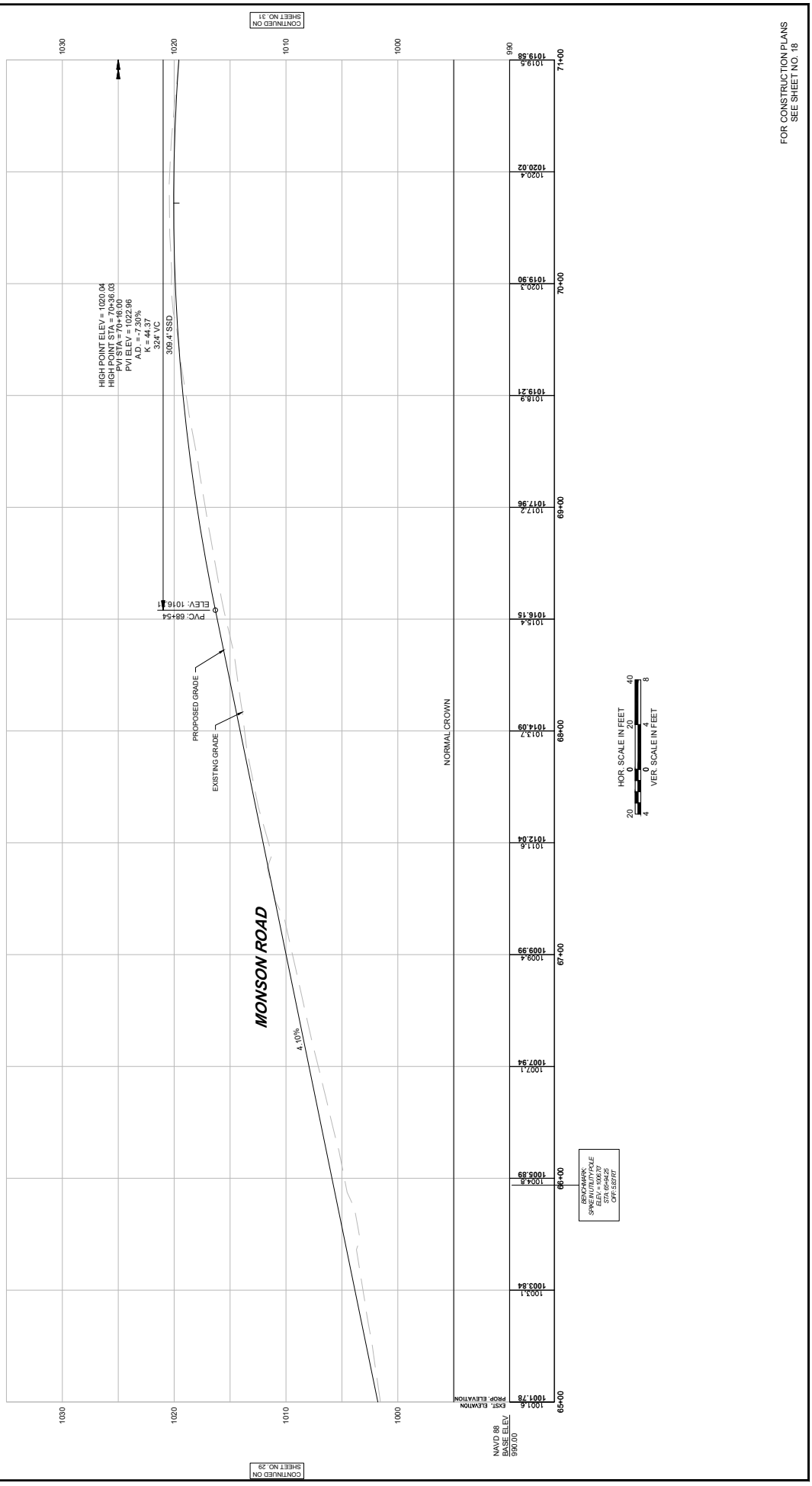
608163_HD4\PROFILE).DWG Plotted on 25-Jun-2024 3:44 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	30	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

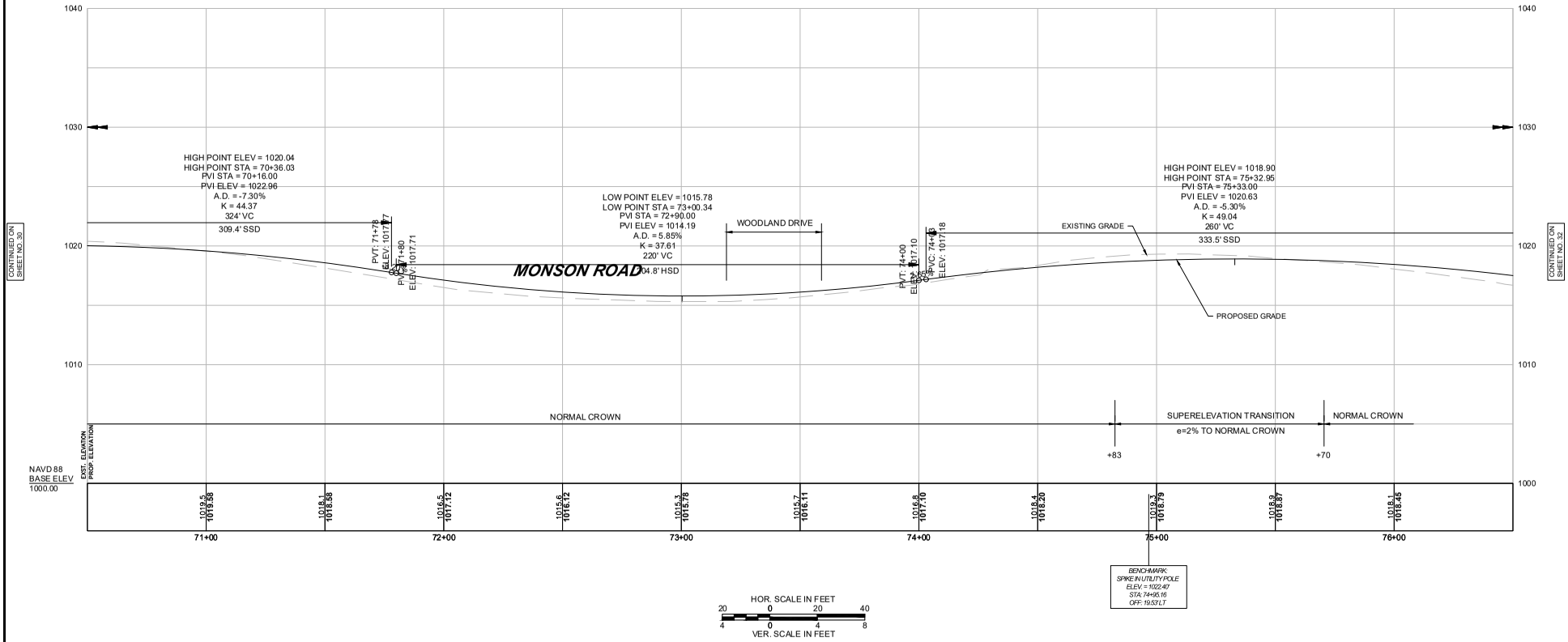
FOR CONSTRUCTION PLANS
SEE SHEET NO. 18



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	31	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 19

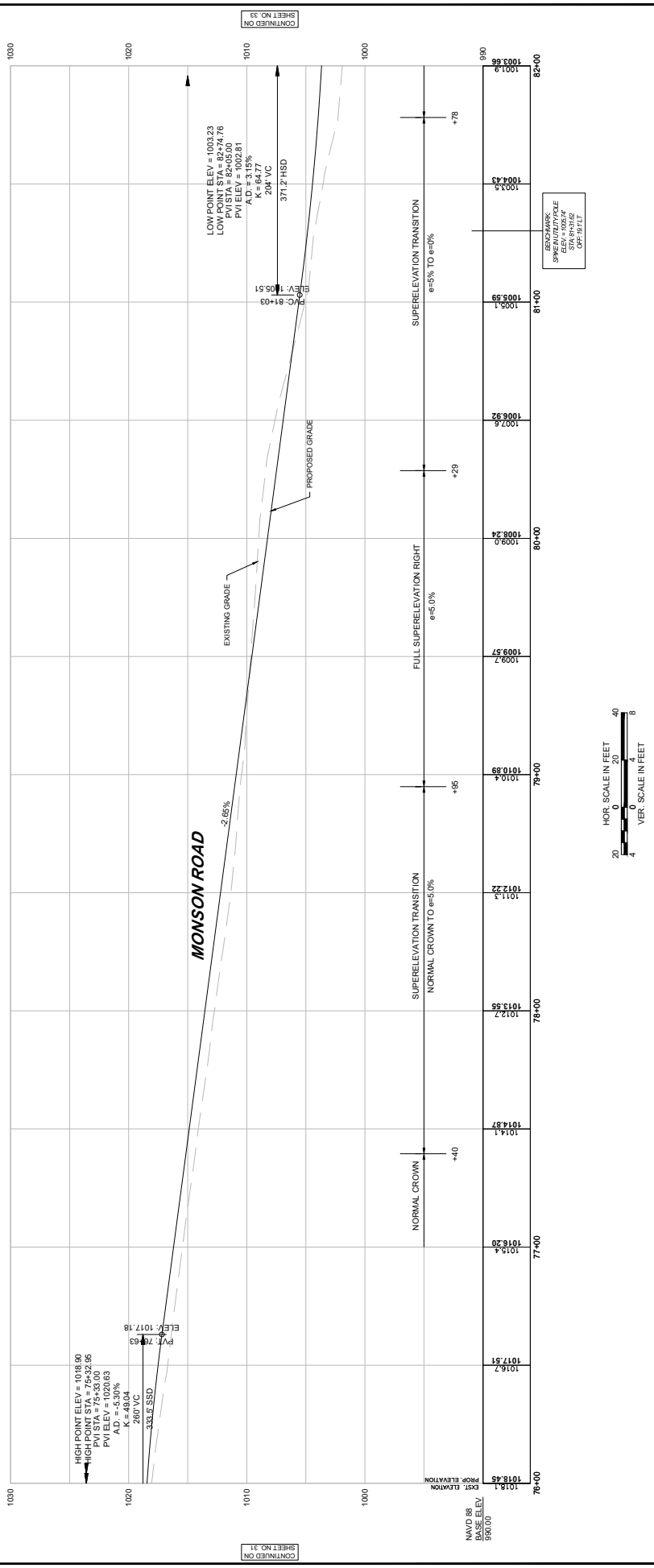
608163_HD4(PROFILE).DWG Plotted on 25-Jun-2024 3:45 PM
Proposal No. 608163-138612
A0849.513

608163_HD4PROFILE.DWG Plotted on 25-Jun-2024 3:45 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	180
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

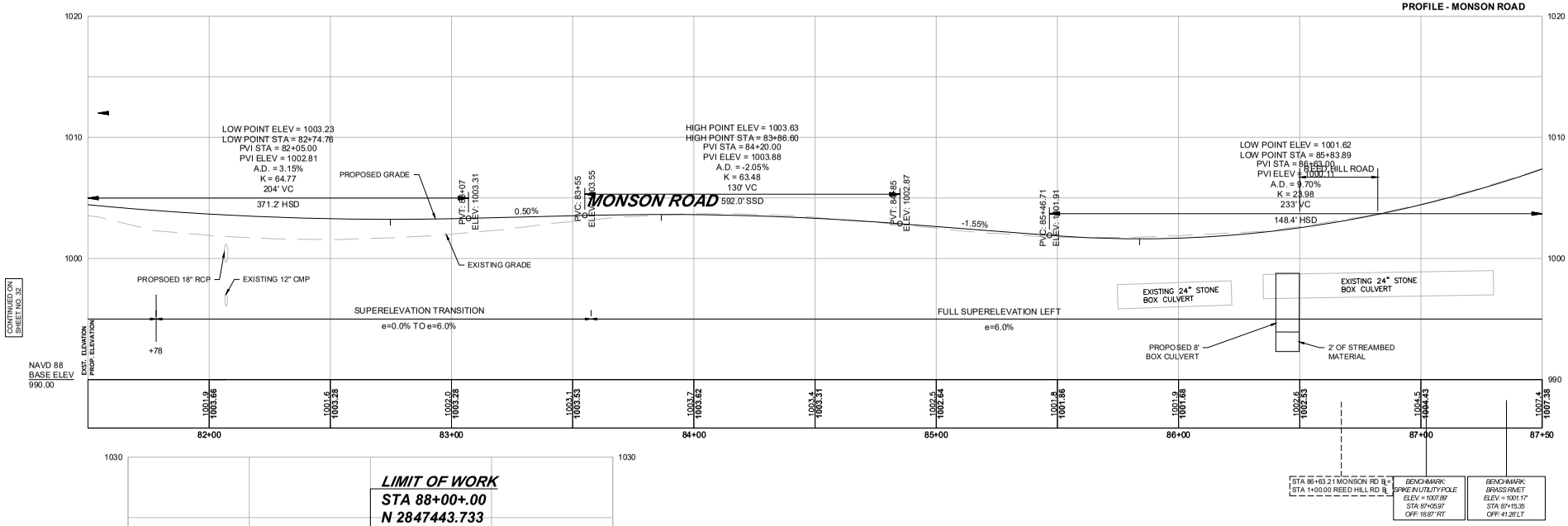


FOR CONSTRUCTION PLANS
SEE SHEET NO. 20

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	180
PROJECT FILE NO.	608163		

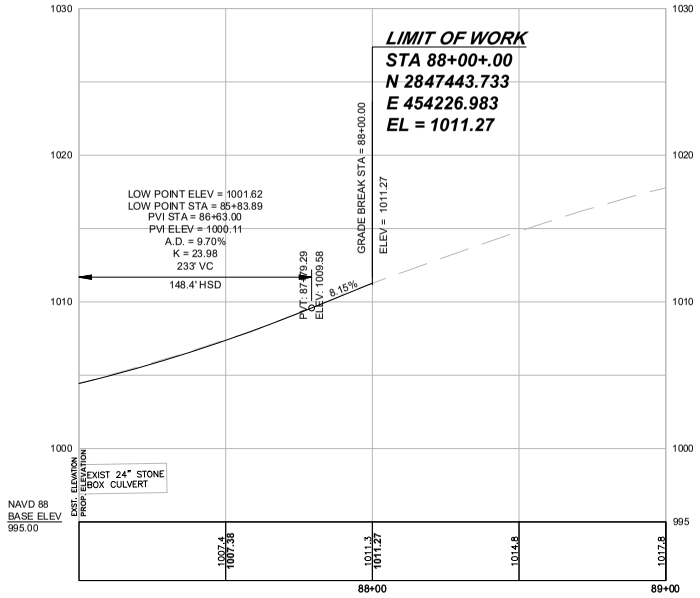
PROFILE - MONSON ROAD



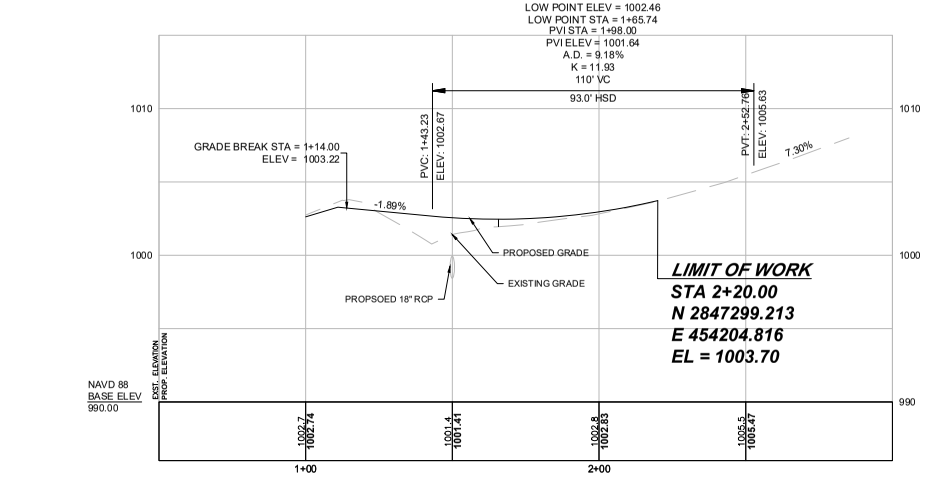
STA 86+63.21 MONSON RD ℄ =
STA 1+00.00 REED HILL RD ℄

BENCHMARK:
SPIKE IN UTILITY POLE
ELEV = 1007.89
STA: 87+05.97
OFF: 18.87' RT

BENCHMARK:
BRASS RIVET
ELEV = 1001.17
STA: 87+15.35
OFF: 41.26' LT



MONSON ROAD

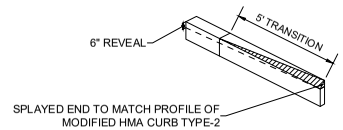


REED HILL ROAD

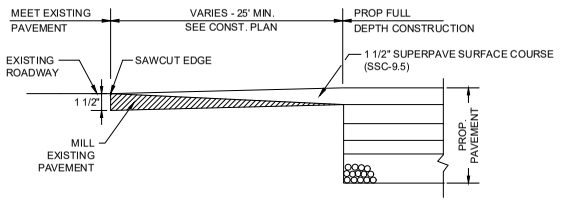
HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

FOR CONSTRUCTION PLANS
SEE SHEET NO. 21

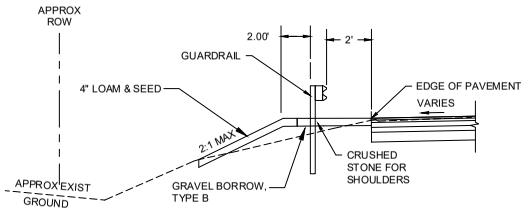
608163_HD4(PROFILE).DWG Plotted on 25-Jun-2024 3:46 PM
Proposal No. 608163, 1,3&12
608163_515



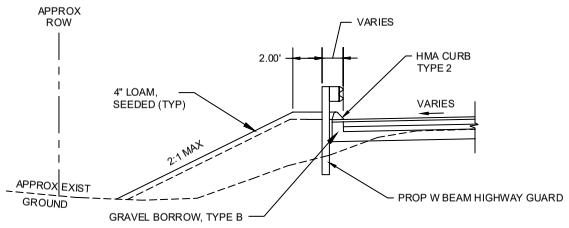
GRANITE CURB - SPLAYED END
NOT TO SCALE



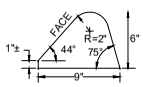
PROPOSED PAVEMENT TRANSITION
(LONGITUDINAL SECTION)
NOT TO SCALE



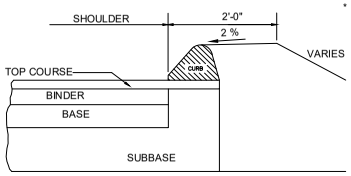
HIGHWAY GUARD INSTALLATION DETAIL
(WITHOUT CURB OR BERM)
NOT TO SCALE



HIGHWAY GUARD INSTALLATION DETAIL
(WITH HMA CURB TYPE 2)
NOT TO SCALE

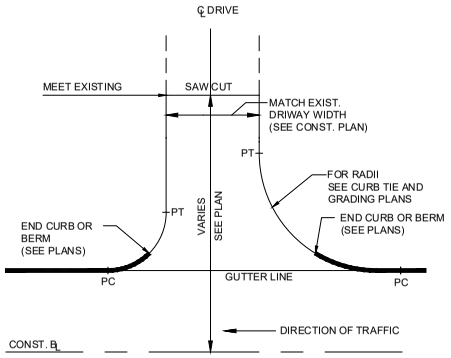


TYPE - 2

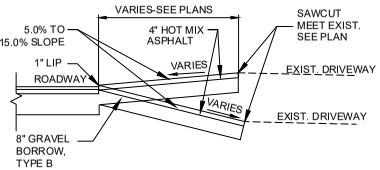


NOTE:
* SEE TYPICAL SECTIONS FOR PROJECT.

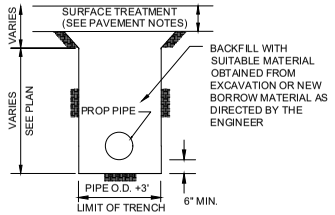
HOT MIX ASPHALT CURB
NOT TO SCALE



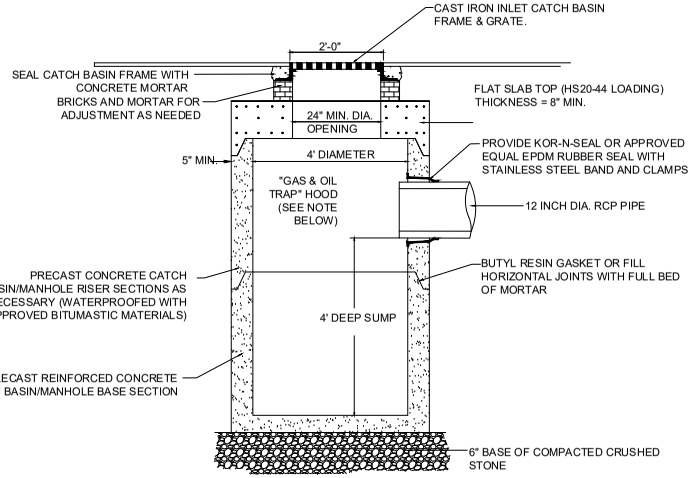
TYPICAL HMA OR GRAVEL DRIVE ENTRANCE
NOT TO SCALE



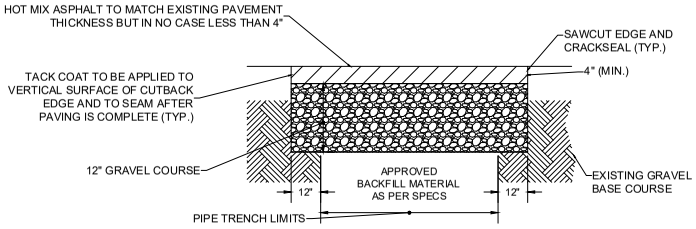
HOT MIX ASPHALT DRIVEWAY APRON
NOT TO SCALE



DRAINAGE TRENCH
NOT TO SCALE

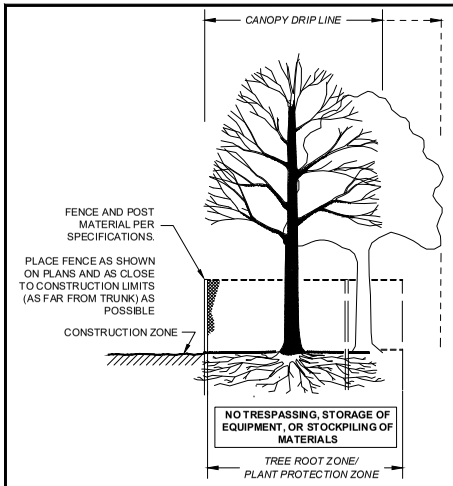


DEEP SUMP CATCH BASIN
NOT TO SCALE

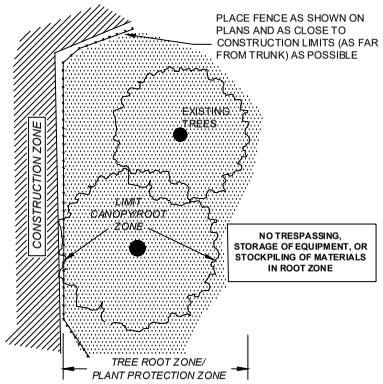


TEMPORARY ASPHALT PATCHING
NOT TO SCALE

608163_HDR\CONSTRUCTION DETAILS.DWG Plotted on 25-Jun-2024 3:47 PM
Proposal No. 608163-132612
A08840 - 516



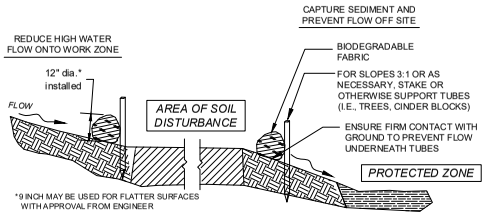
SECTION - FENCE PROTECTION OF ROOT ZONE



PLAN VIEW - FENCE PROTECTION OF ROOT ZONE

TREE PROTECTION - ROOT ZONE

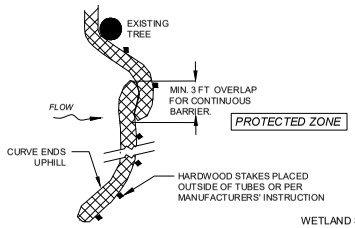
NOT TO SCALE



SECTION

SEDIMENT BARRIER - COMPOST FILTER TUBE

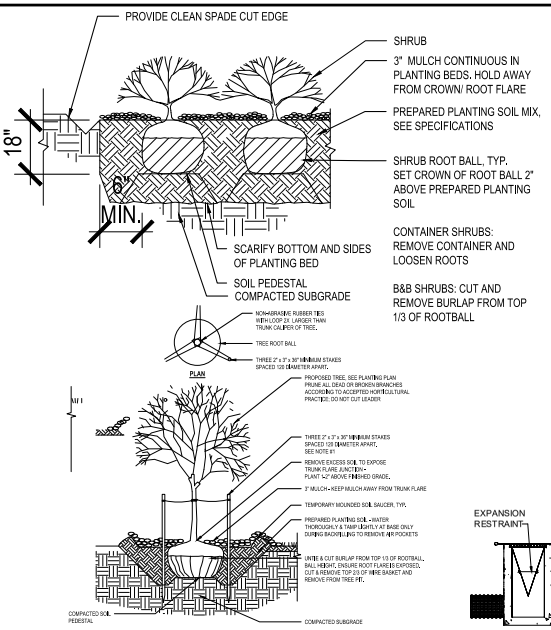
NOT TO SCALE



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

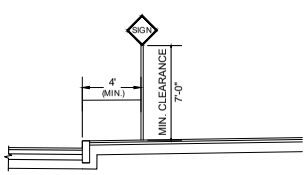
PLAN VIEW



NOTES:
1. CONTRACTOR IS RESPONSIBLE FOR KEEPING THE TREE UPRIGHT AND PLUMB IN ALL DIRECTIONS. DO NOT STAKE TREES EXCEPT WHERE SPECIFIED. STAKE ALL TREES UNLESS SPECIFIED.
2. IF STAKING IS SPECIFIED PROVIDE:
   3" CAL. OR LESS- PROVIDE 2 STAKES MINIMUM
   3" CAL. OR GREATER, PROVIDE 3 STAKES MINIMUM
   OR AS DIRECTED BY LANDSCAPE ARCHITECT
3. REMOVE STAKES AT END OF YEAR 1, UNLESS SPECIFIED BY LANDSCAPE ARCHITECT

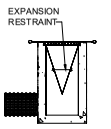
TREE AND SHRUB INSTALLATION

NOT TO SCALE



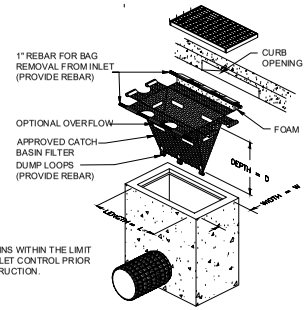
TRAFFIC SIGN PLACEMENT DETAIL

N.T.S.



SIDE VIEW INSTALLED

NOTE:
ALL EXISTING CATCH BASINS WITHIN THE LIMIT OF WORK SHALL HAVE INLET CONTROL PRIOR TO THE START OF CONSTRUCTION.



INLET SEDIMENT CONTROL

NOT TO SCALE

WETLAND SEED MIX -PART SHADE ROADSIDE MIX

BOTANICAL NAME	COMMON NAME	%PLS BY WEIGHT
GRASS		
FESTUCA RUBRA	CREEPING RED FESCUE	25.70%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	24.00%
SCHIZACHYRIUM SCOARIUM	LITTLE BLUE STEM	22.50%
PANICUM VIRGATUM	SWITCH GRASS	10.00%
PANICUM CLANDESTINUM 'TIOGA'	DEER TOUNF 'TIOGA'	7.00%
CAREX VULPINOIDEA	FOX SEDGE	2.00%
AGROSTIS PERENNANS	UPLAND BENTGRASS	2.00%
JUNCUS EFFUSUS	SOFT RUSH	0.20%
		93.40%
CHAMAECRISTA FASCICULATA	PARTRIDGE PEA	3.00%
PENSTEMON DIGITALIS	BEARD-TONGUE	1.00%
ZIZIA AUREA	GOLDEN ALEXANDERS	0.30%
DESMODIUM CANADENSE	SHOWY TICK TREFOIL	0.3%
SOLIDAGO BICOLOR	WHITE GOLDENROD	0.20%
SOLIDAGO CAESIA	WOODLAND GOLDENROD	0.20%
RUDBECKIA HIRTA-VT ECOTYPE	BLACK-EYED SUSAN-VT ECOTYPE	0.20%
ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER	0.20%
SOLIDAGO ODORA	LICORICE SCENTED GOLDENROD	0.20%
ASTER DIVARICATUS	WHITE WOOD ASTER	0.20%
HELIOPSIS HELIANTHOIDES	OX-EYE SUNFLOWER	0.20%
PYCANTHEMUM TENUIFOLIATUM	SLENDER MOUNTAIN MINT	0.20%
MONARDA FISTULOSA	WILD BERGAMONT	0.10%
EUPATORIUM PERFOLIATUM	BONESET	0.10%
ASTER LATERIFLORUS	CALICO ASTER	0.10%
OENOTHERA FRUTICOSA VAR. FRUTICOSA	SUNDROPS	0.10%
		6.60%
		100.00%

SEED RATING:
APPLY THIS MIX AT 15 LBS PLS/ACRE.

CONSTRUCTION SPECIFICATIONS ON SILTATION & EROSION CONTROL

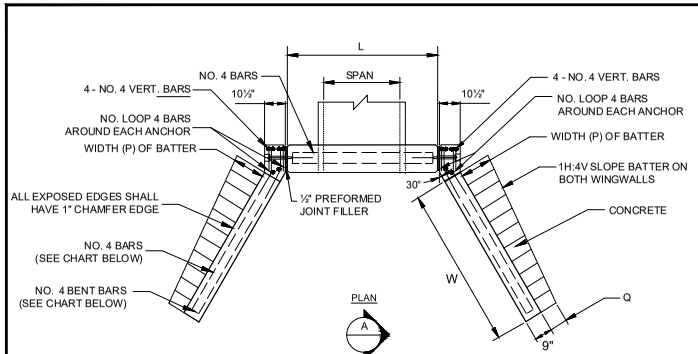
1. EROSION CONTROL MEASURES SHALL BE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. AREAS SUBJECT TO EROSION SHALL BE MINIMIZED IN TERMS OF TIME AND AREA.
3. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
4. DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE PROPOSED LIMIT OF EROSION CONTROL BARRIERS (MULCH TUBE) ACTIVITIES.
5. TEMPORARY SILT CONTROLS SHALL BE PLACED AS SHOWN ON THE PLAN. PERMANENTLY STABILIZE EACH COMPLETED SEGMENT OF CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE TEMPORARY SILT CONTROLS AND ALL ACCUMULATED SILT AND DEBRIS AFTER COMPLETION OF CONSTRUCTION OPERATIONS.
7. SILT CONTROLS SHALL BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
8. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL SILT AND DEBRIS FROM EACH DRAINAGE STRUCTURE UPON COMPLETION OF THE PROJECT.
9. OBJECTS AND/OR AREAS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
10. ALL DISTURBED AREAS SHALL BE RESTORED TO EXISTING GRADE. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED.
11. SILT CONTROLS SHALL BE REMOVED UPON THE SATISFACTORY COMPLETION OF ALL WORK SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
12. SITE PERIMETER SHALL HAVE COMPOST FILTER TUBES INSTALLED AT THE LIMIT OF WORK.

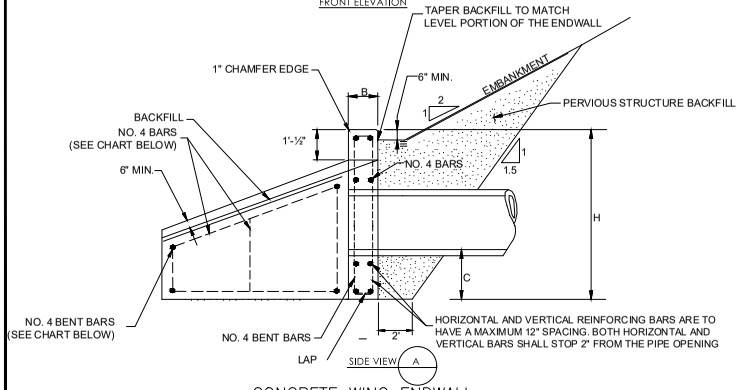
608163_H09(CONSTRUCTION DETAILS).DWG Plotted on 25-Jun-2024 3:47 PM
Proposal No. 608163 132112
A08840 - 4.5"

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	85	180
PROJECT FILE NO.	608163		

CONSTRUCTION DETAILS





CONCRETE WING ENDWALL

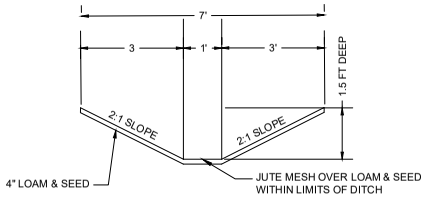
N.T.S.

WING ENDWALL DIMENSIONS ONLY (SEE NOTE # 4 FOR STRAIGHT ENDWALL COMPONENT INFORMATION)									
CONCRETE									
		DEPTH OF CUTOFF WALL	HEIGHT OF	TOTAL	LENGTH OF	WIDTH OF	WIDTH OF BATTER	TAPERED WINGWALL	VOLUME
DIAMETER	BASE	TO INVERT	WINGWALL	HEIGHT	ENDWALL	BATTER	AT ENDPOINT	LENGTH	
(D)	(B)	(C)	(G)	(H)	(L)	(P)	(Q)	(W)	
IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	C.Y.
12"	1'-3"	2'-0"	2'-0"	4'-6"	4'-6"	0'-10¾"	0'-6"	2'-11"	1.8

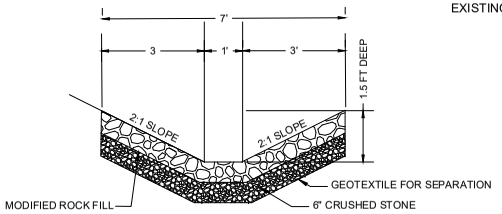
	WINGWALL STEEL REINFORCEMENT		
DIAMETER (D)	NO. 4 BENT BARS	NO. 4 BARS	THREADED ROD CONNECTIONS PER WINGWALL
IN.	EA.	EA.	EA.
12"	4	8	3

GENERAL NOTES:

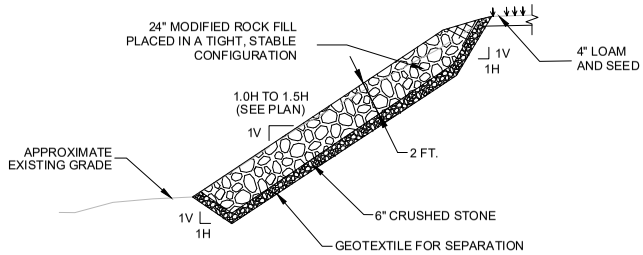
1. ALL REINFORCING BARS SHALL HAVE 2" COVER MIN.
2. ALL REINFORCING BARS ARE TO BE TIED AND NOT WELDED.
3. WET SETTING OF ANY STEEL IS NOT PERMITTED.
4. REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615, GRADE 60 AND SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A767, CLASS 1.
5. WHEN USING PRECAST ALL PORTIONS OF LIFTING AND SEATING DEVICES THAT EXTEND TO OR BEYOND THE FINISHED CONCRETE SURFACE SHALL BE REMOVED. ALL FIXTURES OR HOLES CAST INTO THE SECTIONS FOR LIFTING OR SEATING SHALL BE COMPLETELY FILLED WITH NON-SHRINK GROUT AND FINISHED SMOOTH AND FLUSH WITH THE ADJACENT CONCRETE SURFACE.
6. NON-SHRINK GROUT SHALL CONFORM TO SECTION M4. THE NON-SHRINK GROUT SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI PRIOR TO ALLOWING THE PASSAGE OF WATER OVER THE GROUT.



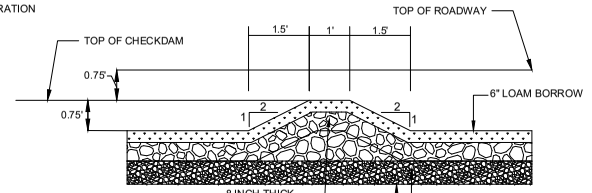
GRASS DRAINAGE DITCH
NOT TO SCALE



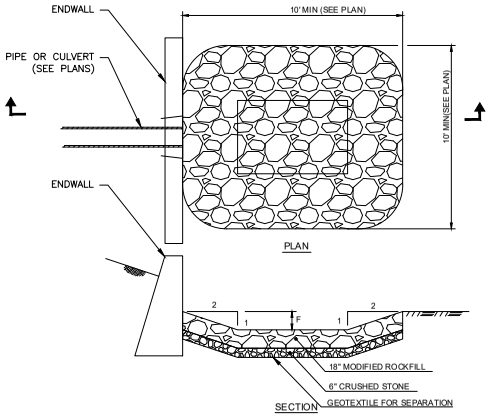
MODIFIED ROCKFILL DRAINAGE DITCH
NOT TO SCALE



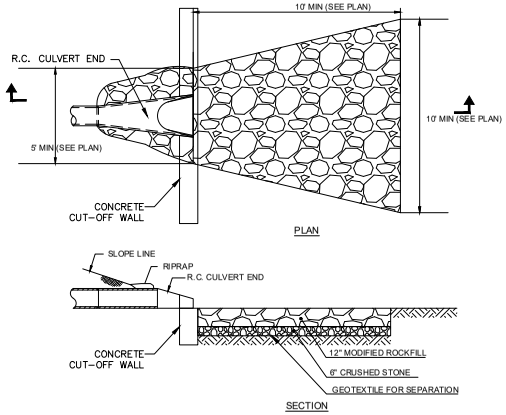
STEEP SLOPE WITH MODIFIED ROCK FILL
NOT TO SCALE



CHECKDAM



PREFORMED MODIFIED ROCK FILL SCOUR HOLE
N.T.S.



MODIFIED ROCK FILL APRON
N.T.S

608163_HDR\CONSTRUCTION DETAILS.DWG Plotted on 25-Jun-2024 3:47 PM

Proposal No. 608163-125121

608163 - 515

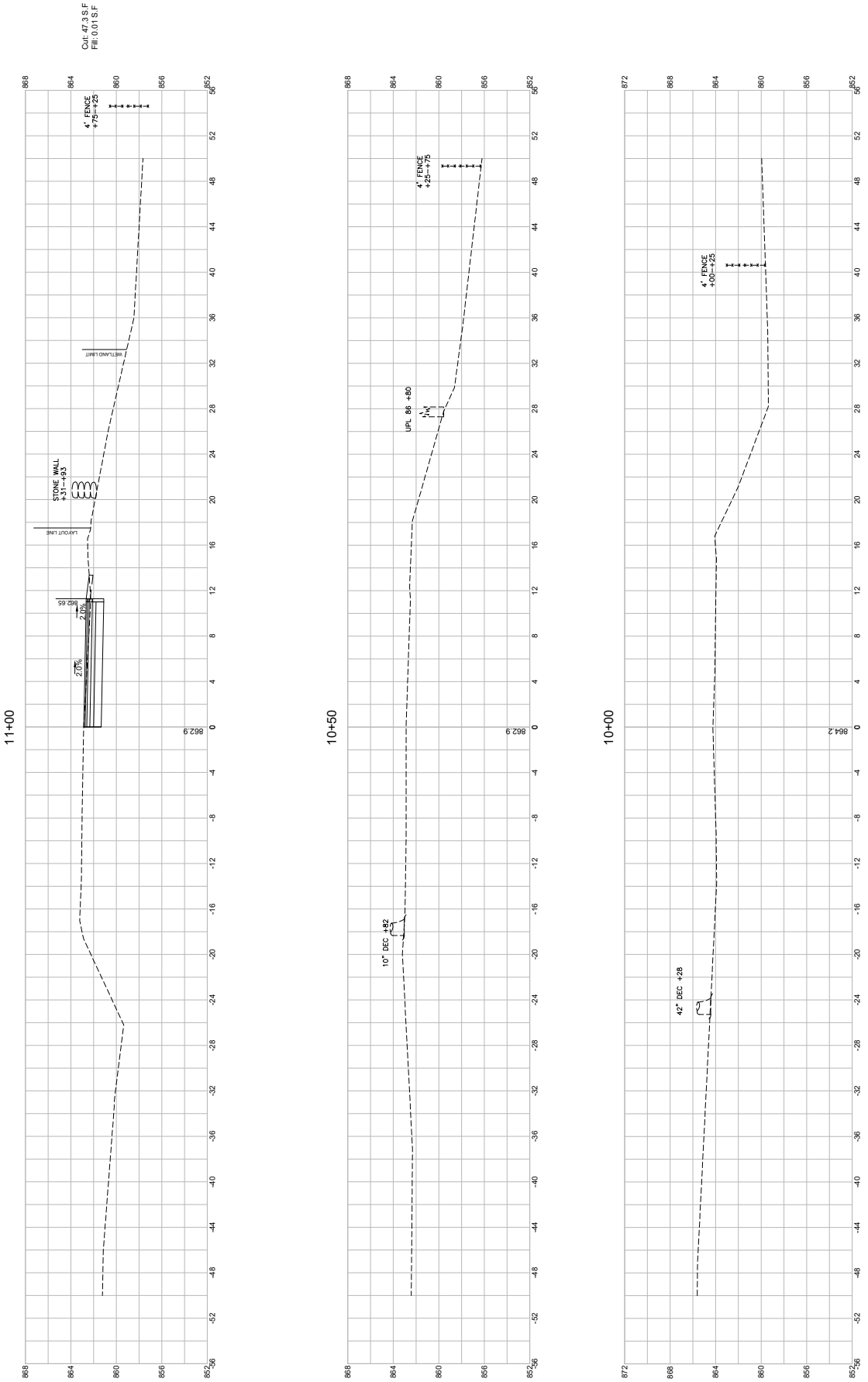
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:28 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	86	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



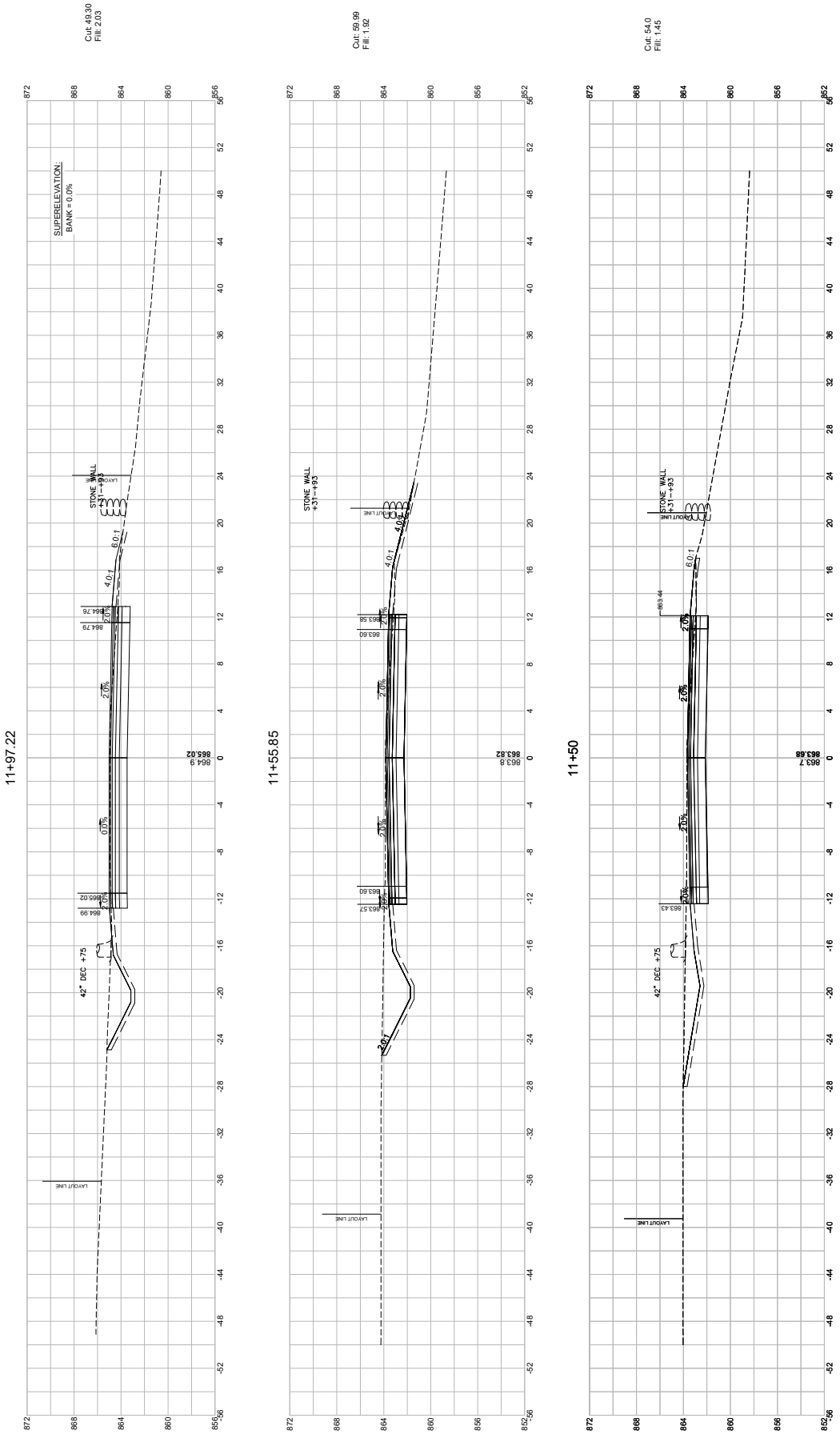
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:27 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	87	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



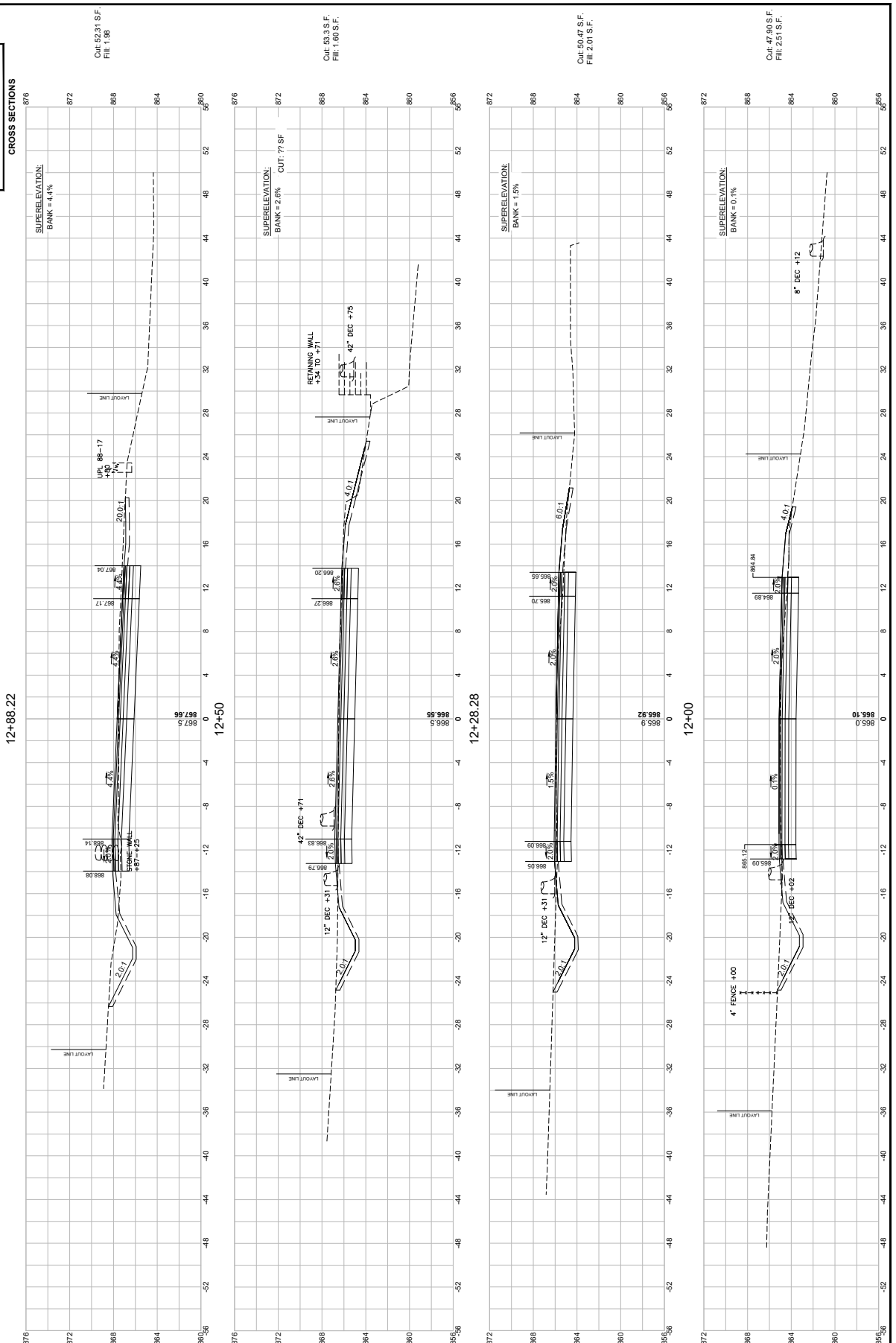
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:27 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	88	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8
VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:28 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	89	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET 4 0 4 8

VER. SCALE IN FEET 4 0 4 8

13+90

Cut: 56.32 S.F.
Fill: 1.42

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE

871.1
870.61
869.91
870.12
871.09
871.03
10.78%
4.4%
2.0%

13+50

Cut: 83.81 S.F.
Fill: 0.88 S.F.

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE

869.6
869.45
868.83
868.96
868.87
869.91
10.27%
4.4%
2.0%
STONE WALL
+25–+70
10" DEC +45
10" DEC +44
12" DEC +57
12" DEC +53
12" DEC +47

13+00

Cut: 56.34 S.F.
Fill: 1.41 S.F.

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE

867.8
868.00
867.38
867.51
868.48
868.42
3.07%
4.4%
2.0%
UPL 88–17
+80
STONE WALL
+87–+25

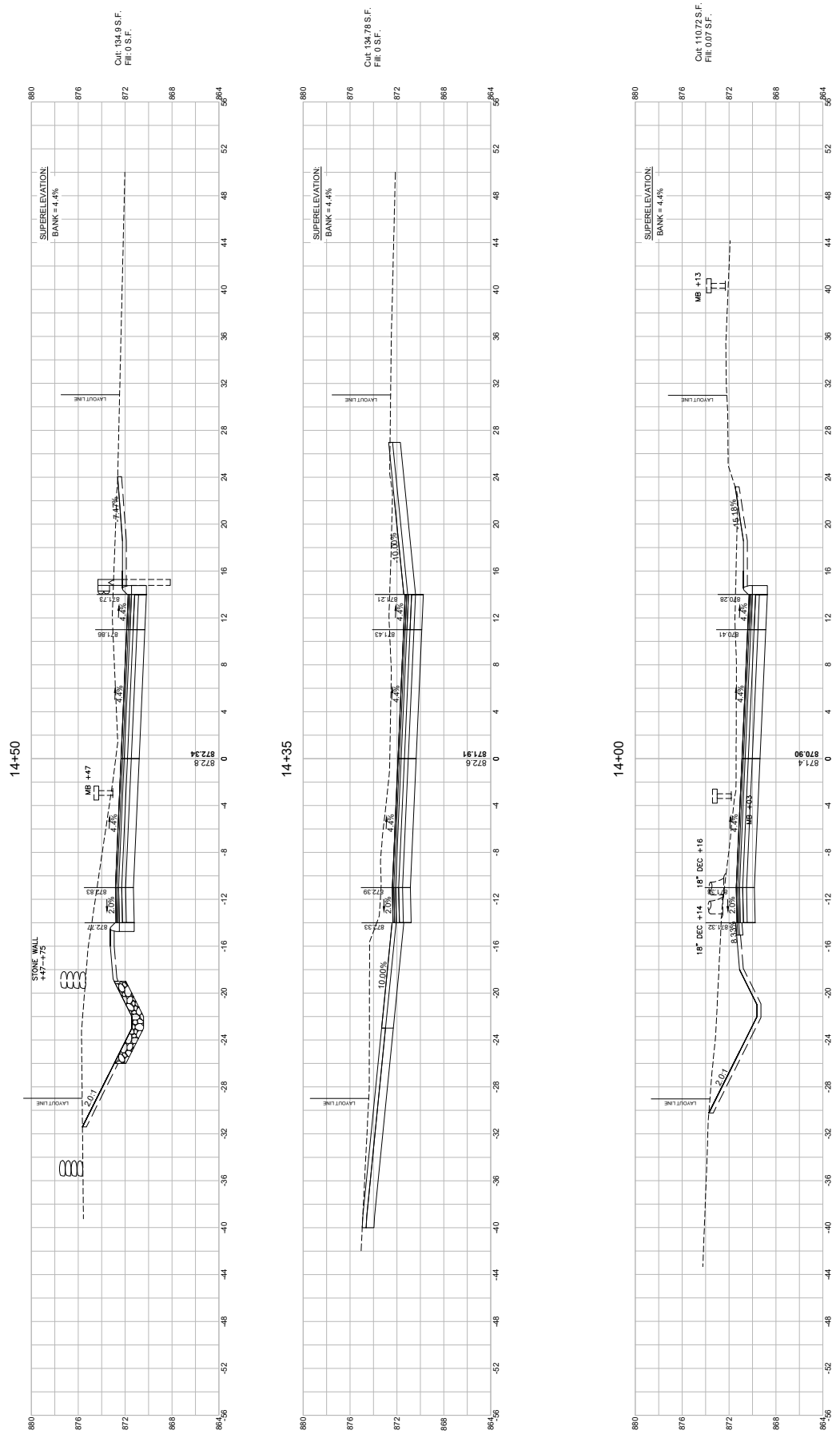
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:28 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	90	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:29 PM

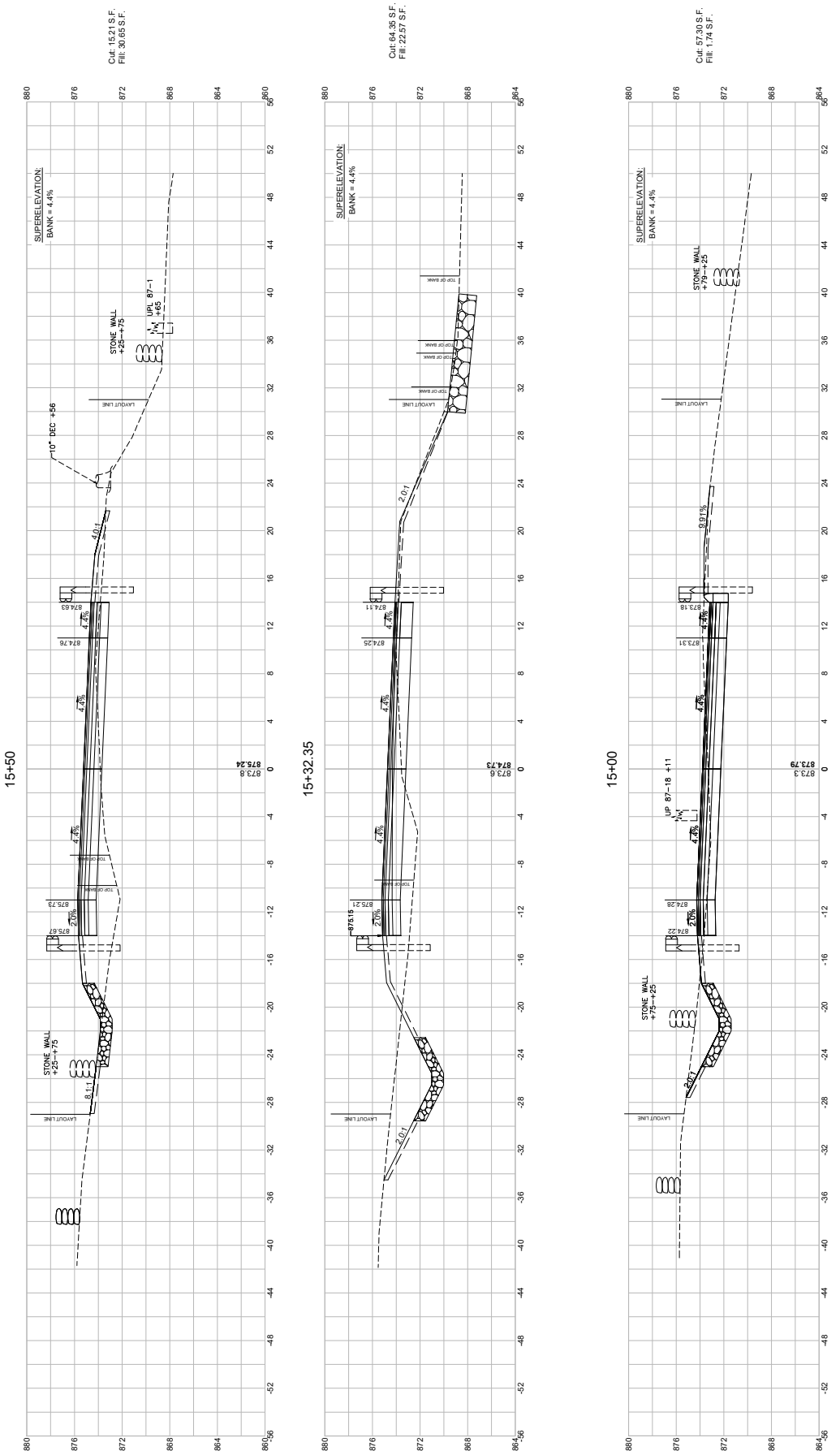
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	91	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



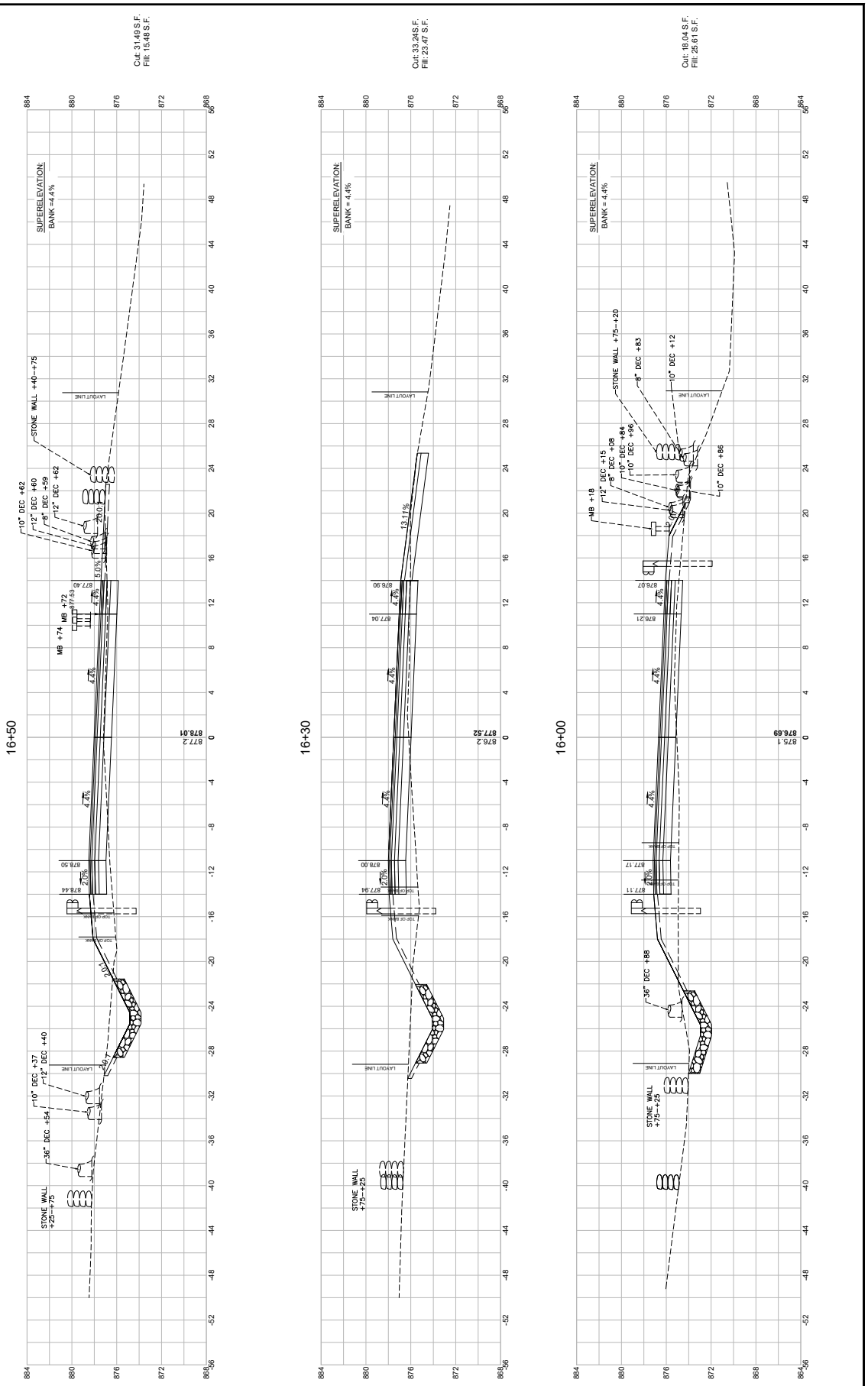
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:29 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	92	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 4 0 4 8



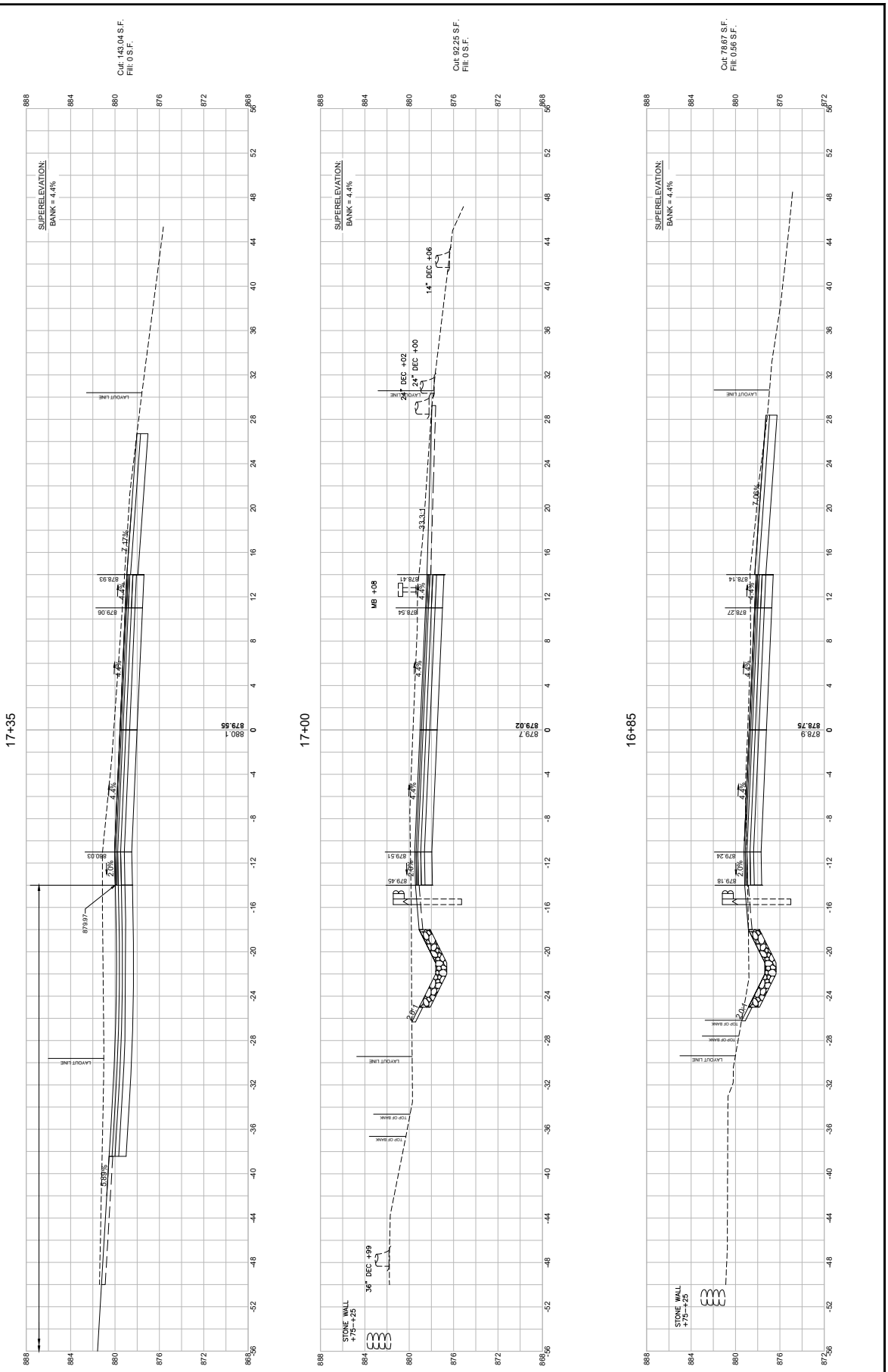
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:30 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	93	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



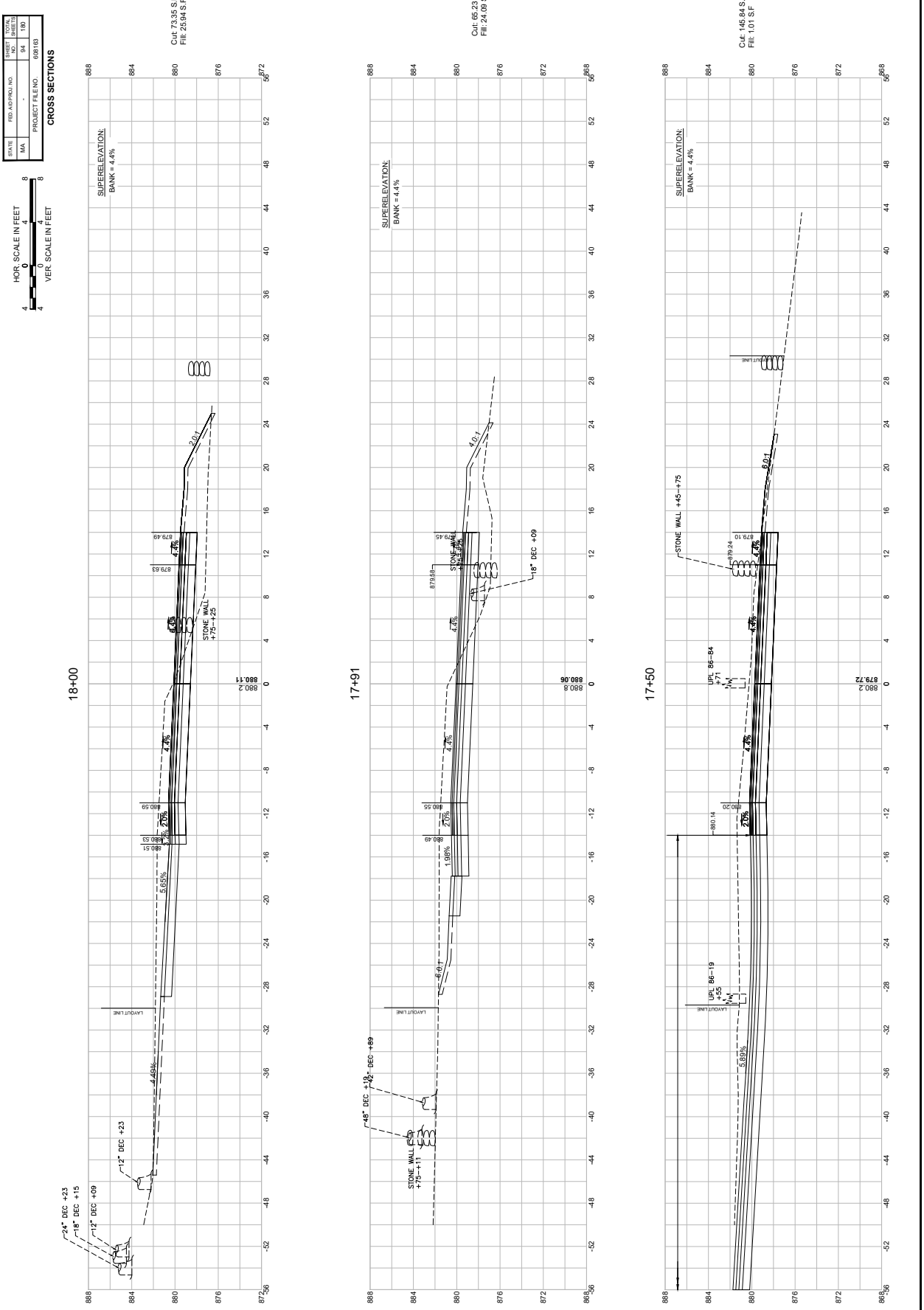
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:30 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	94	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET



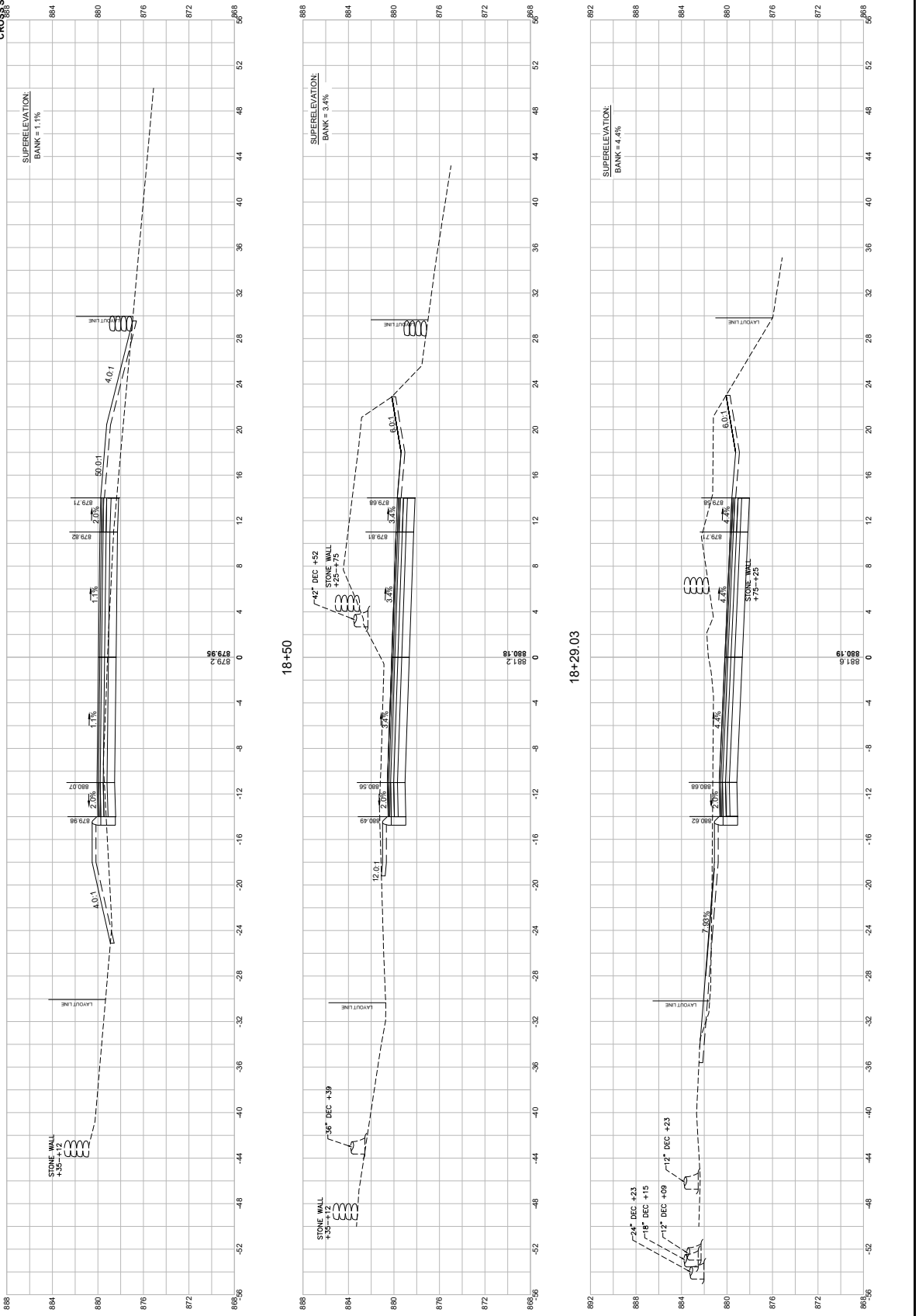
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:31 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	95	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 4 0 4 8



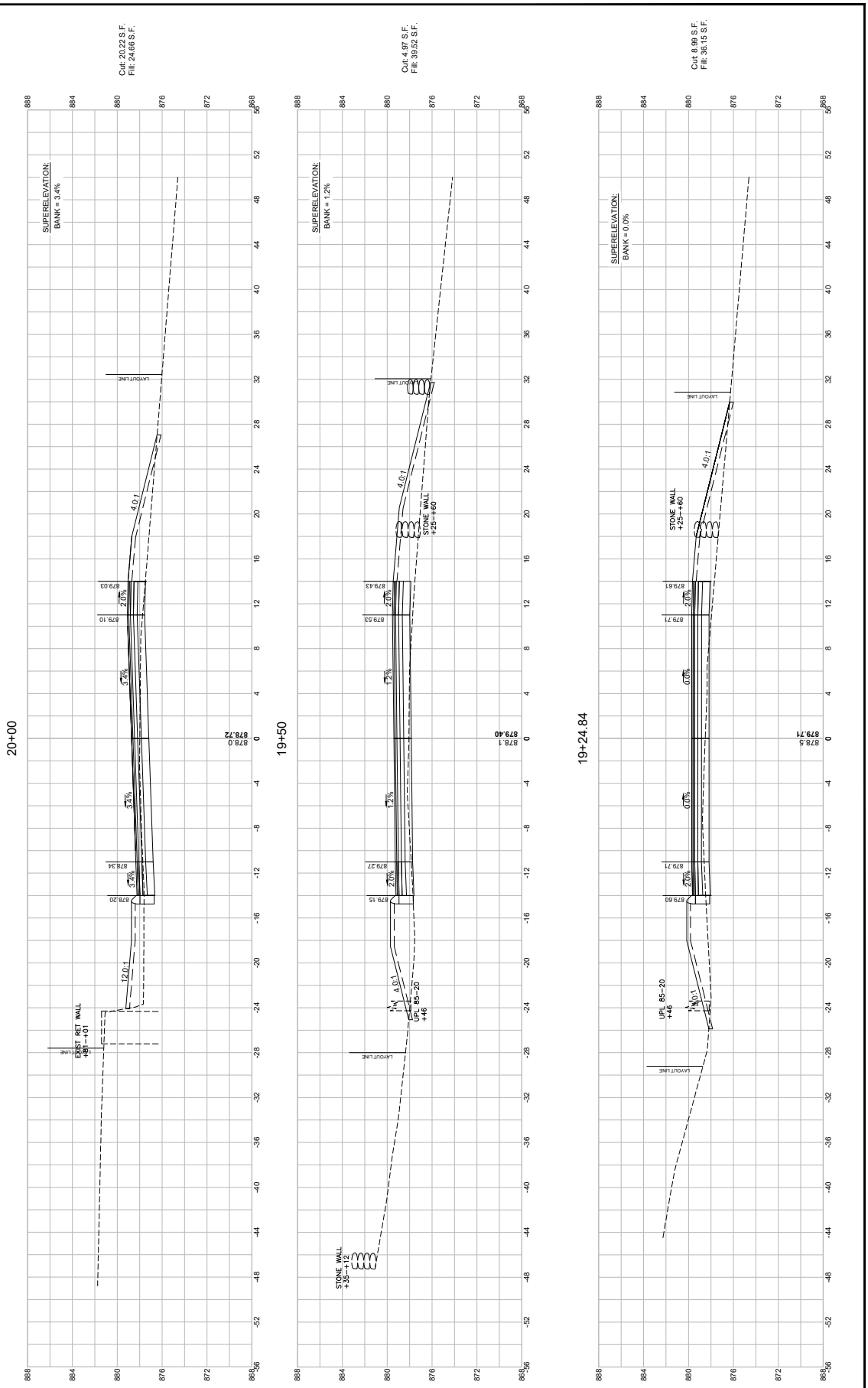
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:31 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	96	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:32 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	97	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
8 4 0 4 8

VER. SCALE IN FEET
4 0 4

20+97.43

Cut: 49.78 S.F.
Fill: 9.96 S.F.

SUPERELEVATION:
BANK = 5.8%

20+51.40

Cut: 41.11 S.F.
Fill: 17.54 S.F.

SUPERELEVATION:
BANK = 5.8%

20+50

Cut: 40.62 S.F.
Fill: 17.44 S.F.

SUPERELEVATION:
BANK = 5.7%

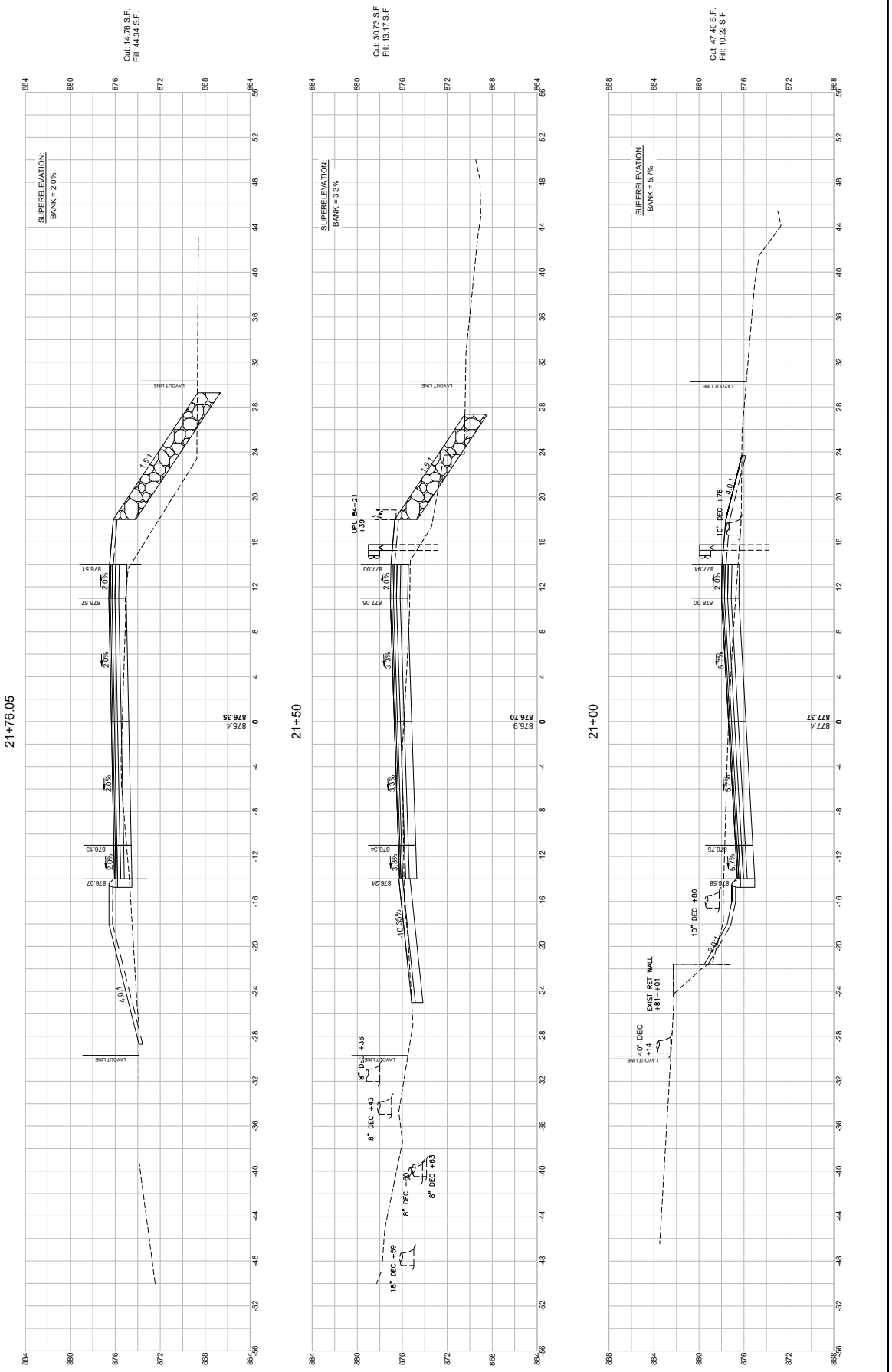
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:32 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	98	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:33 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	99	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

22+50

Cut: 47.53 S.F.
Fill: 4.10 S.F.

SUPERELEVATION:
BANK = -1.6%

875.25 875.31 875.26 875.20 875.48 875.2

2.0% 1.6% 2.0% 2.0%

1.5:1 4.0:1

LAYOUT LINE

22+17.43

Cut: 25.94 S.F.
Fill: 36.73 S.F.

SUPERELEVATION:
BANK = 0.0%

876.39 875.80 875.58 875.52 875.80 875.1

2.0% 0.0% 2.0% 2.0%

1.5:1 5.0:1

LAYOUT LINE

22+00

Cut: 21.81 S.F.
Fill: 34.46 S.F.

SUPERELEVATION:
BANK = 0.8%

876.06 876.12 875.80 875.74 876.02 875.2

2.0% 0.8% 2.0% 2.0%

1.5:1 4.0:1

LAYOUT LINE

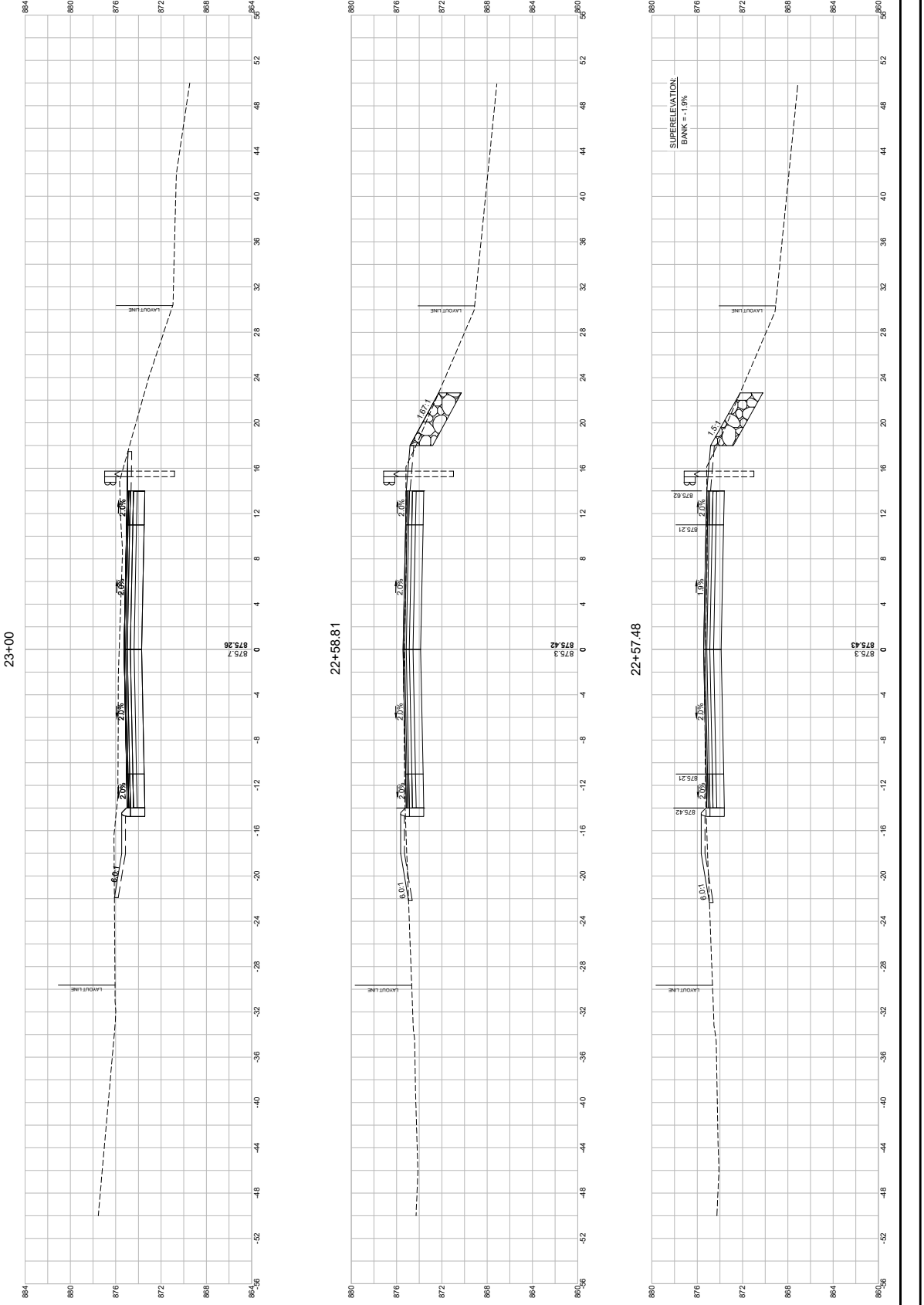
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:33 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	100	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET



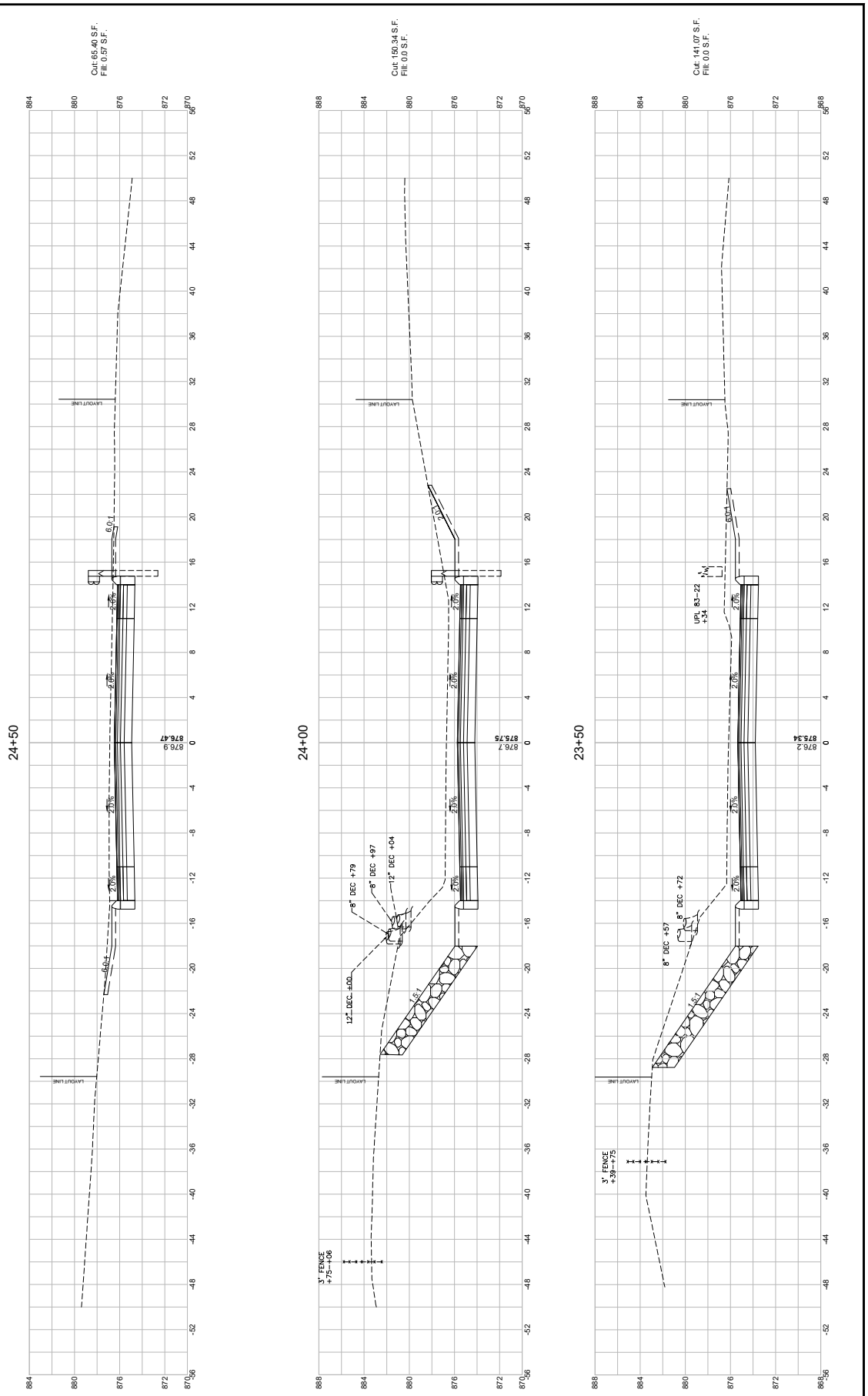
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:33 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	101	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



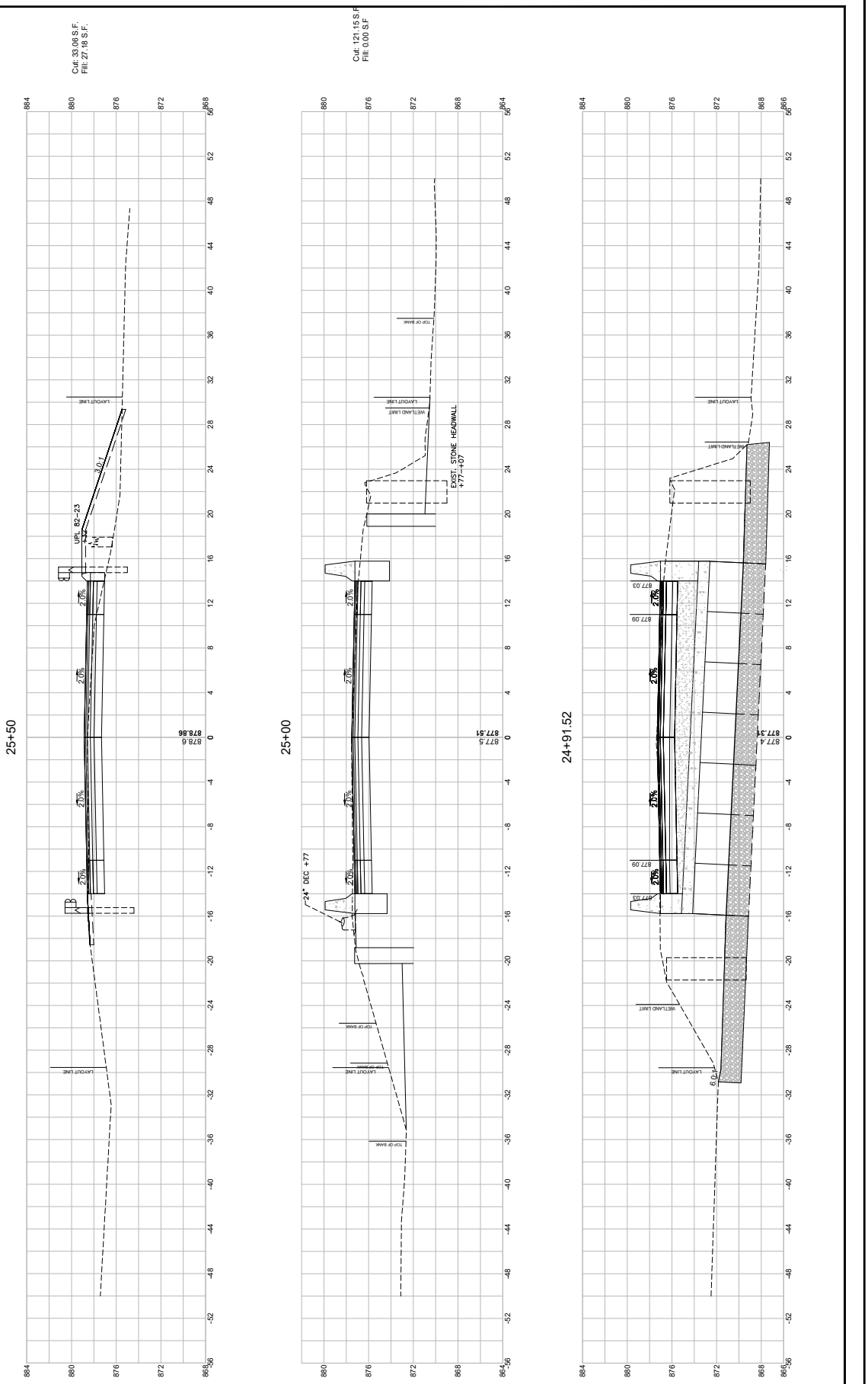
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:34 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	102	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 8 4 0 4 8
VER. SCALE IN FEET 4 0 4



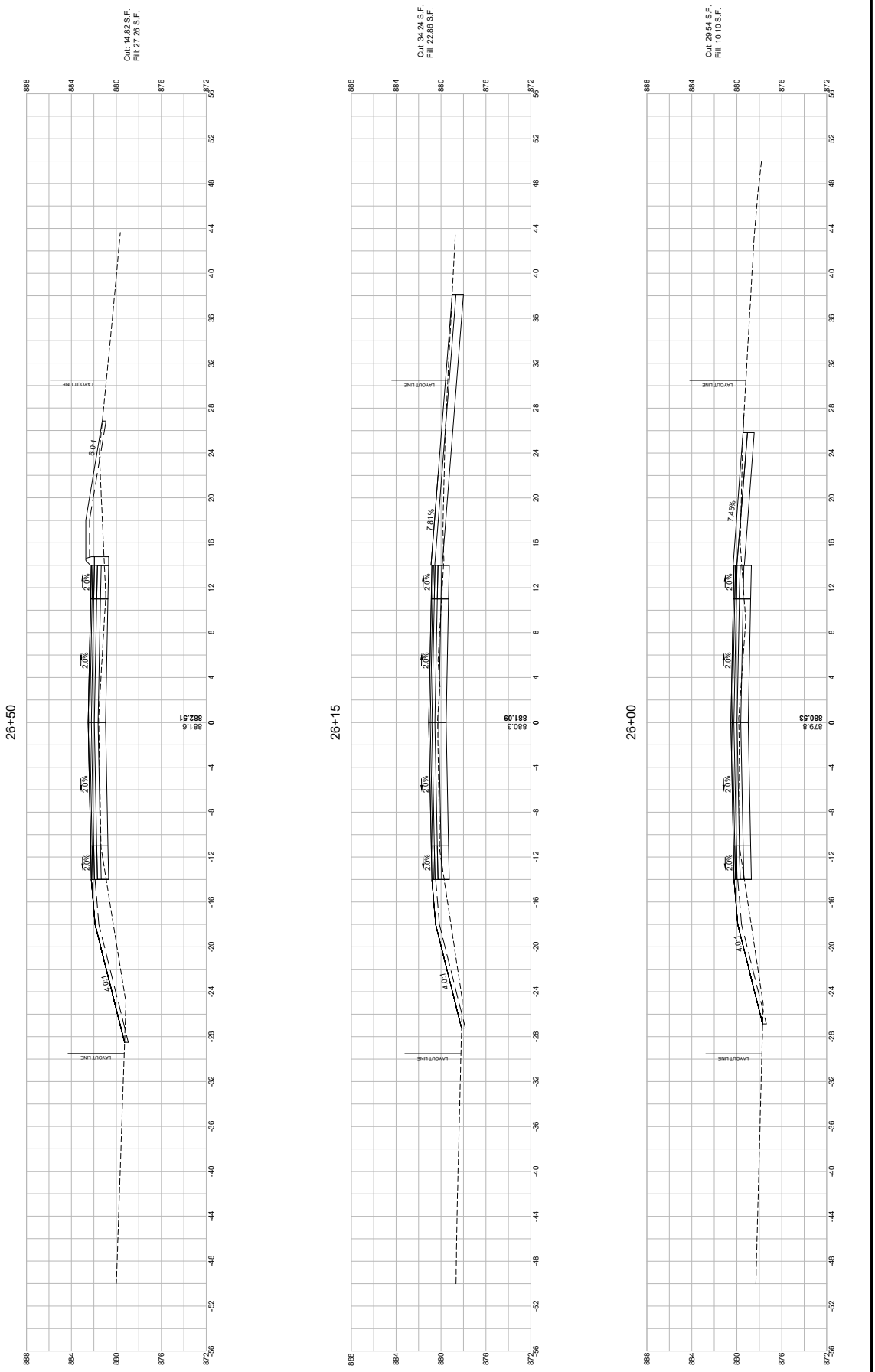
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:34 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	103	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:35 PM

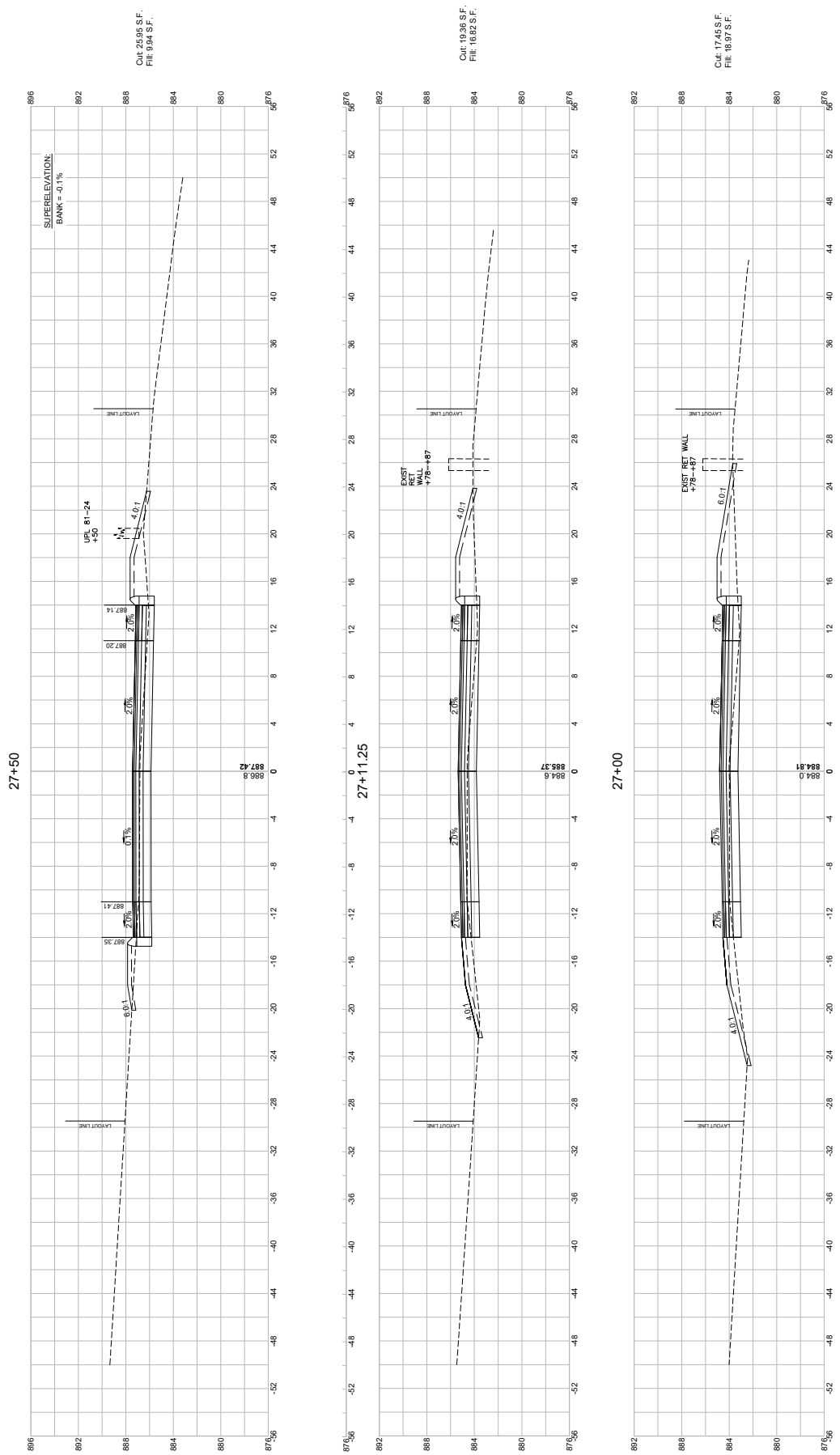
WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	104	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



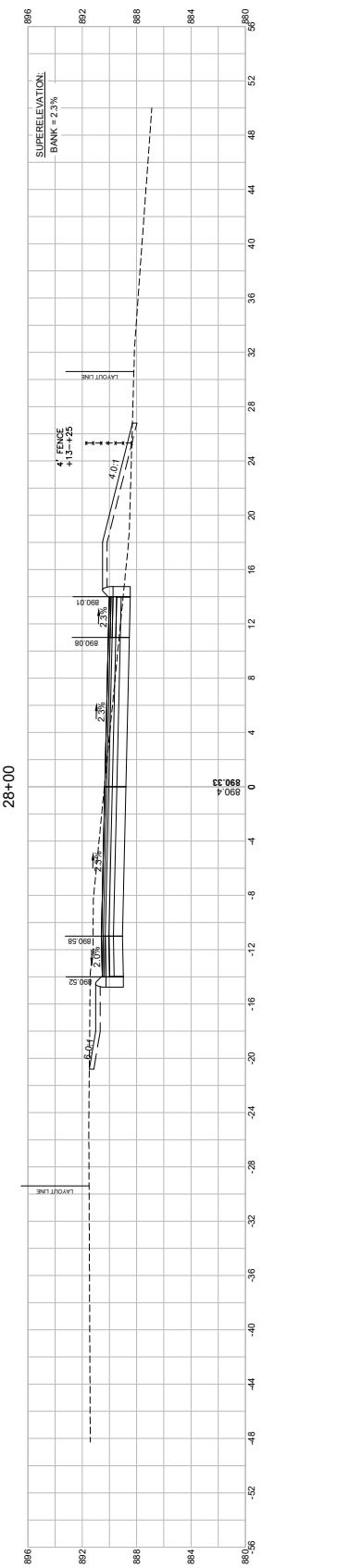
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:35 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	105	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 8 4 0 4 8
VER. SCALE IN FEET 8 4 0 4 8



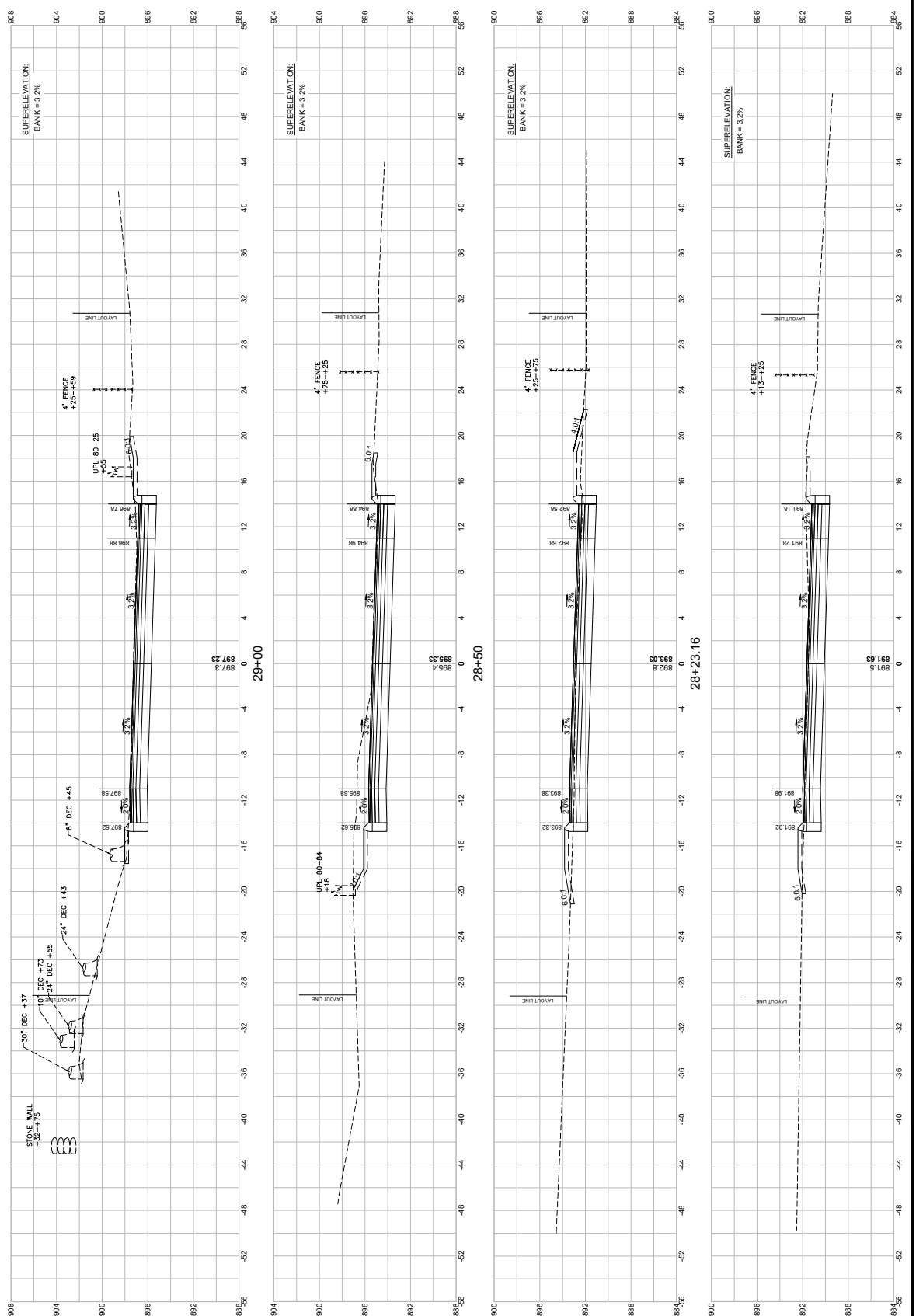
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:38 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	106	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:38 PM

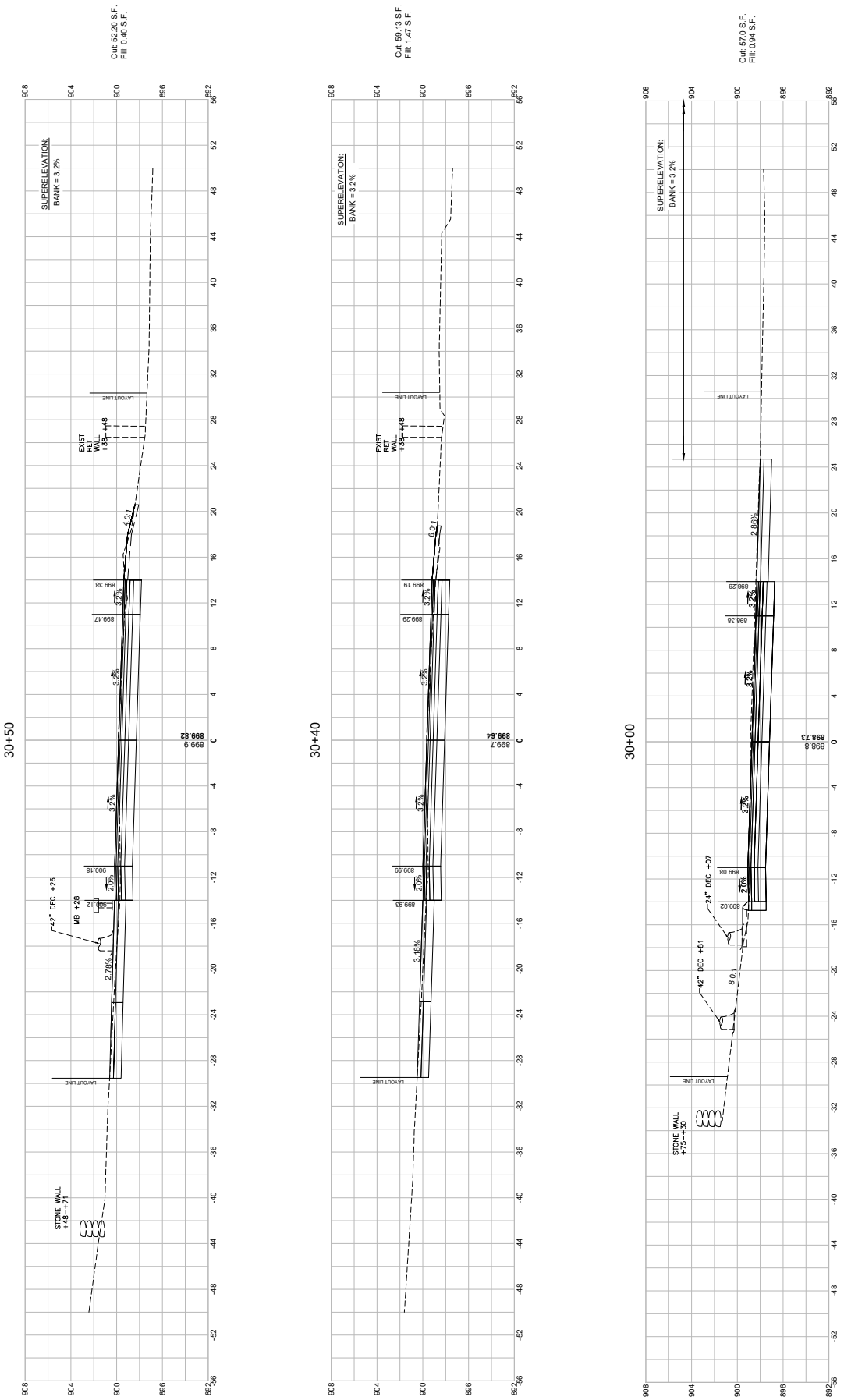
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	107	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8

VER. SCALE IN FEET
4 0 4 8



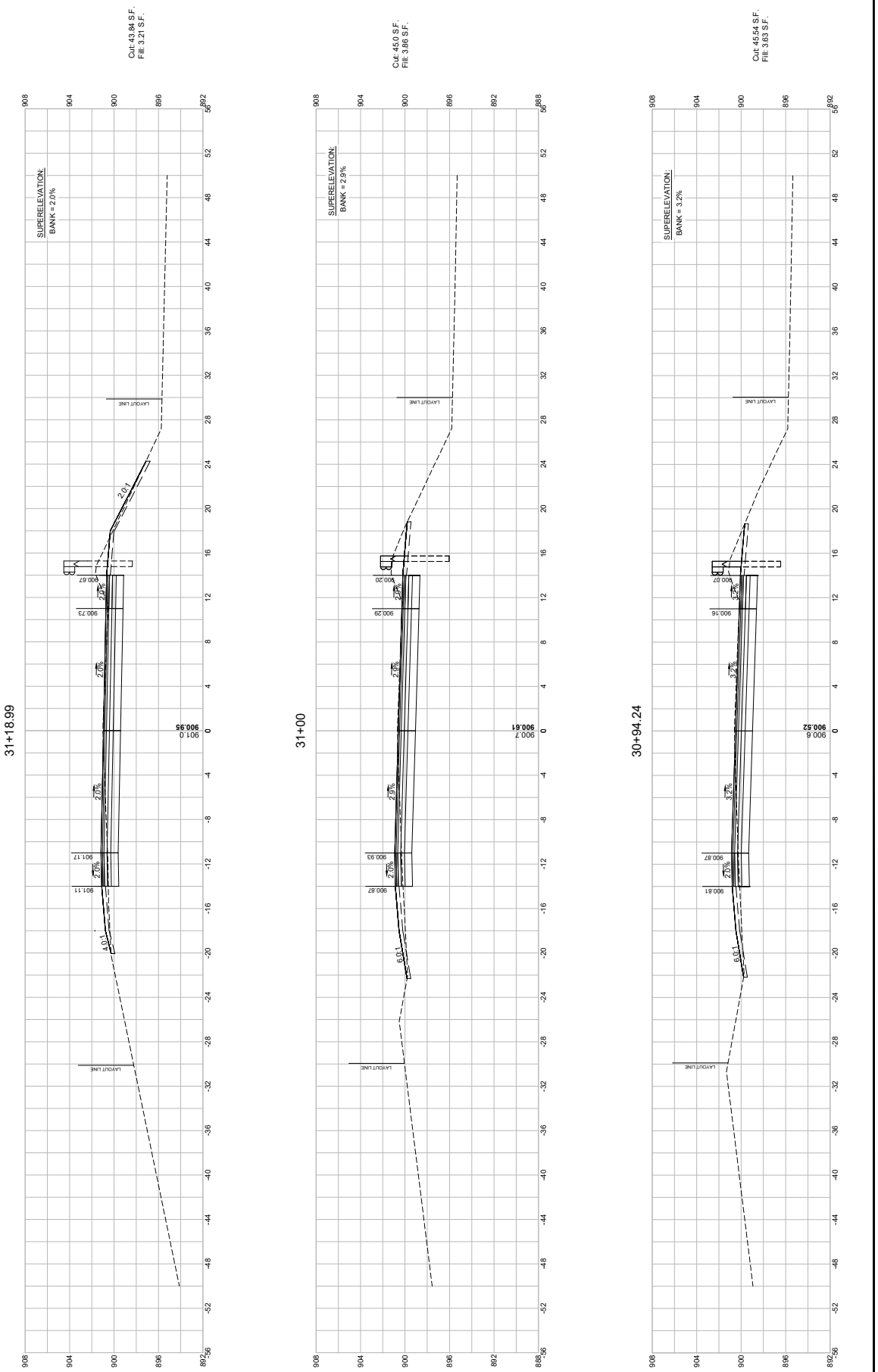
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:37 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	108	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET



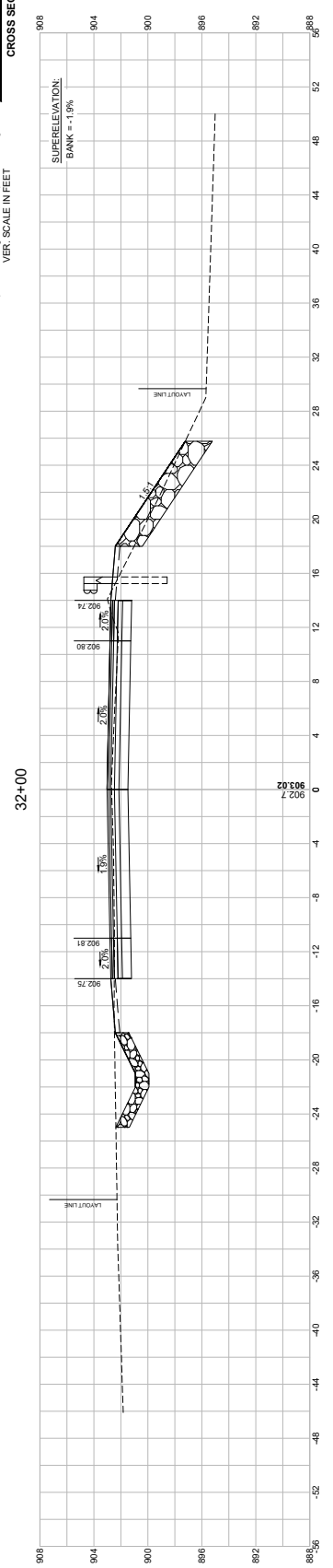
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:37 PM

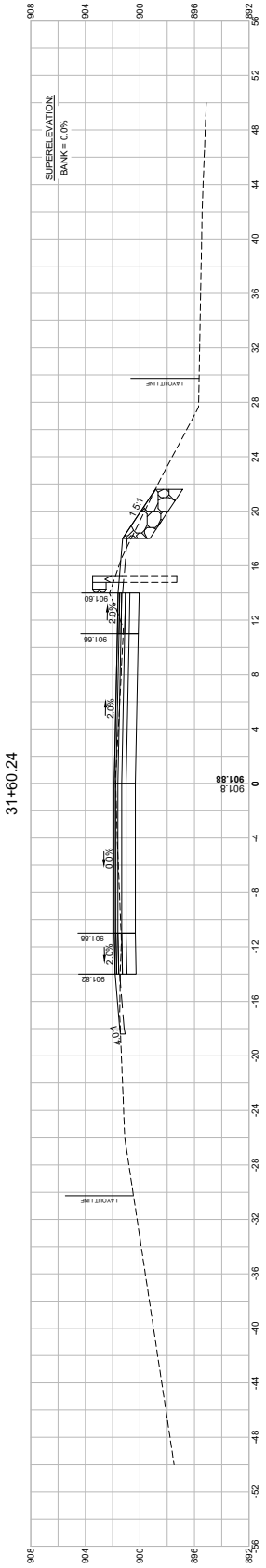
WALES
MONSON ROAD

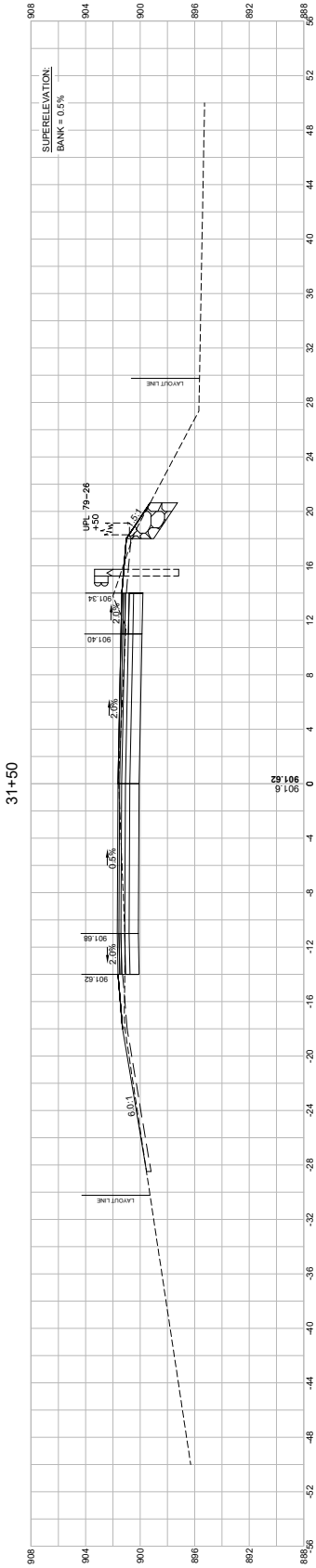
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	109	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET







608163_HD10(XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:38 PM

WALES
MONSON ROAD

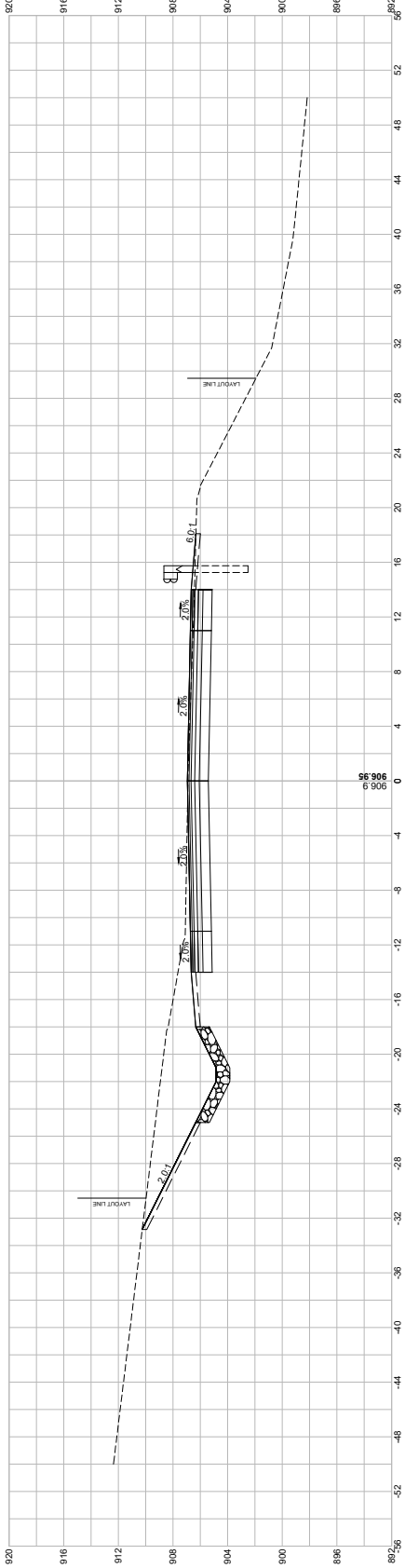
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	110	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8
4 0 4 8
VER. SCALE IN FEET

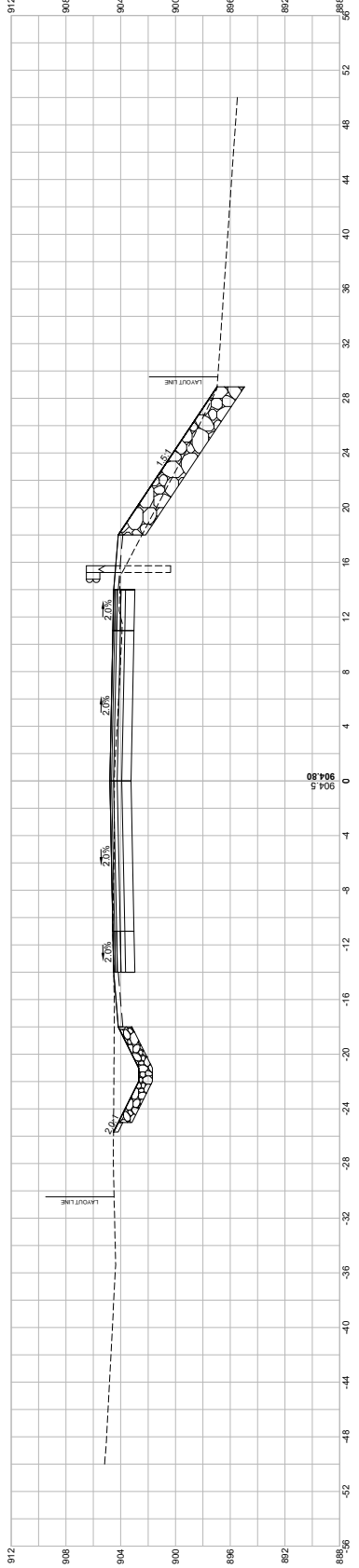
33+00

Cut: 98.3 S.F.
Fill: 0.51 S.F.



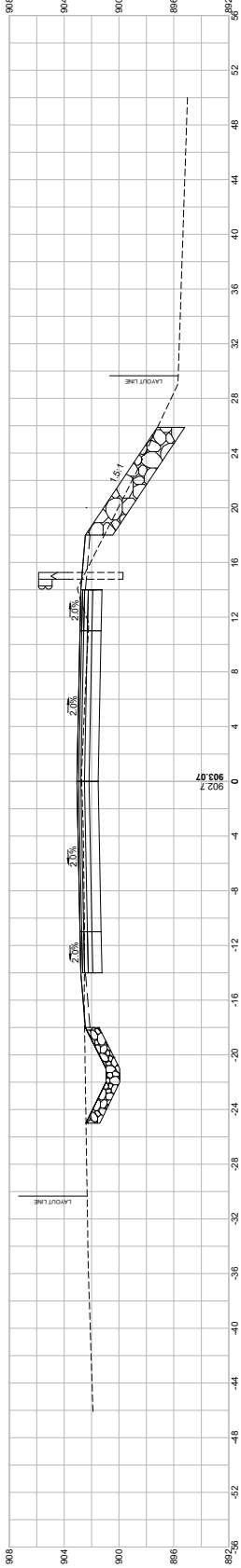
32+50

Cut: 63.2 S.F.
Fill: 3.65 S.F.



32+01.49

Cut: 57.32 S.F.
Fill: 2.62 S.F.



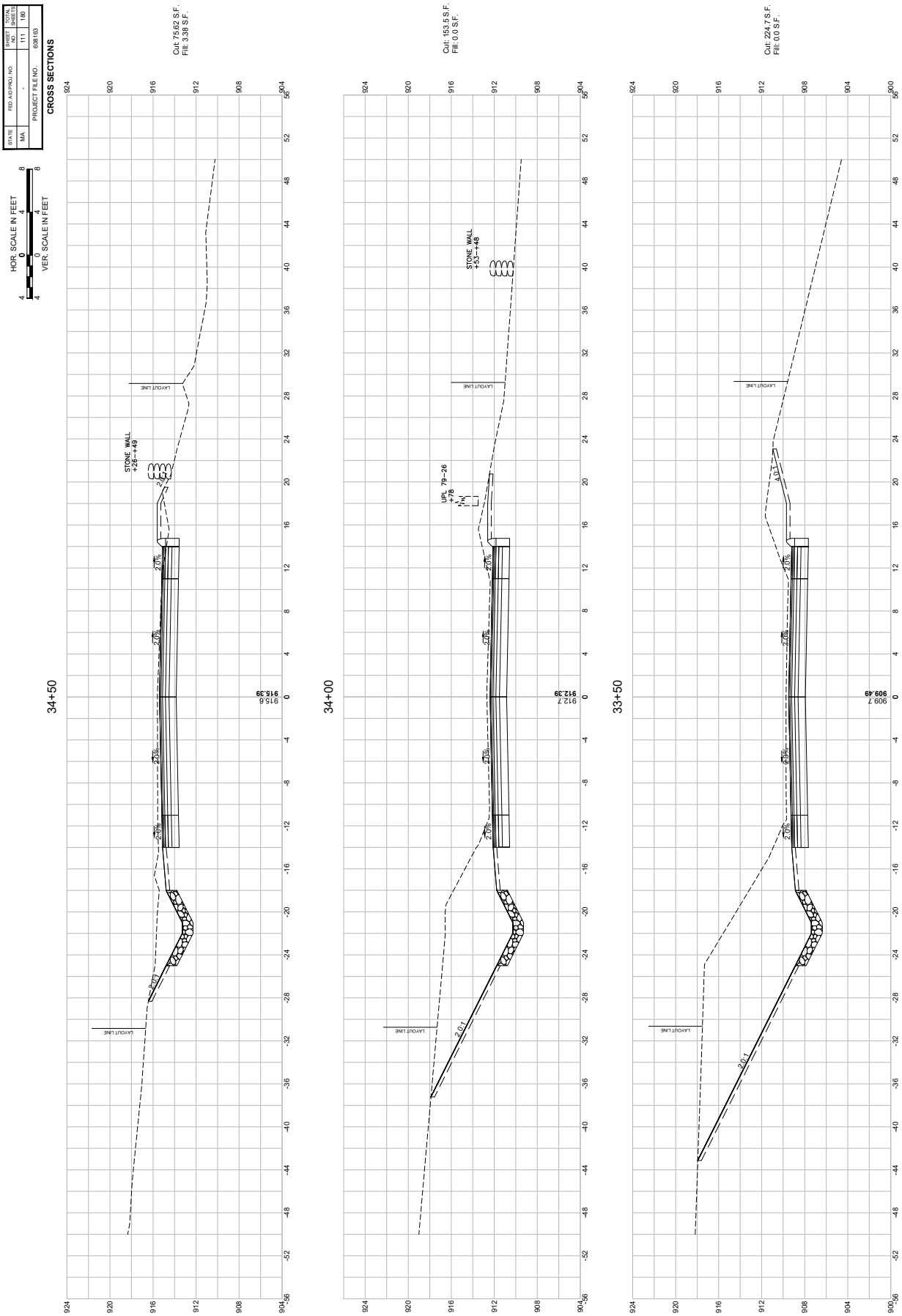
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:38 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	111	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:39 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	112	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 8 4 0 4 8
VER. SCALE IN FEET 4 0 4

36+00

Cut: 71.9 S.F.
Fill: 0.0 S.F.

924.39

35+50

Cut: 83.19 S.F.
Fill: 0.41 S.F.

921.39

35+00

Cut: 97.26 S.F.
Fill: 3.20 S.F.

918.39

608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:39 PM

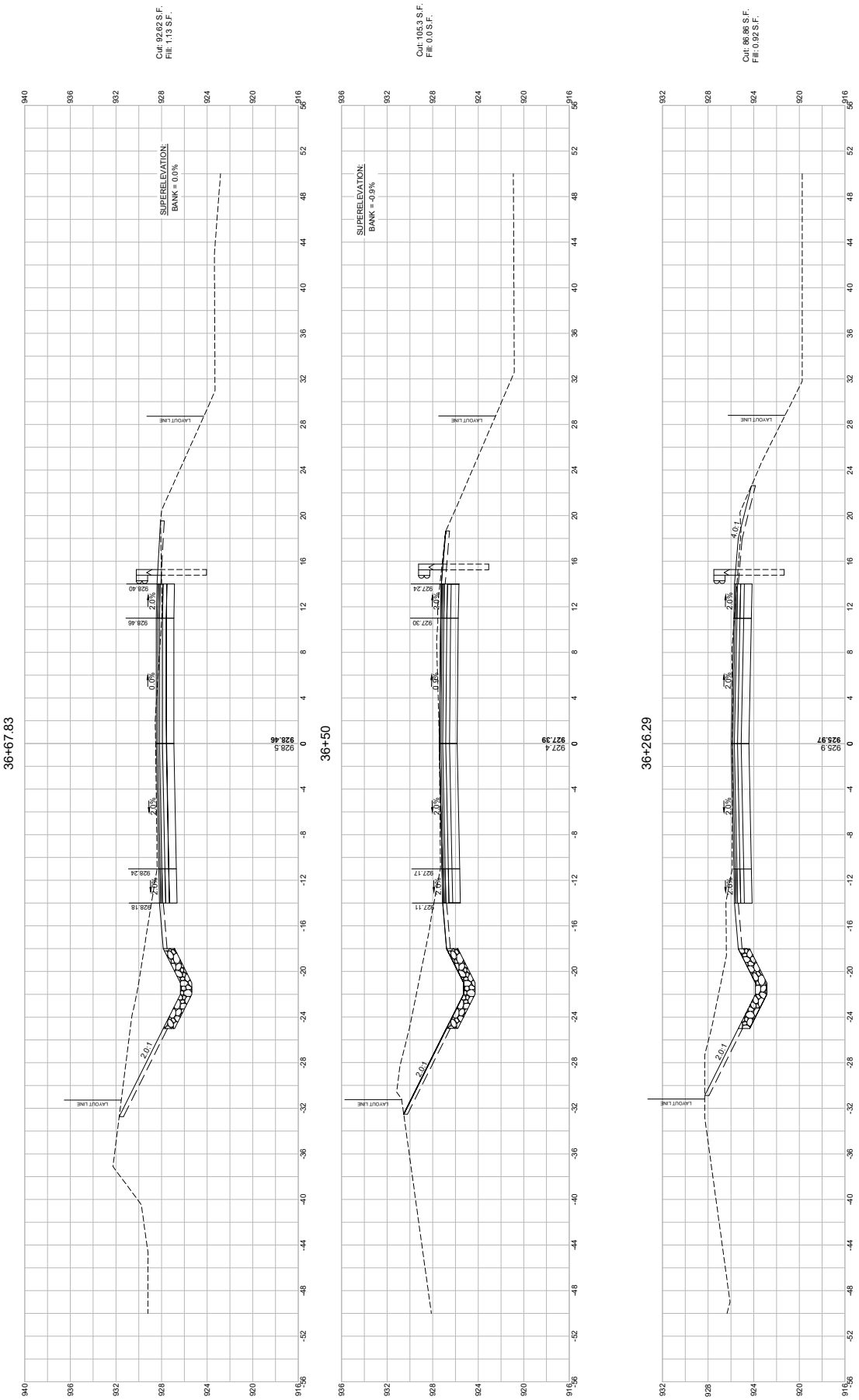
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	113	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8

VER. SCALE IN FEET 4 0 4 8



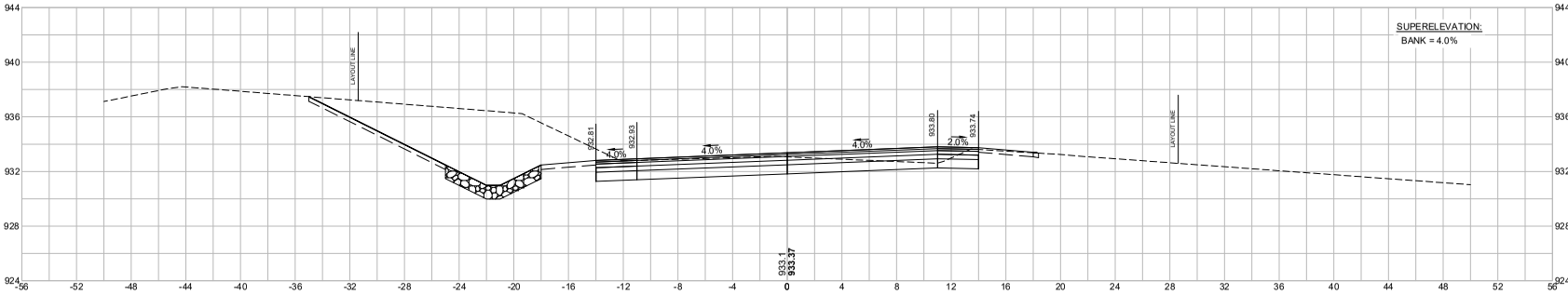
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	114	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

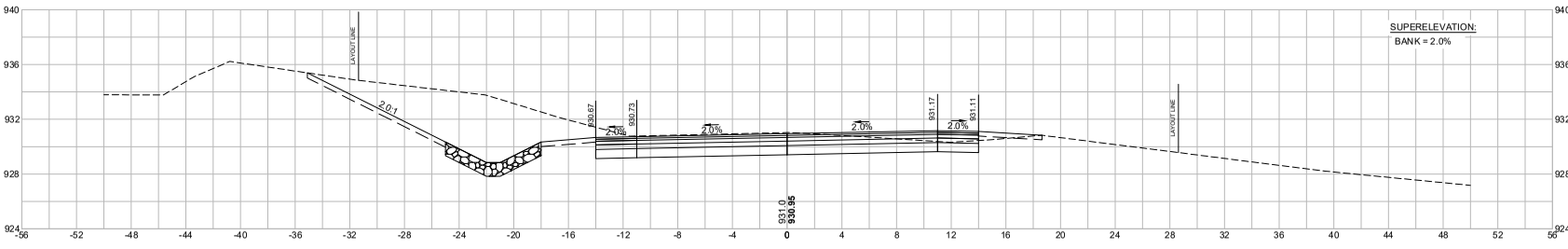
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

37+50



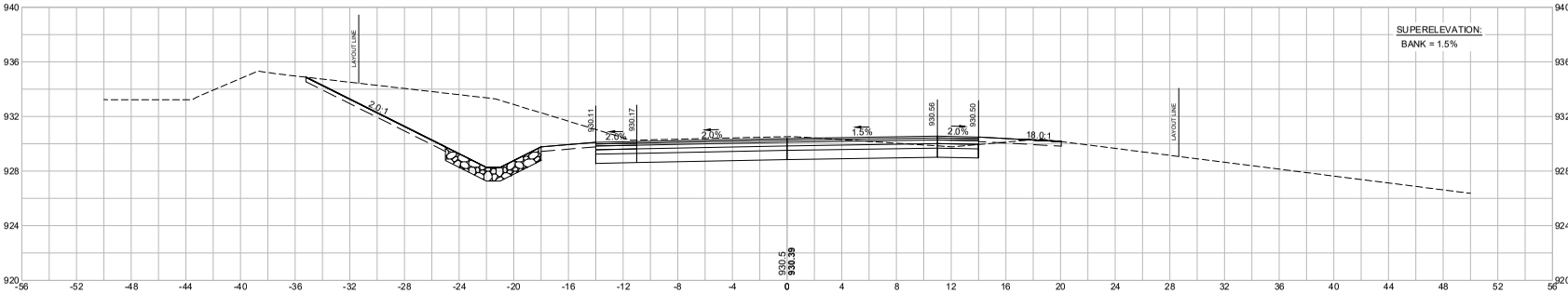
Cut: 106.50 S.F.
Fill: 0.35 S.F.

37+09.37



Cut: 104.00 S.F.
Fill: 1.59 S.F.

37+00



Cut: 110.57 S.F.
Fill: 1.06 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 4:40 PM

Proposal No. 608163-131813

Adobe PDF

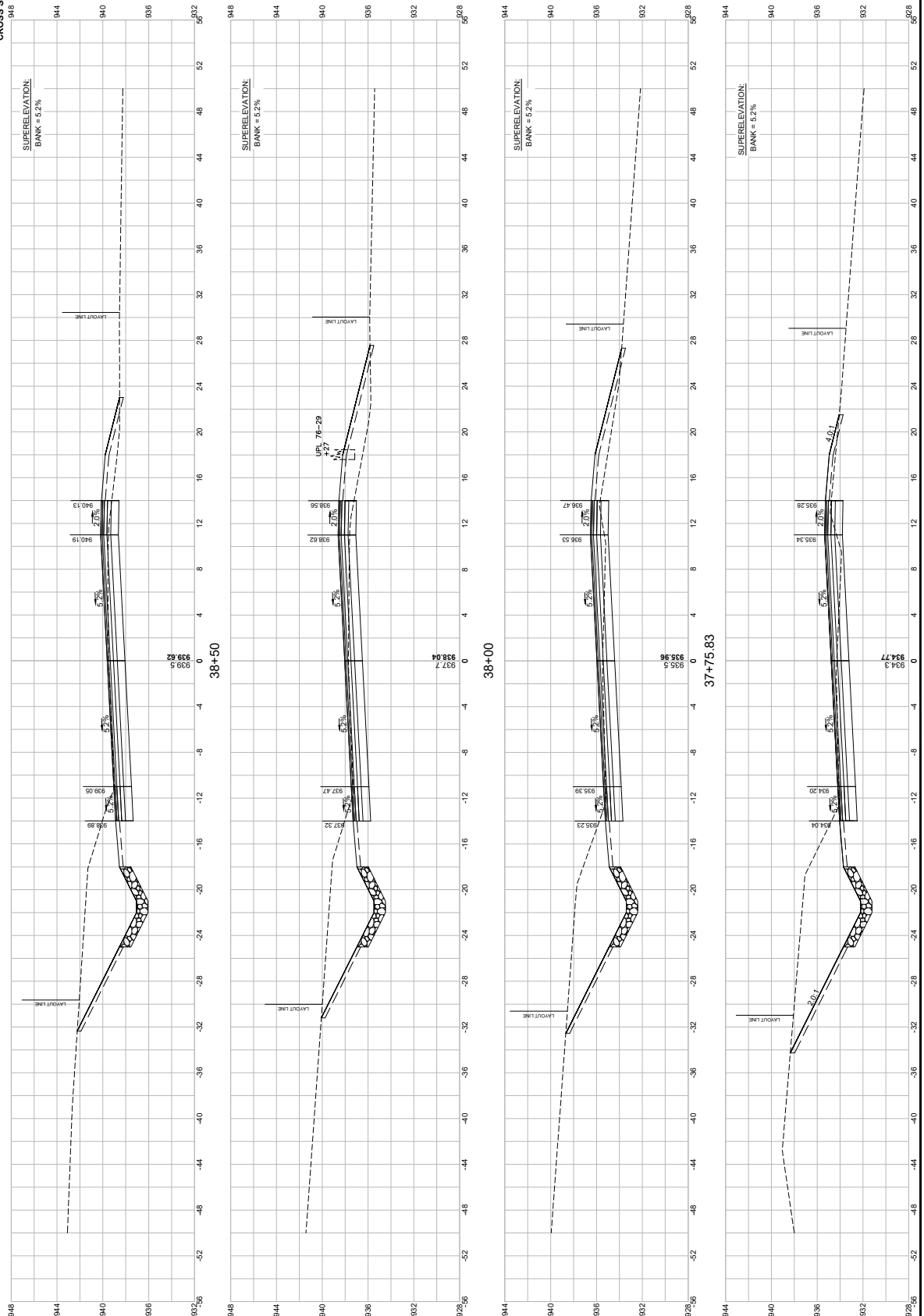
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:40 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	115	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:41 PM

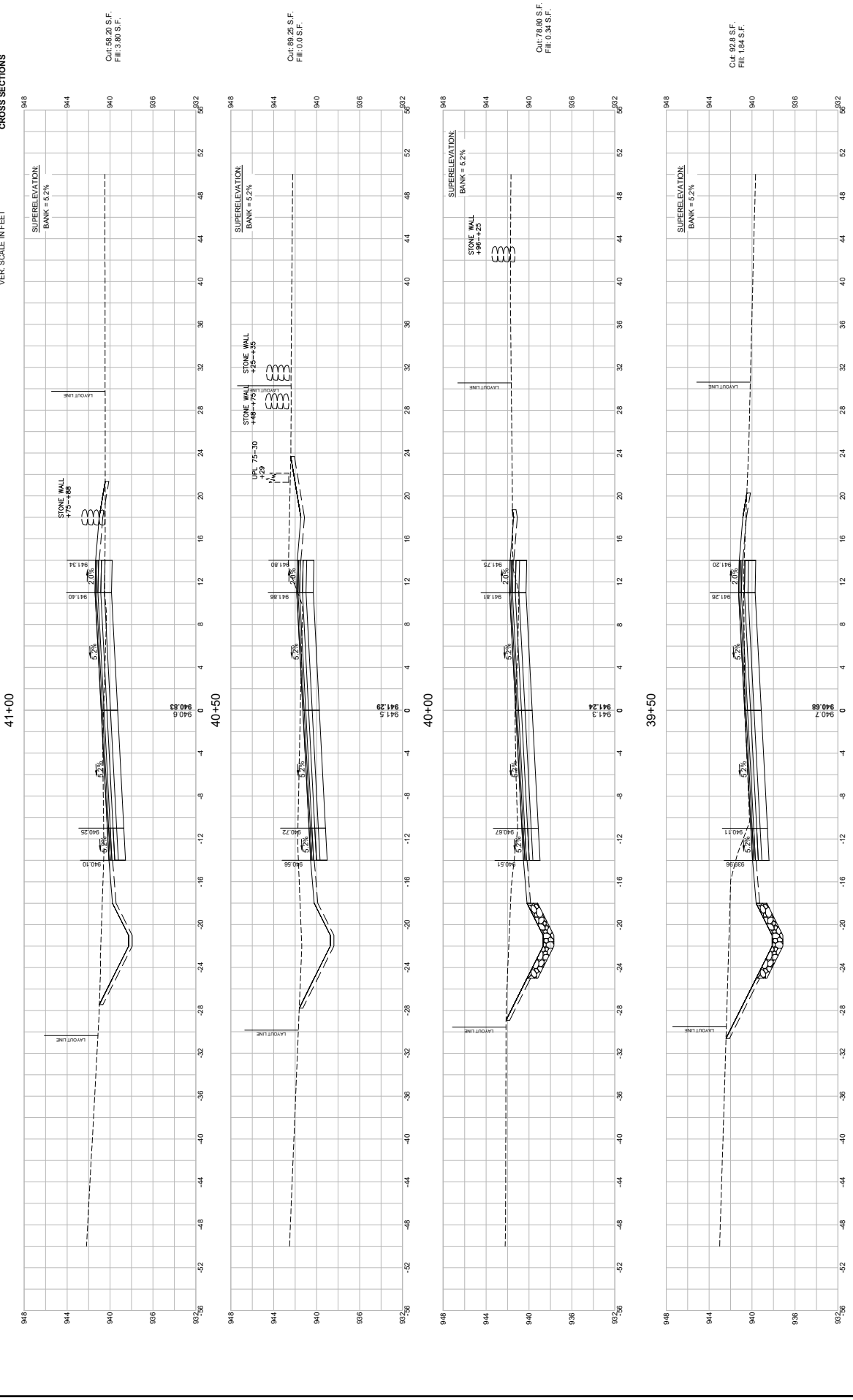
WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	116	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



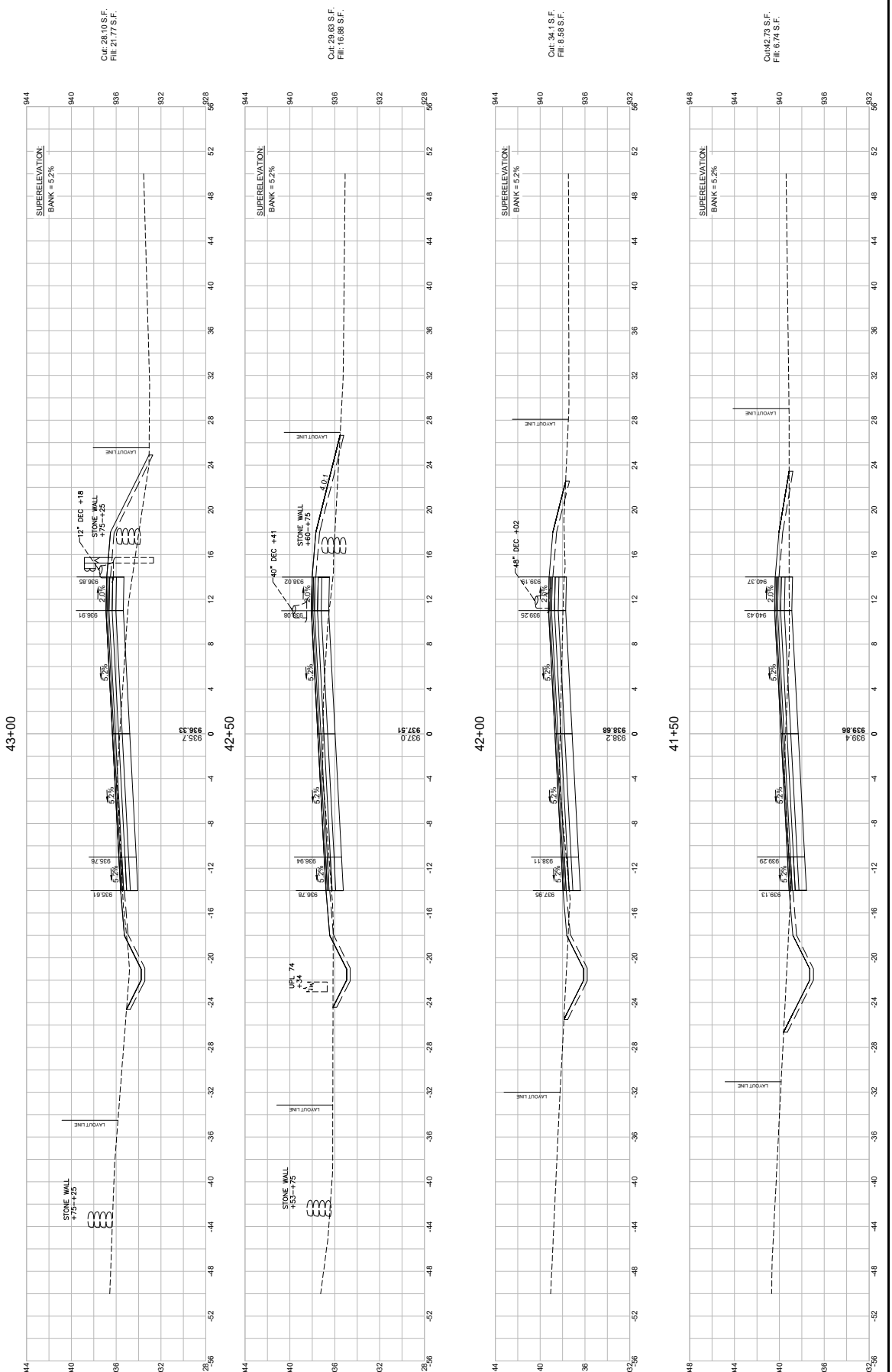
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:42 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	117	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8
VER. SCALE IN FEET
0 4 8



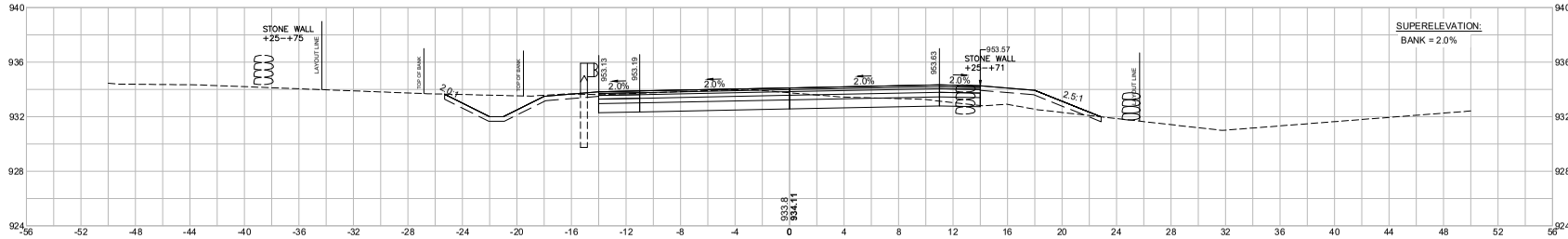
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	118	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

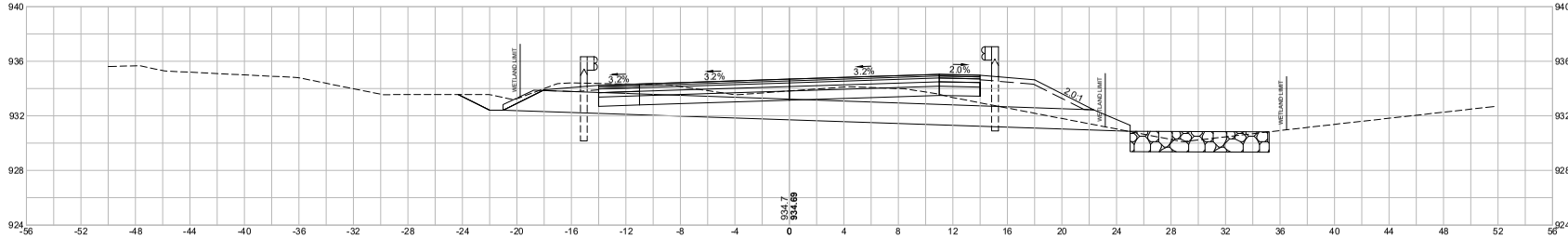
CROSS SECTIONS

43+94.64



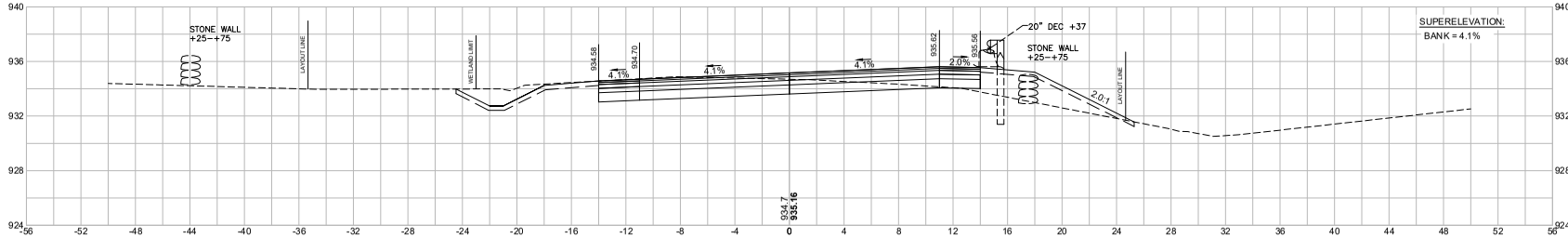
Cut: 39.15 S.F.
Fill: 8.87 S.F.

43+70 (SECTION CUT ALONG CENTERLINE OF PROPOSED CULVERT)



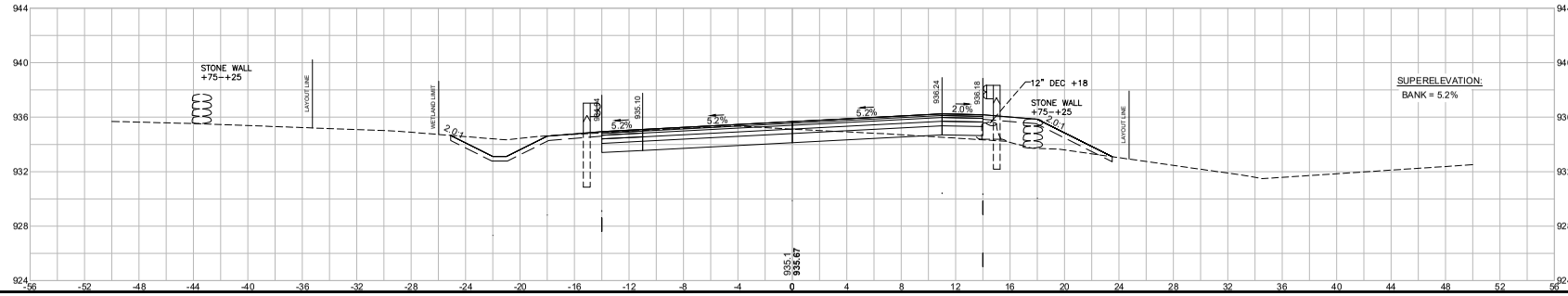
Cut: 96.36 S.F.
Fill: 12.89 S.F.

43+50



Cut: 35.54 S.F.
Fill: 16.37 S.F.

43+28.17



Cut: 33.29 S.F.
Fill: 14.32 S.F.

608163_HD100OSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 4:42 PM

Proposal No. 608163-118121

A08940 551

608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:43 PM

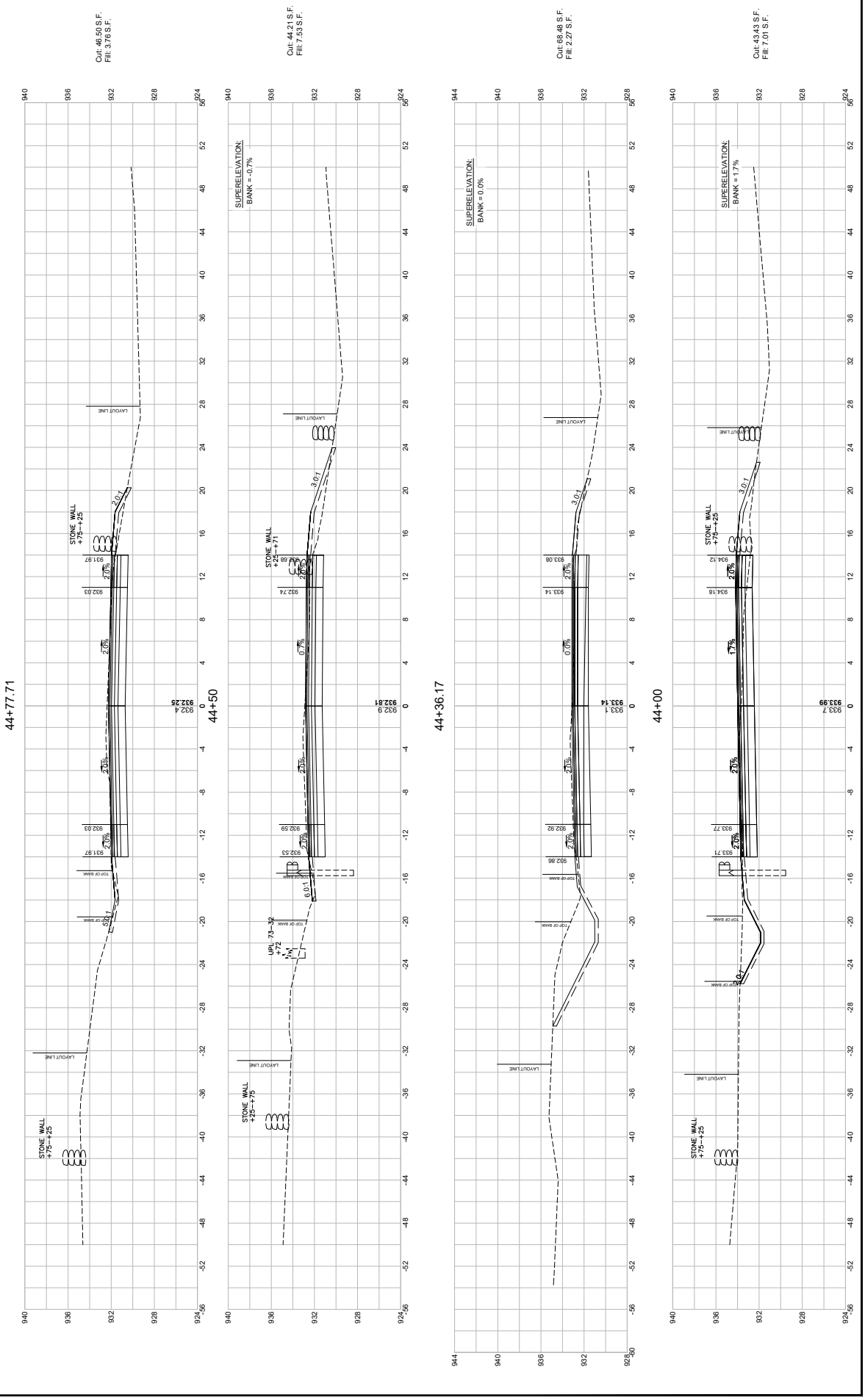
WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	119	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



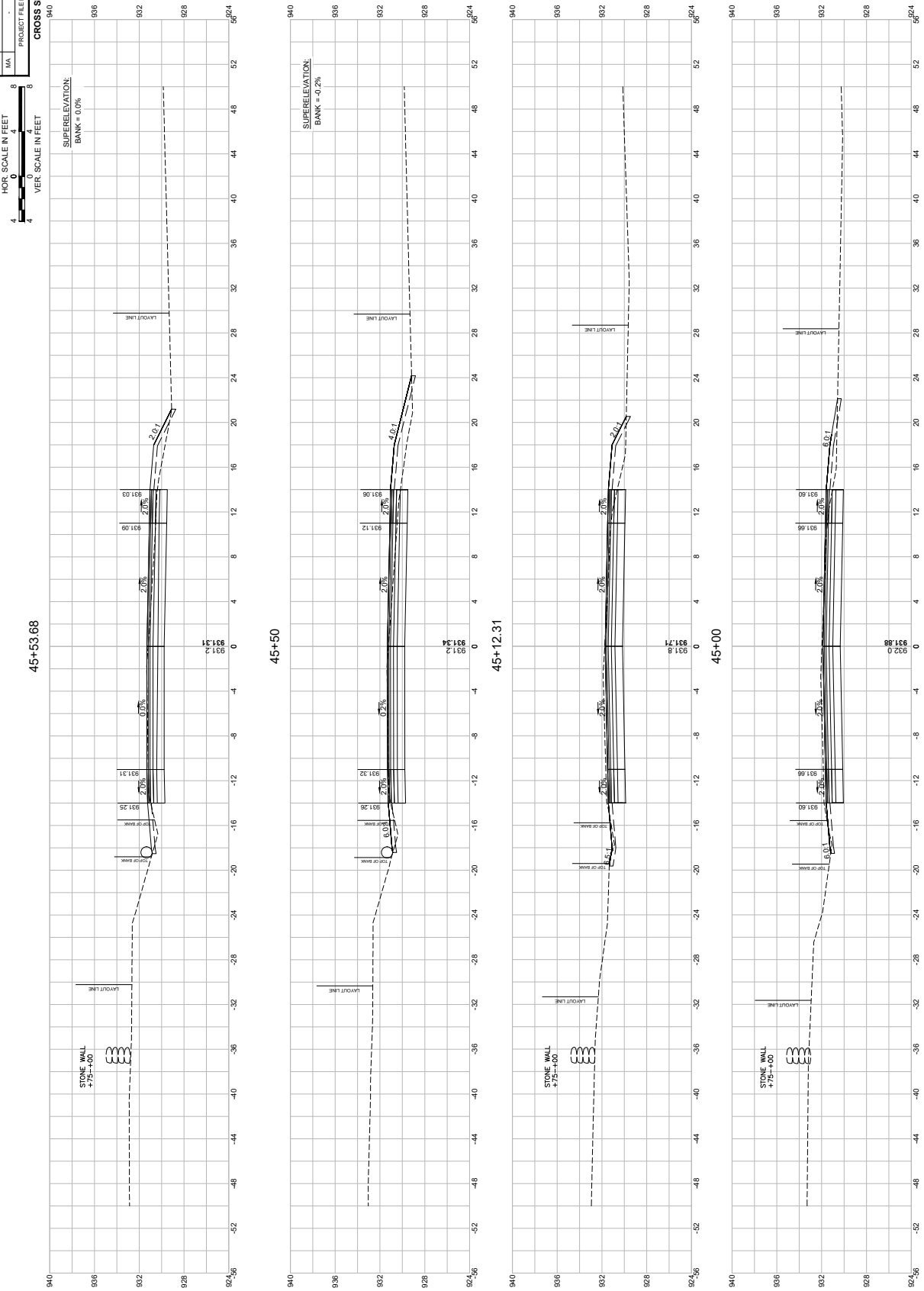
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:43 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	120	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



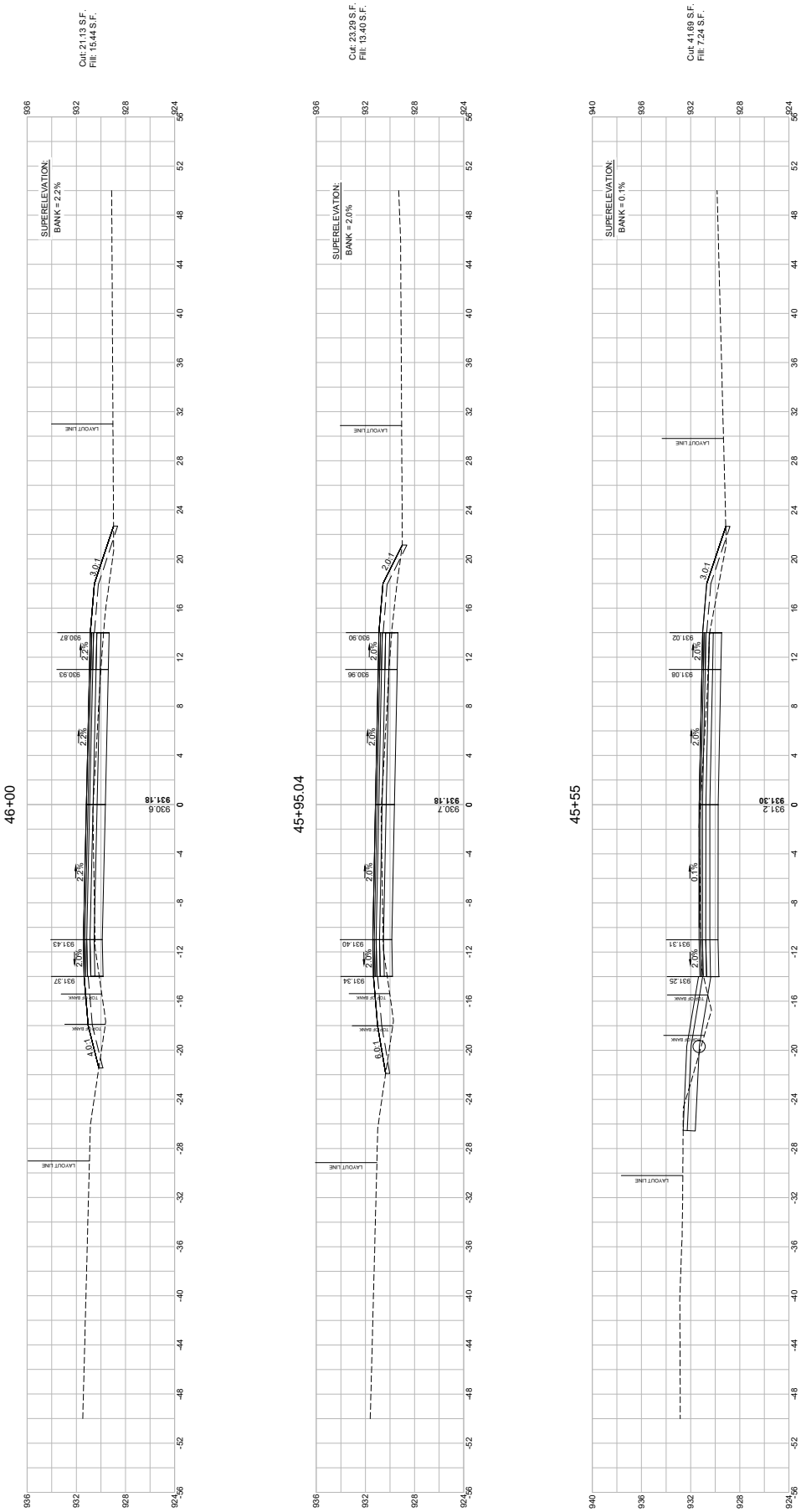
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:44 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	121	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



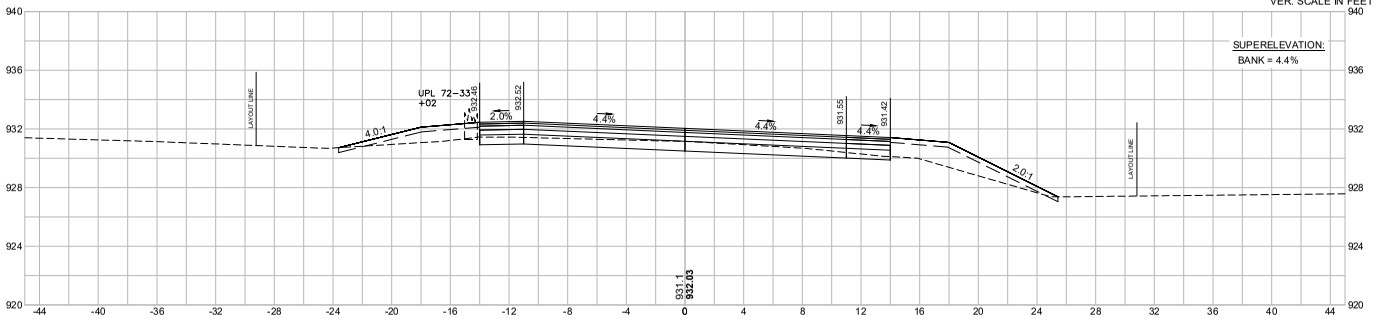
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	122	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

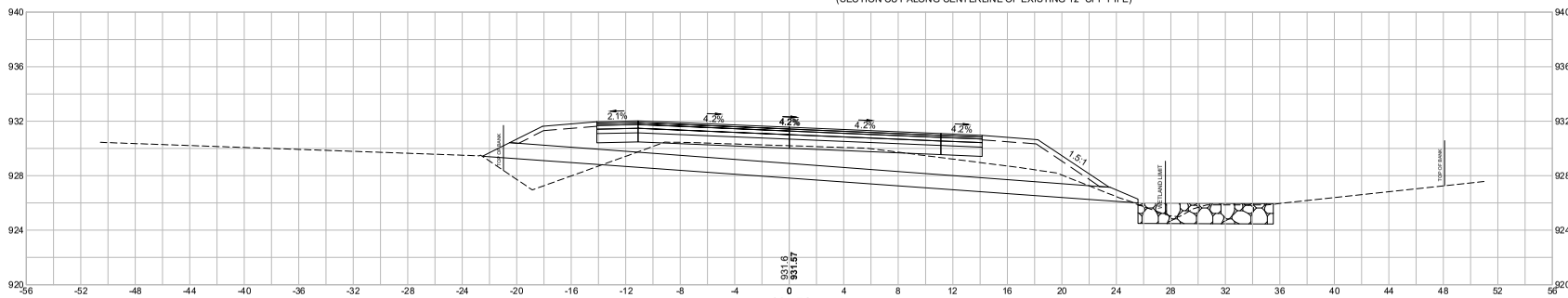
47+00



Cut: 15.09 S.F.
Fill: 19.53 S.F.

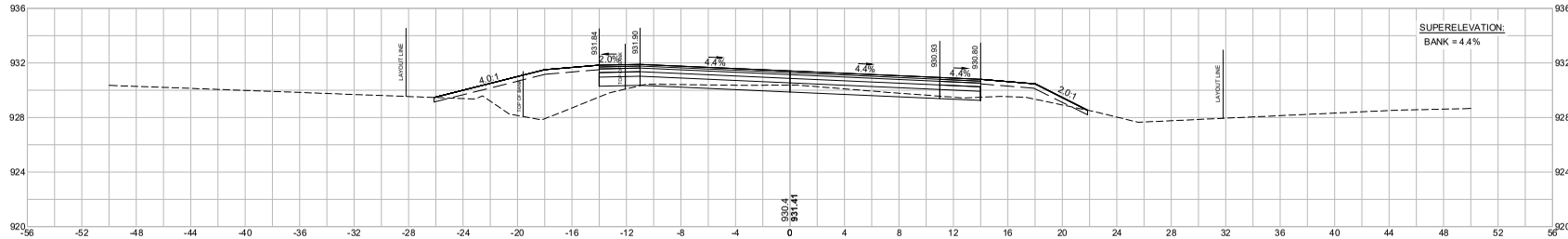
46+64.76

(SECTION CUT ALONG CENTERLINE OF EXISTING 12" CPP PIPE)



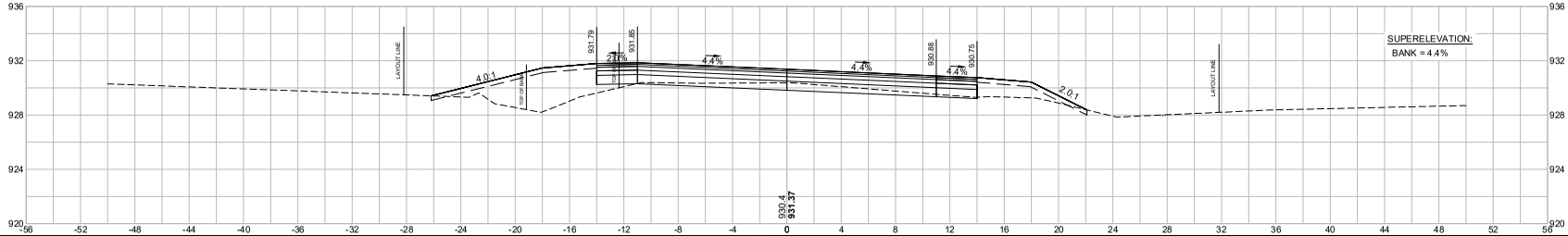
Cut: 85.75 S.F.
Fill: 36.70 S.F.

46+50



Cut: 7.89 S.F.
Fill: 32.80 S.F.

46+44.68



Cut: 8.27 S.F.
Fill: 30.60 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 4:45 PM
Proposal No. 608163 (61)
A08940 .555

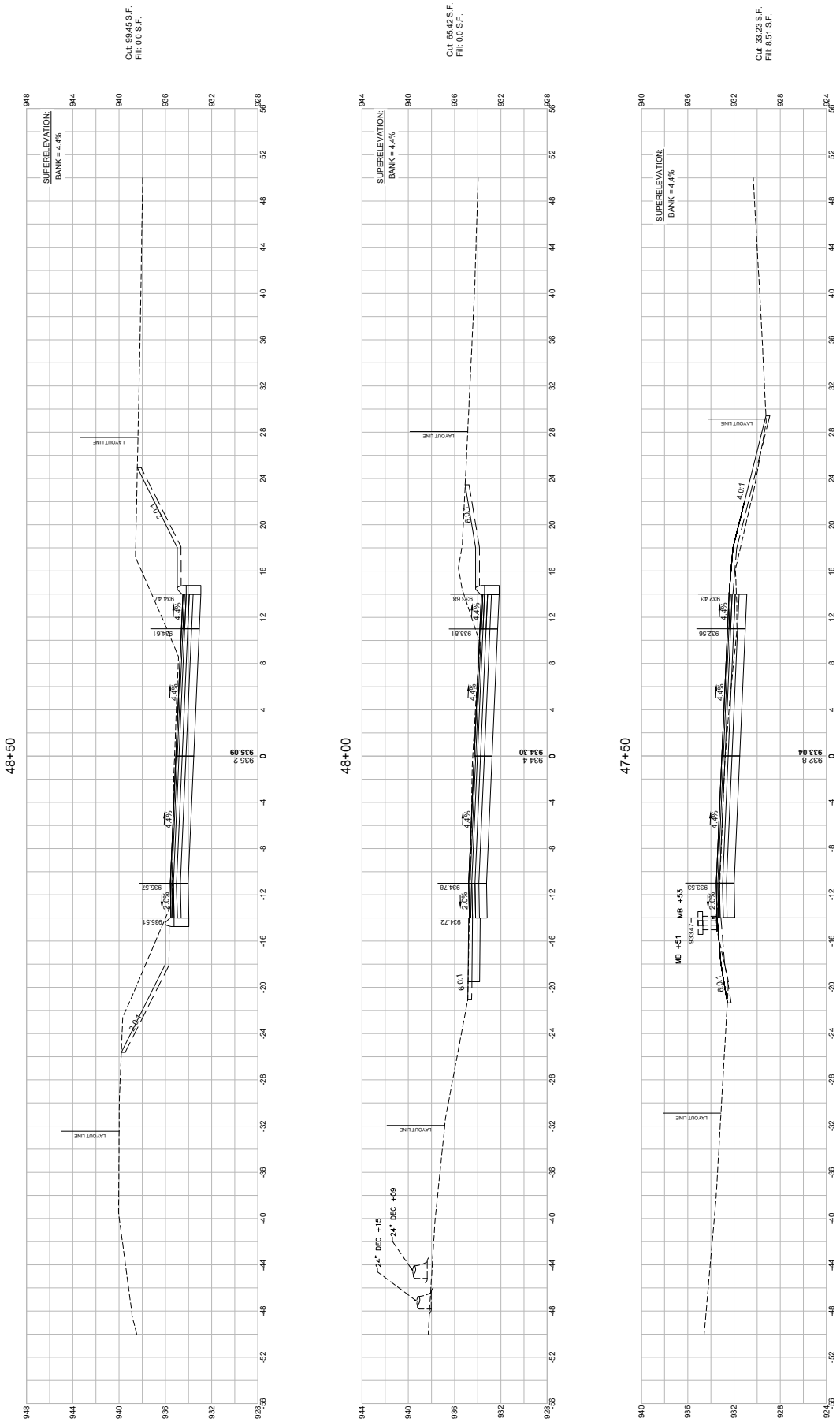
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:45 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	123	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



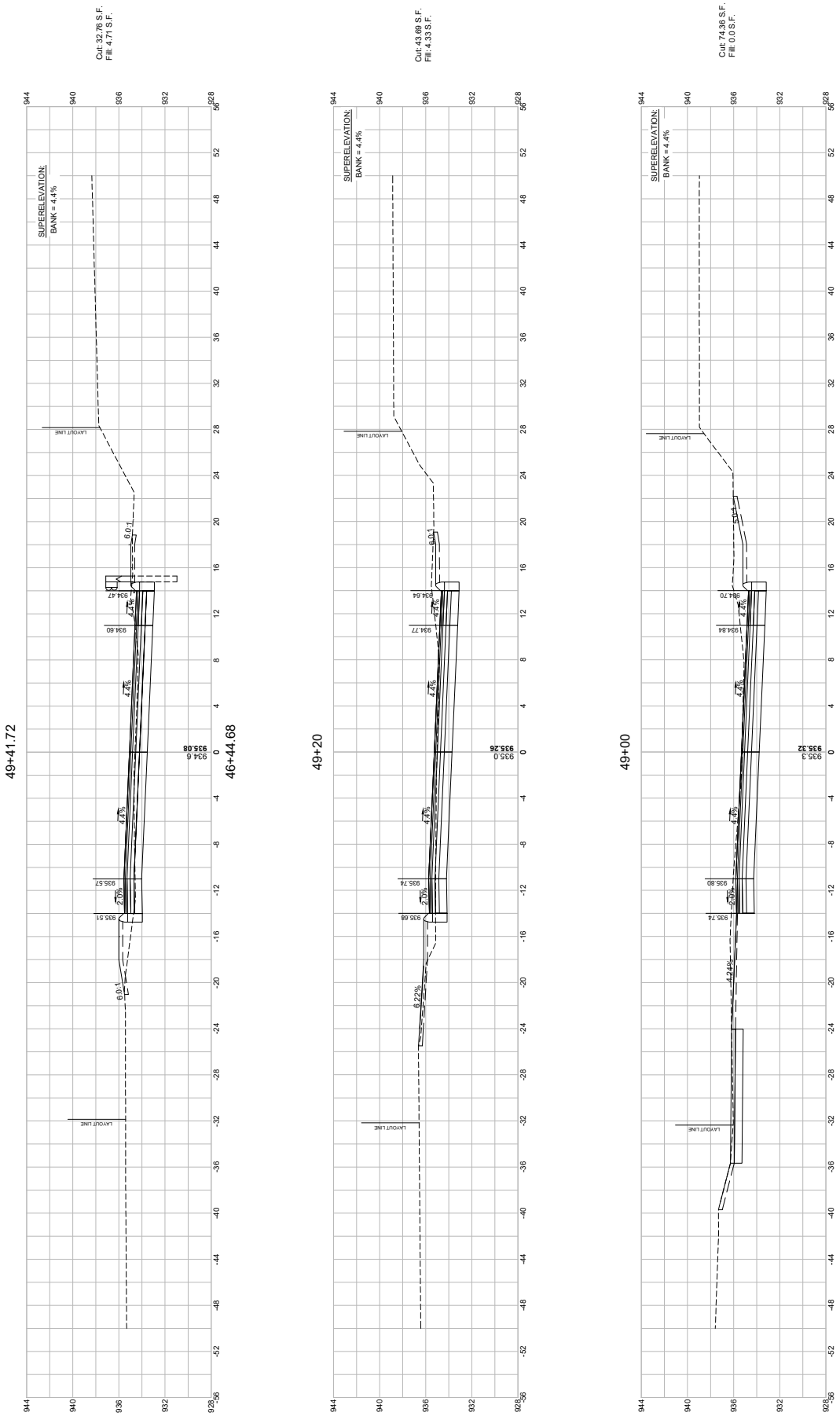
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:46 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	124	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET
4 0 4 8



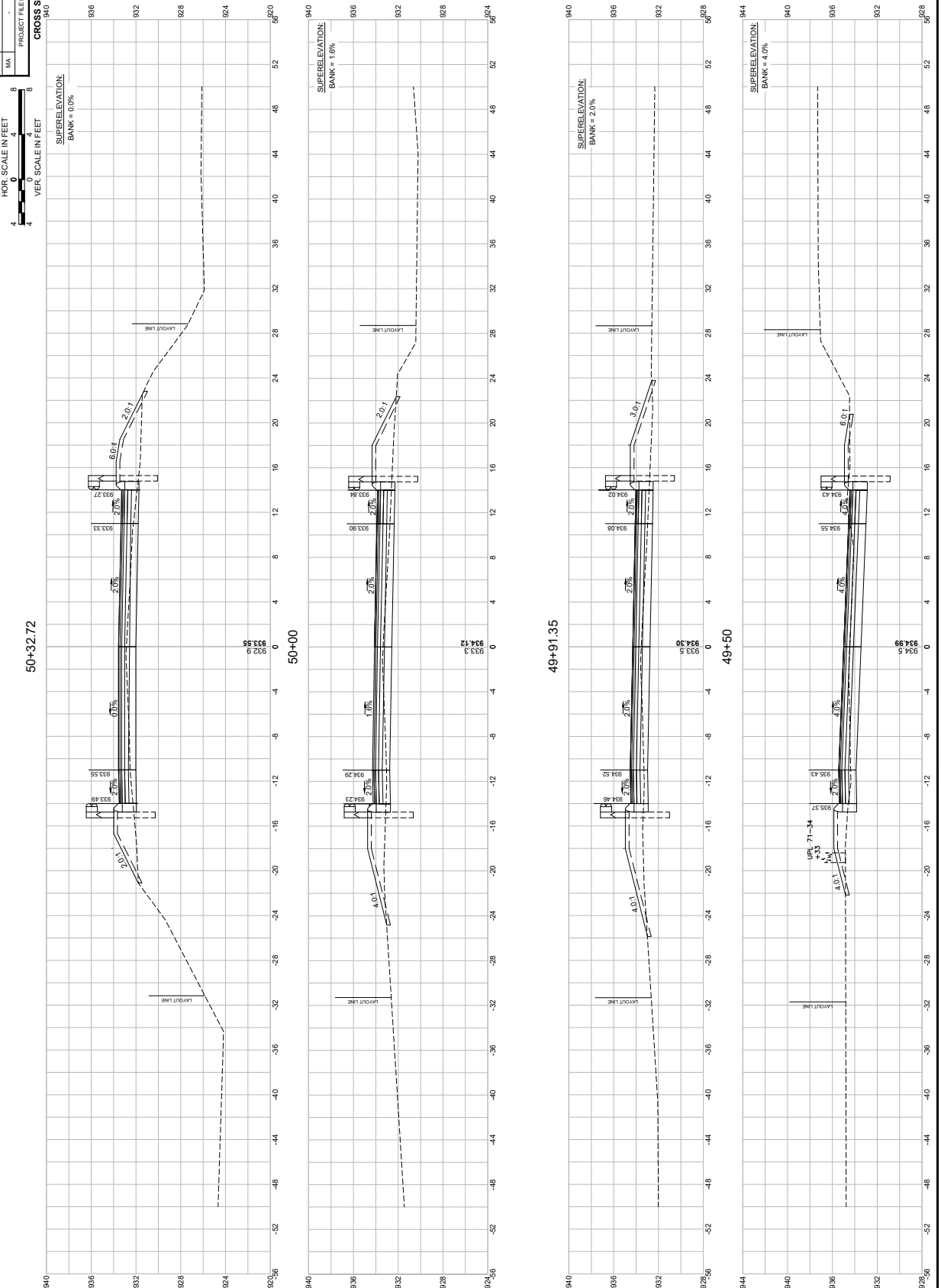
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:46 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	125	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



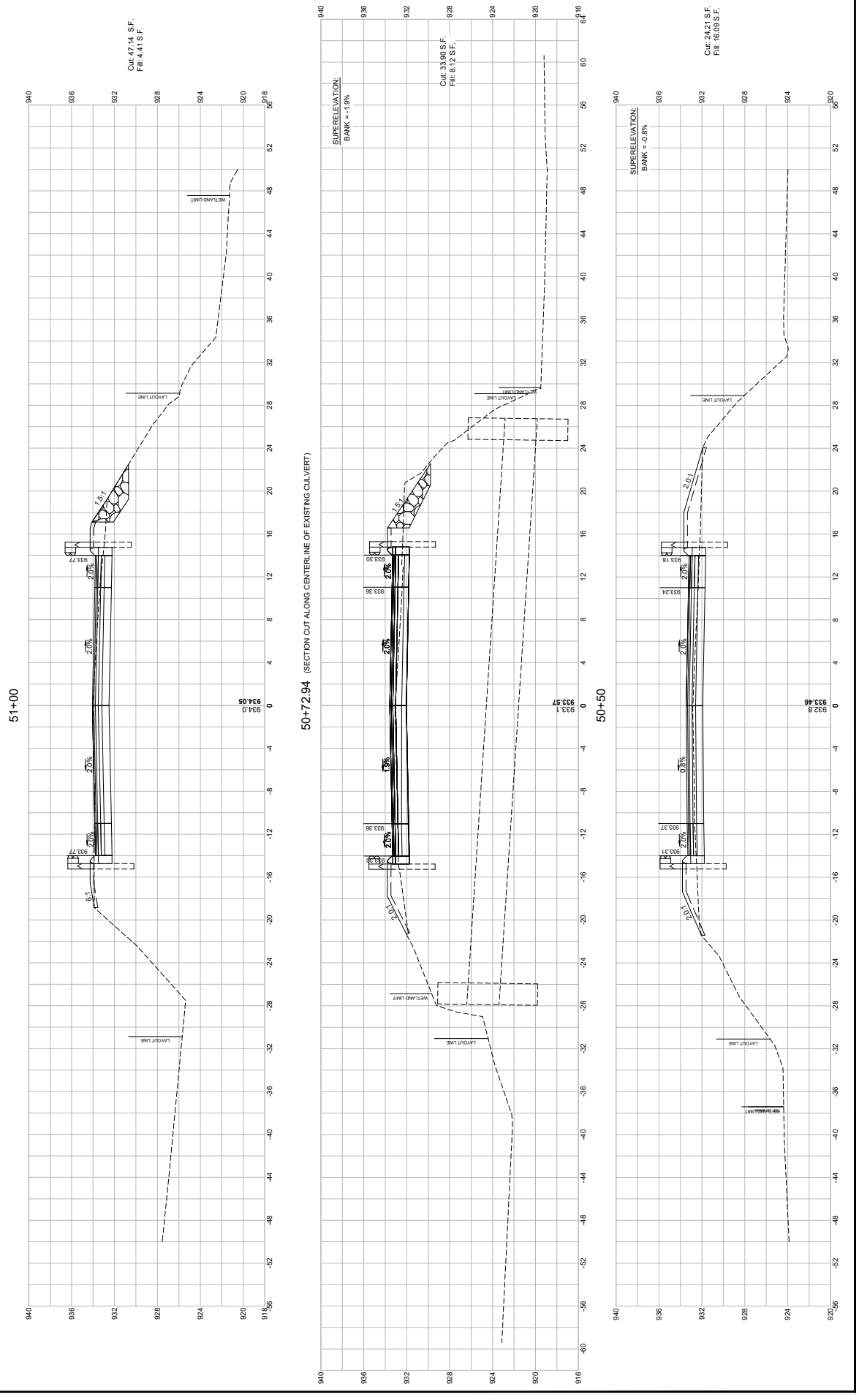
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:47 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	126	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:47 PM

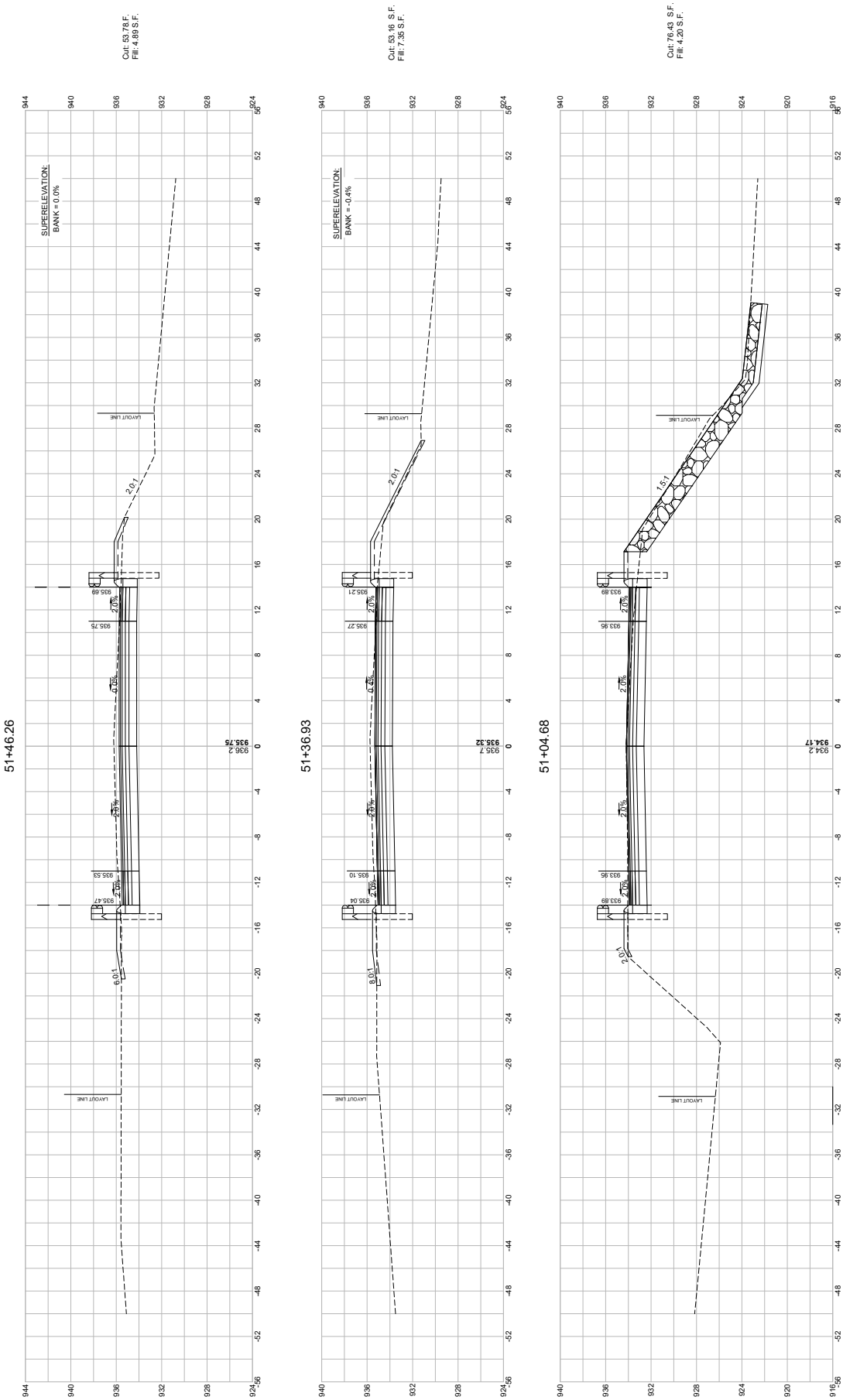
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	127	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:48 PM

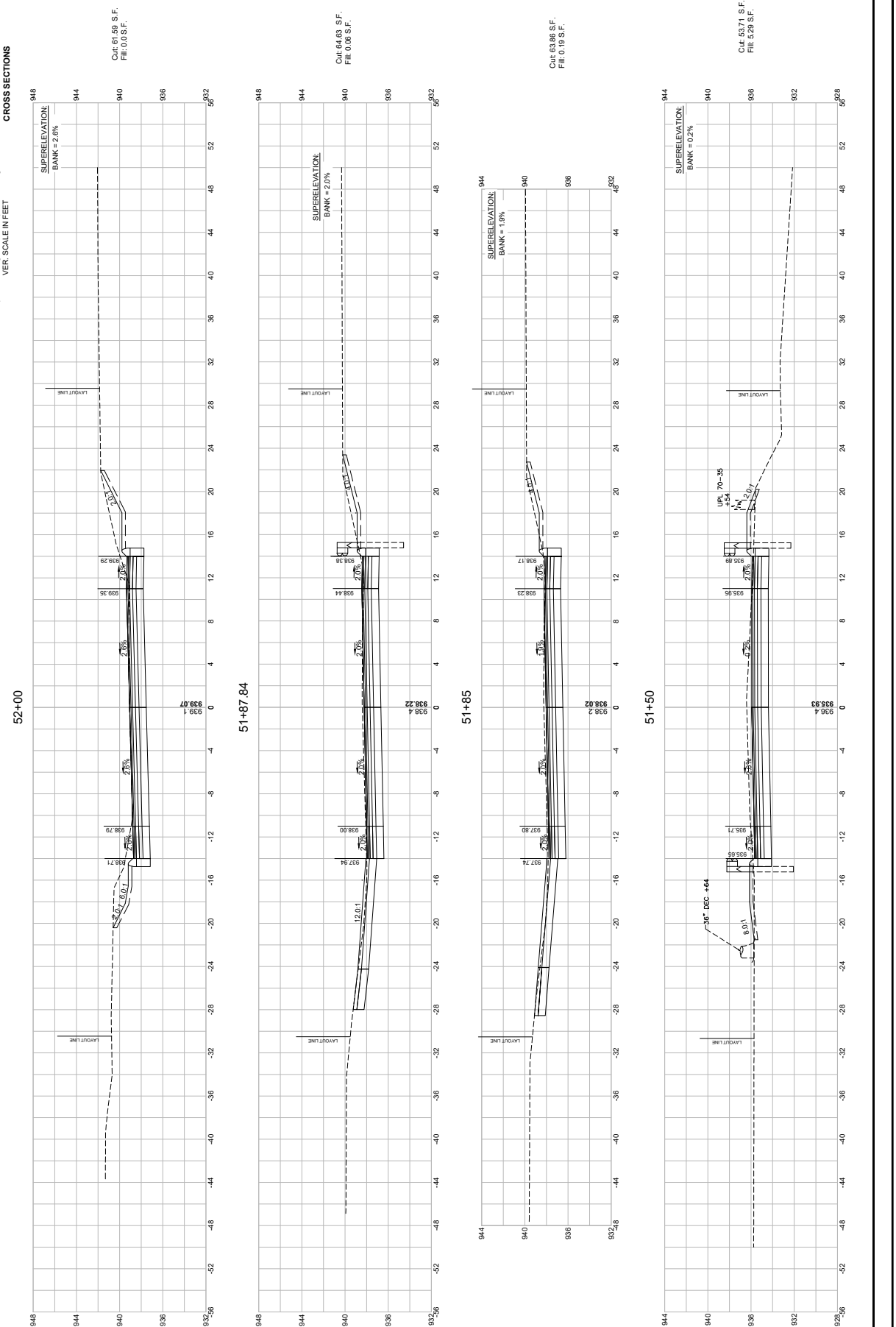
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	128	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
8 4 0 4 8

VER. SCALE IN FEET
4 0 4



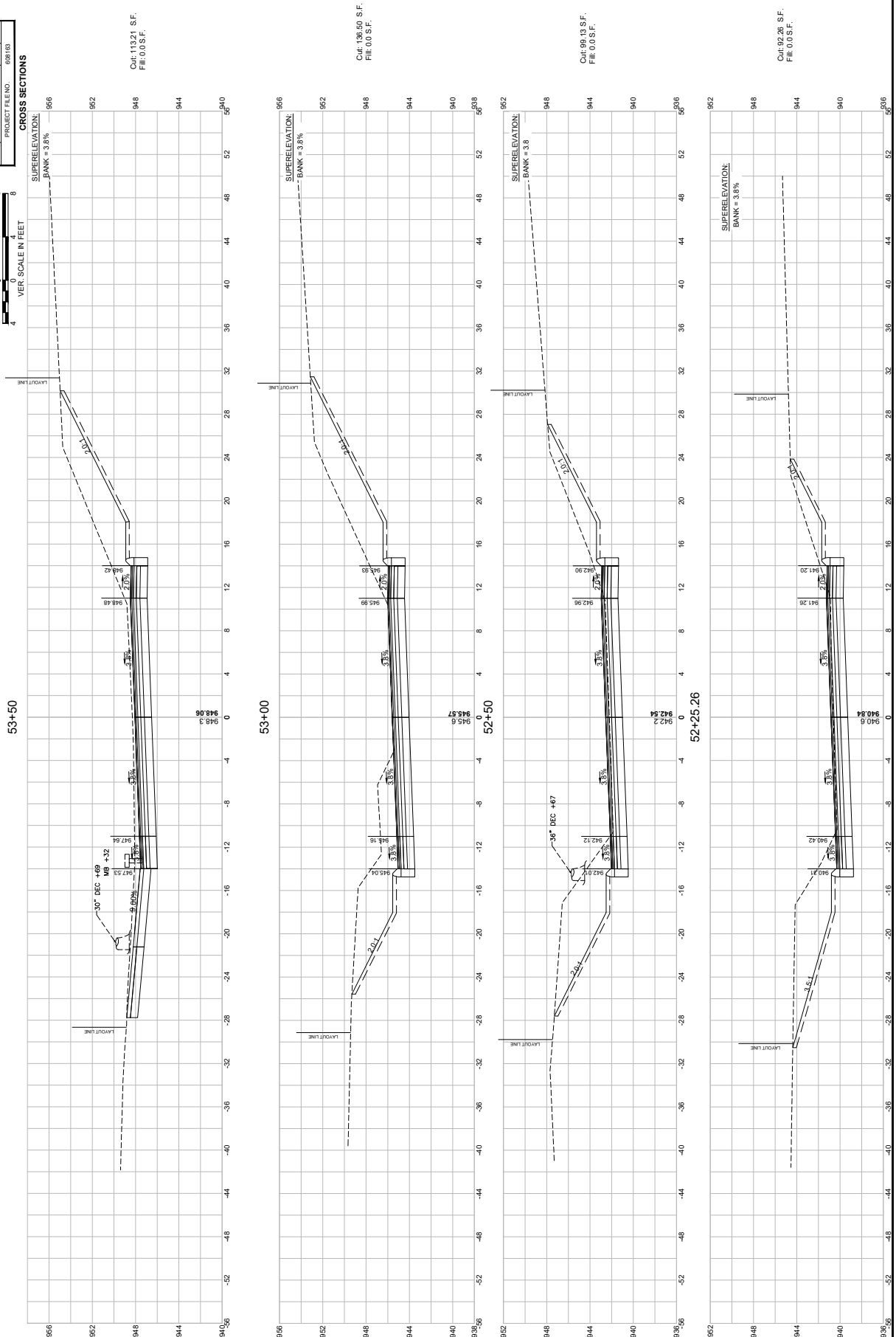
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:48 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	129	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



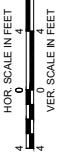
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:49 PM

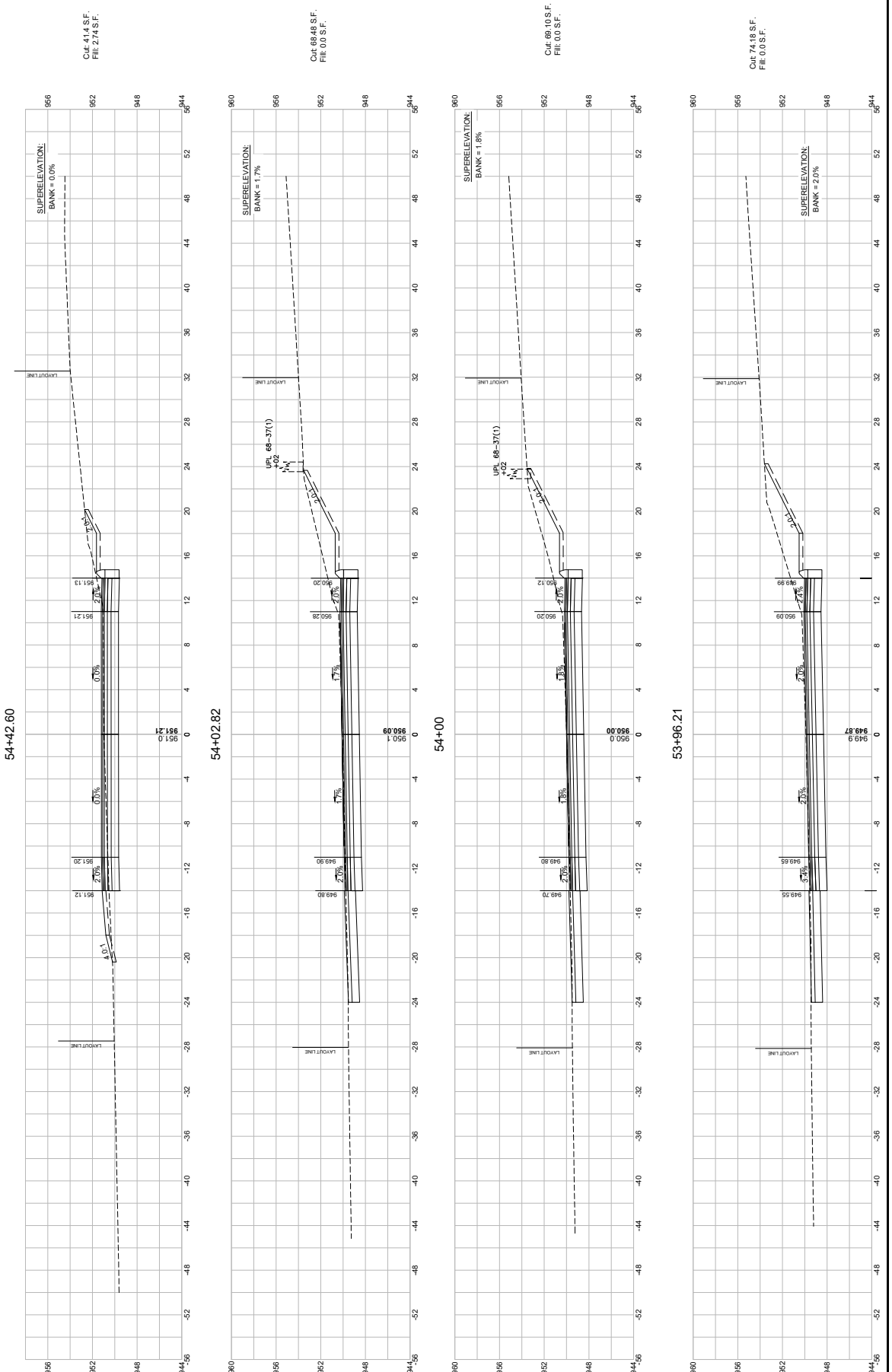
WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	130	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET





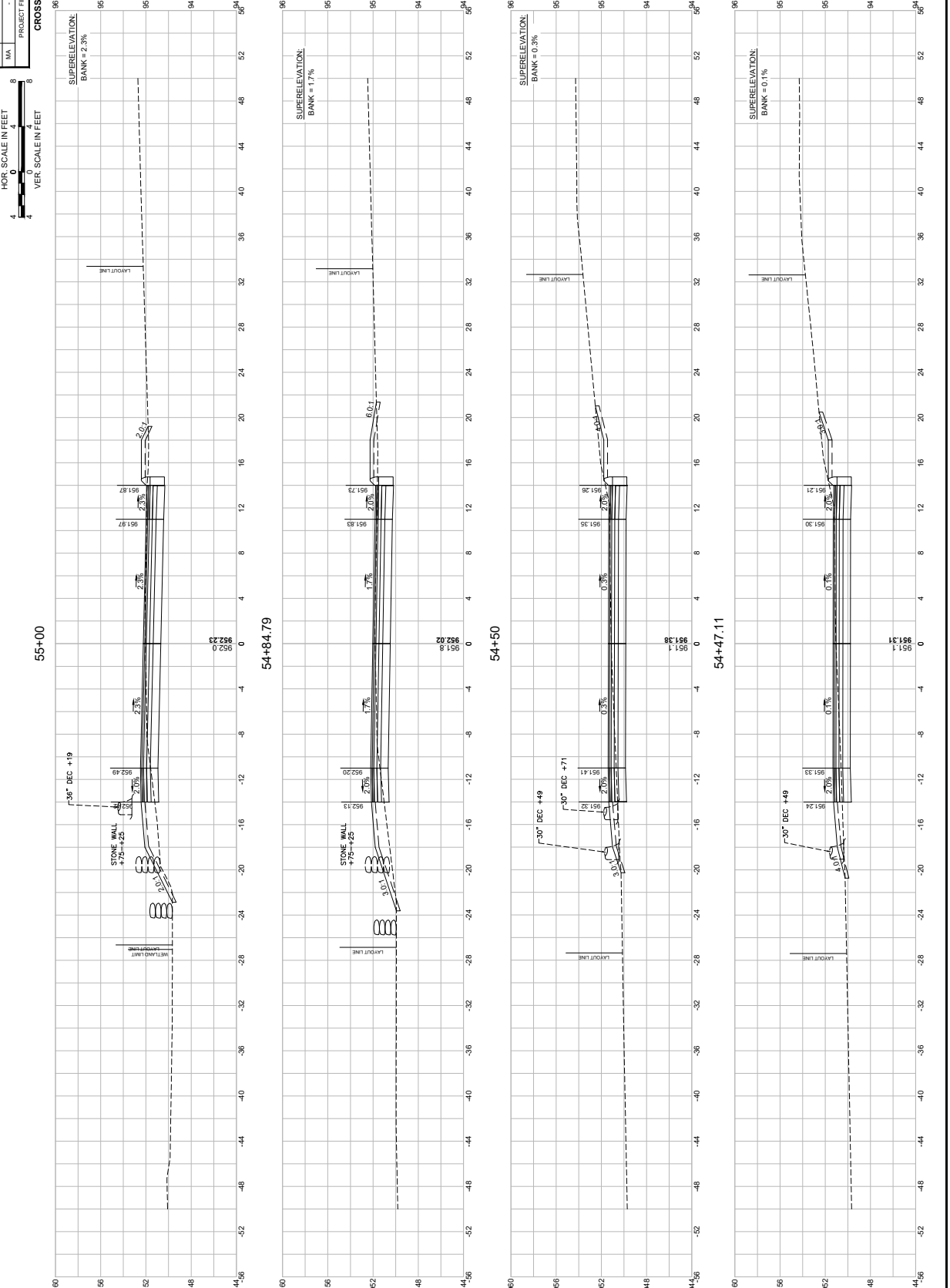
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:49 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	131	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



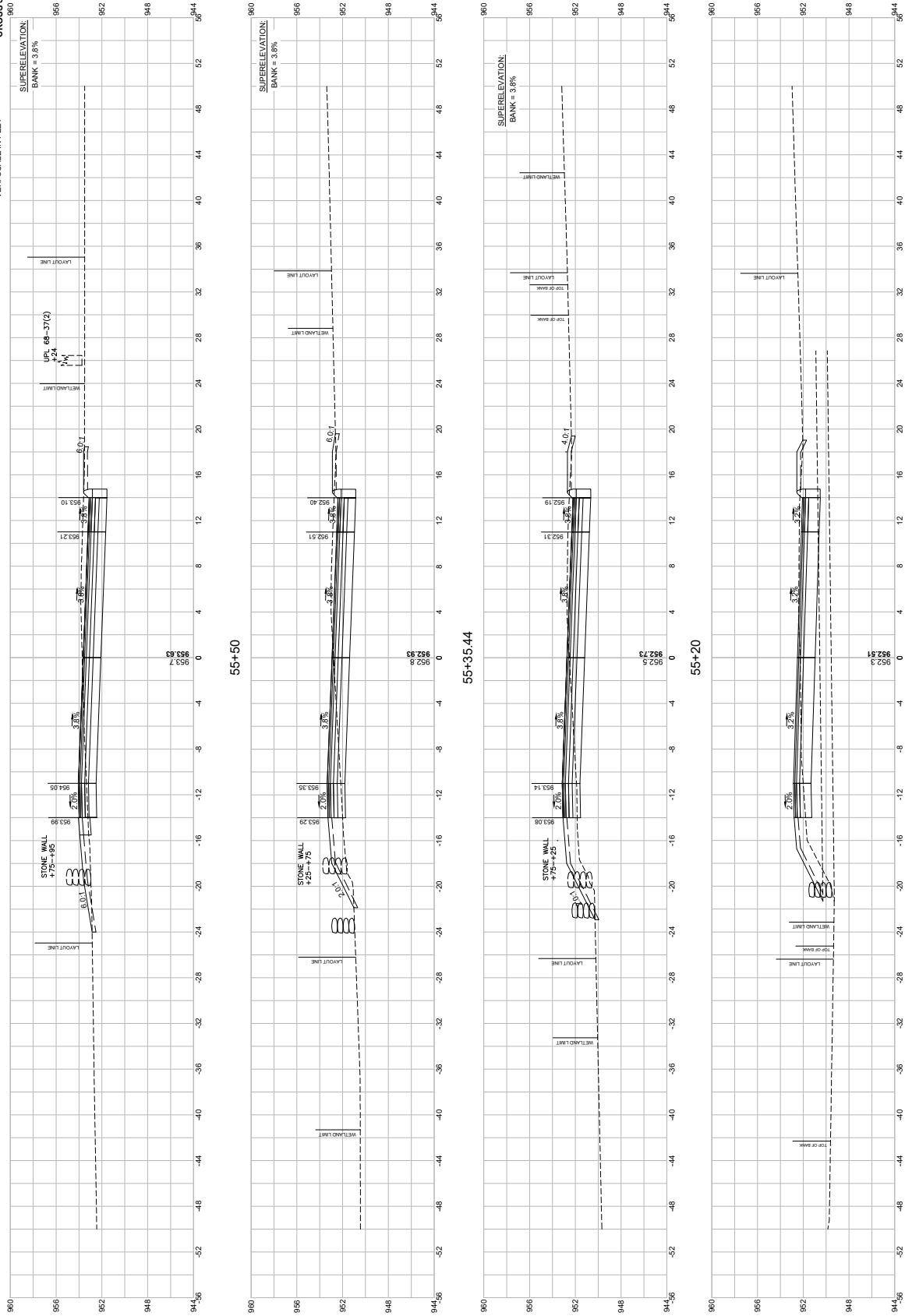
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:50 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	132	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



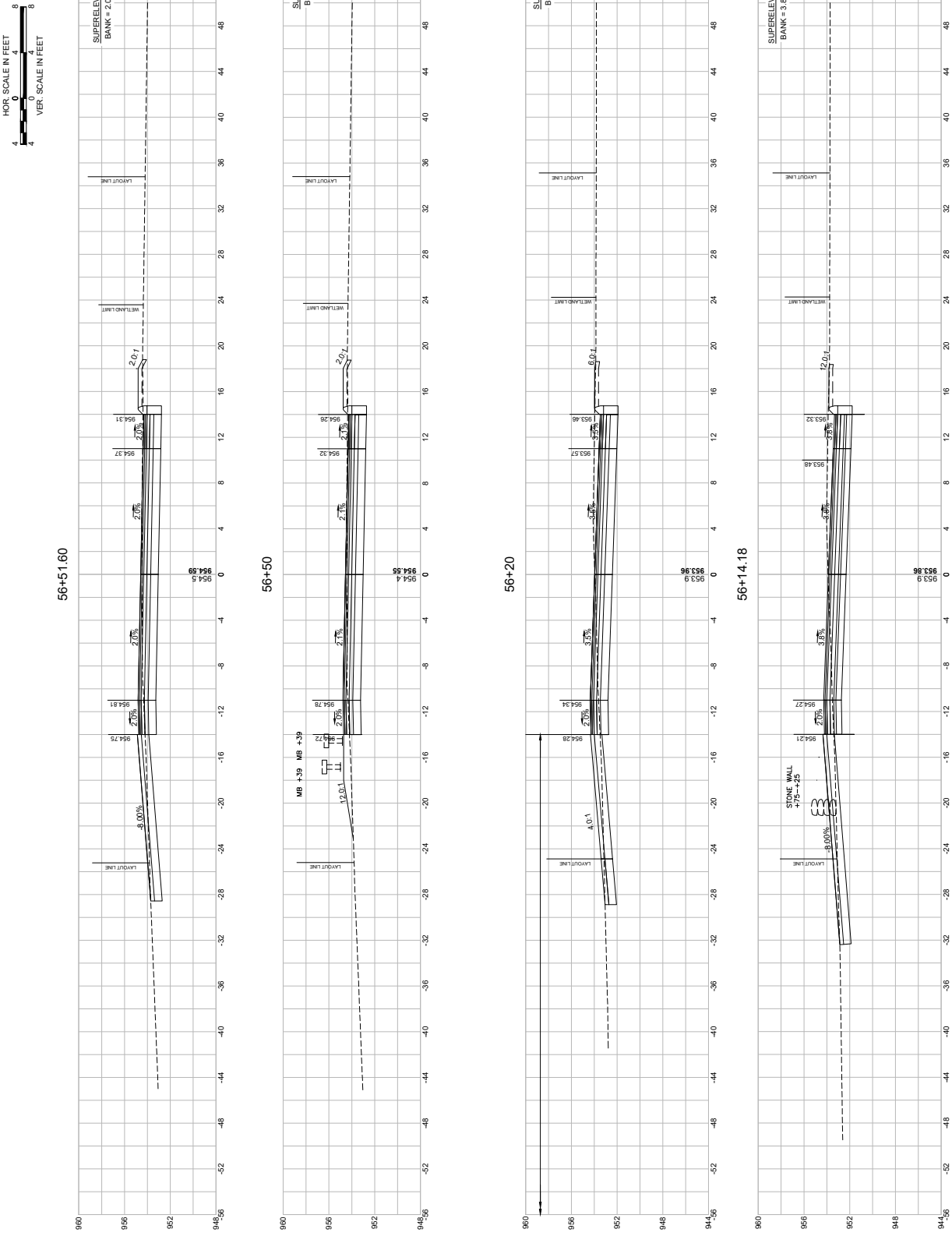
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:51 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	133	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET



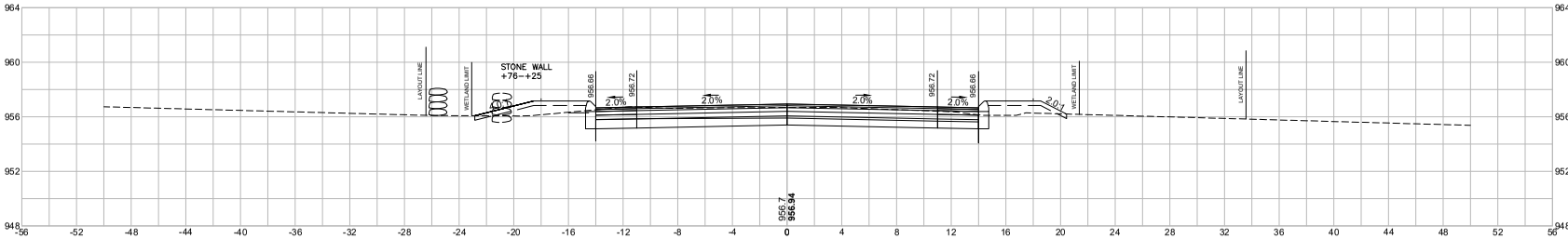
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	134	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

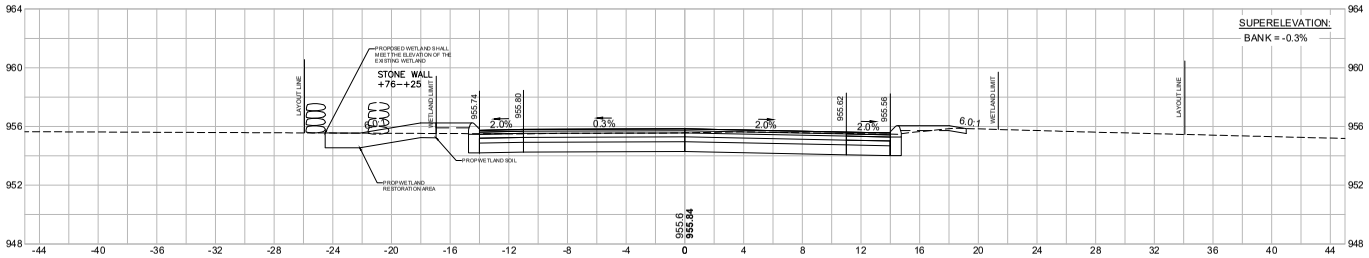
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

57+34.75



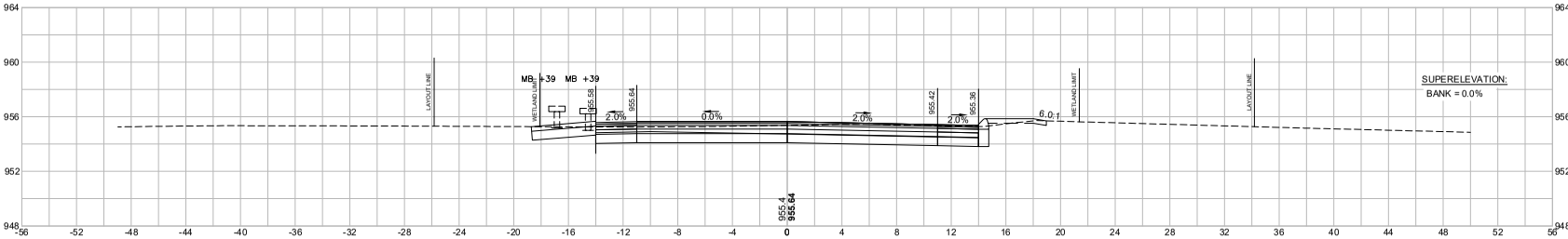
Cut: 39.6 S.F.
Fill: 10.37 S.F.

57+00



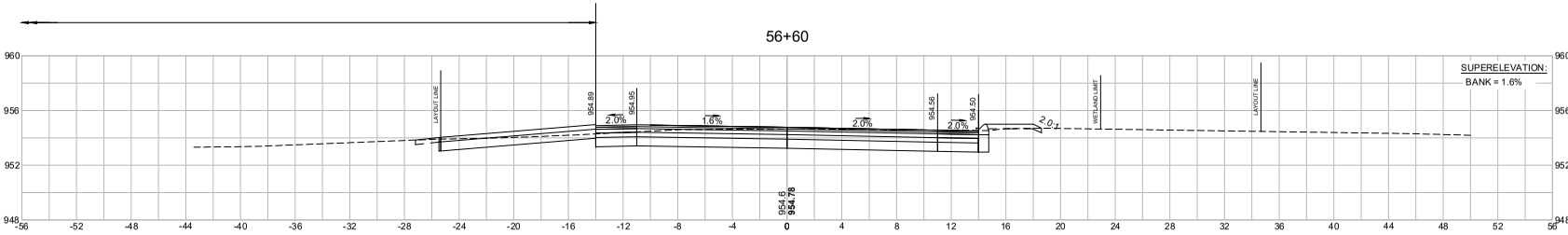
Cut: 40.32 S.F.
Fill: 5.17 S.F.

56+93.18



Cut: 41.77 S.F.
Fill: 1.19 S.F.

56+60



Cut: 46.38 S.F.
Fill: 1.33 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 4:51 PM
Proposal No. 608163 13121
A0Bl4d -56"

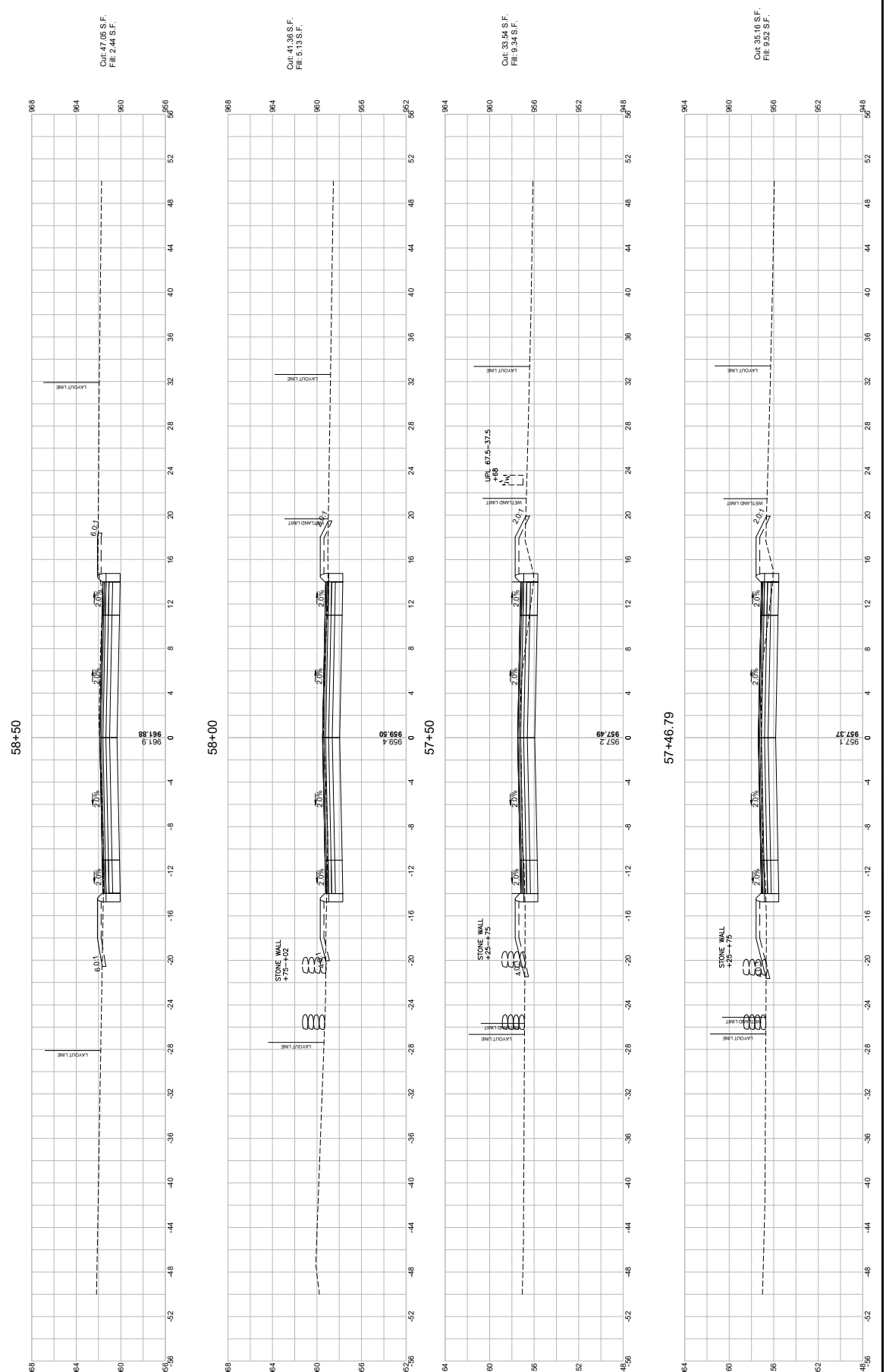
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:52 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	135	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



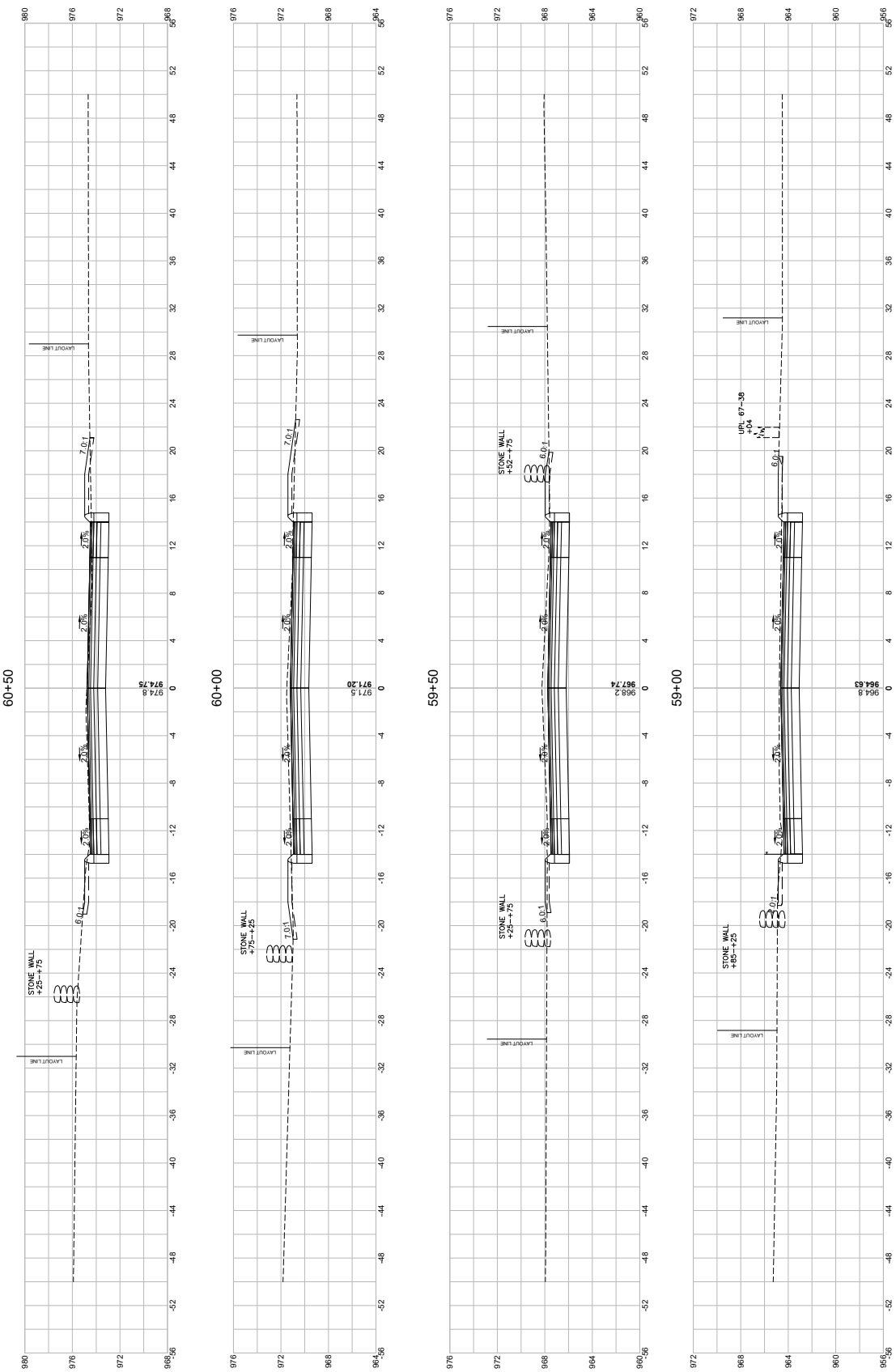
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:53 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	136	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



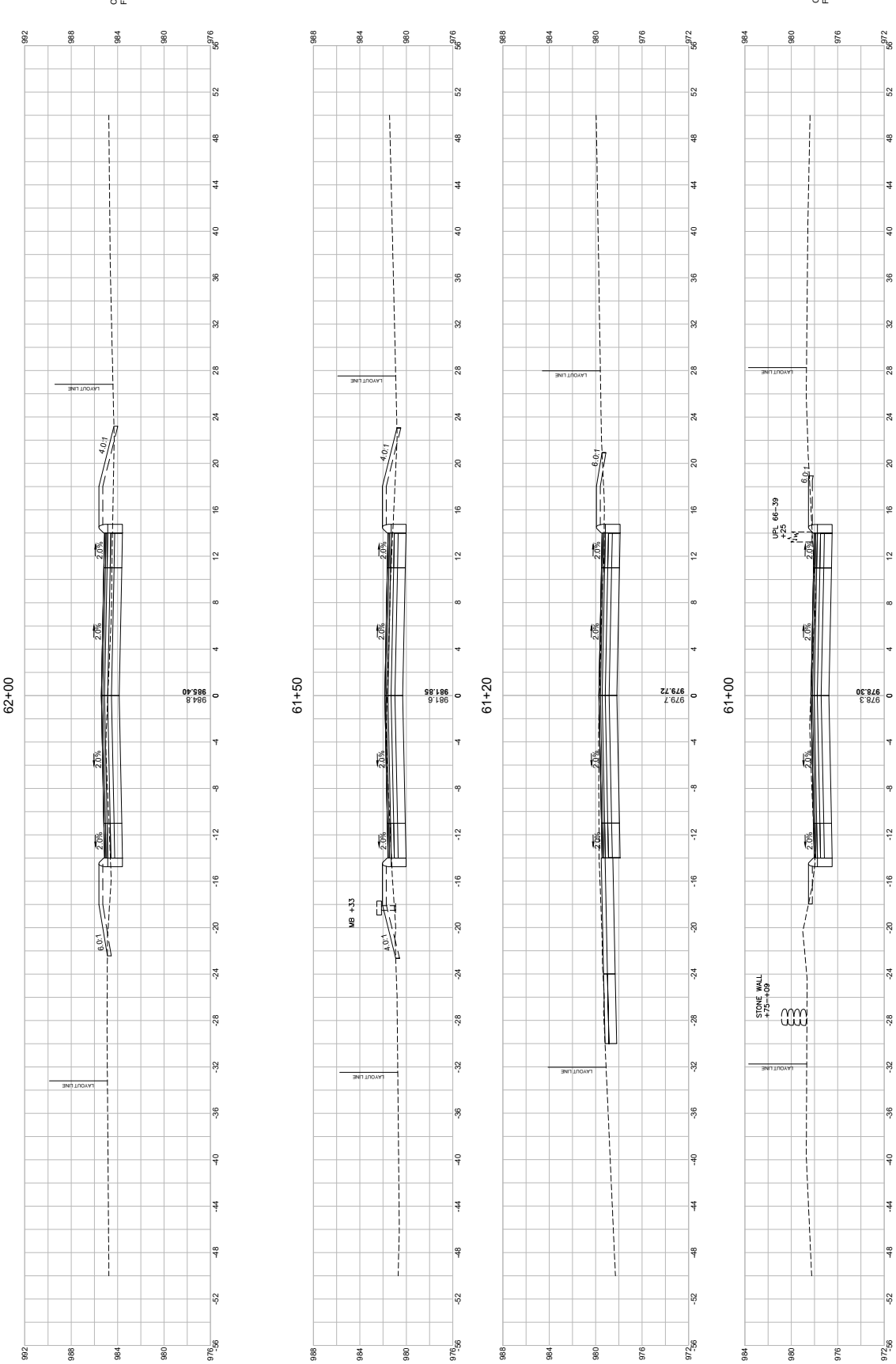
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:53 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	137	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:54 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	138	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8

64+00

Cut: 61.35 S.F.
Fill: 0.27 S.F.

63+50

Cut: 50.9 S.F.
Fill: 3.02 S.F.

63+00

Cut: 39.10 S.F.
Fill: 8.85 S.F.

62+50

Cut: 35.31 S.F.
Fill: 7.73 S.F.

608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:55 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	139	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET

65+00

Cut: 38.10 S.F.
Fill: 5.02 S.F.

SUPERELEVATION:
BANK = 0.7%

LAYOUT LINE

STONE WALL
+00 – +15

1001.50
1001.56
1001.78
1001.6

2.0%
6.0:1

64+85.04

Cut: 55.0 S.F.
Fill: 1.88 S.F.

LAYOUT LINE

1000.89
1000.95
1001.17
1001.3

2.0%
4.0:1

64+50

Cut: 59.20 S.F.
Fill: 1.51 S.F.

SUPERELEVATION:
BANK = 1.6%

LAYOUT LINE

UPL 65 – 40
+35

999.43
1000.0
999.71

2.0%
6.0:1

64+41.04

Cut: 60.90 S.F.
Fill: 0.89 S.F.

LAYOUT LINE

UPL 65 – 40
+35

999.7
999.32

2.0%
6.0:1

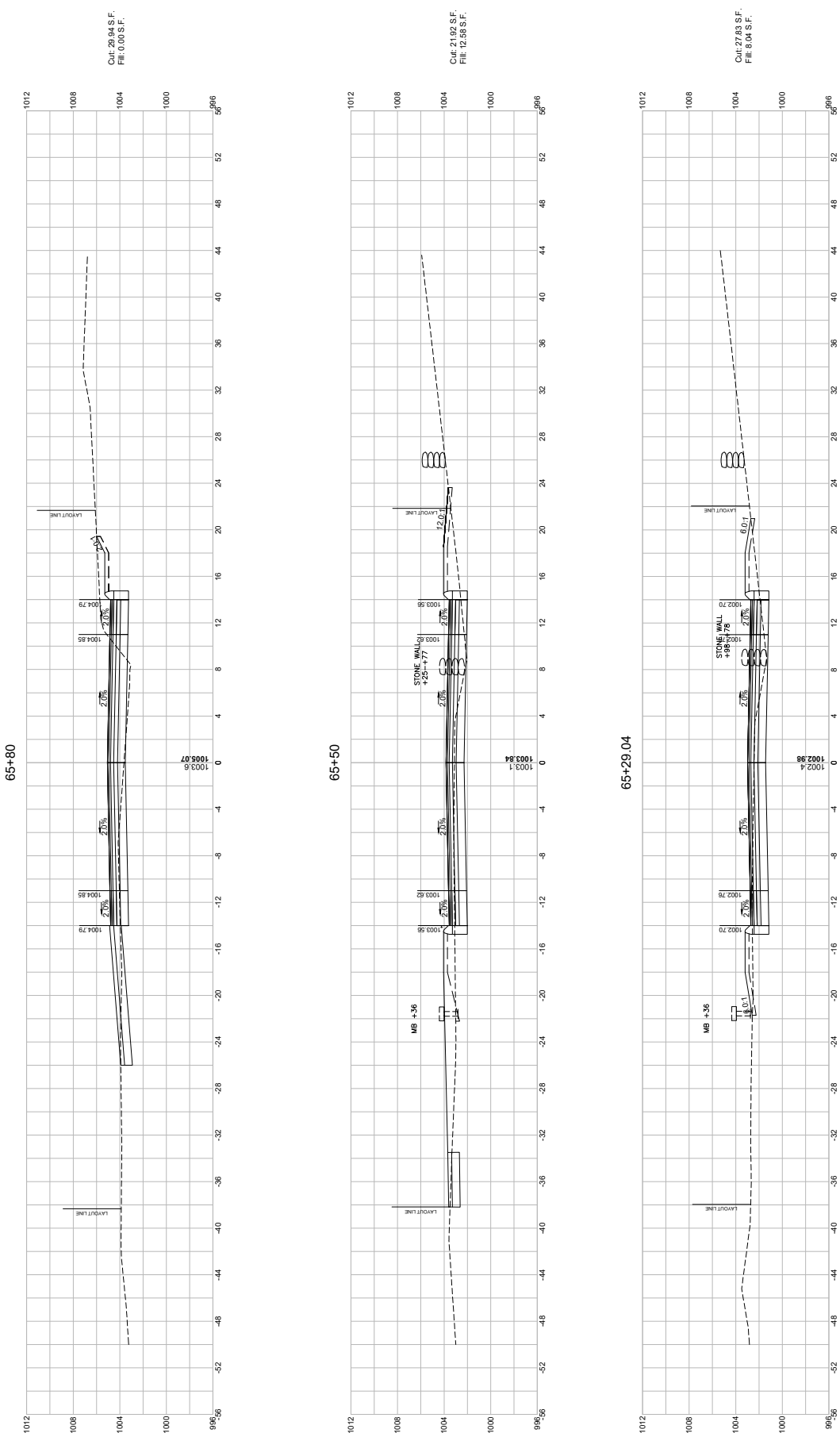
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 4:55 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	140	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:56 PM

WALES
MONSON ROAD

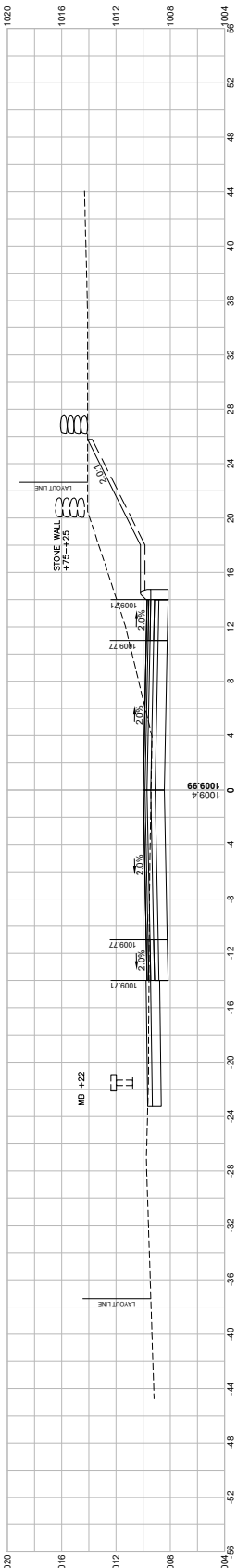
CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	141	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

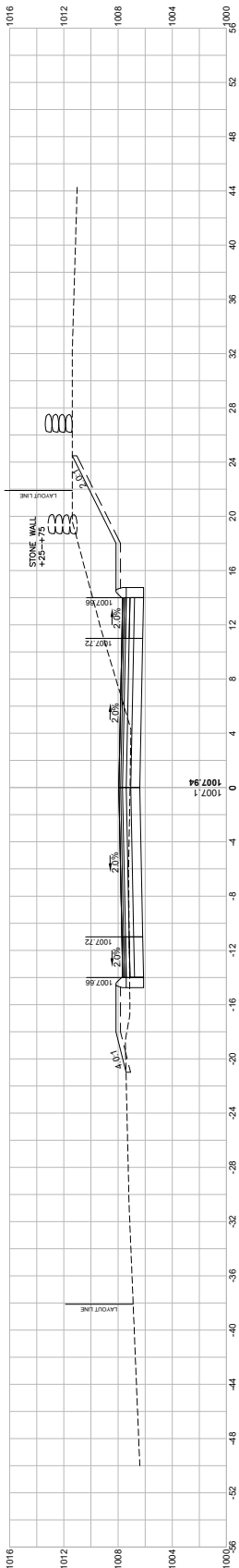
67+00

Cut: 81.16 S.F.
Fill: 0.00 S.F.



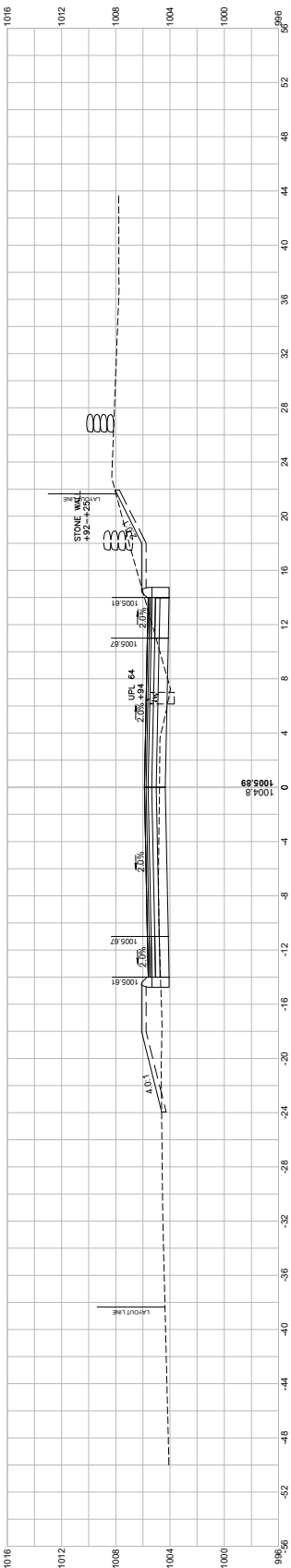
66+50

Cut: 63.05 S.F.
Fill: 4.29 S.F.



66+00

Cut: 23.70 S.F.
Fill: 9.34 S.F.



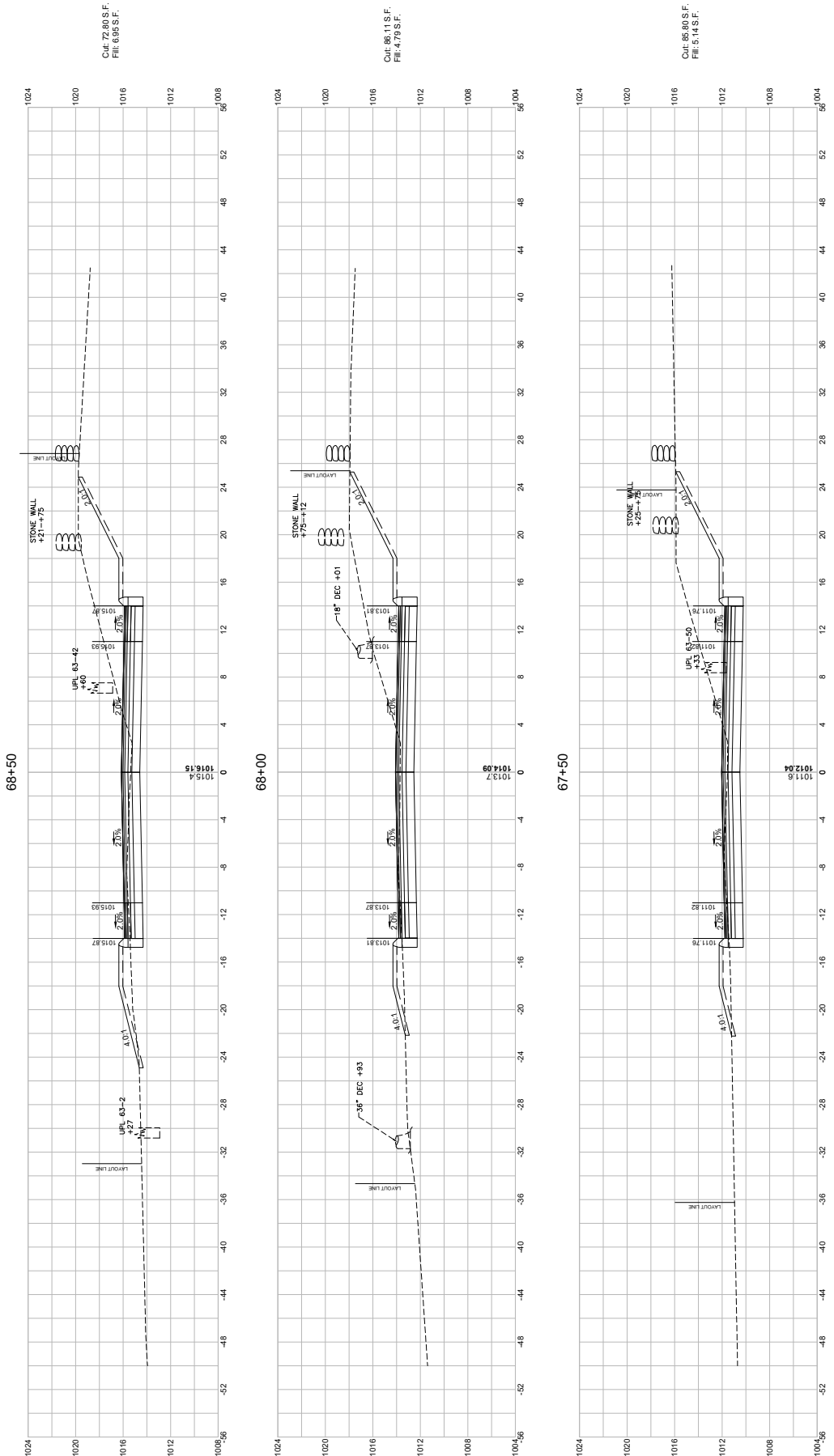
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:58 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	142	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:57 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	143	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
VER. SCALE IN FEET

70+00

Cut: 98.06 S.F.
Fill: 1.25 S.F.

69+50

Cut: 93.16 S.F.
Fill: 4.26 S.F.

69+00

Cut: 91.73 S.F.
Fill: 5.36 S.F.

608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:57 PM

WALES
MONSON ROAD

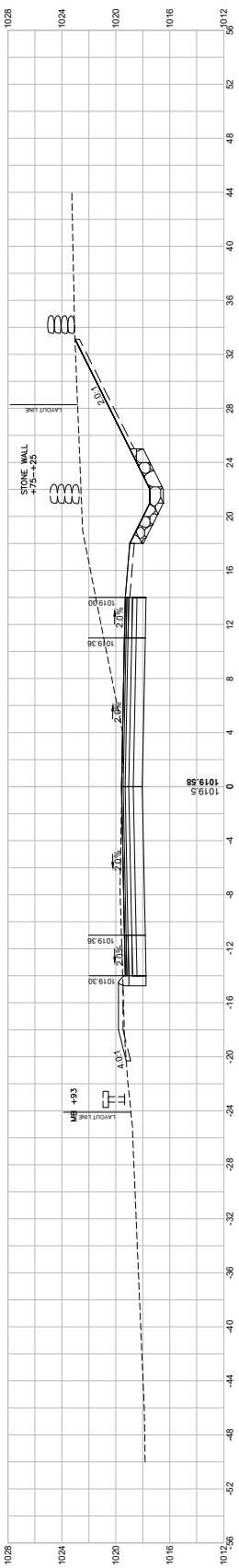
STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	144	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

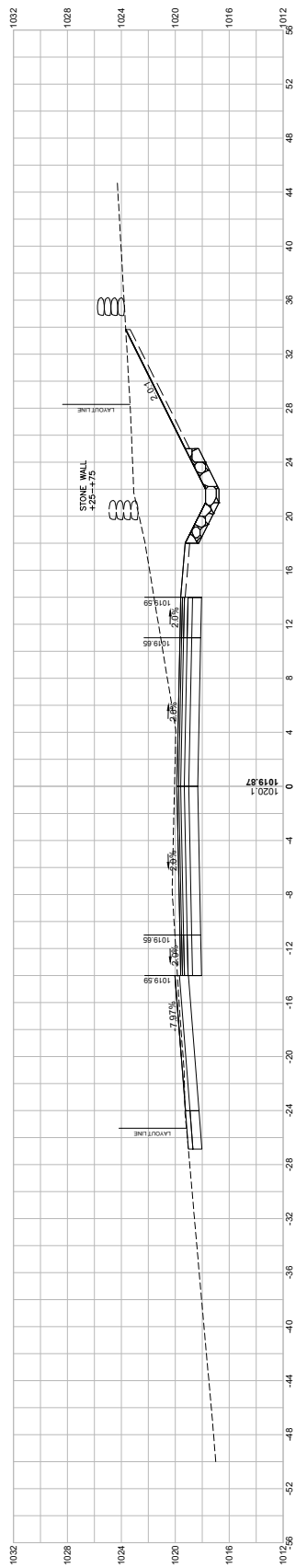
71+00

Cut: 126.30 S.F.
Fill: 1.73 S.F.



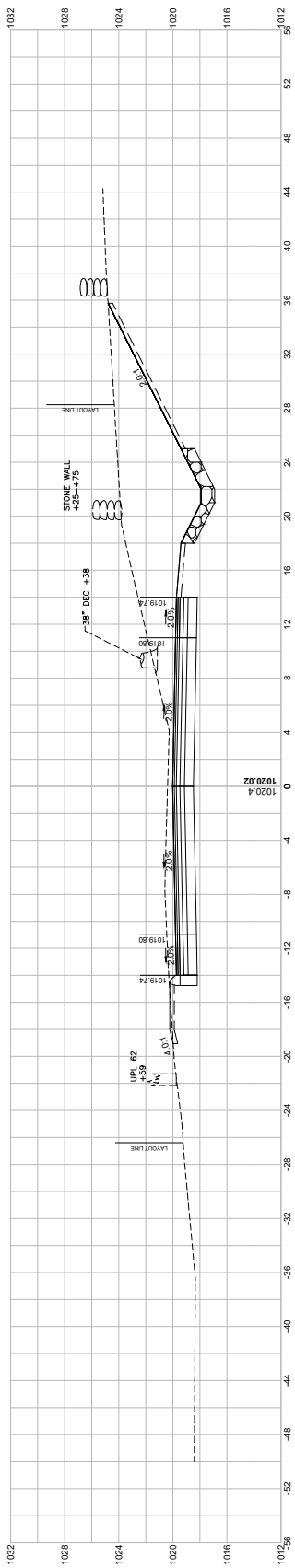
70+75

Cut: 141.04 S.F.
Fill: 0.00 S.F.



70+50

Cut: 160.04 S.F.
Fill: 0.38 S.F.



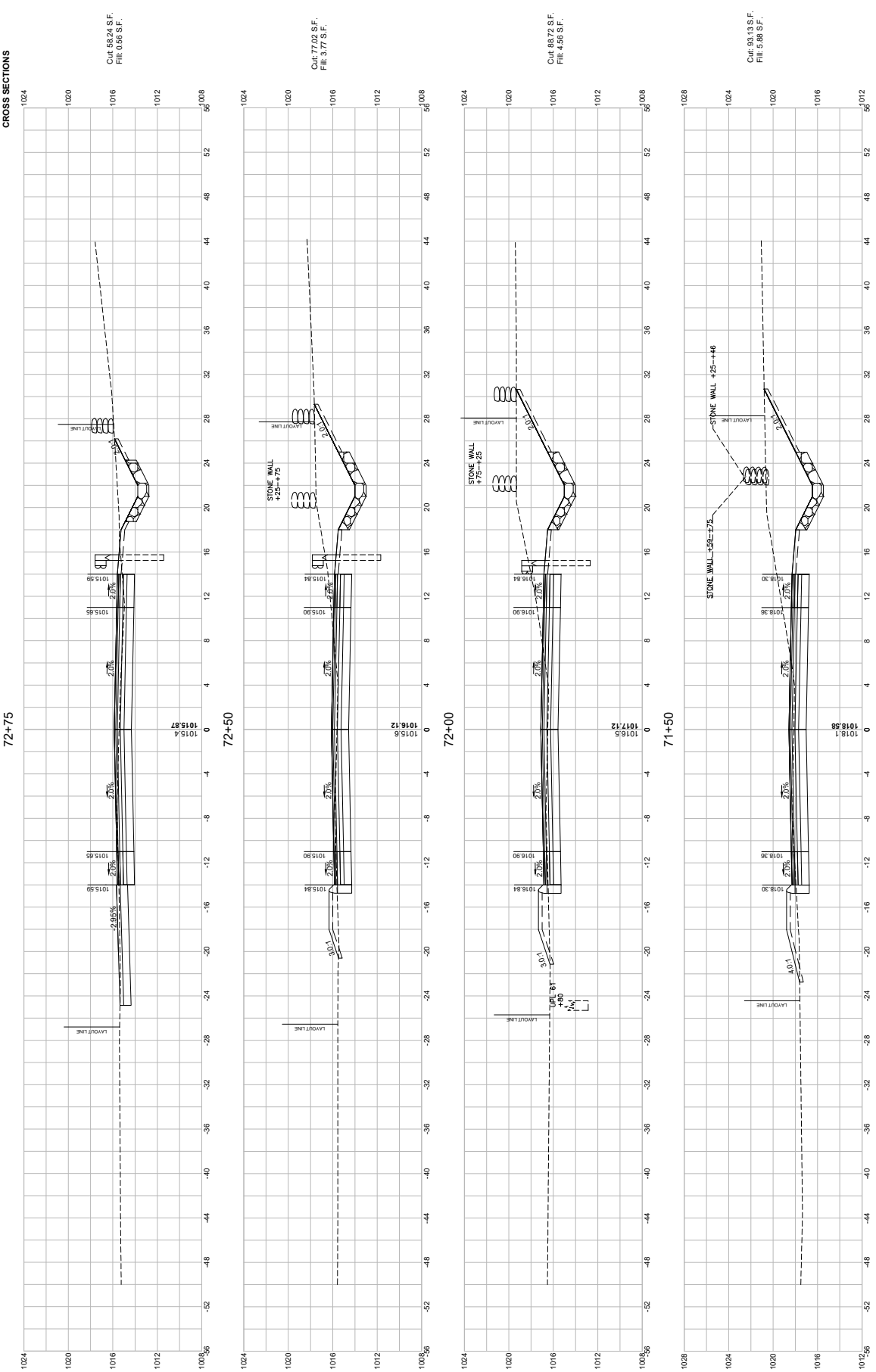
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:58 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	145	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



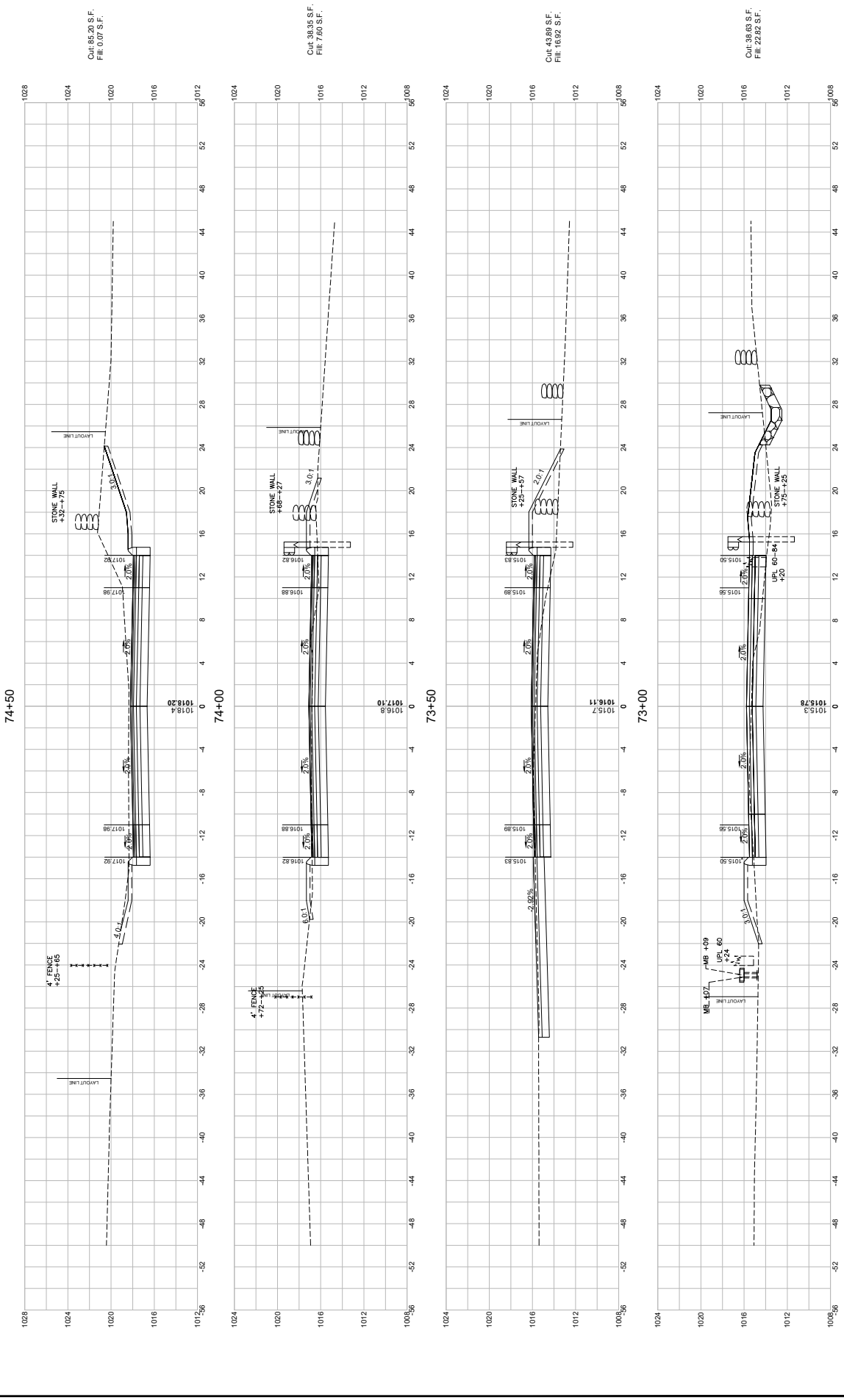
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:58 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	146	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



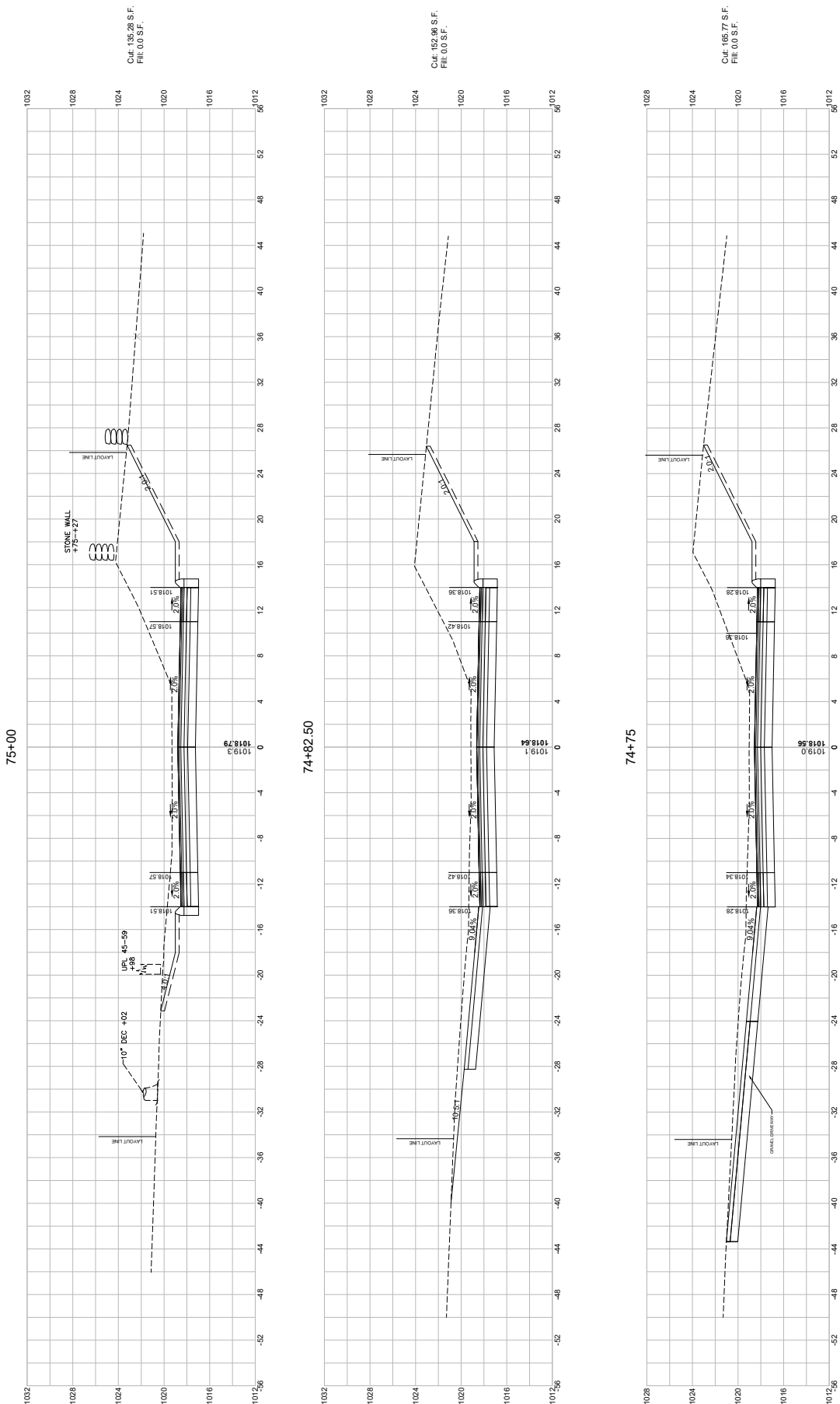
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:59 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	147	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



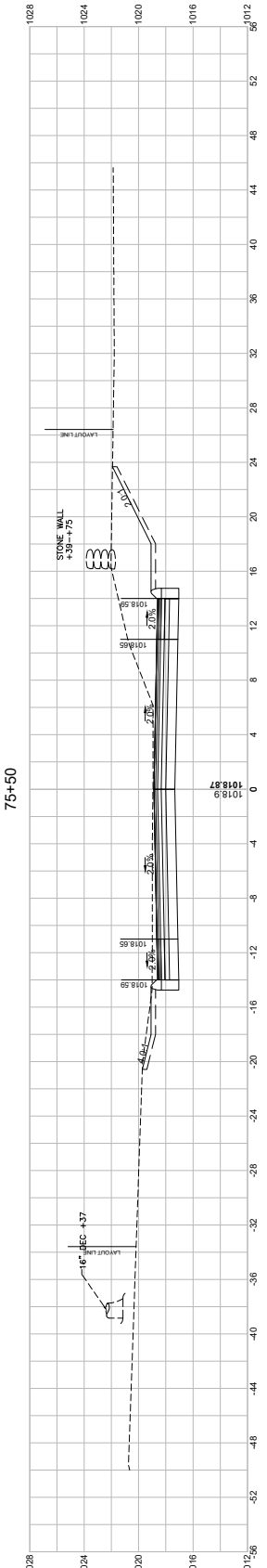
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 4:59 PM

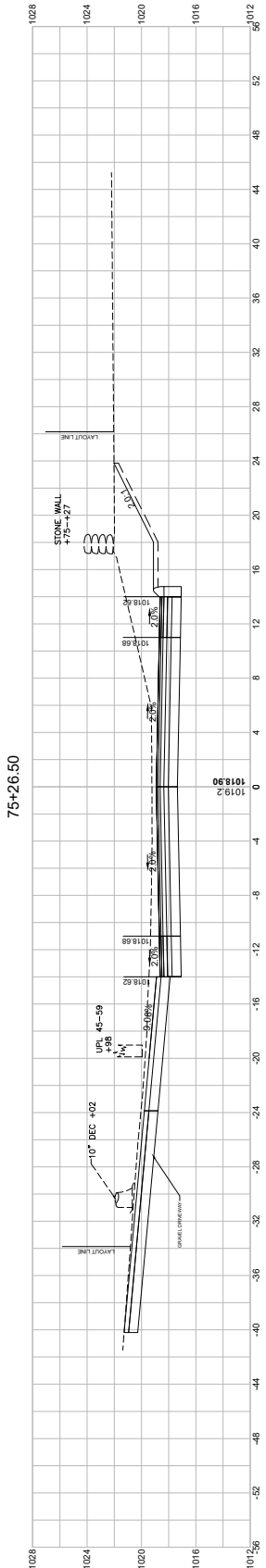
WALES
MONSON ROAD

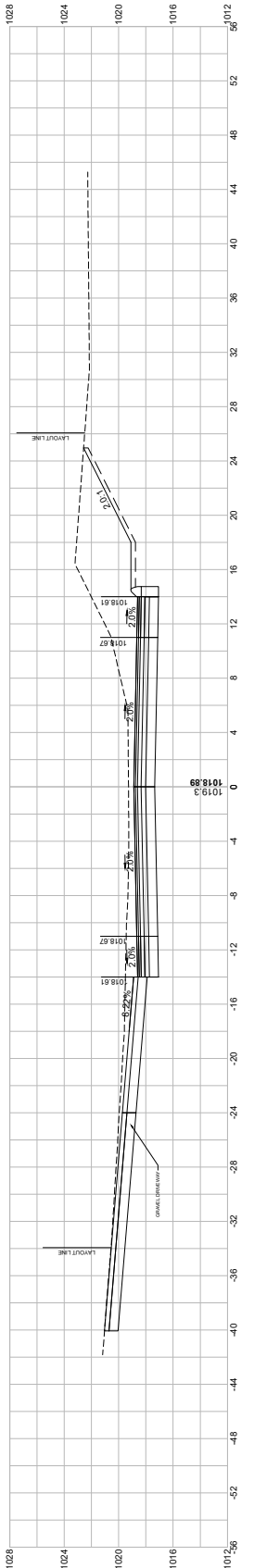
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	148	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8







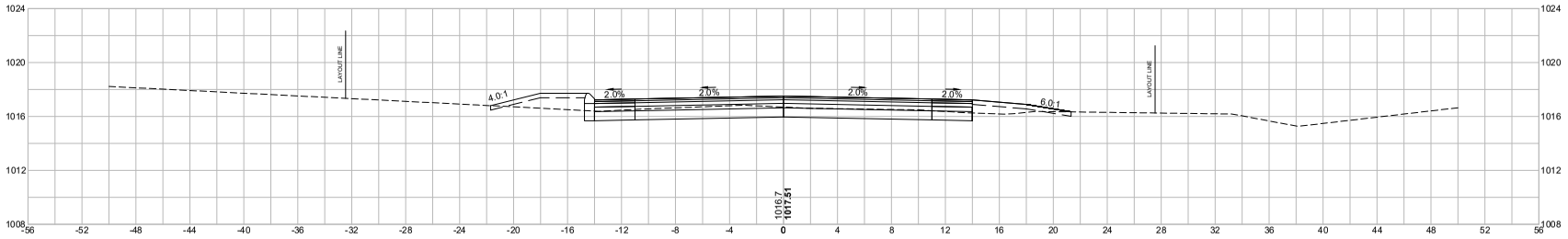
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	149	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

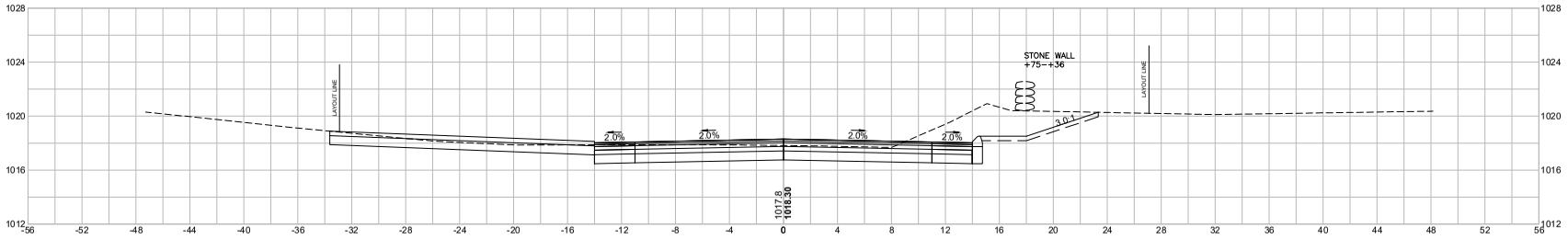
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

76+50



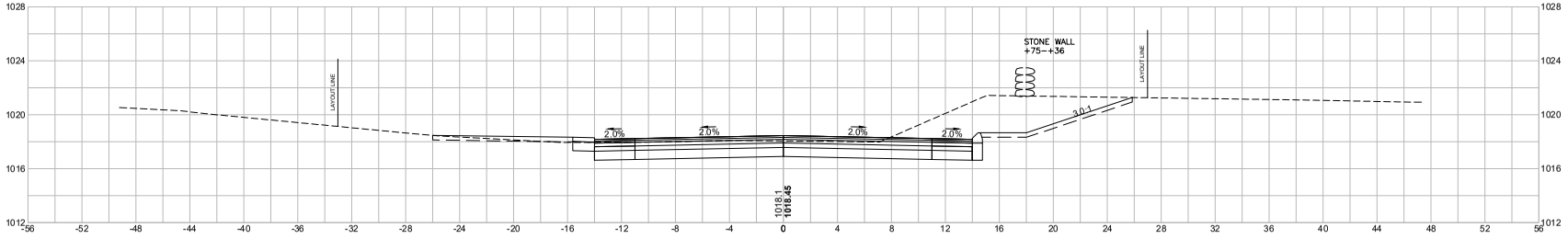
Cut: 22.10 S.F.
Fill: 10.28 S.F.

76+10



Cut 71.43 S.F.
Fill: 0.00 S.F.

76+00



Cut: 72.86 S.F.
Fill: 2.27 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 5:00 PM

Proposal No. 608163-138121

A08840 -SE

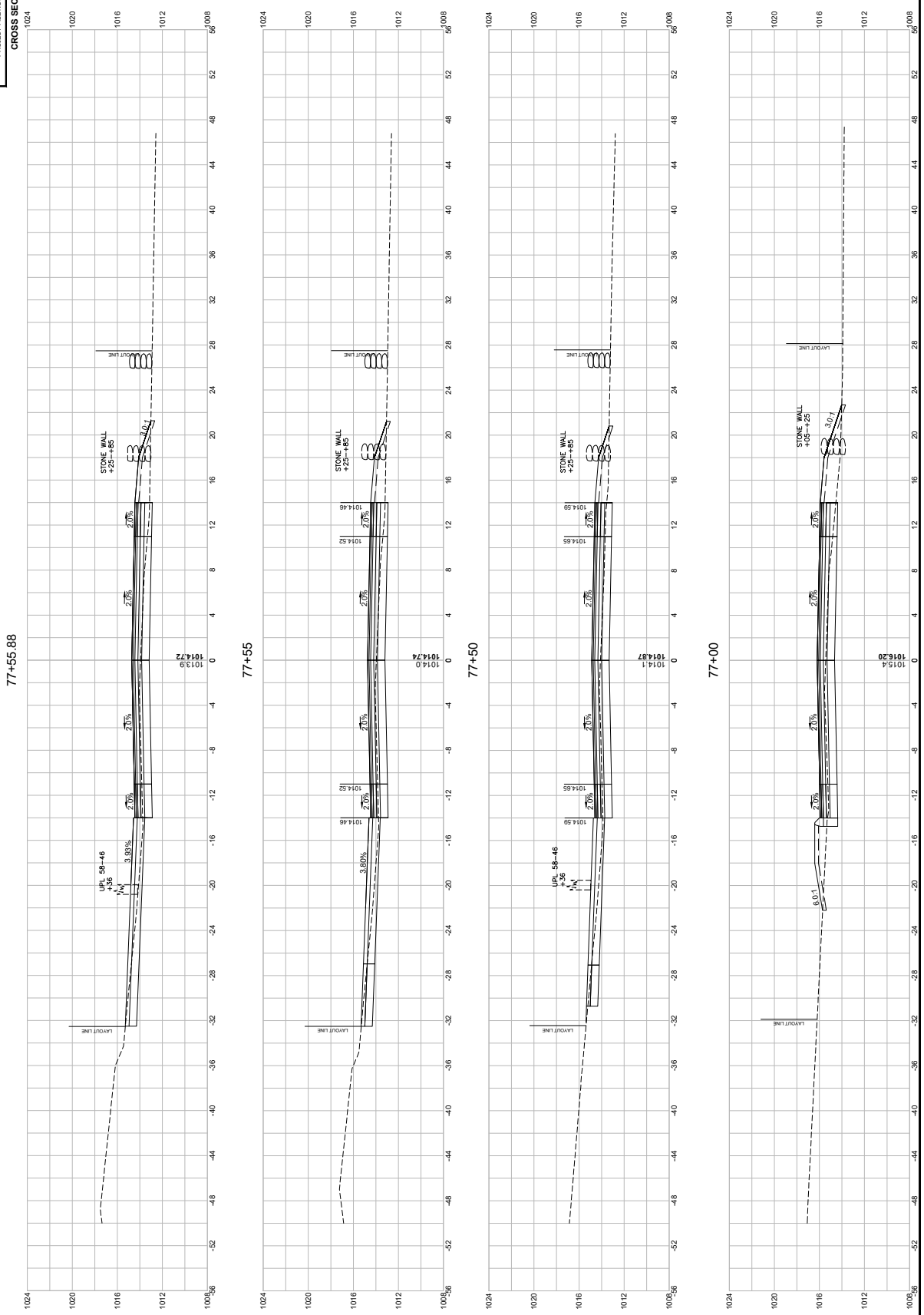
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:00 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	150	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 0 4 8



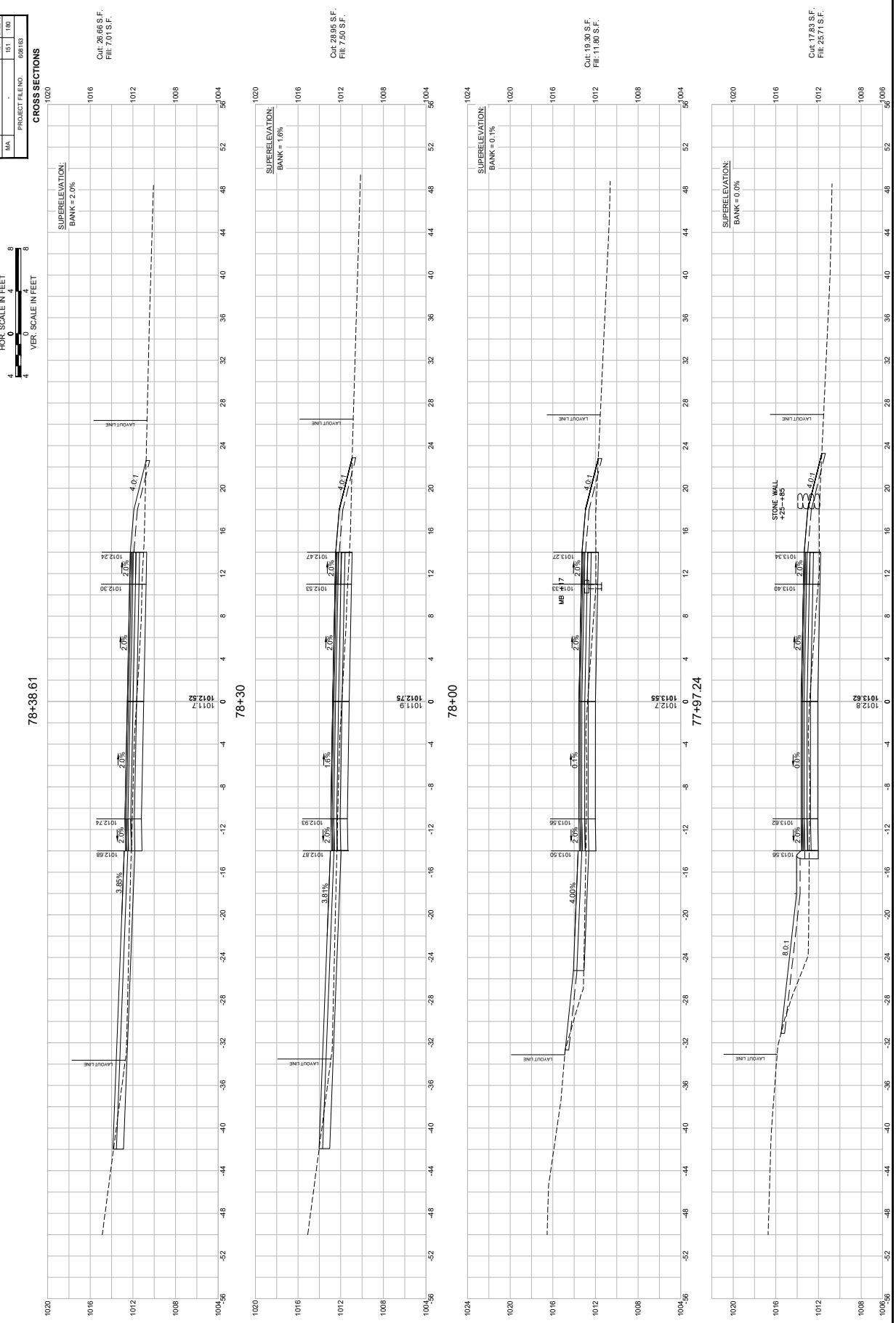
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:01 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	151	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET 0 4 8
VER. SCALE IN FEET 4 0 4 8



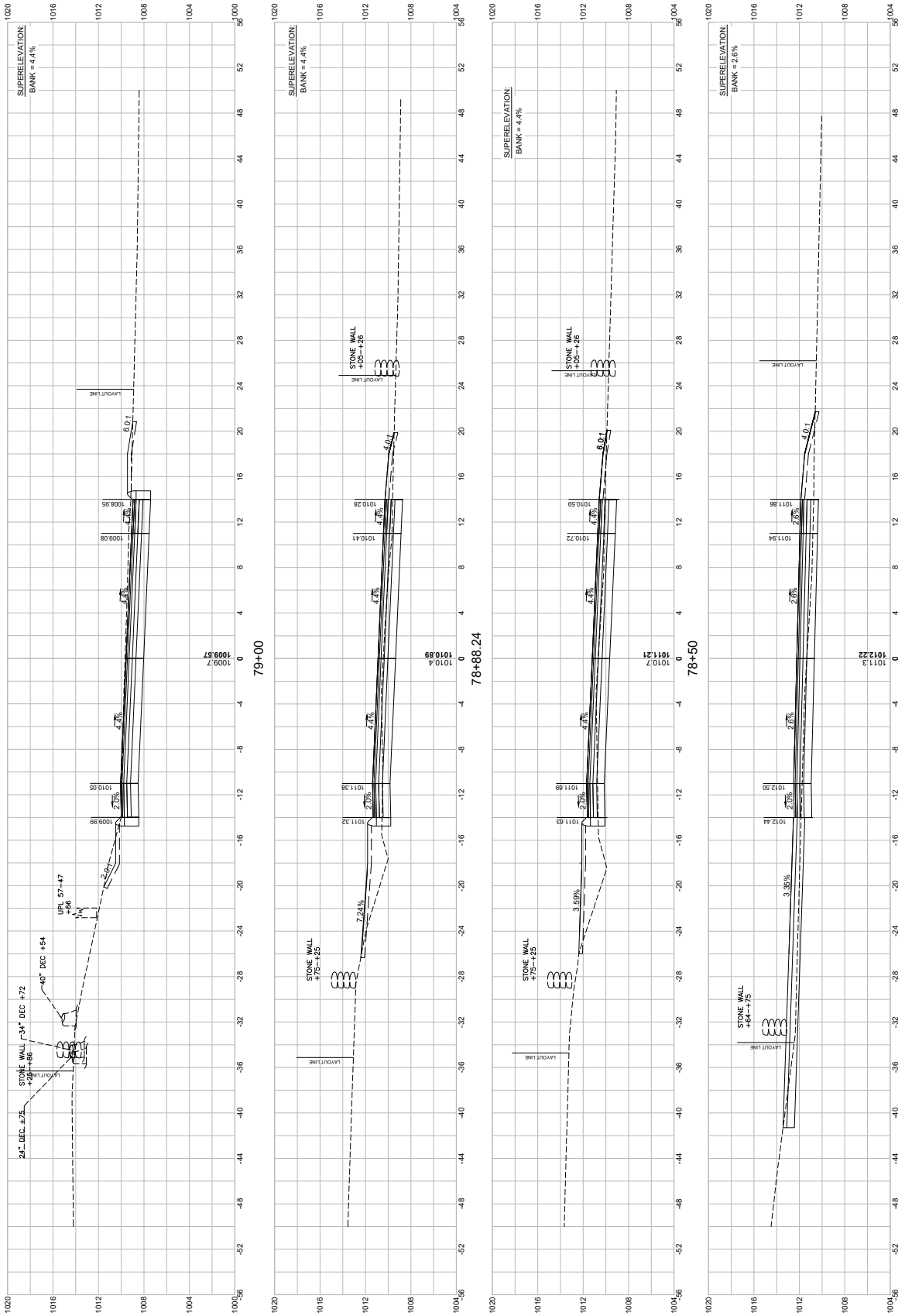
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:01 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	152	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



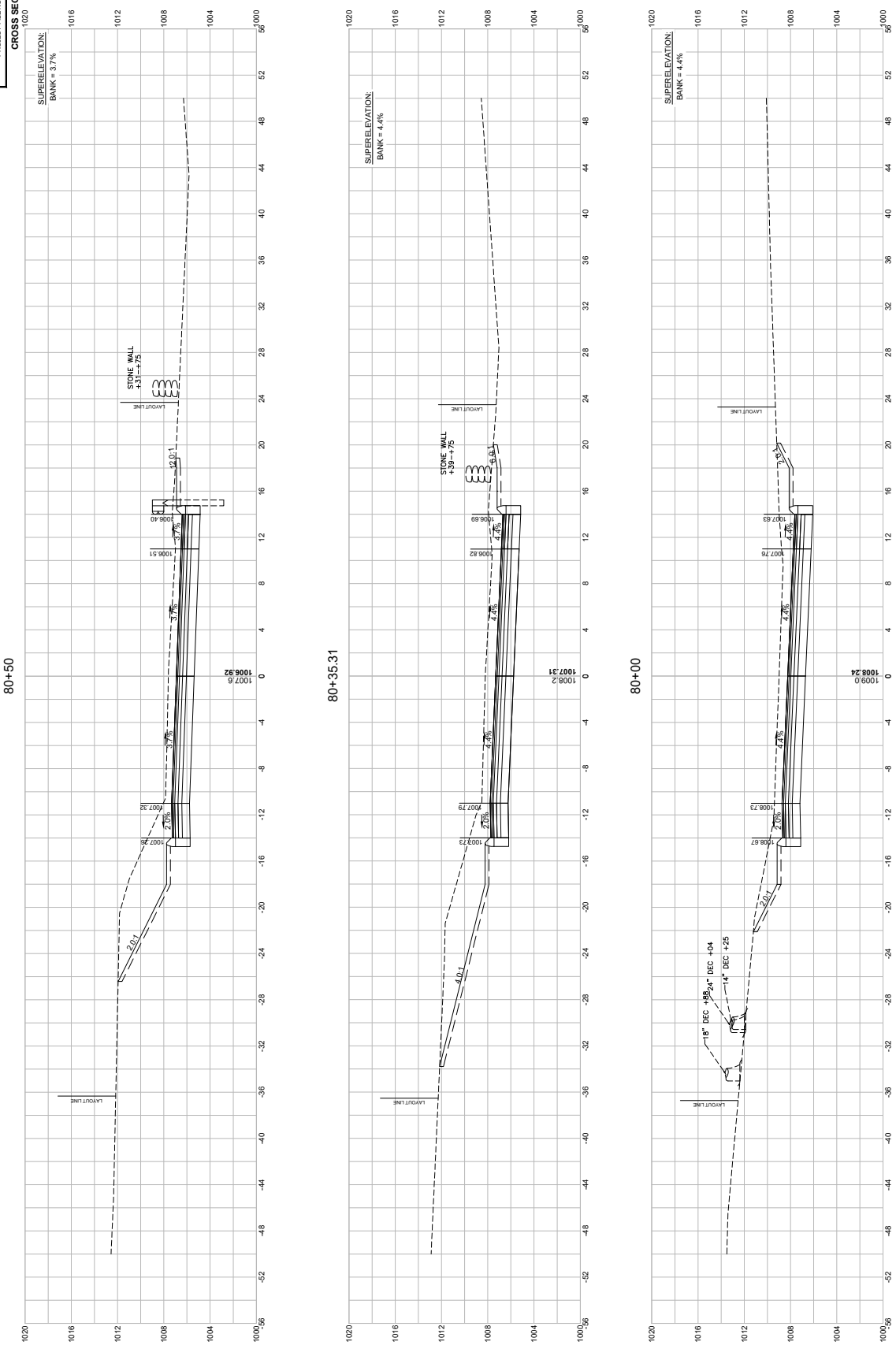
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:02 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	153	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



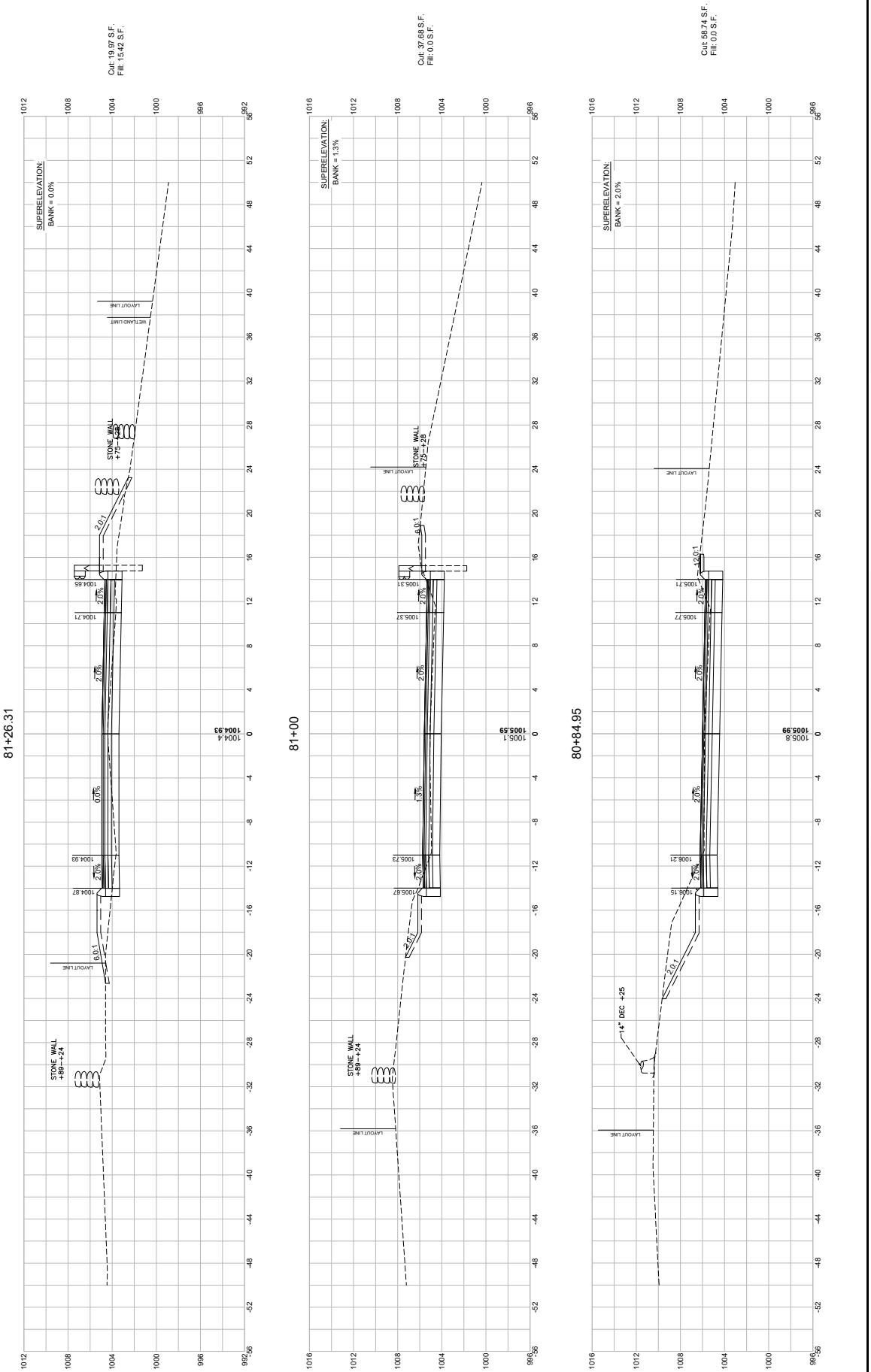
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 5:02 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	154	180
PROJECT FILE NO.		608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 5:03 PM

WALES
MONSON ROAD

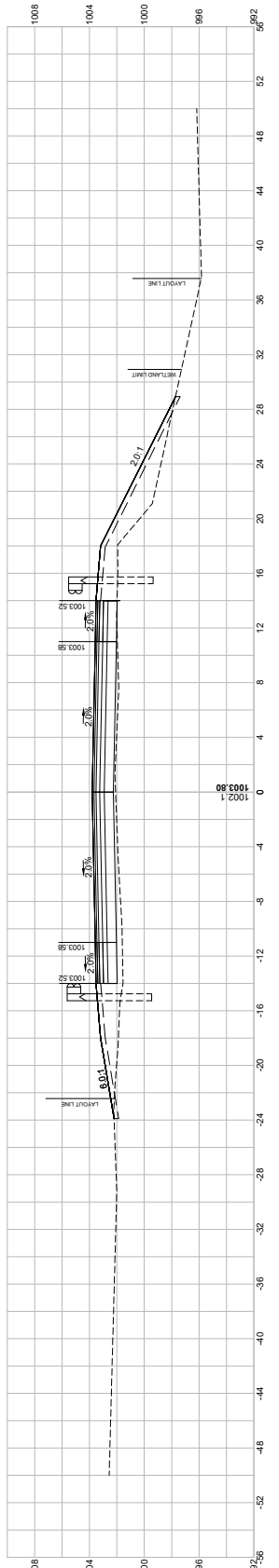
STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	155	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

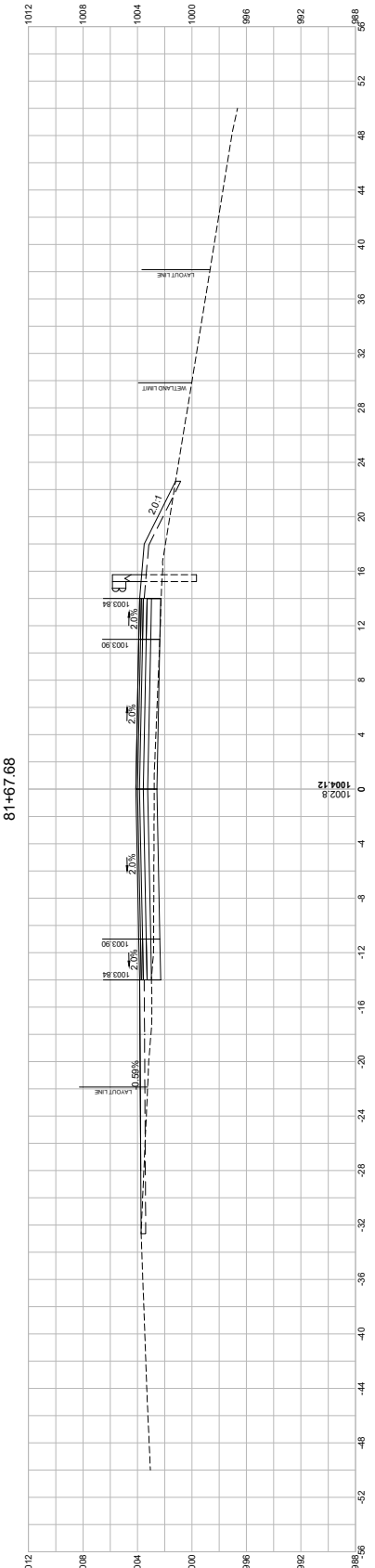
81+89.27

Cut: 0.54 S.F.
Fill: 35.84 S.F.



81+67.68

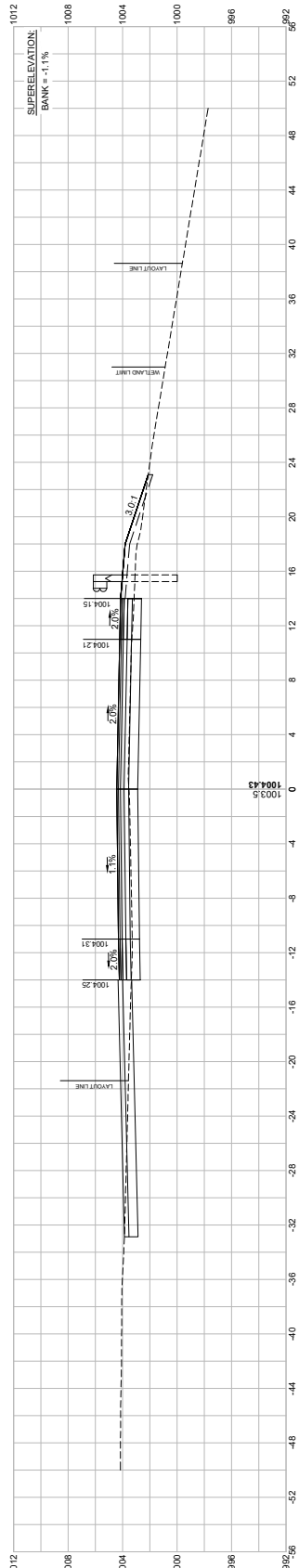
Cut: 7.80 S.F.
Fill: 18.58 S.F.



81+50

Cut: 27.4 S.F.
Fill: 6.20 S.F.

SUPERELEVATION:
BANK = -1.1%



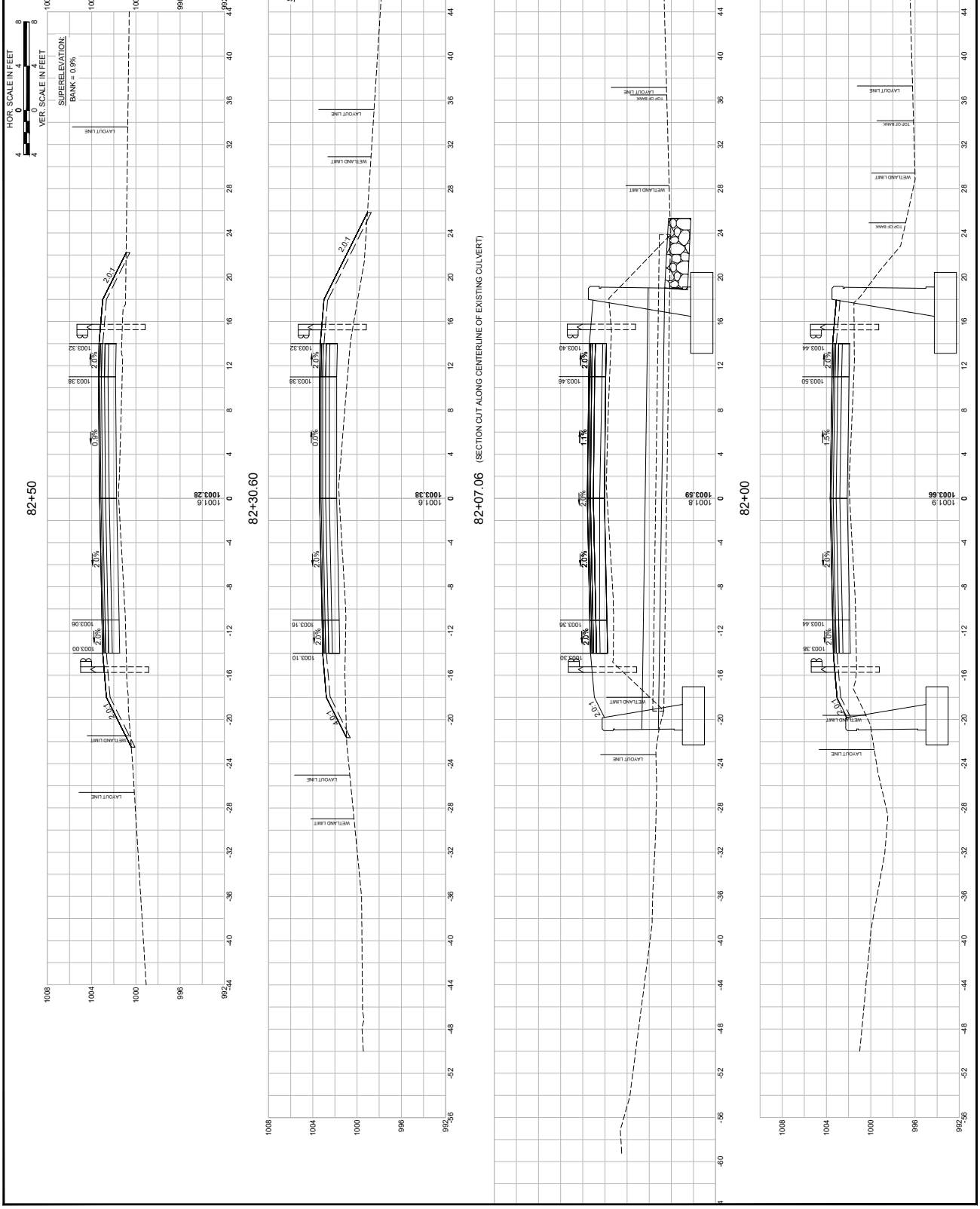
608163_HD10\XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:03 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	156	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



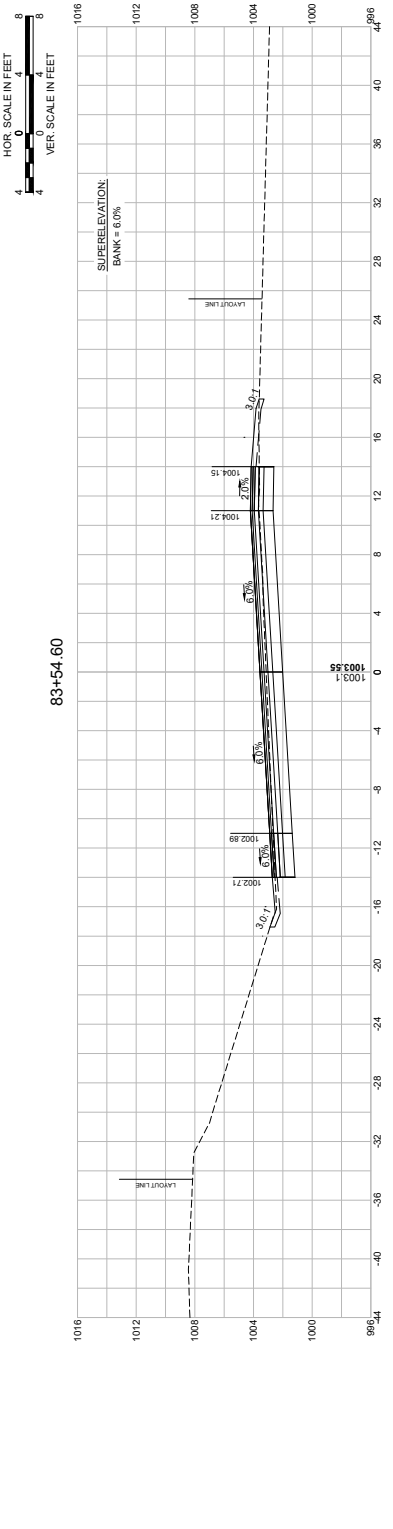
608163_HD10XSC_GRADINGCALC.DWG Plotted on 25-Jun-2024 5:04 PM

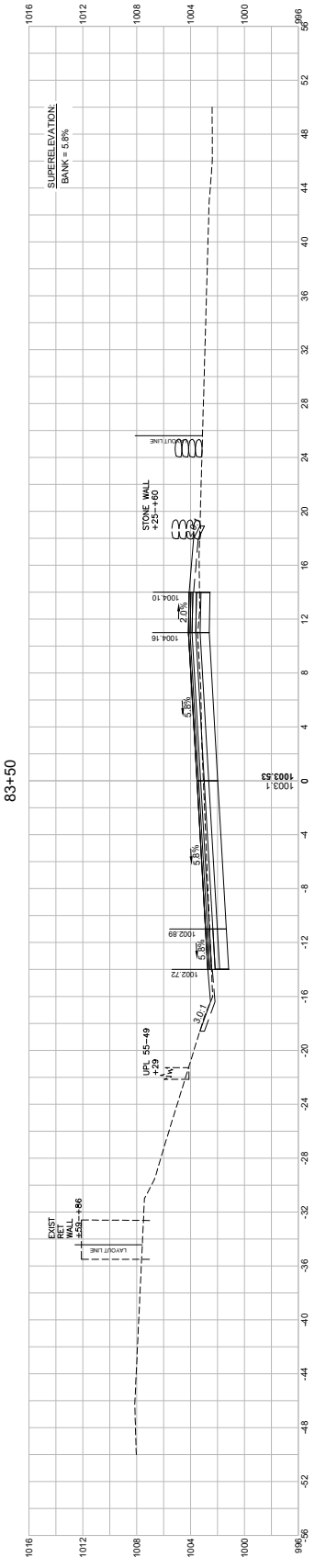
WALES
MONSON ROAD

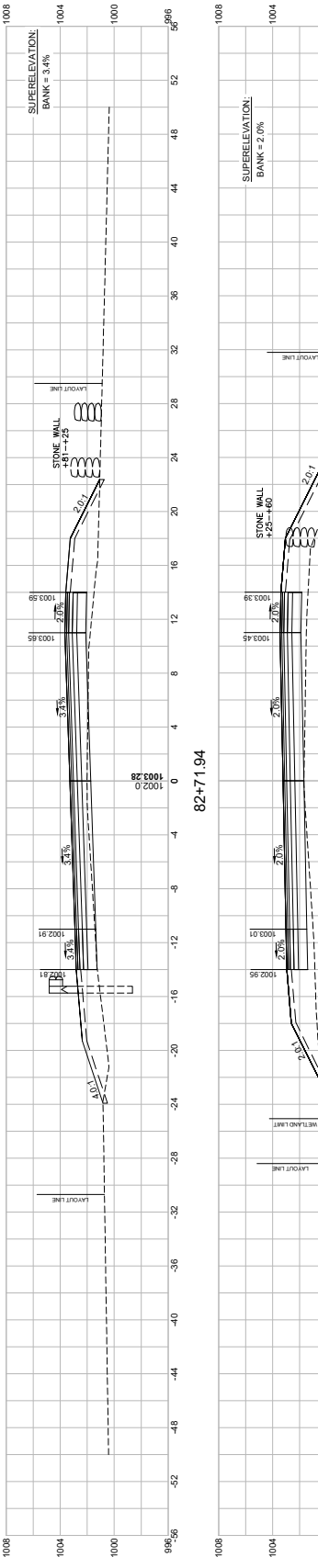
CROSS SECTIONS

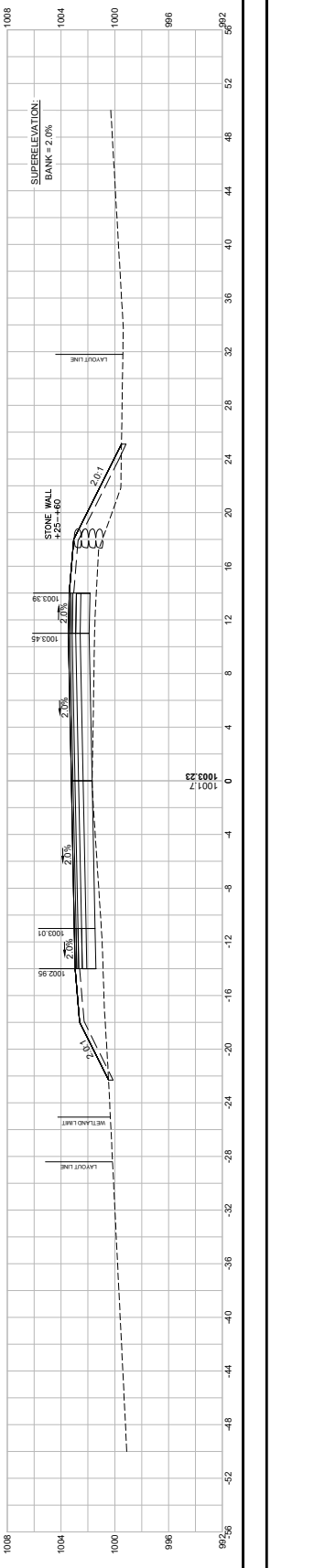
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	157	180
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
VER. SCALE IN FEET









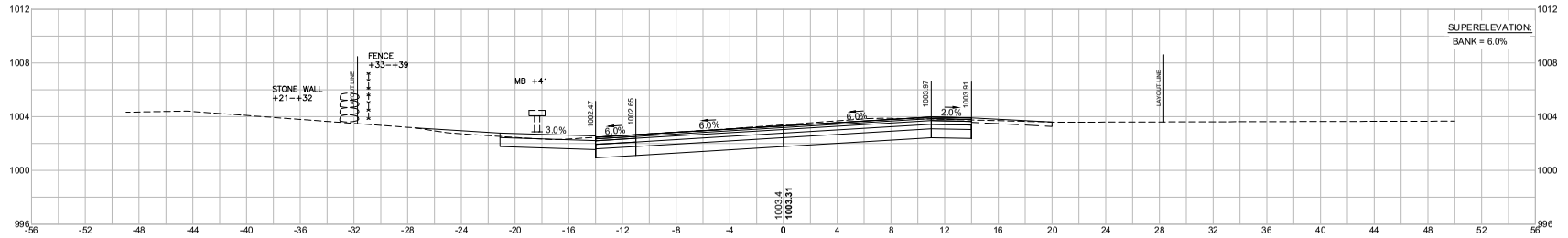
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	158	180
PROJECT FILE NO.	608163		

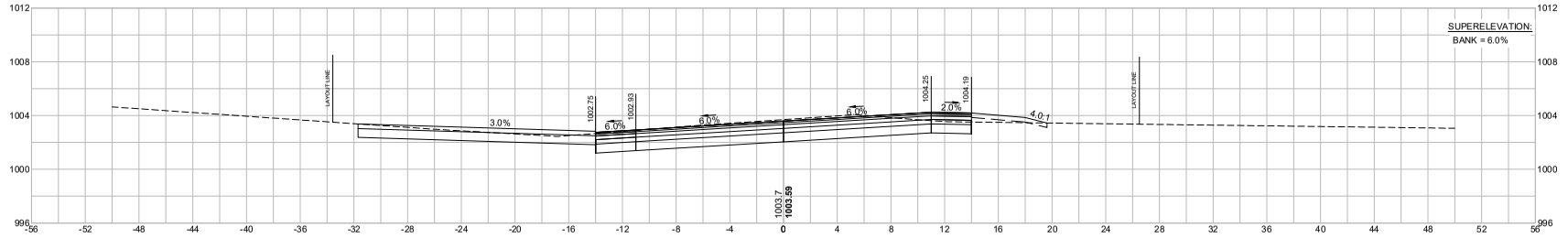
CROSS SECTIONS

84+50



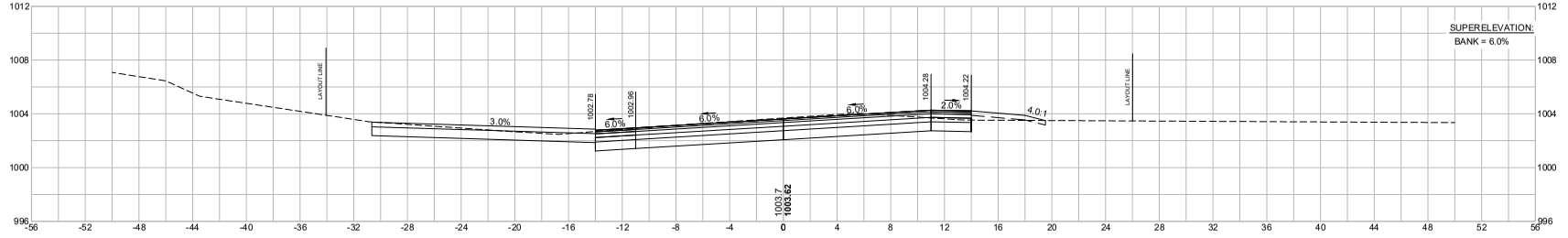
Cut: 49.71 S.F.
Fill: 0.22 S.F.

84+10



Cut: 54.83 S.F.
Fill: 7.06 S.F.

84+00



Cut: 53.80 S.F.
Fill: 6.88 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 5:04 PM
Project No. 608163.138112
A08840 .591

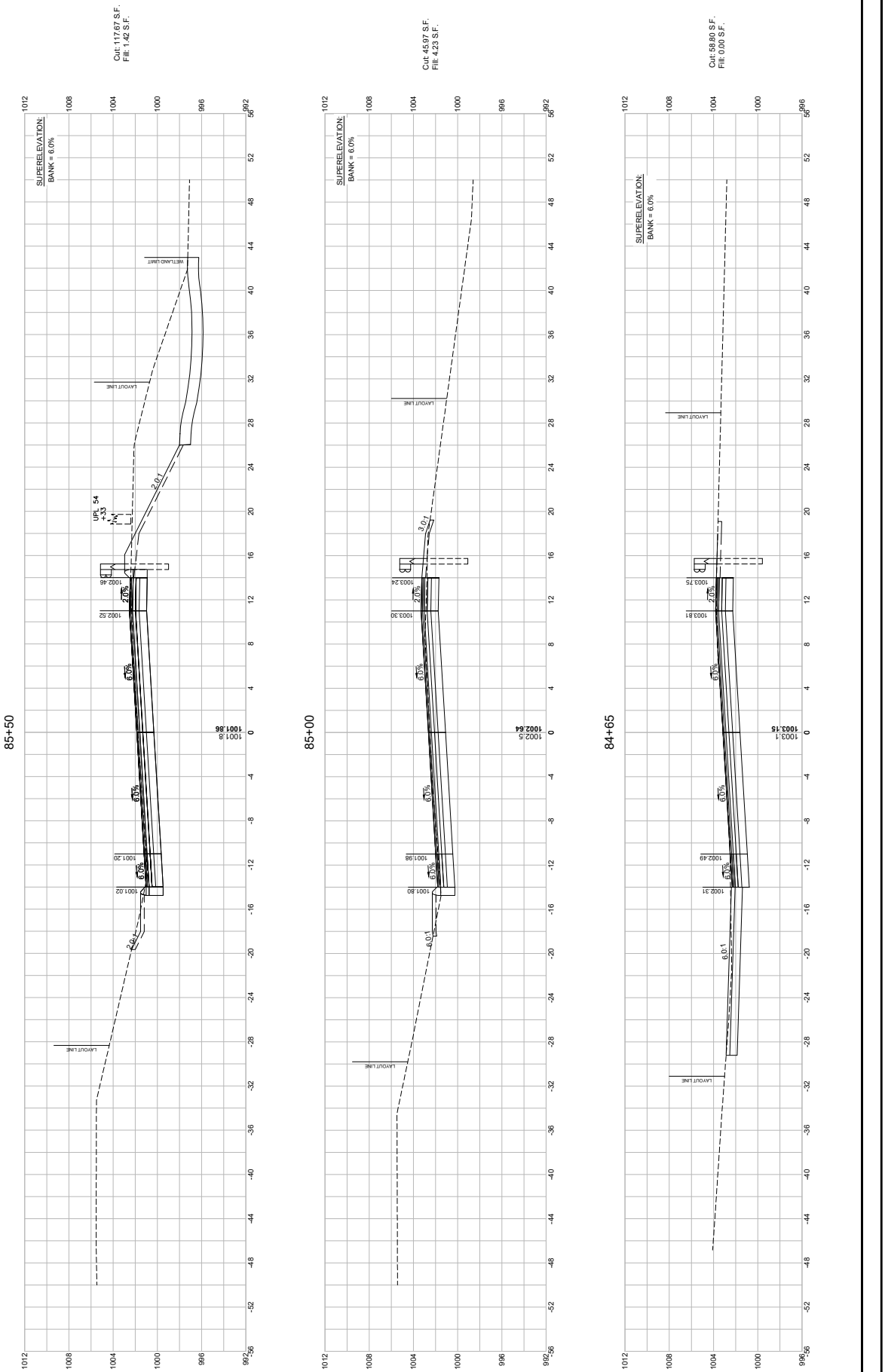
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 5:05 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	159	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



HOR. SCALE IN FEET

4 0 4 8

4 0 4 8

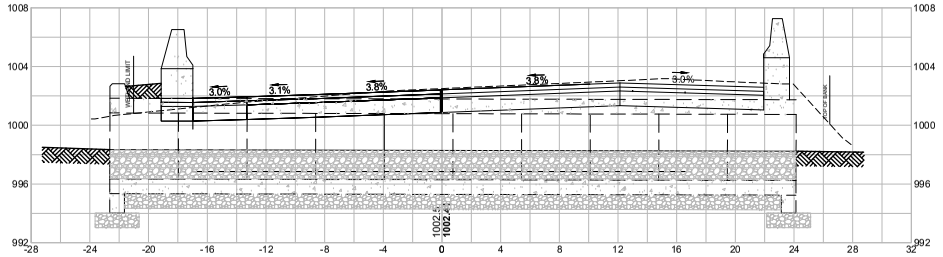
VER. SCALE IN FEET

WALES
MONSON ROAD

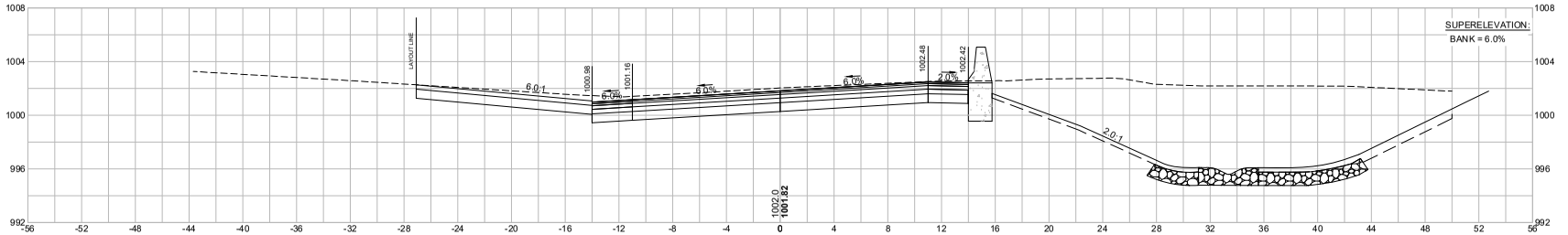
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	160	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

86+45.09 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

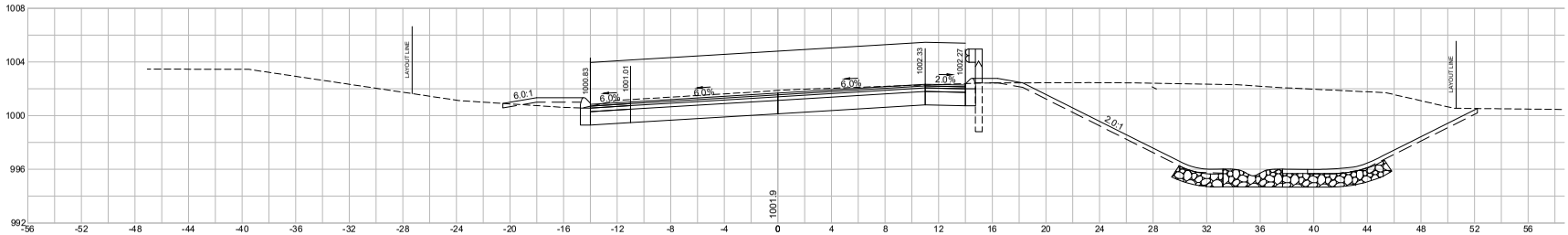


86+15



Cut: 238.87 S.F.
Fill: 0.0 S.F.

86+00



Cut: 202.10 S.F.
Fill: 4.42 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 25-Jun-2024 5:05 PM
Proposal No. 608163-138121
A08840-.S01

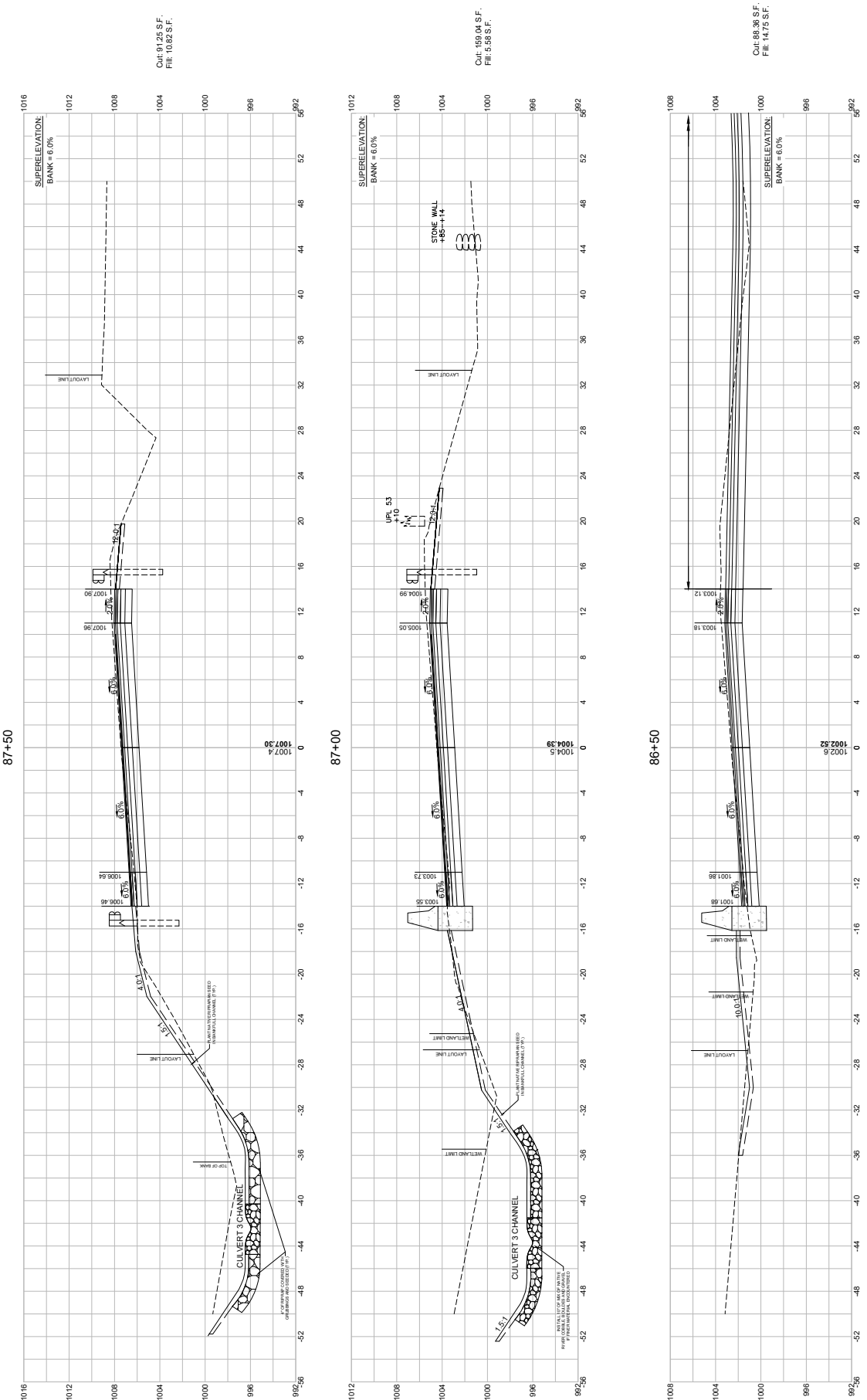
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 5:06 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	161	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



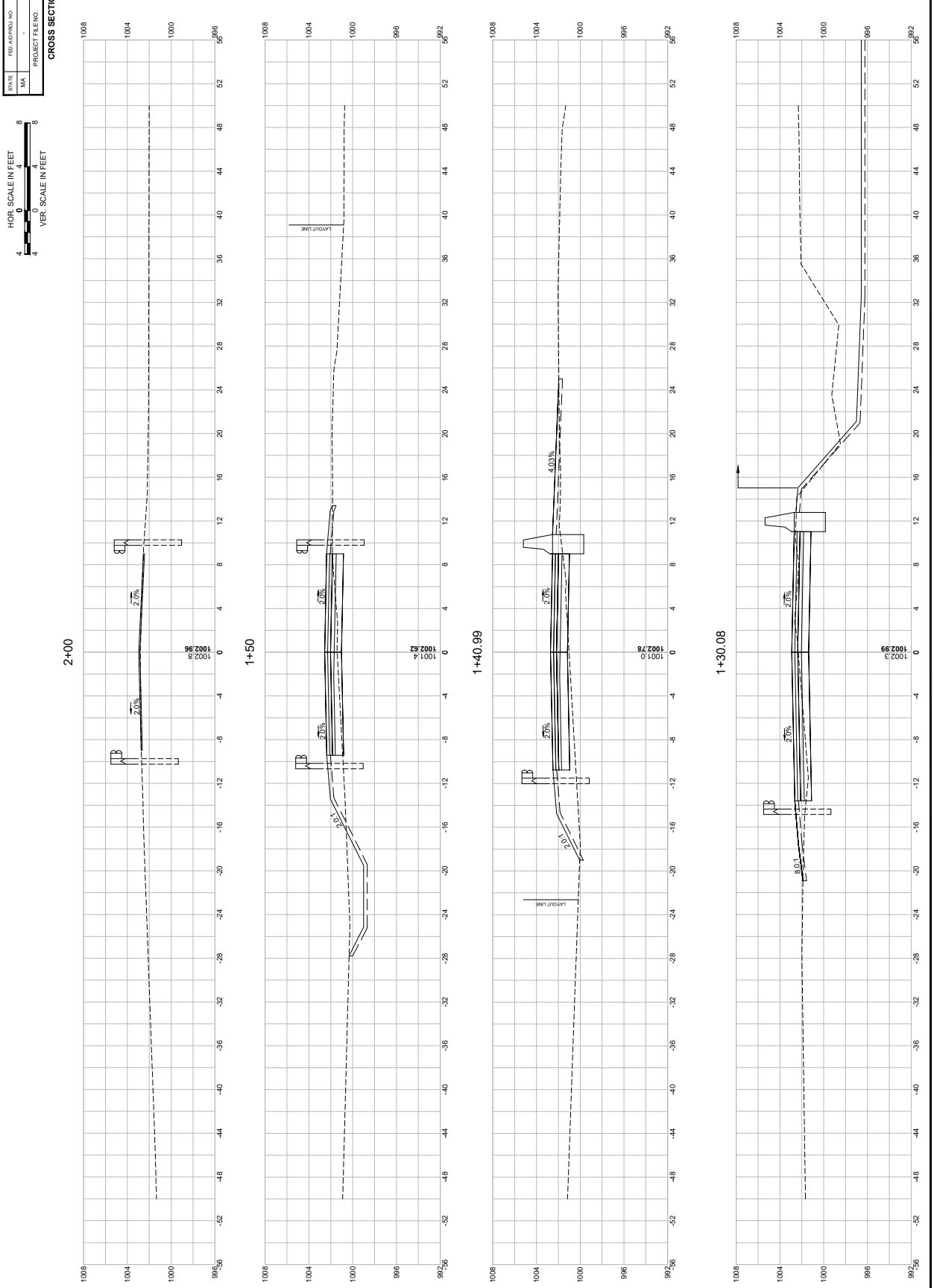
608163_HD10XSC_GRADINGCALC).DWG Plotted on 25-Jun-2024 5:07 PM

WALES
REED HILL ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	162	180
	PROJECT FILE NO.	608163	

CROSS SECTIONS

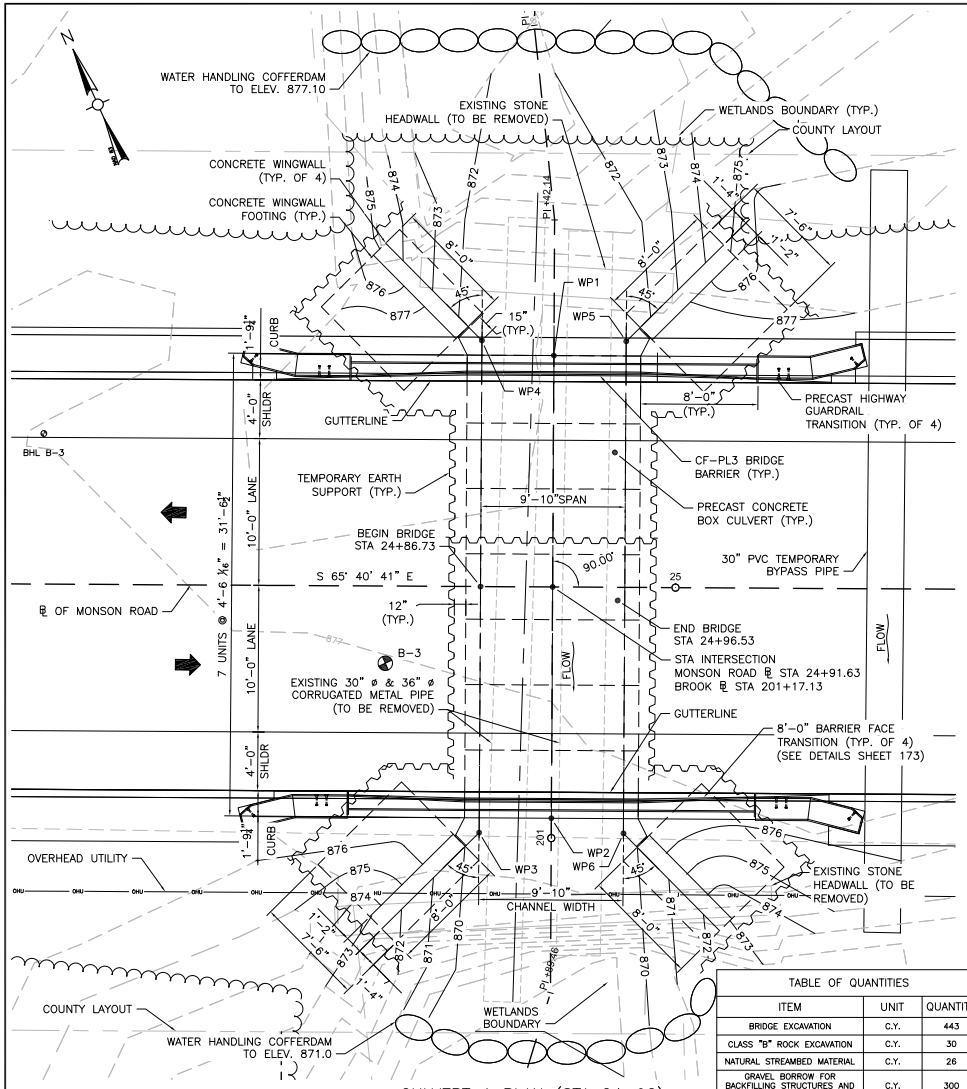
HOR. SCALE IN FEET
VER. SCALE IN FEET



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	163	180
PROJECT FILE NO.	608163		

CULVERT 1 KEY PLAN AND NOTES



CULVERT 1 PLAN (STA 24+92)
SCALE: 1" = 4'

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2848111.9174	448173.3849
2	2848083.1730	448160.3979
3	2848084.2791	448155.5221
4	2848114.8452	448169.3343
5	2848110.8082	448178.2683
6	2848080.2408	448164.4559

NOTES:

1. THE FACTORED BEARING PRESSURE = 1.70 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.33 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	443
CLASS "B" ROCK EXCAVATION	C.Y.	30
NATURAL STREAMBED MATERIAL	C.Y.	26
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	300
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	18
PRECAST GUARDRAIL HIGHWAY TRANSITION	EA.	4
4000 PSI, 1½", 565 CEMENT CONCRETE	C.Y.	50
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	27
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	17050
DAMPPROOFING	S.F.	1244
PRECAST CONCRETE BOX CULVERT – SITE 1	L.S.	1
TEMPORARY SUPPORT OF EARTH	L.S.	1

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 21+38± (RT) MAGNAIL IN UTILITY POLE: EL. 876.92 FT

BENCHMARK STA 29+60± (RT) MAGNAIL IN UTILITY POLE: EL. 900.23 FT

BENCHMARK STA 29+90± (LT) MAGNAIL BRASS RIVET: EL. 901.72 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

4000 PSI, 1½", 565 CEMENT CONCRETE.....WINGWALLS

5000 PSI, ¾", 685 CEMENT CONCRETE.....CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

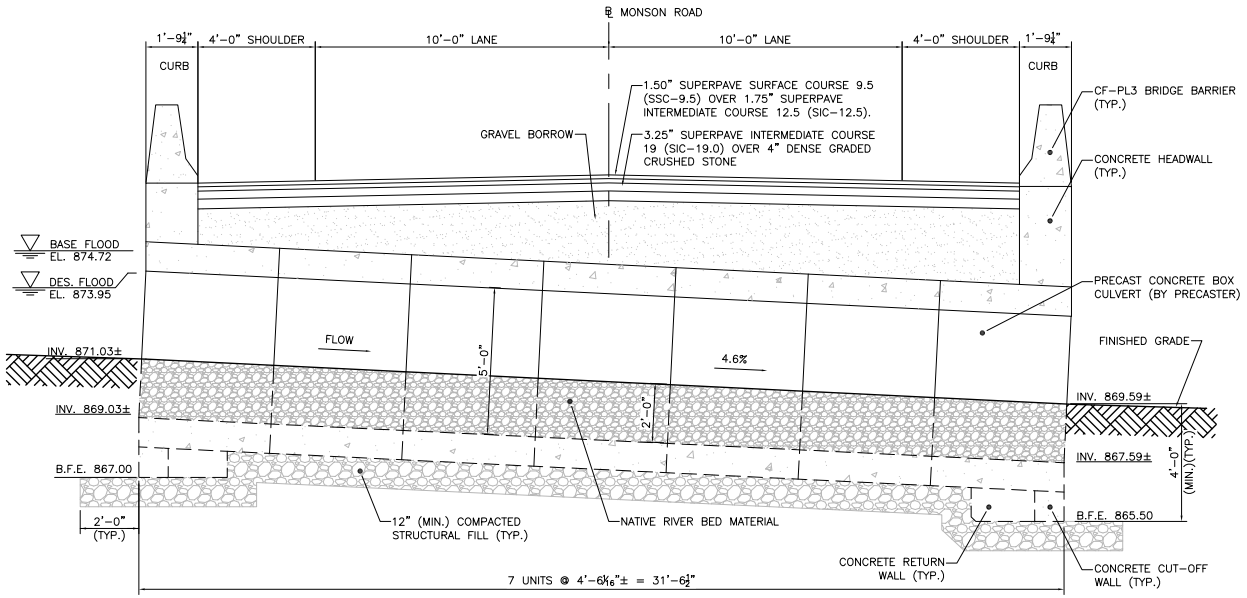
TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S.)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	7.72
DESIGN FLOOD ELEVATION (FEET, NAVD)	876.1

608163_HD11\STRUCTURAL PLAN\DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-138312
A08840_036



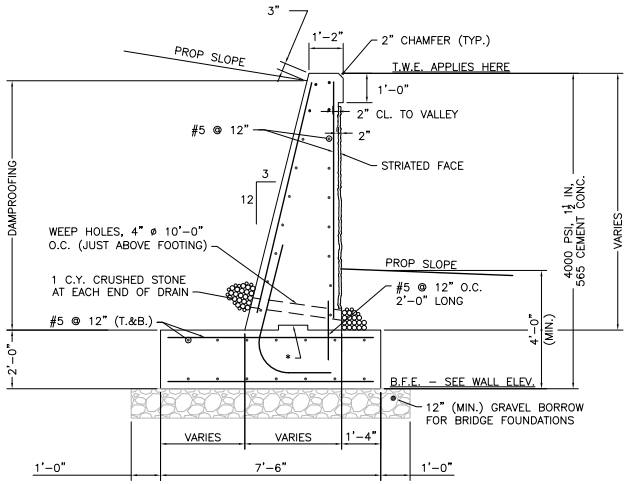
CULVERT 1 LONGITUDINAL SECTION

SCALE: ½" = 1'-0"

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	164	180
PROJECT FILE NO. 608163			

CULVERT 1 SECTION & DETAILS



WINGWALL TYPICAL SECTION

SCALE: ½" = 1'-0"

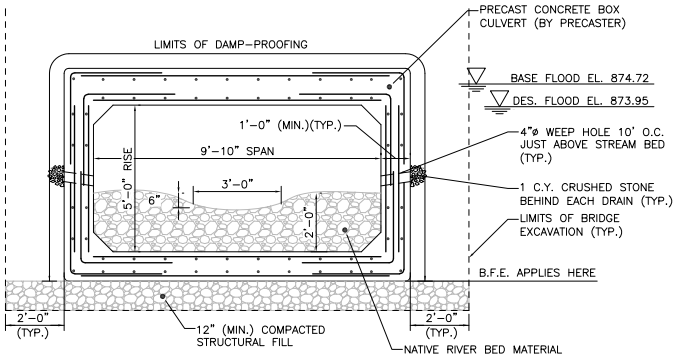
PRECAST BOX CULVERT NOTES:

1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 9'-10" WIDE, 5'-0" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO 9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 1.70 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.33 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



CULVERT 1 TRANSVERSE SECTION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

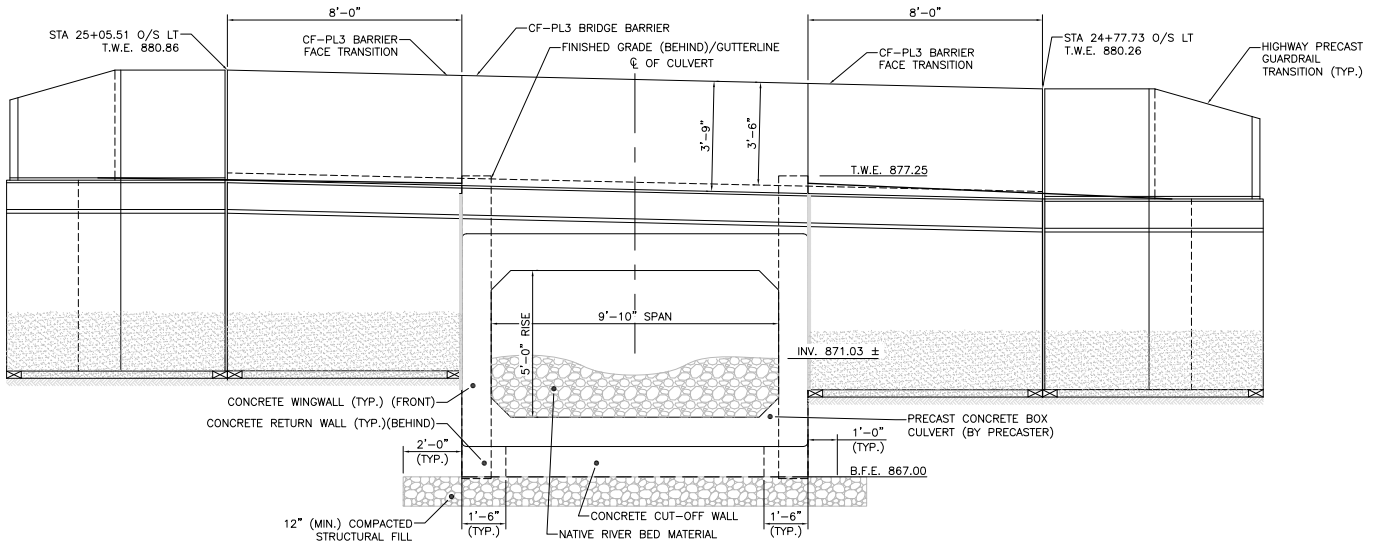
1. FOR CULVERT 1 HEADWALL ELEVATIONS, SEE SHEET NO. 165.
2. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
3. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-138112
608163_467

WALES
MONSON ROAD

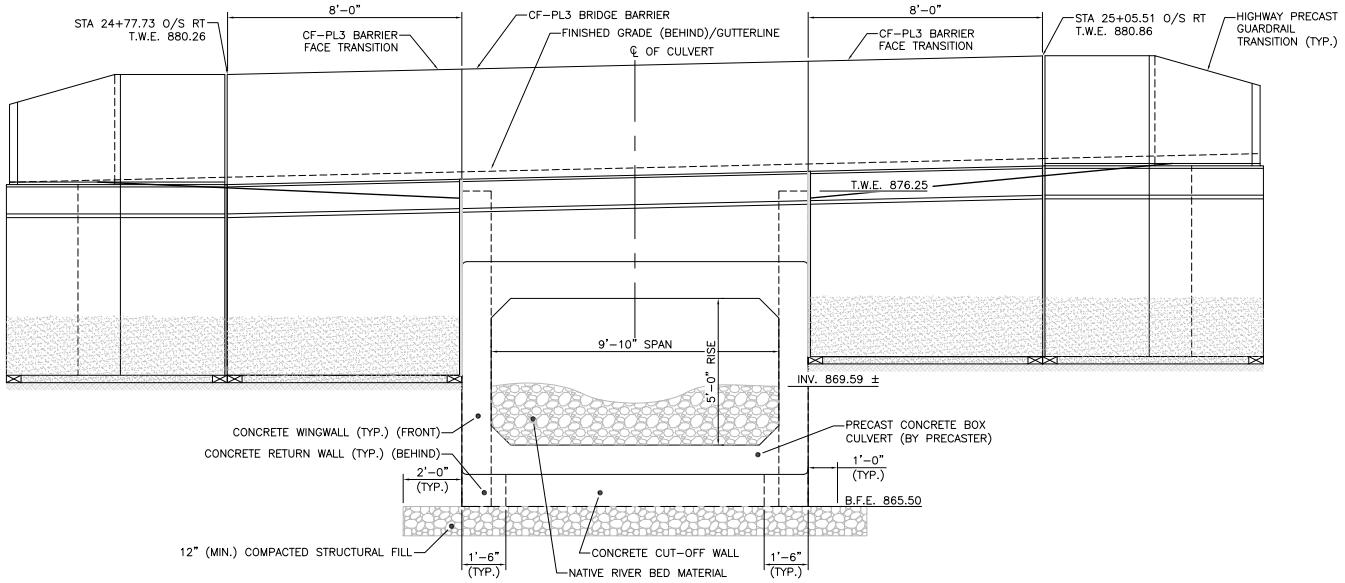
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	165	180
PROJECT FILE NO.	608163		

CULVERT 1 HEADWALL ELEVATIONS



CULVERT 1 INLET ELEVATION

SCALE: ½" = 1'-0"



CULVERT 1 OUTLET ELEVATION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

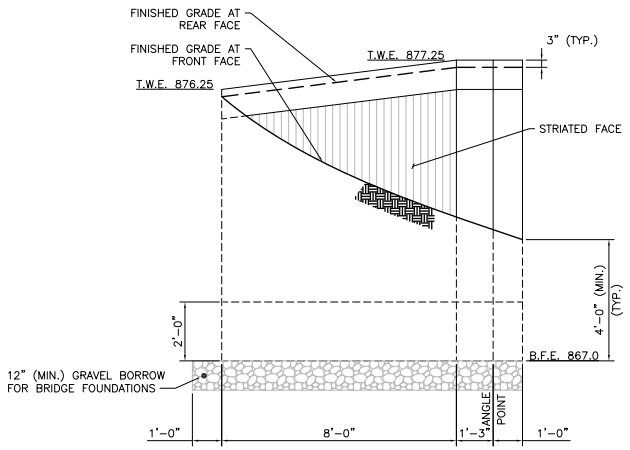
1. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
2. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-138212
A08840-398

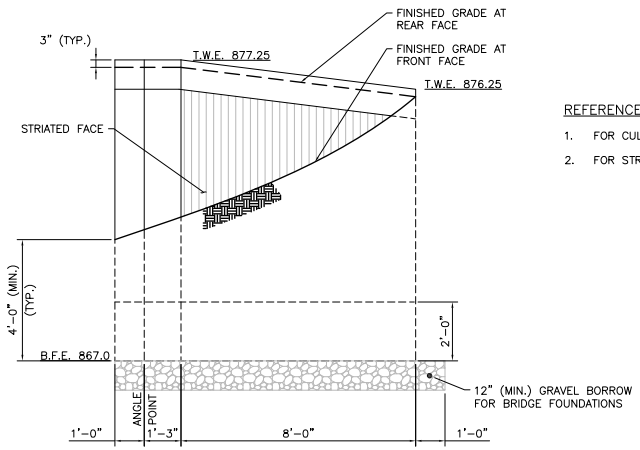
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	166	180
PROJECT FILE NO.	608163		

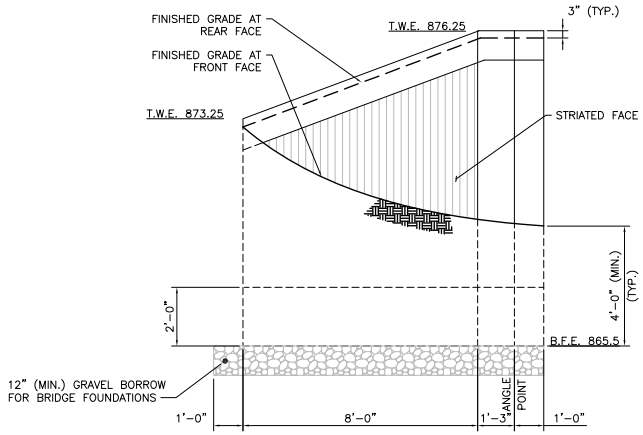
CULVERT 1 WINGWALL ELEVATIONS



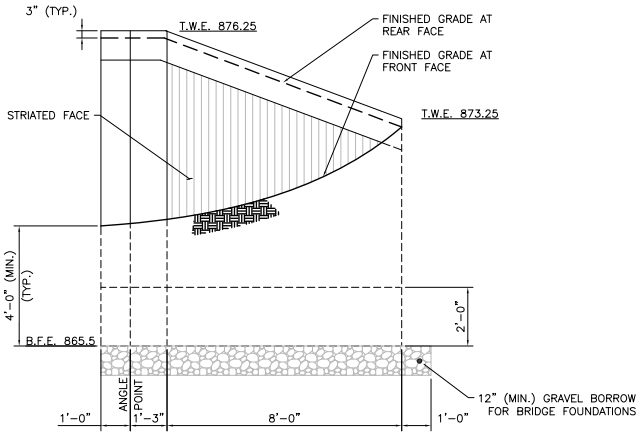
NORTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



NORTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

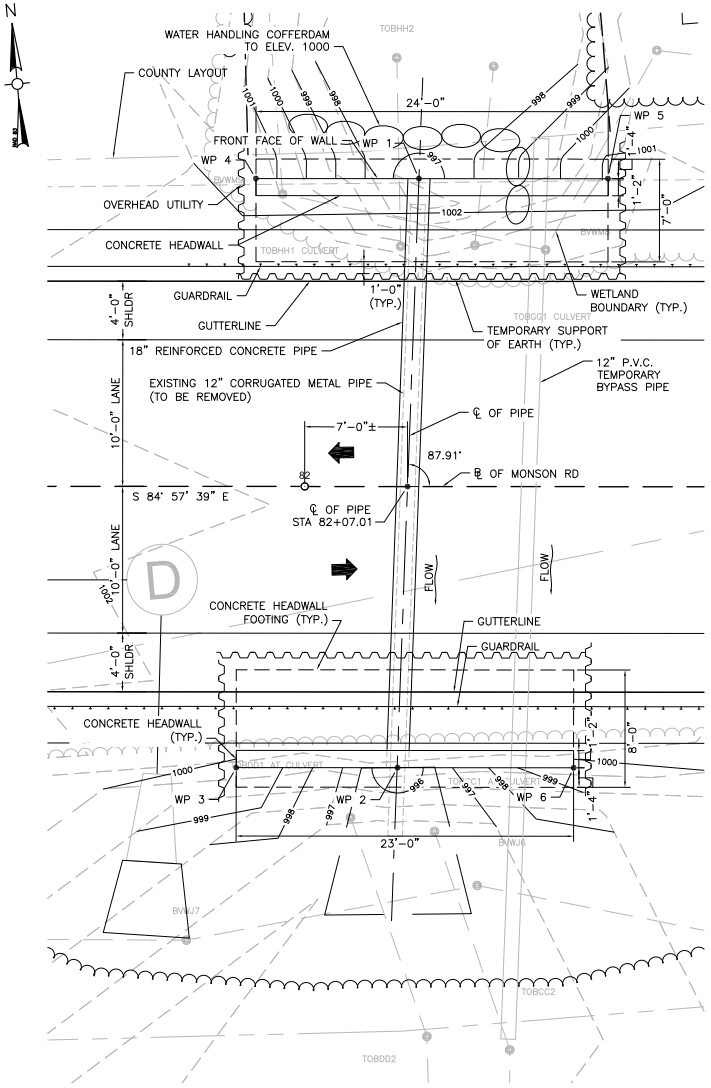


SOUTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

REFERENCE NOTES:

1. FOR CULVERT 1 WINGWALL SECTION, SEE SHEET NO. 164.
2. FOR STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-1321212
A08840 -339



CULVERT 2 PLAN (STA 82+07)

SCALE: 1" = 4'

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.22 KSF AT THE INLET HEADWALL AND 2.38 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.66 KSF AT THE INLET HEADWALL AND 5.83 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 81+25± (LT) SPIKE IN UTILITY POLE: EL. 1005.74

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

4000 PSI, 1½", 565 CEMENT CONCRETE.....HEADWALLS

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING PIPES.
4. INSTALL THE PROPOSED PIPE & HEADWALLS.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE PROPOSED CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
CLASS "A" TRENCH EXCAVATION	C.Y.	209
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	150
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	20
4000 PSI 1½" 565 CEMENT CONCRETE	C.Y.	52
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	10010
DAMPPROOFING	S.F.	426
TEMPORARY SUPPORT OF EARTH	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847313.7204	453680.2286
2	2847273.8336	453675.2733
3	2847274.8008	453664.3163
4	2847314.6939	453669.1581
5	2847312.5891	453693.0567
6	2847272.7828	453687.1995

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	167	180
PROJECT FILE NO. 608163			

CULVERT 2 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	10.24
DESIGN FLOOD DISCHARGE (C.F.S.)	9
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	0.14
DESIGN FLOOD ELEVATION (FEET, NAVD)	996.14
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	9
BASE FLOOD ELEVATION (FEET, NAVD)	999.20
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

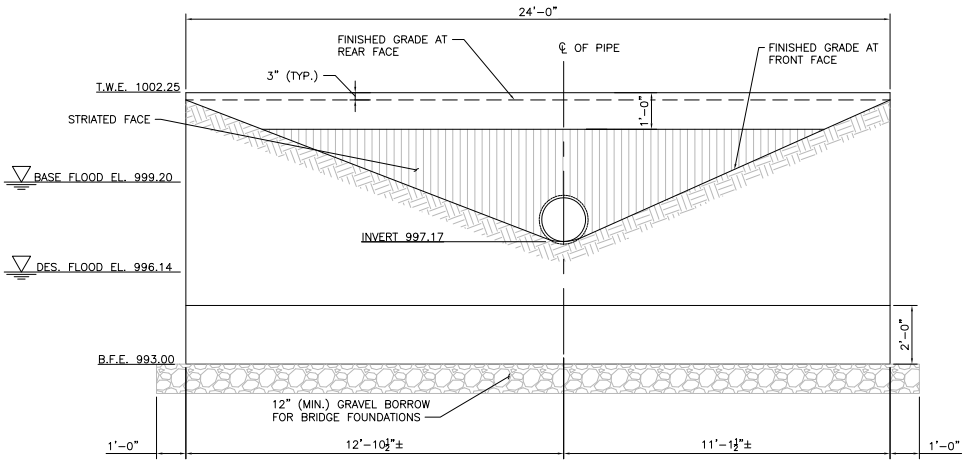
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	5
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	6.70
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.46

608163_HD11\STRUCTURAL PLAN\.DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-1-36127
AQ8640 .dgn

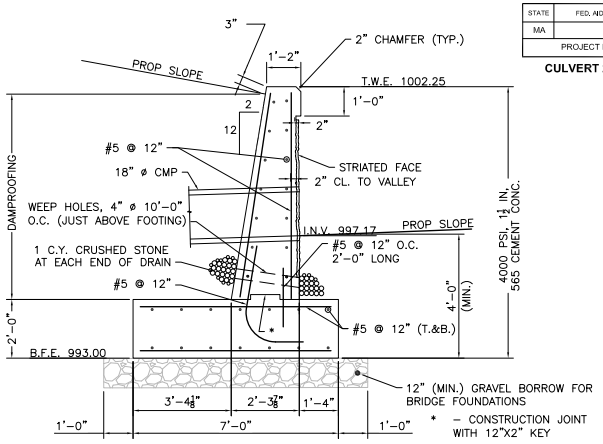
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	168	180
PROJECT FILE NO.	608163		

CULVERT 2 WALL DETAILS



NORTH INLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"

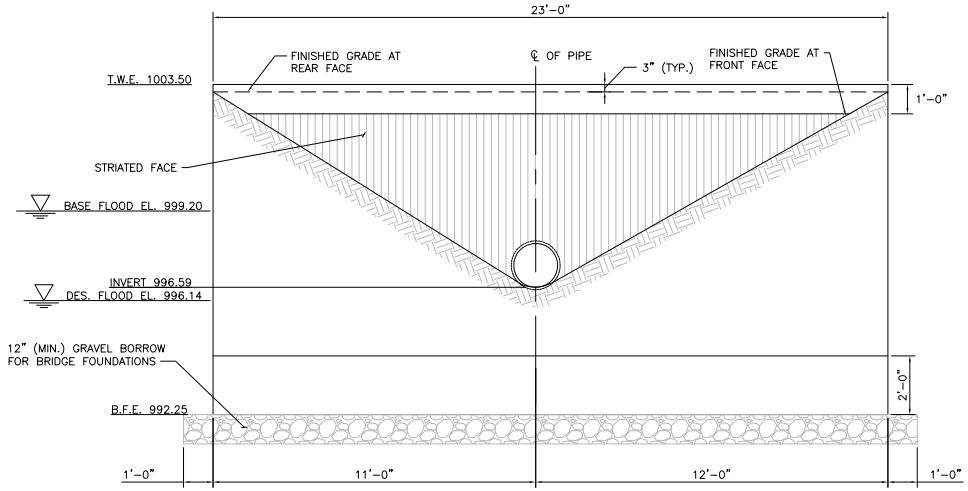


NORTH INLET HEADWALL SECTION
SCALE: ½" = 1'-0"

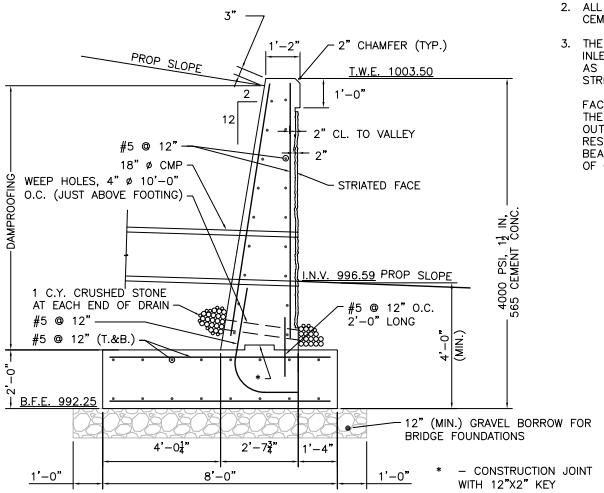
NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 2.22 KSF AT THE INLET HEADWALL AND 2.38 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

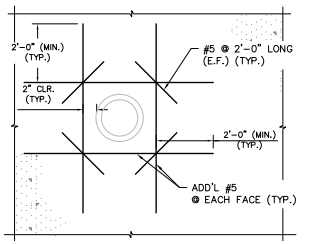
   FACTORED BEARING RESISTANCE = 5.66 KSF AT THE INLET HEADWALL AND 5.83 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



SOUTH OUTLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"



SOUTH OUTLET HEADWALL SECTION
SCALE: ½" = 1'-0"

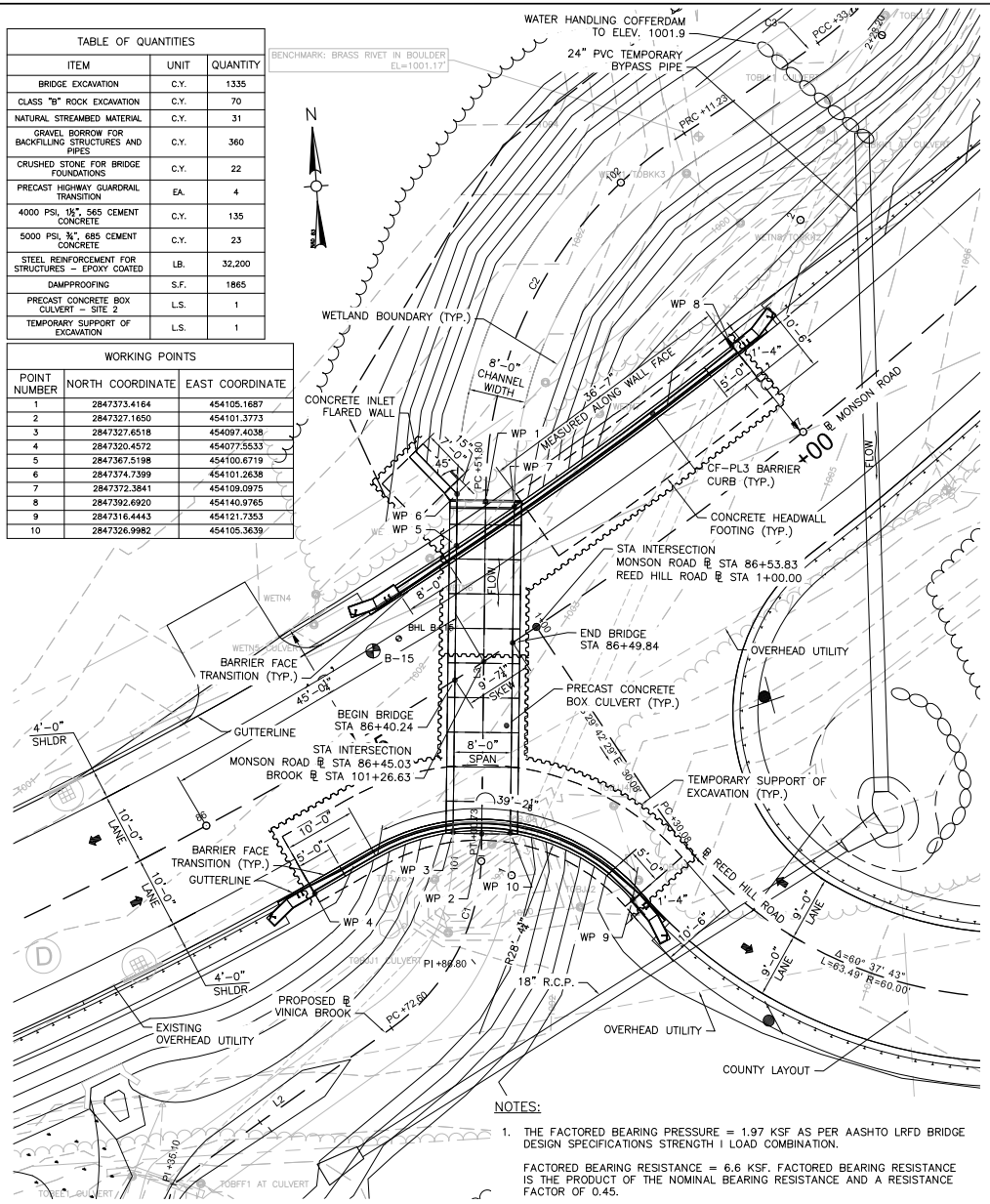


ADDITIONAL REINFORCEMENT AT PIPE
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:17 AM
Proposal No. 608163-138121
A08840.401

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	1335
CLASS "B" ROCK EXCAVATION	C.Y.	70
NATURAL STREAMBED MATERIAL	C.Y.	31
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	360
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	22
PRECAST HIGHWAY GUARDRAIL TRANSITION	EA.	4
4000 PSI, 1½", 565 CEMENT CONCRETE	C.Y.	135
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	23
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	32,200
DAMPPROOFING	S.F.	1865
PRECAST CONCRETE BOX CULVERT – SITE 2	L.S.	1
TEMPORARY SUPPORT OF EXCAVATION	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847373.4164	454105.1687
2	2847327.1650	454101.3773
3	2847327.6518	454097.4038
4	2847320.4572	454077.5533
5	2847367.5198	454100.6719
6	2847374.7399	454101.2638
7	2847372.3841	454109.0975
8	2847392.6920	454140.9765
9	2847316.4443	454121.7353
10	2847326.9982	454105.3639



NOTES:

1. THE FACTORED BEARING PRESSURE = 1.97 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.6 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL–93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 87+10± (RT) SPIKE IN UTILITY POLE: EL. 1007.89 FT

BENCHMARK STA 87+20± (LT) BRASS RIVET: EL. 1001.17 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

4000 PSI, 1½", 565 CEMENT CONCRETE.....HEADWALLS

5000 PSI, ¾", 610 CEMENT CONCRETE.....CF–PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	169	180
PROJECT FILE NO. 608163			

CULVERT 3 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S.)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.40
BASE (100–YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

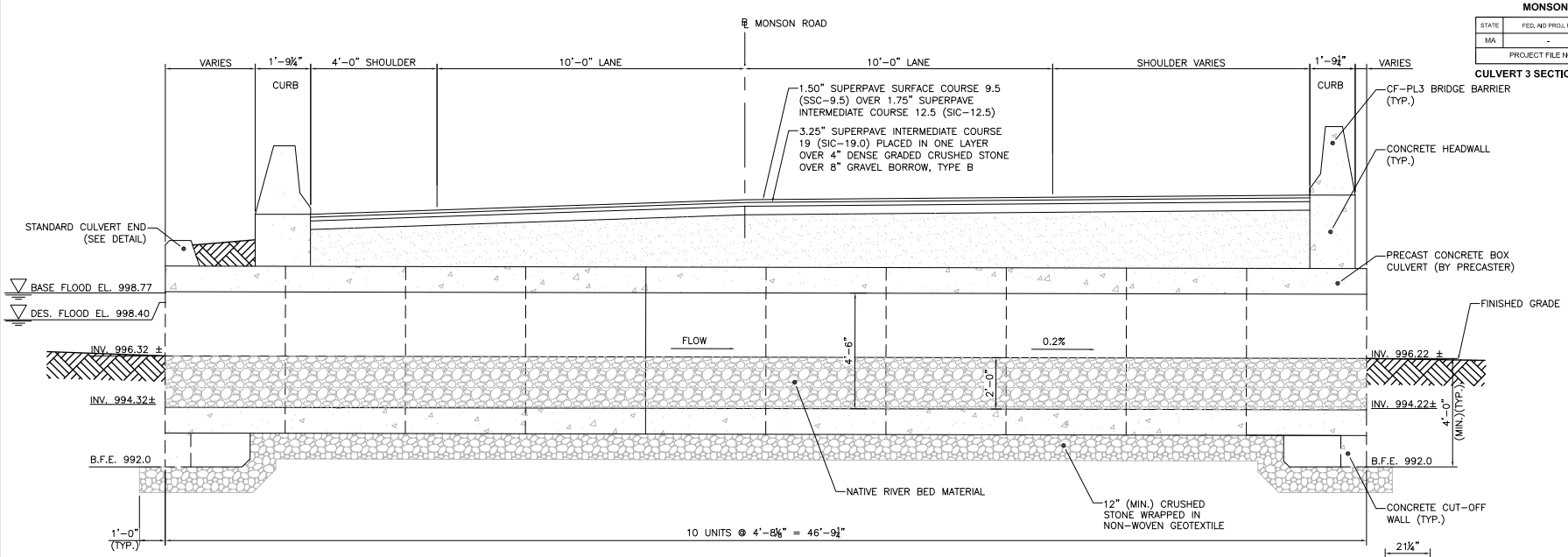
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	8.91
DESIGN FLOOD ELEVATION (FEET, NAVD)	1001.42

608163_HD11\STRUCTURAL PLAN\.DWG Plotted on 25-Jun-2024 8:17 AM
Proposal No. 608163-128212
AGENDA #22

WALES
MONSON ROAD

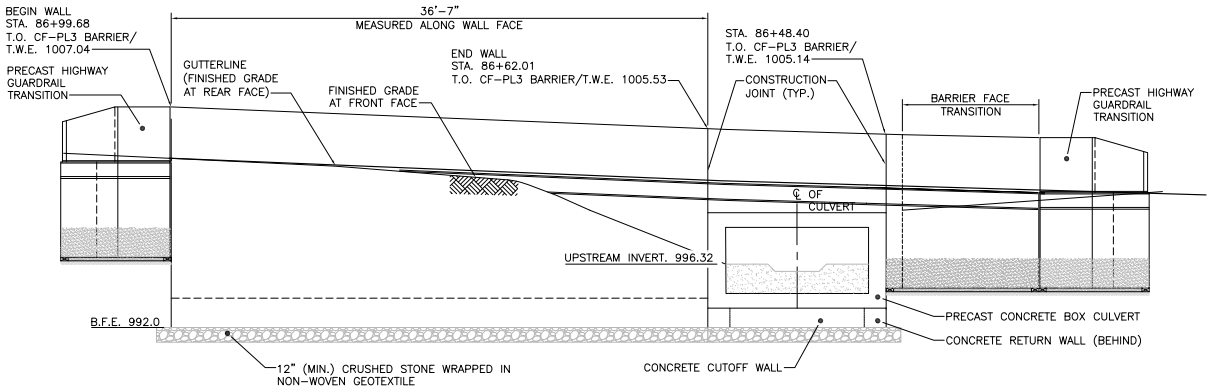
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	170	180
PROJECT FILE NO.	608163		

CULVERT 3 SECTION AND DETAILS



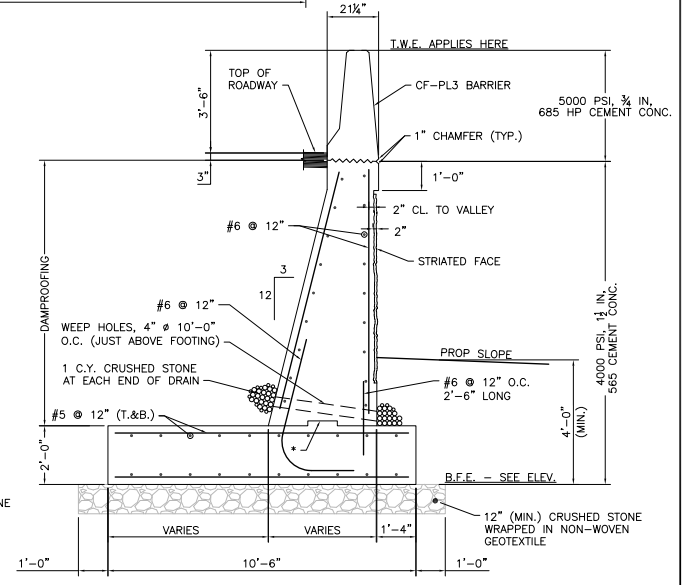
CULVERT LONGITUDINAL SECTION – ALONG STREAM BASELINE

SCALE: ½" = 1'-0"



CULVERT INLET NORTH ELEVATION

SCALE: ¼" = 1'-0"



RETAINING WALL SECTION

SCALE: ½" = 1'-0"

* – CONSTRUCTION JOINT WITH 12"X2" KEY

REFERENCE NOTES:

1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 1.97 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

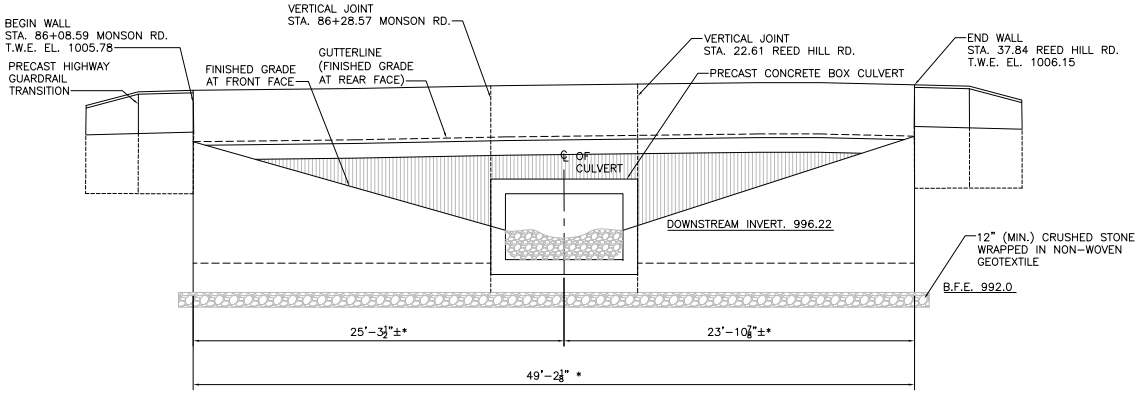
   FACTORED BEARING RESISTANCE = 6.6 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 25-Jun-2024 8:17 AM
Proposal No. 608163-138112
A08840.483

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	171	180
PROJECT FILE NO.	608163		

CULVERT 3 WALL ELEVATION AND DETAILS



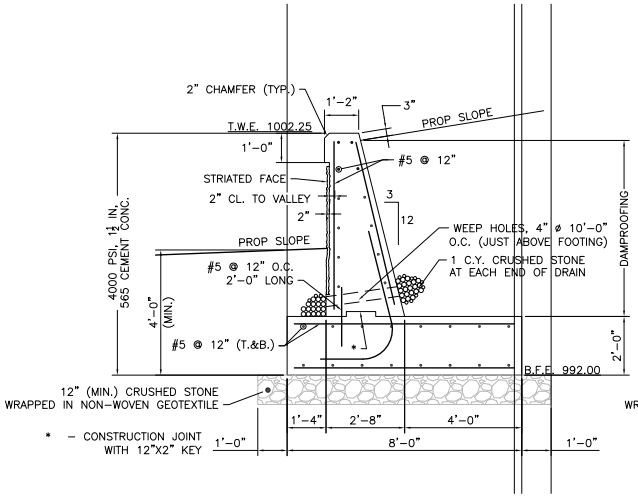
CULVERT 3 OUTLET/SOUTH ELEVATION
SCALE: ¼" = 1'-0"

PRECAST BOX CULVERT NOTES:

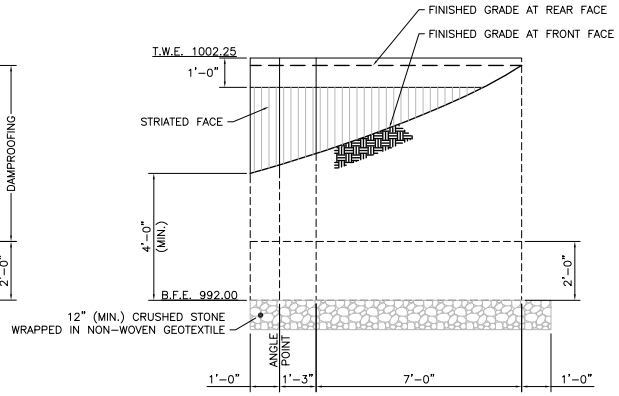
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 8'-0" WIDE, 4'-6" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

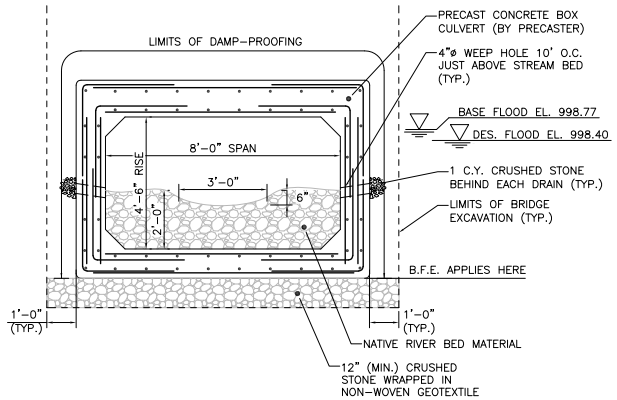
1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 3 INLET FLARED WALL - SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - ELEVATION
SCALE: ½" = 1'-0"



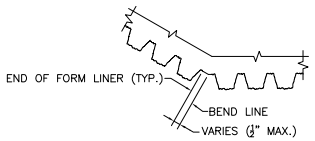
CULVERT 3 TRANSVERSE SECTION
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:18 AM
Proposal No. 608163-138112
608163_454

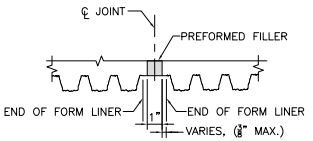
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	172	180
PROJECT FILE NO. 608163			

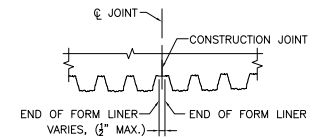
CULVERT & WALL DETAILS



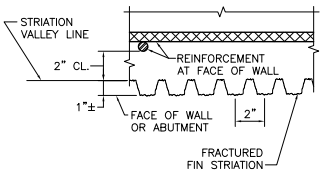
DETAIL AT WALL CORNER
SCALE: 3" = 1'-0"



EXPANSION JOINT
SCALE: 3" = 1'-0"



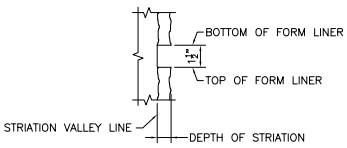
CONSTRUCTION JOINT
SCALE: 3" = 1'-0"

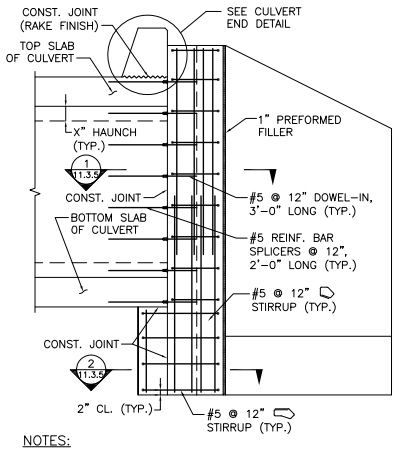


NOTES:

1. THE CONTRACTOR SHALL MAKE SURE THAT THE STRIATION FINS ARE PLUMB AND LINED UP VERTICALLY FROM PANEL TO PANEL FOR THE FULL HEIGHT OF THE WALL.
2. THE HORIZONTAL JOINT MAY BE OMITTED IF THE CONTRACTOR CAN DEMONSTRATE THAT THE FORM LINER PANELS CAN BE INSTALLED END TO END WITHOUT CREATING A VISIBLE SEAM IN THE FINAL CAST CONCRETE.

TYPICAL STRIATION DETAIL
SCALE: 3" = 1'-0"

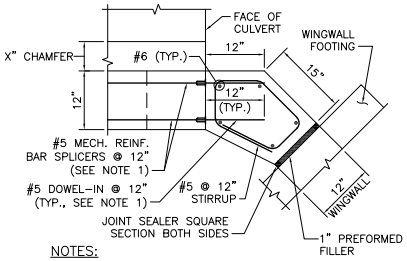




NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 DOWELS, 3'-0" LONG FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

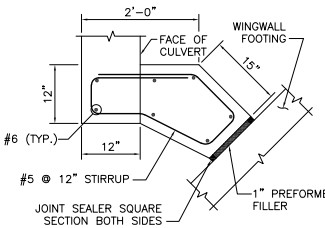
SECTION AT WINGWALL
SCALE: ½" = 1'-0"



NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 DOWELS, 3'-0" LONG, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

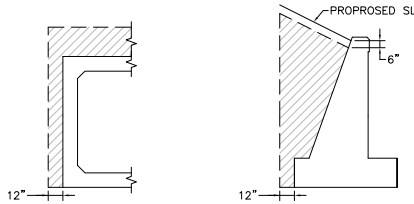
SECTION 1
SCALE: 1" = 1'-0"



NOTE:

CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

SECTION 2
SCALE: 1" = 1'-0"



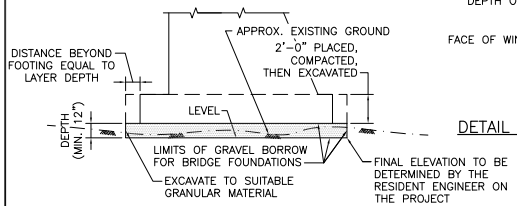
BOX CULVERT (OR FRAME)

HEADWALL

NOTE:

HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES.

LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
SCALE: ¼" = 1'-0"

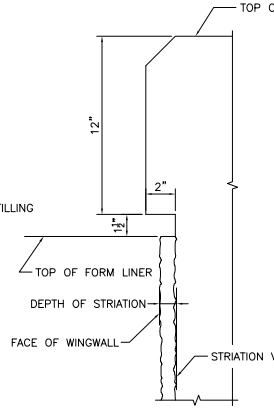


NOTES:

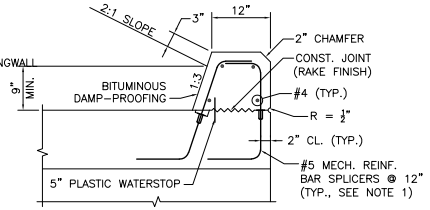
1. SAME TREATMENT IS TO BE USED AT ENDS OF WALLS.

LIMITS OF CRUSHED FOR BRIDGE FOUNDATIONS
NOT TO SCALE

HORIZONTAL PANEL JOINT
SCALE: 3" = 1'-0"



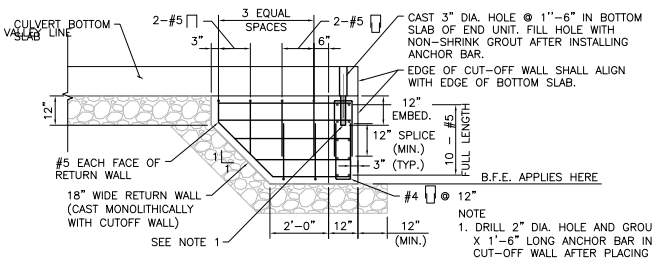
DETAIL AT TOP OF WINGWALL
SCALE: 3" = 1'-0"



NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 ∫⌐ DOWELS, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

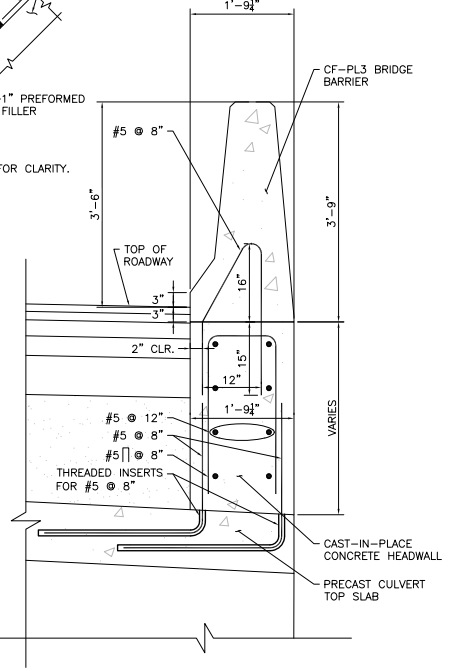
CULVERT END DETAIL
SCALE: 1" = 1'-0"



NOTE

1. DRILL 2" DIA. HOLE AND GROUT #6 X 1'-6" LONG ANCHOR BAR INTO CUT-OFF WALL AFTER PLACING END UNIT. USE NON-SHRINK GROUT. CENTER ANCHOR BAR IN HOLE IN BOTTOM SLAB.

CUT-OFF AND RETURN WALL DETAIL
SCALE: ½" = 1'-0"



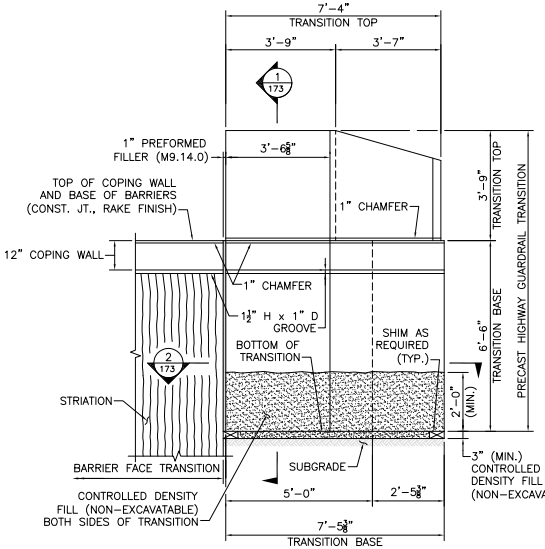
SECTION AT BOX CULVERT HEADWALL
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 25-Jun-2024 8:15 AM
Proposal No. 608163-132612
ADDEND. 485

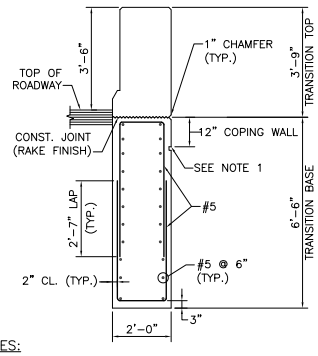
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	173	180
PROJECT FILE NO.	608163		

BARRIER CURB DETAILS I

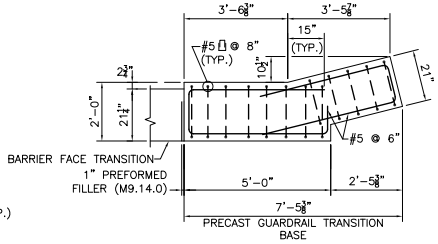


PRECAST GUARDRAIL TRANSITION
ELEVATION AT U-WINGWALL
SCALE: ½" = 1'-0"



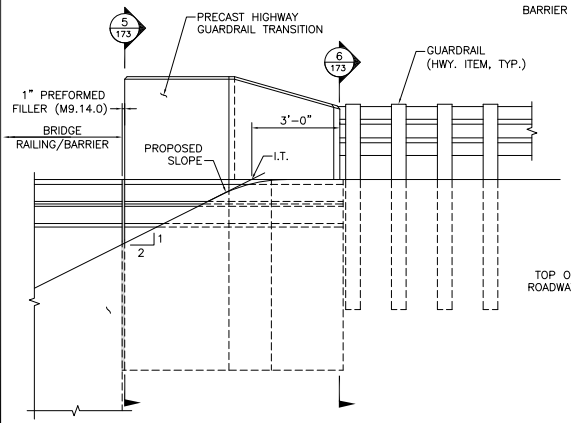
NOTES:
1. 1½" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 1
SCALE: ½" = 1'-0"

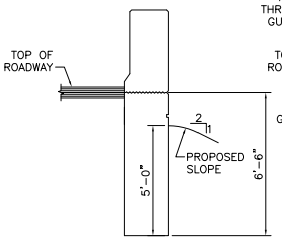


NOTE:
WINGWALL REINFORCEMENT AND STRIATIONS NOT SHOWN FOR CLARITY.

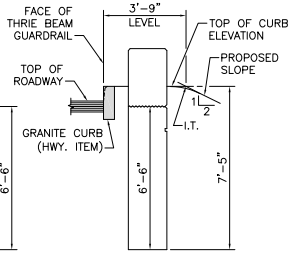
SECTION 2
SCALE: ½" = 1'-0"



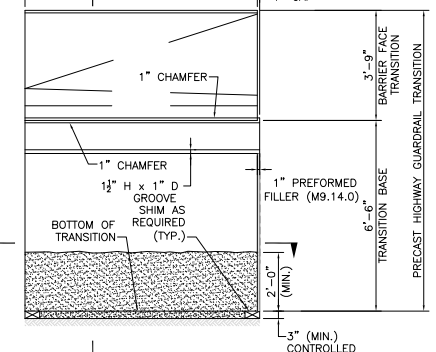
GRADING REQUIREMENTS
ELEVATION
SCALE: ½" = 1'-0"



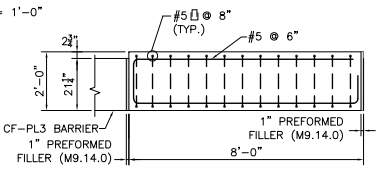
SECTION 5
SCALE: ⅜" = 1'-0"



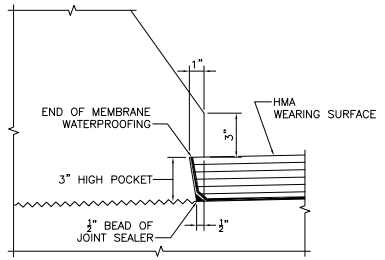
SECTION 6
SCALE: ⅜" = 1'-0"



BARRIER FACE TRANSITION CURB
SCALE: ½" = 1'-0"

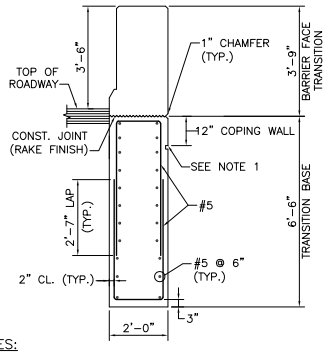


SECTION 4
SCALE: ½" = 1'-0"



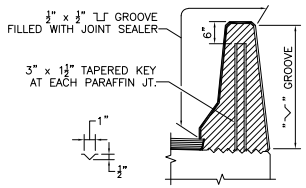
NOTE:
TURN MEMBRANE UP INTO 3" HIGH POCKET.

FACE OF SAFETY CURB DETAILS
SCALE: 3" = 1'-0"



NOTES:
1. 1½" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

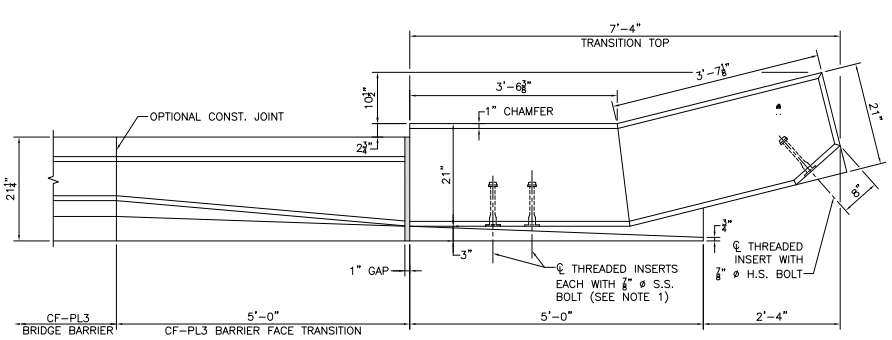
SECTION 3
SCALE: ½" = 1'-0"



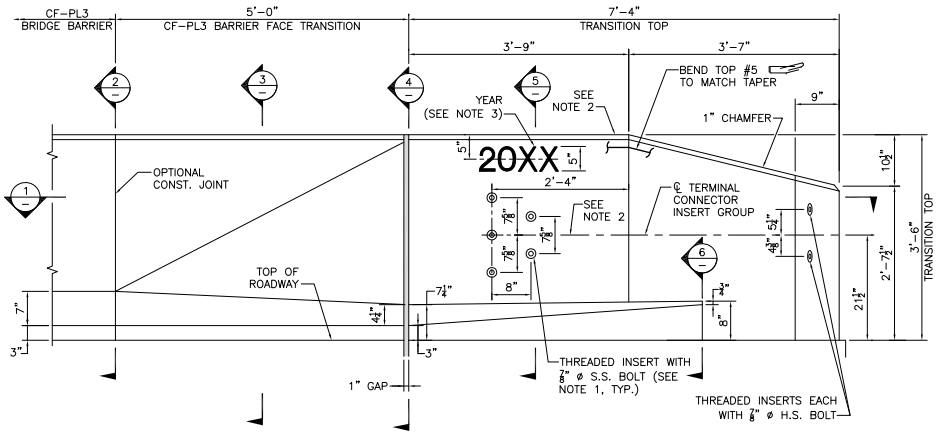
NOTES:
1. ALL CONCRETE ABOVE SLAB SHALL BE POURED IN ALTERNATING SECTIONS WITH NOT LESS THAN 3 DAYS BETWEEN POURS.
2. DO NOT CARRY LONGITUDINAL BARS THROUGH THE PARAFFIN JOINTS. END THE REINFORCEMENT 2" CLEAR OF JOINT.
3. JOINT SHALL BE SQUARE TO FACE OF CURB *(or coping)*.

PARAFFIN JOINT DETAILS
SCALE: ¾" = 1'-0"

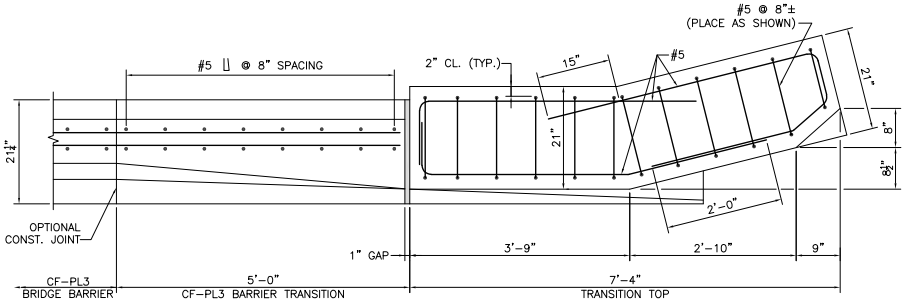
608163_HD11STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:19 AM
Project No. 608163.13612
A08840.dgn



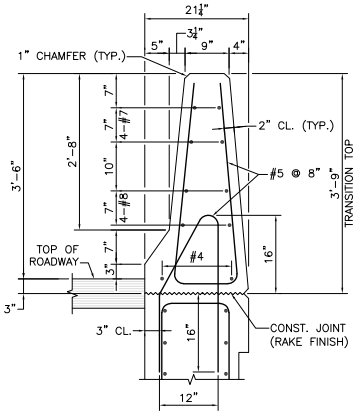
PLAN
SCALE: 1" = 1'-0"



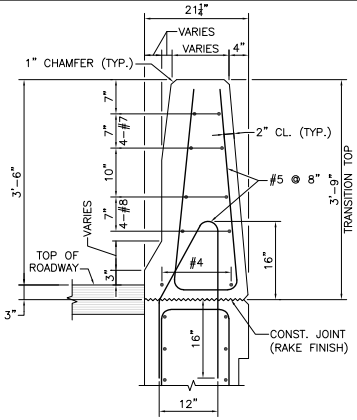
ELEVATION
SCALE: 1" = 1'-0"



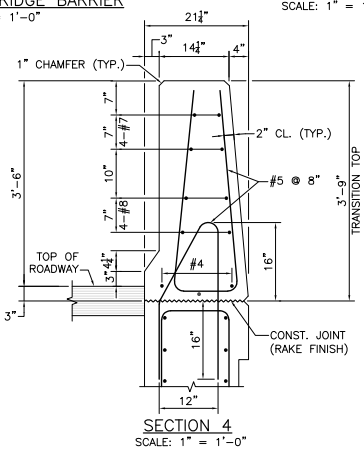
SECTION 1
SCALE: 1" = 1'-0"



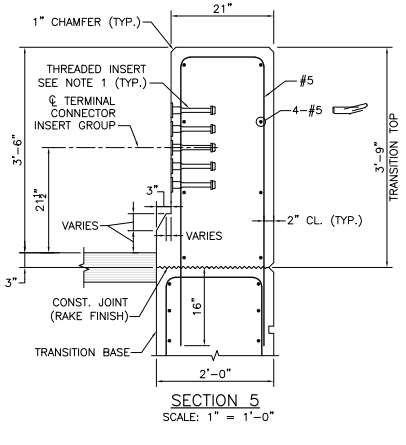
SECTION 2
TYPICAL CF-PL3 BRIDGE BARRIER
SCALE: 1" = 1'-0"



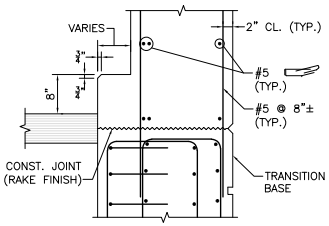
SECTION 3
SCALE: 1" = 1'-0"



SECTION 4
SCALE: 1" = 1'-0"



SECTION 5
SCALE: 1" = 1'-0"



SECTION 6
SCALE: 1" = 1'-0"

NOTES:

1. THREADED INSERTS SHALL BE PREQUALIFIED BY THE MANUFACTURER AS BEING CAPABLE OF DEVELOPING A NOMINAL SHEAR RESISTANCE OF 20 KIPS PER ⅞" ø S.S. BOLT. S.S. BOLTS SHALL BE ⅞" ø x 1½" LONG FULLY THREADED AISI TYPE 304N STAINLESS STEEL. INSERTS FOR ⅞" S.S. BOLTS SHALL BE GALVANIZED AND CAST INTO THE TRANSITION.
2. FOR AN APPROACH GRADE UP TO 3%, THE TRANSITION MAY BE CAST SQUARE AND SET PLUMB WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SQUARE TO THE POST.

   FOR AN APPROACH GRADE IN EXCESS OF 3%, THE TRANSITION TOP AND THE TOP OF THE BRIDGE BARRIERS SHALL FOLLOW THE APPROACH GRADE. THE HEIGHT OF THE TRANSITION TOP SHALL VARY PROVIDED THAT THE MINIMUM DIMENSIONS SHOWN ON THE CONSTRUCTION DRAWINGS ARE MET. THE BOTTOM OF THE TRANSITION BASE SHALL BE SET LEVEL WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SLOPED TO FOLLOW THE APPROACH GRADE.
3. USE LATEST CONTRACT COMPLETION YEAR IN EFFECT WHEN THE FIRST GUARDRAIL TRANSITION IS CAST. USE THIS YEAR FOR ALL GUARDRAIL TRANSITIONS.
4. ALL CONCRETE FOR THE PRECAST HIGHWAY GUARDRAIL TRANSITION SHALL BE 5000 PSI, ¾", 685 HP CEMENT CONCRETE.
5. LIFTING DEVICES (NOT SHOWN), INCLUDING THEIR NUMBER AND LOCATION, SHALL BE DESIGNED AND DETAILED BY THE PRECASTER. THEY SHALL BE GALVANIZED AND SHALL BE PLACED AND RECESSED IN POCKETS TO PROVIDE 1½" CLEAR COVER TO THE FACE OF THE TRANSITION CONCRETE. THESE DEVICES SHALL BE CLEARLY SHOWN ON THE SHOP DRAWINGS ALONG WITH ALL SUPPORTING CALCULATIONS AND/OR CATALOG CUTS. ONCE THE PRECAST TRANSITION IS SET IN PLACE, THE LIFTING DEVICE POCKETS SHALL BE FILLED WITH A NON-SHRINK GROUT THAT MATCHES THE COLOR OF THE TRANSITION CONCRETE WHEN CURED AND THE FILLED POCKETS SHALL BE RUBBED WITH A CORUNDUM STONE TO BLEND OUT THE JOINTS.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	174	180
PROJECT FILE NO. 608163			

CF-PL3 BARRIER DETAILS

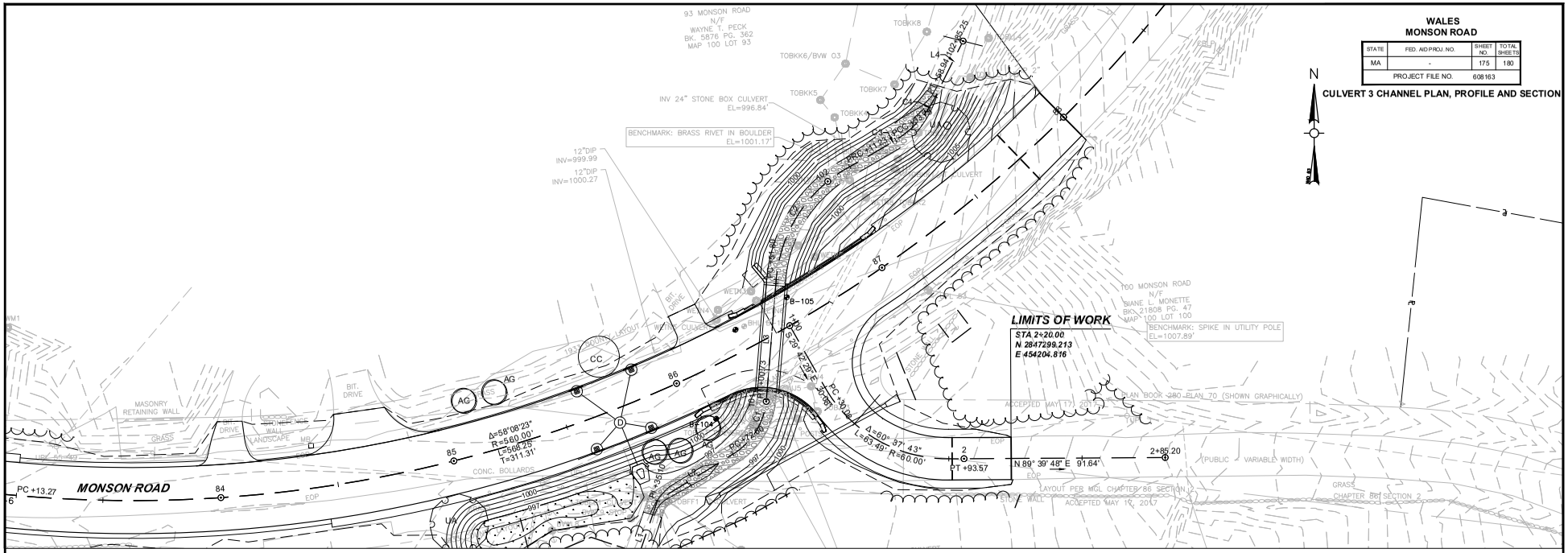
TOP OF PRECAST HIGHWAY GUARDRAIL TRANSITION FOR CF-PL3 BARRIER

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 25-Jun-2024 8:20 AM
Proposal No. 608163-136112
ADDENDUM #1

WALES
MONSON ROAD

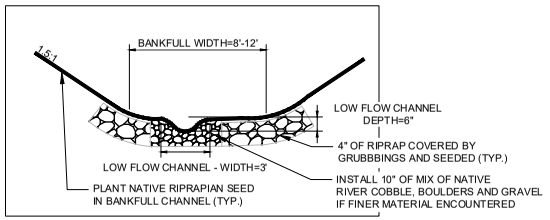
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	175	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION

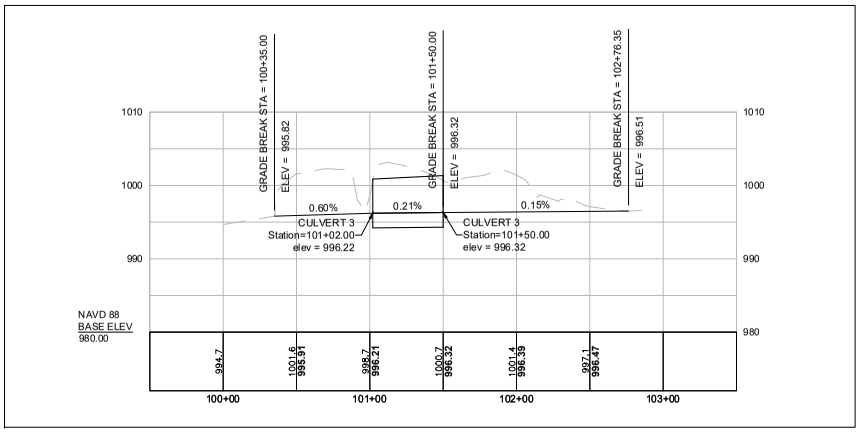


CULVERT 3 CHANNEL PLAN

0 20 40 60 80
SCALE: 1" = 20'



CULVERT 3 CHANNEL TYPICAL SECTION



CULVERT 3 CHANNEL PROFILE

HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

608163_HD12\WATER HANDLING\.DWG Plotted on 25-Jun-2024 3:54 PM

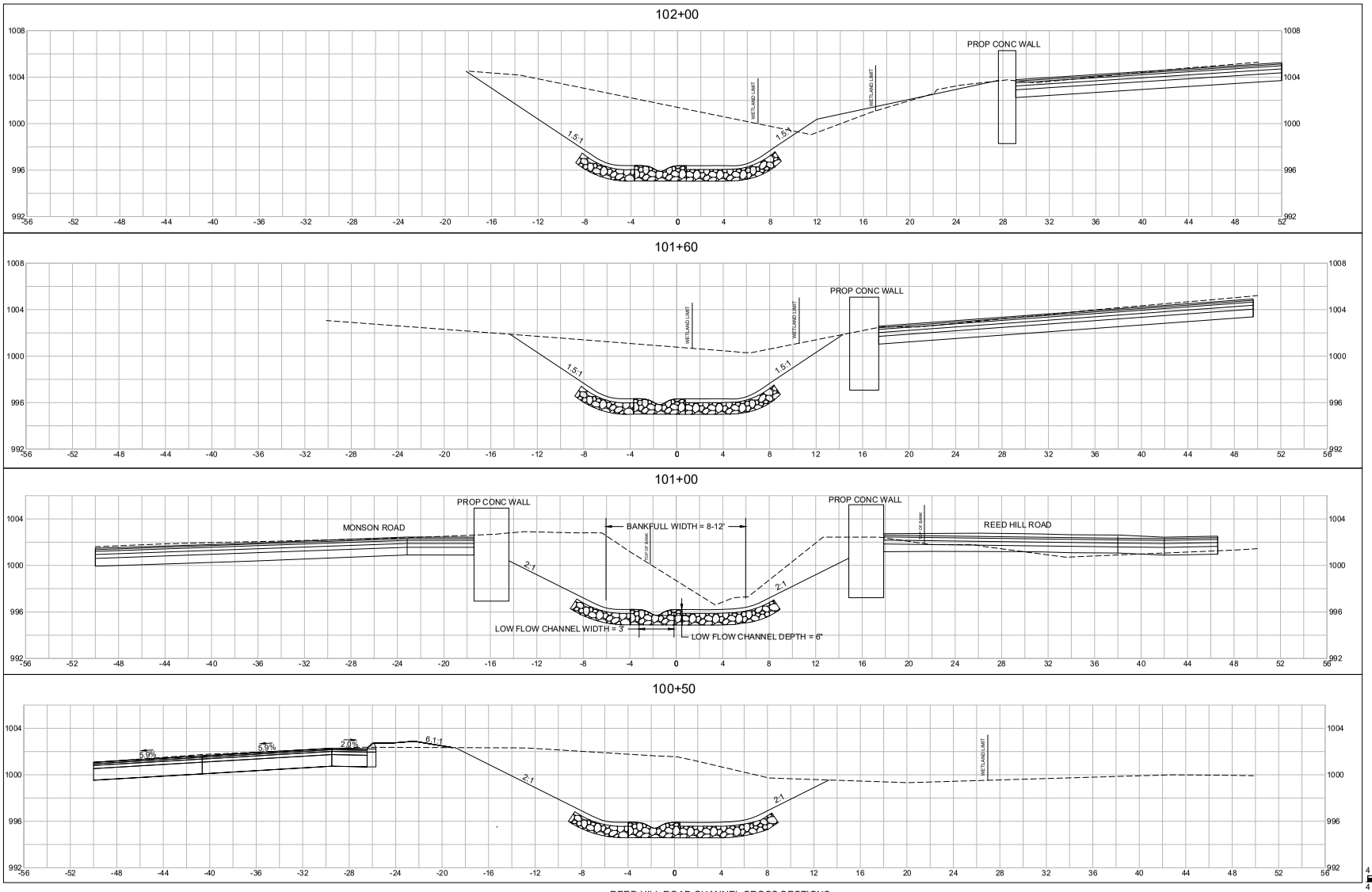
Proposal No. 608163-132612

ADDEND. #08

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	176	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS



REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

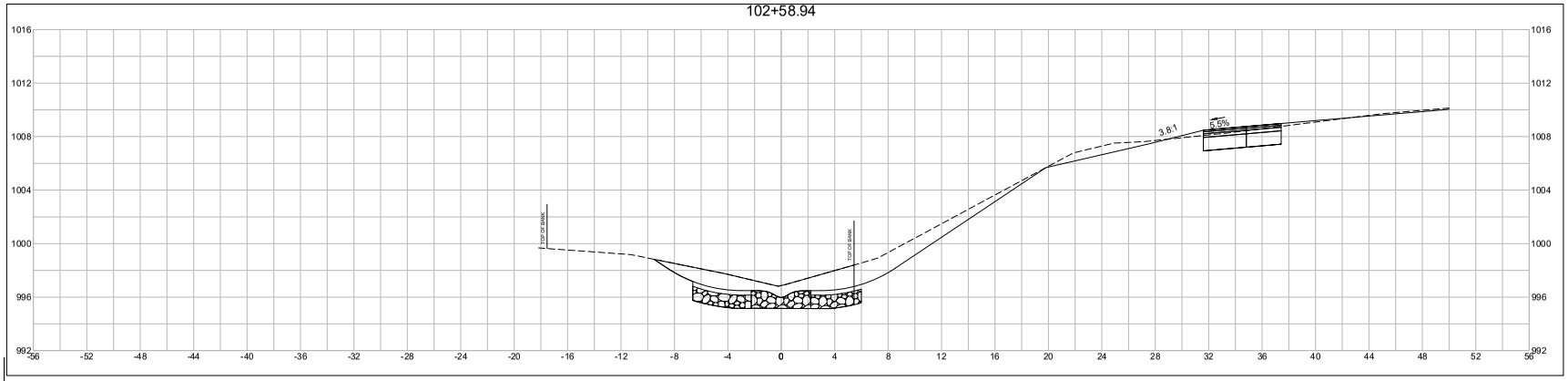
608163_HD12/WATER HANDLING1.DWG Plotted on 25-Jun-2024 3:54 PM
Proposal No. 608163-121212
A08840 .dgn

WALES
MONSON ROAD

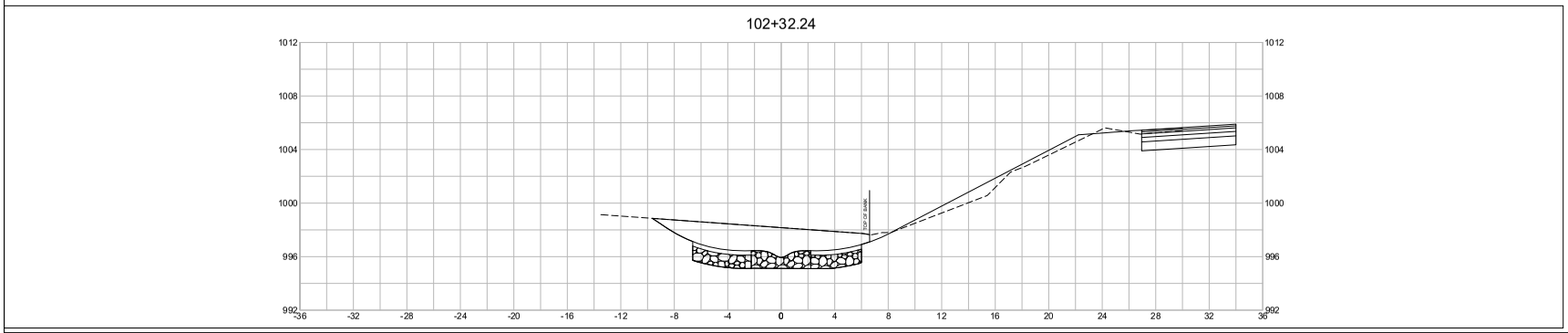
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	177	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS

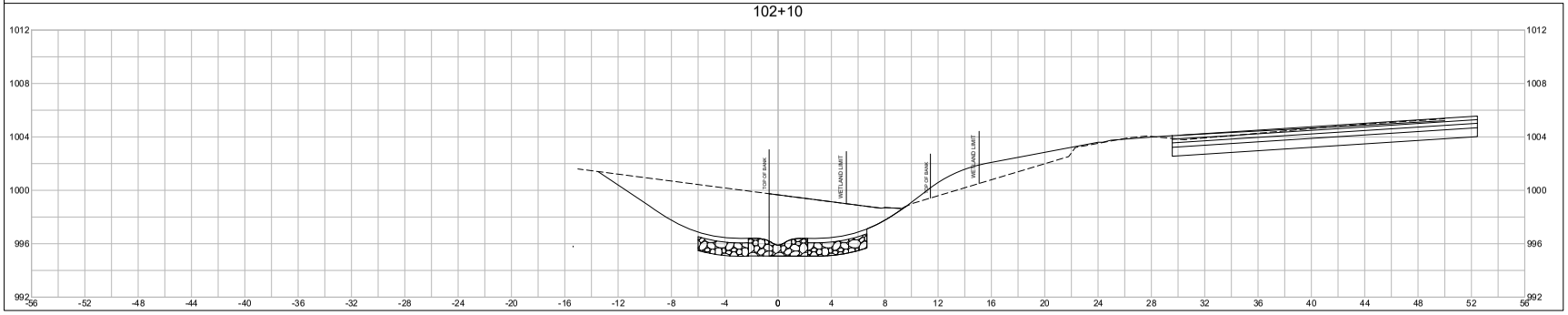
102+58.94



102+32.24



102+10



REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

608163_HD12/WATER HANDLING\.DWG Plotted on 25-Jun-2024 3:55 PM

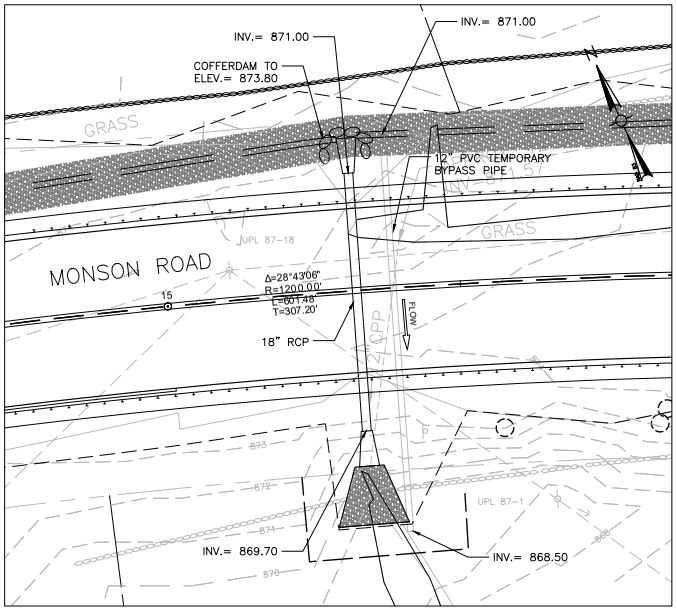
Proposal No. 608163-181212

A08840.410

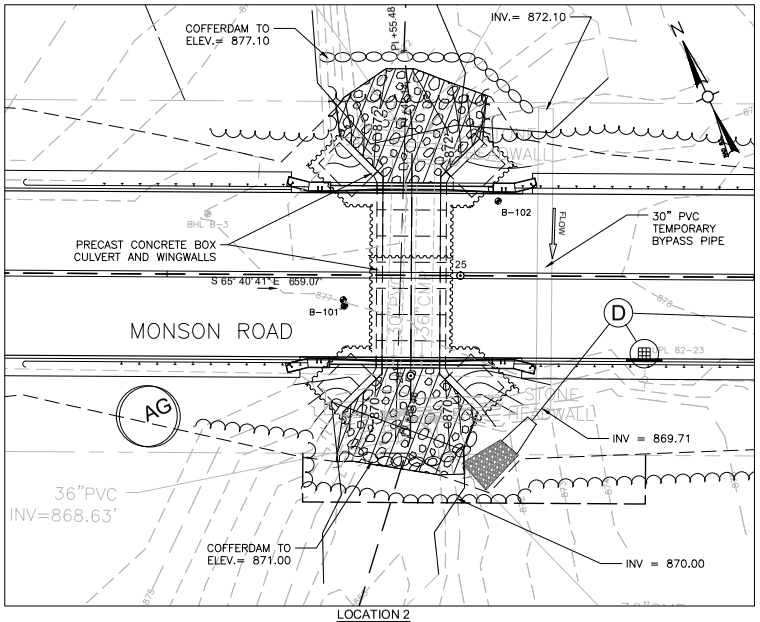
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	178	180
PROJECT FILE NO.	608163		

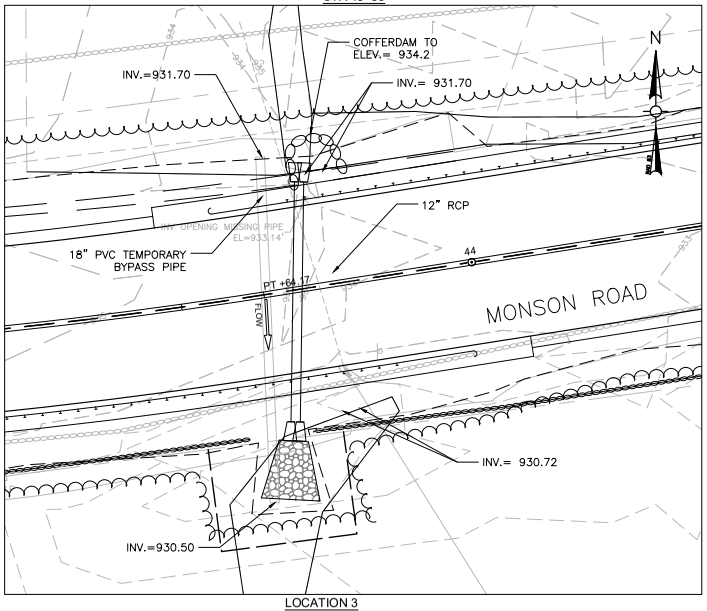
CONTROL OF WATER PLANS



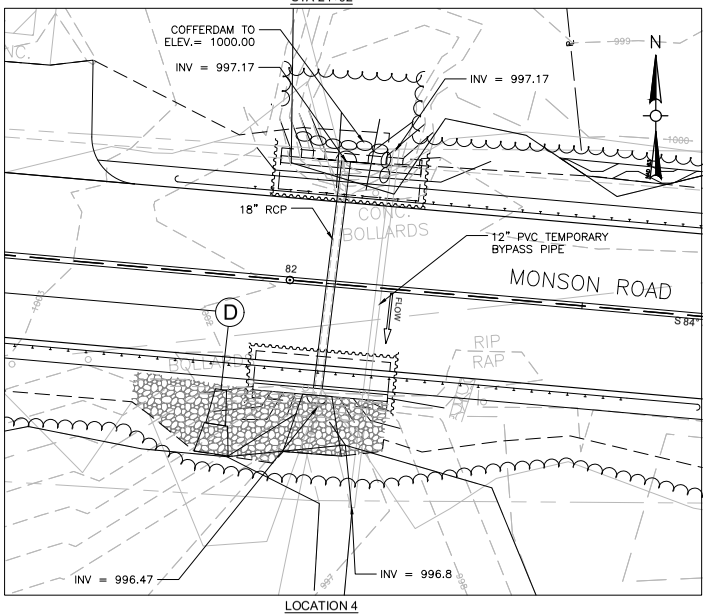
LOCATION 1
STA 15+33



LOCATION 2
STA 24+92



LOCATION 3
STA 43+76



LOCATION 4
STA 82+07

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS AND END WALLS

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE) AND INSTALL THE COFFERDAMS IN THE STREAM ON BOTH ENDS OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND ENDWALLS.
4. INSTALL THE NEW CULVERT.
5. INSTALL THE END WALLS.
6. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT. RECONFIGURE THE COFFERDAMS AROUND THE SIDE THAT WILL BE CONSTRUCTED NEXT.
7. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
8. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

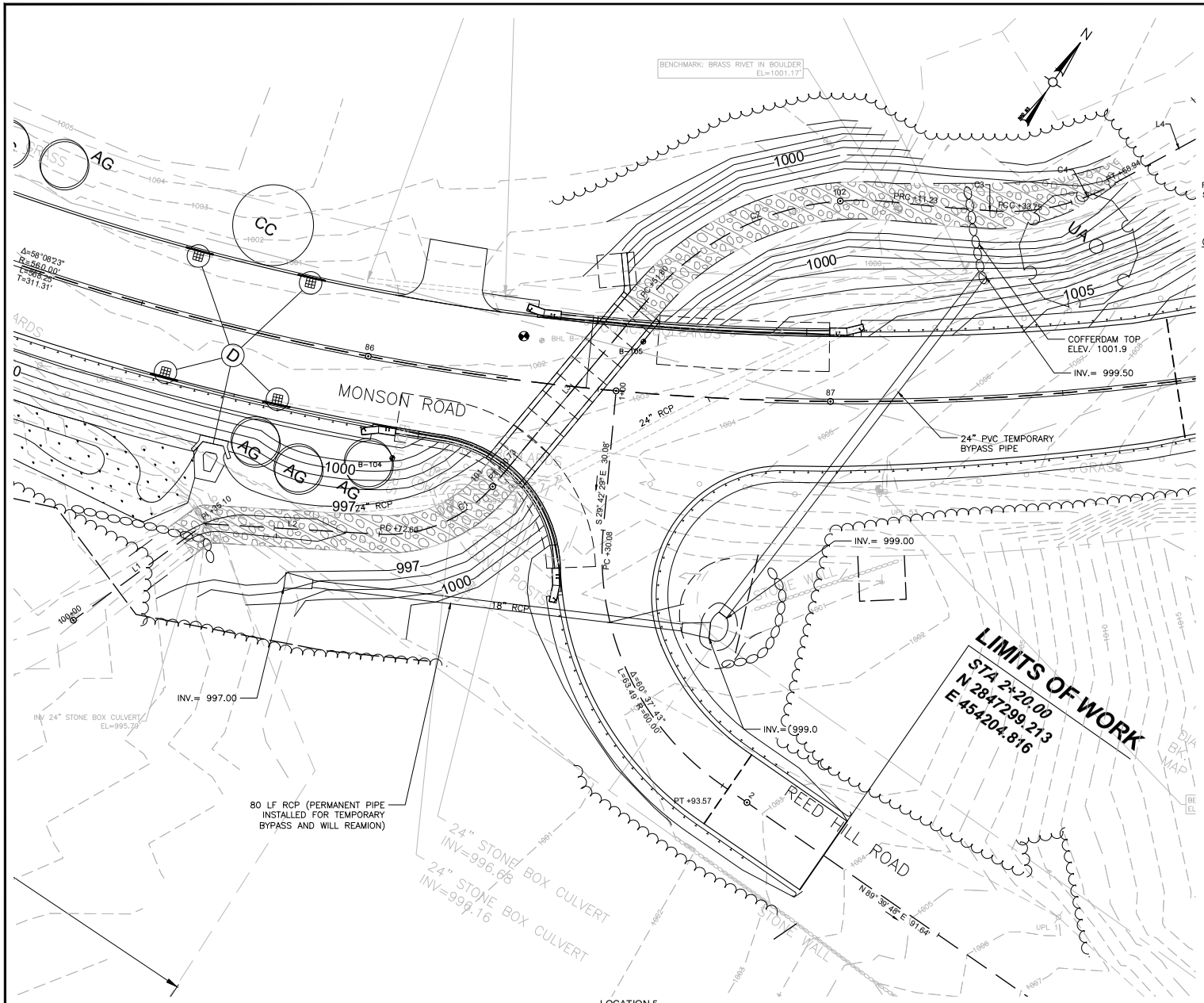
0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING\.DWG Plotted on 25-Jun-2024 3:56 PM
Proposal No. 608163-128212
A08840.451

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	179	180
PROJECT FILE NO. 608163			

CONTROL OF WATER PLAN - CULVERT 3



LOCATION 5
STA 87+00 and STA 1+33

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE:

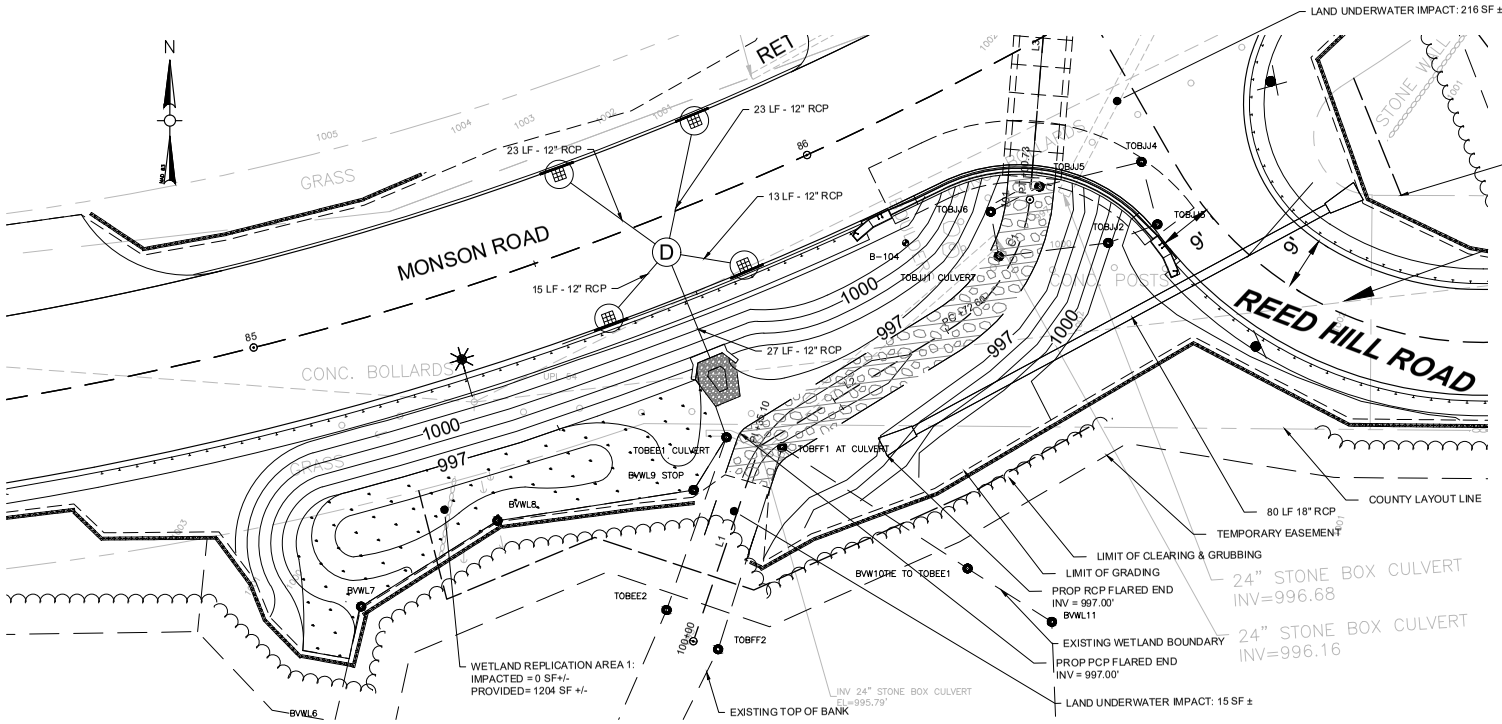
1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

608163_HD12\WATER HANDLING\.DWG Plotted on 25-Jun-2024 3:56 PM
Proposal No. 608163-132612
A0BMJ-612

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	180	180
PROJECT FILE NO.	608163		

WETLAND REPLICATION AREA DETAIL



WETLAND REPLICATION AREA 1 GRADING PLAN

0 10 20 30 40

SCALE: 1" = 10'

WETLAND SEED MIX - OBLIGATE MIX

BOTANICAL

GRASS	COMMON NAME	%PLS BY WEIGHT
CAREX VULPINOIDEA	FOX SEDGE	26.50%
CAREX LURIDA	SHALLOW SEDGE	15.00%
SAPERGANIUM EURYCARPUM	GIANT BUR REED ECO PA	10.00%
CAREX LUPULINA	HOP SEDGE	7.00%
CAREX CRINITA	FRINGED SEDGE	6.00%
SCRIPUS CYPERINUS	WOOLGRASS	4.00%
JUNCUS EFFUSUS	SOFT RUSH	3.00%
CAREX COMOSA	BEAREDED SEDGE	3.00%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3.00%
SPARGANIUM AMERICANUM	BURRWEED	2.50%
SCIRPUS VALIDUS	BULRUSH, SOFT-STEM	2.00%
CAREX STRICTA	TUSSOCK SEDGE	1.00%
GLYCERIA CANADENISIS	MANNA GRASS	1.00%
		86.00%
VERBENA HASTATA	BLUE VERVAIN	4.00%
ASTER PUNICEUS	ASTER - SWAMP	2.00%
EUPATORIUM MACULATUM	JOE-PYE WEED	1.50%
EUPATORIUM PERFOLIATUM	BONESET	2.00%
IRIS VERSICOLOR	BLUE FLAG IRIS	2.00%
ALISMA SUBCORDATUM	MUD PLAINTAIN	1.00%
VERONIA NOVEBORACENSIS	NEW YORK IRONWEED	1.00%
BUDENS CERNUA	NODDING BURR MARIGOLD	1.00%
SOLIDAGO PATULA	ROUGHLEAF GOLDENROD	0.50%
MIMULUS RINGENS	MONKEY FLOWER	0.50%
CHELONE GLABRA	WHITE TURTLEHEAD	0.50%
		14.00%
		100.00%

SEED RATING:
SPECIES ECOTYPE SHALL BE AS NATIVE TO NEW ENGLAND REGION AS POSSIBLE. APPLY THIS MIX AT 20 LBS PLS/ACRE.

WETLAND REPLACEMENT AREA 1 NOTES:

1. A WETLAND SCIENTIST SHALL BE PROVIDED ON-SITE TO MONITOR CONSTRUCTION OF THE WETLAND MITIGATION AREA TO ENSURE COMPLIANCE WITH THE MITIGATION PLAN.
2. AT LEAST 12 INCHES OF NATURAL OR MANMADE WETIAND SOIL SHALL BE INSTALLED IN THE WETLAND REPLICATION AREA.
3. ONLY PLANT MATERIALS NATIVE AND INDIGENOUS TO THE REGION SHALL BE USED. SPECIES NOT SPECIFIED IN THE REPLICATION PLAN SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE REGULATORY AUTHORITIES. PLANT SPECIES ON THE INVASIVE SPECIES PLANT LIST IN THE CORPS MITIGATION INTRODUCTION: PERFORMANCE STANDARDS AND SUPPLEMENTARY INFORMATION DATED 2/21/01 SHALL NOT BE USED IN AND WITHIN 100 FEET OF MITIGATION SITES.
4. A SUPPLY OF DEAD AND DYING WOODY DEBRIS SHALL COVER between 5%-20% OF THE GROUND THROUGHOUT THE MITIGATION SITE AFTER THE COMPLETION OF CONSTRUCTION OF THE MITIGATION SITE. THESE MATERIALS SHOULD NOT INCLUDE INVASIVE SPECIES.
5. TEMPORARY DEVICES AND STRUCTURES TO CONTROL EROSION AND SEDIMENTATION IN AND AROUND MITIGATION SITES SHALL BE DISASSEMBLED AND PROPERLY DISPOSED OF NO LATER THAN NOVEMBER 1 THREE FULL GROWING SEASON AFTER PLANTING. SEDIMENT COLLECTED BY THESE DEVICES SHALL BE REMOVED AND PROPERLY DISPOSED OF IN A MANNER THAT PREVENT ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.

WETLAND REPLICATION AREA 1 PLANTING PLAN

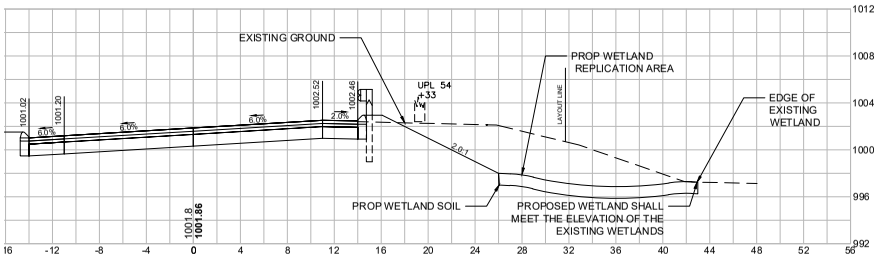
SHRUBS
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM
WINTERBERRY (ILEX VERTICILLATE): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM

FERNS
CINNAMON FERN (OSMUNDA CINNAMOMEA): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.
SENSITIVE FERN (ONOCLEA SENSIBILIS): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.

SEED MIX
IN WETLAND REPLICATION AREA: SEE WETLAND SEED - OBLIGATE MIX - THIS SHEET
(SAME MIX TO BE USED ON PLAN SHEET 16 FOR WETLAND RESTORATION AREA 1)

FOR ALL AREA OUTSIDE AND ADJACENT TO WETLAND RESTORATION AND/OR REPLICATION AREAS PROVIDE PART SHADE ROADSIDE SEED MIX AS INDICATED ON CONSTRCUTION DETAIL SHEET 84.

85+50



WETLAND REPLICATION AREA CROSS SECTION

608163_H013\WETLAND REPLICATION.DWG Plotted on 25-Jun-2024 4:00 PM
Proposal No. 608163-130121
ADDEND. 4&5

THIS PAGE IS INTENTIONALLY LEFT BLANK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE TOWN OF

WALES

HAMPDEN COUNTY

100% SUBMITTAL

401 ENVIRONMENTAL PERMIT PLAN SET

WALES
MONSON ROAD

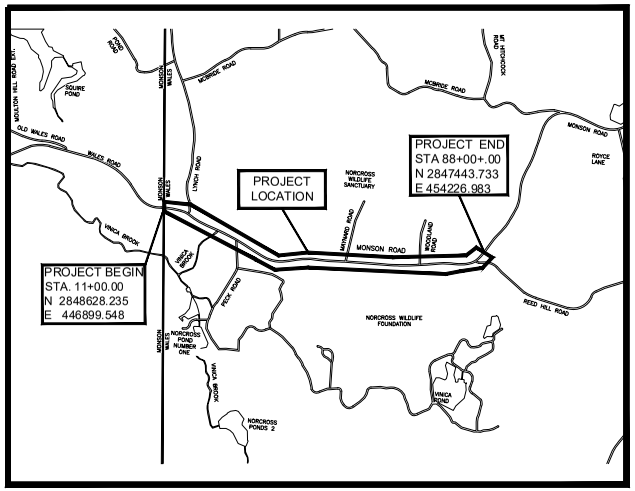
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

TITLE SHEET & INDEX

THESE PLANS ARE SUPPLEMENTED BY THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2024, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND, ABBREVIATIONS & GENERAL NOTES
4	TYPICAL SECTIONS
5-12	CONSTRUCTION PLANS
13-18	PROFILES
19-26	CROSS SECTIONS
27-35	STRUCTURAL PLANS
36	CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION
37-38	CULVERT 3 CHANNEL CROSS SECTIONS
39-40	TEMPORARY WATER HANDLING PLAN
41	WETLAND REPLICATION AREA DETAIL



2000 0 2000 4000

LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

August 2024

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

COMMONWEALTH OF MASSACHUSETTS
SCOTT R. BRUSO
STRUCTURAL
No. 48661
REGISTERED PROFESSIONAL ENGINEER

Weston & Sampson
712 Brook Street, Suite 103
Rocky Hill, CT 06067
860.513.1473
www.westonandsampson.com

DATE	DESCRIPTION	REV #

massDOT
Massachusetts Department of Transportation
Highway Division

APPROVED

CHIEF ENGINEER DATE

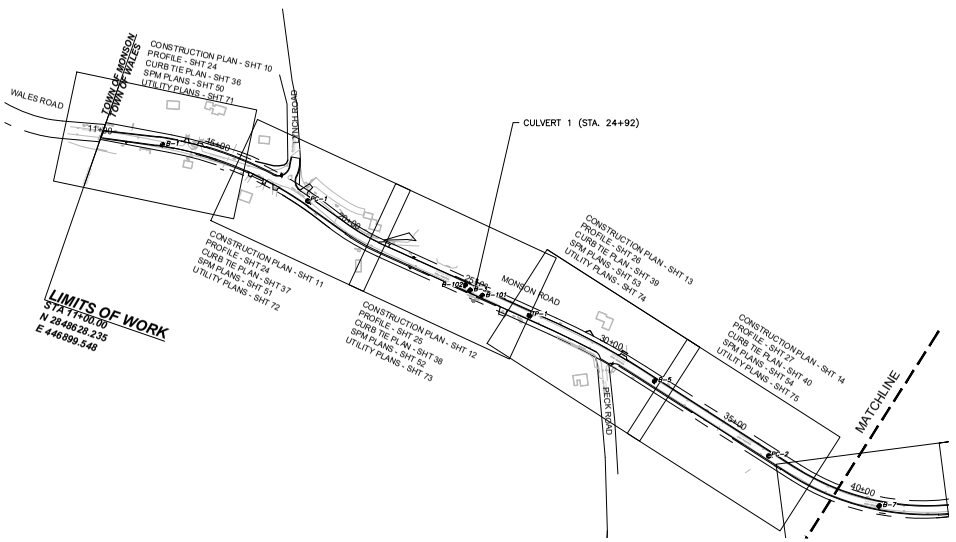
608163_HDI\TITLE_LEGEND, KEY & TYPICAL SECTIONS\401.DWG Plotted on 8-Aug-2024 11:59 AM

Project No. 608163.128127

A08840.415

NOTES:

1. BENCH MARK:
   MAGNAIL U.P.L. LOCATED EAST OF NORTH STREET AT STATION 12+79.94 AND EL. 869'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 21+37.43 AND EL. 877'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 29+56.65 AND EL 900'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 29+94.76 AND EL 902'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 38+22.13 AND EL 938'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 56+22.73 AND EL 957'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 65+94.25 AND EL 1007'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 74.95.16 AND EL 1022'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 81+31.62 AND EL 1006'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 87+05.97 AND EL 1008'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 87+15.35 AND EL 1001'



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

KEY PLAN

BORING LOCATIONS (FEET)

BORING	NORTHING	EASTING	STATION	OFFSET	SURFACE EL.	H.B.E.
B-1	2,848,584	447,074	12+80	22.4 RT	868.0	861.5
B-3	2,848,121	448,154	24+56	10.0 LT	877.0	865.2
B-5	2,847,789	448,792	31+89	10.8 LT	902.0	897.5
B-7	2,847,423	449,318	38+27	18.1 RT	941.0	937.0
B-9	2,847,397	450,584	51+05	9.6 LT	933.0	916.5
B-10	2,847,355	451,197	57+19	6.7 LT	956.0	951.5
B-11	2,847,315	451,727	62+51	14.1 LT	989.0	984.5
B-12	2,847,272	452,354	68+80	16.0 LT	1011.0	1007.0
B-13	2,847,294	452,969	74+98	19.4 LT	1019.0	1014.5
B-14	2,847,322	453,443	79+72	12.1 LT	1009.0	1004.5
B-15	2,847,355	454,092	86+37	9.1 LT	1002.0	999.1
B-101	2,848,098	448,155	24+80	4.2 RT	877.1	861.9
B-102	2,848,103	448,186	25+06	12.85 LT	877.5	849.0
B-104	2,847,316	454,080	86+09	20.6 RT	1002.4	974.4
B-105	2,847,367	454,110	85+59	11.0 RT	1001.8	987.7

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-138127
A08840.616

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
	CBCI	CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
	OHU	OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		EROSION AND SEDIMENT CONTROL BARRIER
		TREE LINE
		LIMITS OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT AREA BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
		SIGN AND POST
		SIGN AND DOUBLE POST

ABBREVIATIONS

GENERAL	
AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CBCI-DB	DOUBLE GRATE CATCH BASIN W/ CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN

ABBREVIATIONS (cont.)

GENERAL	
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCCE	REINFORCED CONCRETE CULVERT END
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STA
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
SWTU	STORMWATER TREATMENT UNIT
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
	SL	12"-WIDE STOP LINE
	SWL	6"-WIDE SOLID WHITE LINE
	DBYL	DOUBLE YELLOW LINE (2 - 6"-WIDE YELLOW LINES)

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

LEGEND, ABBREVIATIONS & GENERAL NOTES

GENERAL NOTES:

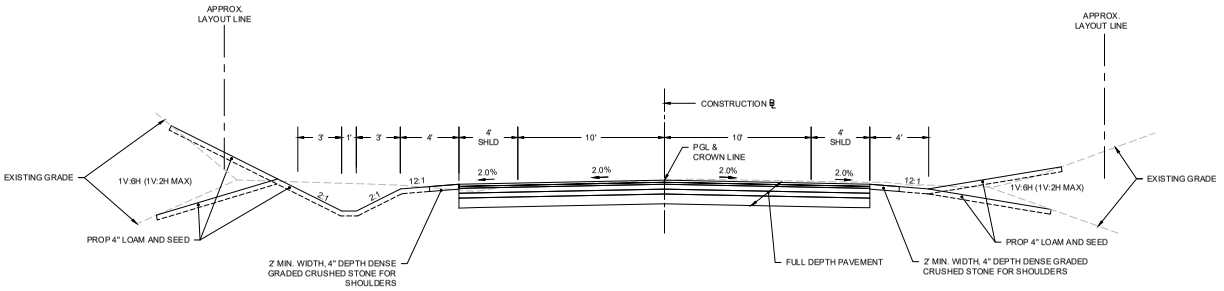
1. TOPOGRAPHICAL INFORMATION BASED ON AN ON-THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ON DECEMBER 2017 AND SUPPLEMENTED BY CHAPPELL ENGINEERING IN OCTOBER 2023. WETLAND FLAGGING WAS PERFORMED BY WESTON & SAMPSON IN NOVEMBER 2020 AND REFLAGGED IN SEPTEMBER OF 2023.
2. THE HORIZONTAL COORDINATES ARE BASED ON NAD 83, THE VERTICAL DATUM IS NAVD 88.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL DIG TEST PITS WITH THE LOCATIONS BEING APPROVED BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK TO EXACTLY LOCATE EXISTING UTILITIES.
4. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY OWNER. ANY ALTERATIONS SHALL BE INCIDENTAL TO THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY SUPPORT OF ALL UTILITIES TO REMAIN IN PLACE AND SHALL DESCRIBE IN WRITING, TO THE SATISFACTION OF THE ENGINEER, HIS METHOD OF TEMPORARY SUPPORT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. THE TERM "PROPOSED (PROP)" INDICATES WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET (R&R)".
8. ALL EXISTING STATE, COUNTY AND TOWN LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
9. ALL EXCESS MATERIAL FROM ROADWAY RECONSTRUCTION OR THE EXCAVATION PROCESS SHALL BE REUSED ON SITE OR REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL AND PROPER MANNER.
10. THE CONTRACTOR SHALL CALL DIGSAFE AT 1-888-344-7233 AT LEAST 72 HOURS, SATURDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE TOWN PRIOR TO EXCAVATION.
11. JOINTS BETWEEN HOT MIX ASPHALT TRENCH PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.
12. IF DEEMED NECESSARY DUE TO THE WORK, THE CONTRACTOR SHALL COORDINATE WITH THE TOWN OF WALES HIGHWAY DEPARTMENT, THE WALES FIRE DEPARTMENT, AND THE ENGINEER FOR APPROVAL OF SHUTTING DOWN ANY EXISTING WATER MAINS AND SHALL ALSO OBTAIN APPROVAL FOR DISRUPTING ANY EXISTING SEWER FLOWS.
13. THE CONTRACTOR SHALL BE AWARE THAT ONLY TOWN PERSONNEL ARE ALLOWED TO OPERATE WATER GATES AND HYDRANTS. ANY REQUESTS TO OPERATE THE GATES SHALL BE COORDINATED THROUGH THE ENGINEER.
14. THE CONTRACTOR SHALL COORDINATE ANY WORK FOR THE PROJECT WITH ALL ADJACENT/CONCURRENT PROJECTS AND CONTRACTORS.
15. THE CONTRACTOR SHALL INSTALL PRIOR TO COMMENCEMENT OF WORK, MAINTAIN, AND REMOVE AT THE END OF THE PROJECT INLET SEDIMENT CONTROL BAGS IN ALL CATCH BASINS, WITHIN OR ADJACENT TO THE PROJECT LIMITS. THE CONTRACTOR SHALL ALSO MAINTAIN SILT FENCE AND COMPOST FILTER TUBES AS SHOWN ON THE PLANS THROUGHOUT THE DURATION OF THE PROJECT AND REMOVE AT THE END.
16. ANY GRASS AREAS DISTURBED BY THE WORK SHALL BE RESTORED WITH LOAM AND SEED.
17. ANY LANDSCAPED AREAS DISTURBED BY THE WORK SHALL BE RESTORED TO EXISTING CONDITIONS WITH EXISTING OR NEW GROUND COVER MATERIALS AS DIRECTED BY THE ENGINEER. ANY PLANTS, SHRUBS, OR FLOWERS DISTURBED BY THE WORK SHALL BE RESET TO EXISTING CONDITIONS OR REPLACED WITH NEW PLANTS, SHRUBS, OR FLOWERS AS DIRECTED BY THE ENGINEER. ALL WORK TO RESTORE LANDSCAPE AREAS, NEW GROUND COVER MATERIALS, NEW PLANTS, NEW SHRUBS, OR NEW FLOWERS REQUIRED BY THE ENGINEER SHALL BE INCIDENTAL TO THE PROJECT.
18. CONTRACTOR TO COORDINATE WITH UTILITY POLE OWNERS IN AREAS WHERE UNDERGROUND UTILITY WORK IS WITHIN CLOSE PROXIMITY AND POSSIBLE UTILITY POLE SHORING IS REQUIRED WHILE INSTALLING PROPOSED UTILITIES.
19. RAISE AND ADJUST FRAMES AND GRATES, FRAMES AND COVERS AND GATE BOXES PRIOR TO PAVEMENT OVERLAY, IF REQUIRED.
20. CONTRACTOR IS RESPONSIBLE FOR REPLACING ANY PROPERTY PINS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION, TO THEIR LOCATION JUST PRIOR TO CONSTRUCTION.
21. ALL TRAFFIC SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS OTHERWISE NOTED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
22. CONTRACTOR TO ESTABLISH TEMPORARY BENCHMARKS EVERY 1000 FEET BASED ON THE PERMANENT BENCHMARKS LOCATED AT STA 29+85.04, 24.73 LEFT AND STA 87+27.18, 41.17 LEFT OR AS REQUIRED BY THE ENGINEER.
23. CONTRACTOR TO PROVIDE ADDITIONAL TRAVERSE POINTS AND TRAVERSE LINES IN THE VICINITY OF EXISTING TRAVERSE POINTS WHERE THE EXISTING TRAVERSE POINT IS LOCATED IN "SOFT GROUND" OR AS REQUIRED BY THE ENGINEER.
24. ALL EXISTING STONE WALLS PROPOSED FOR RELOCATION SHALL NOT BE REMOVED FROM THE IMMEDIATE AREA SHOWN ON THE PLANS.

608163_HD1\TITLE, LEGEND, KEY & TYPICAL SECTIONS.DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-128112
608163_417

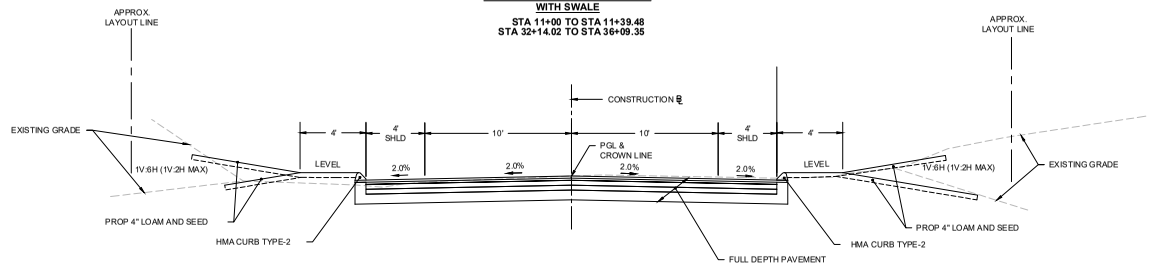
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

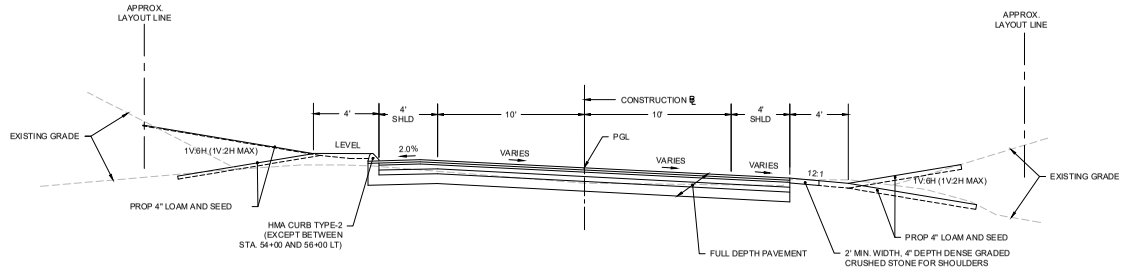
TYPICAL SECTIONS



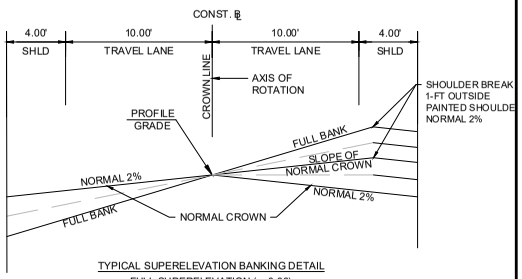
MONSON ROAD TYPICAL SECTION
WITH SWALE
STA 11+00 TO STA 11+39.48
STA 32+14.02 TO STA 36+09.35



MONSON ROAD TYPICAL SECTION
WITH CURBING
STA 22+70.43 TO STA 26+98.72
STA 57+46.79 TO STA 64+41.04
STA 75+70.50 TO STA 77+39.51



MONSON ROAD TYPICAL SECTION
FULL SUPERELEVATION AND TRANSITIONS
STA 11+39.48 TO STA 22+70.43
STA 26+98.72 TO STA 32+14.02
STA 36+09.35 TO STA 57+46.79
STA 64+41.04 TO STA 75+70.50
STA 77+39.51 TO STA 88+00



TYPICAL SUPERELEVATION BANKING DETAIL
FULL SUPERELEVATION (e=0.06)
N.T.S.

PAVEMENT NOTES

PROPOSED PAVEMENT MILLING AND OVERLAY:

1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.50" PAVEMENT MILLING

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).

BASE COURSE: 3.25" SUPERPAVE INTERMEDIATE COURSE 19 (SIC-19.0) PLACED IN ONE LAYER.

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT A RATE OF 0.07 TO 0.09 GAL/SY OVER MILLED SURFACES AND 0.06 TO 0.08 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY :

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2.50" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5)

FOUNDATION: 8" GRAVEL BORROW, TYPE B

PROPOSED GRAVEL DRIVEWAY:

8" GRAVEL BORROW, TYPE B

PROPOSED CEMENT CONCRETE WALK

4" CEMENT CONCRETE OVER

8" GRAVEL BORROW, TYPE B

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-136127
608163_418

HIGHWAY GUARD DETAILS

STA 14+65 TO STA 14+78 LT TANGENT END TREATMENT TL-3
STA 14+78 TO STA 16+88 LT (TL-3)
STA 14+50 TO STA 14+63 RT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	QTY (MASTER TOTAL)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	13	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	27	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	13	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

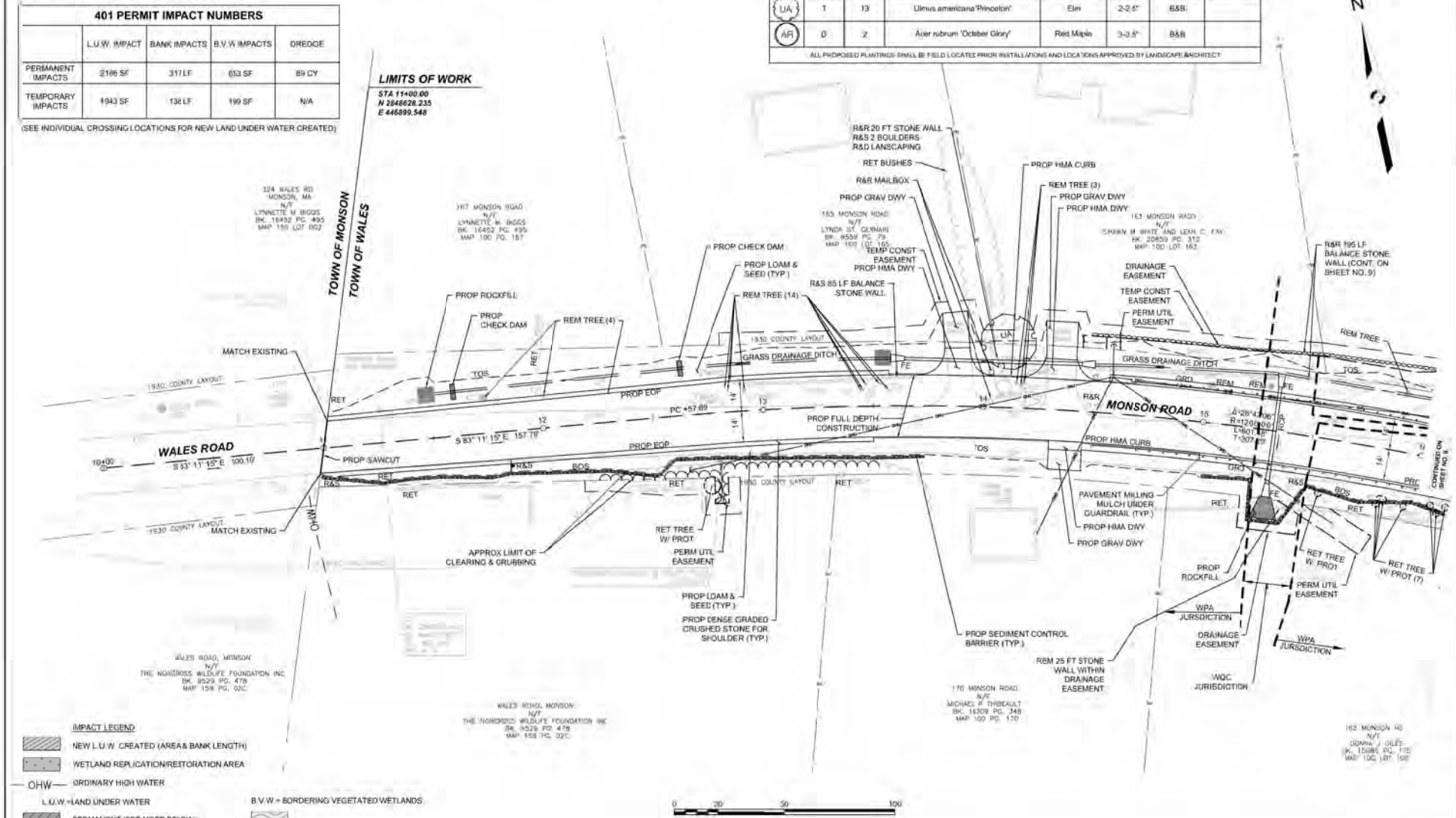
STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP(HSIP)-0032(043)X		
	PROJECT FILE NO.	608163	

CONSTRUCTION PLANS

401 PERMIT IMPACT NUMBERS

	L.U.W. IMPACT	BANK IMPACTS	B.V.W IMPACTS	DREDGE
PERMANENT IMPACTS	2186 SF	317 LF	653 SF	89 CY
TEMPORARY IMPACTS	1943 SF	138 LF	199 SF	N/A

(SEE INDIVIDUAL CROSSING LOCATIONS FOR NEW LAND UNDER WATER CREATED)



IMPACT LEGEND

NEW L.U.W. CREATED (AREA & BANK LENGTH)

WETLAND REPLICATION/RESTORATION AREA

OHW ORDINARY HIGH WATER

L.U.W. = LAND UNDER WATER

PERMANENT (SEE NOTE BELOW)

TEMPORARY

B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

FOR PROFILE SEE SHEET NO. 22

Addendum #3
Proposal No. 608163 (38)12

HIGHWAY GUARD DETAILS

STA 14+78 TO STA 16+88 LT (TL-3)
STA 16+88 TO STA 17+00 LT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)
STA 16+02 TO STA 16+14 RT TANGENT END TREATMENT TL-3
STA 20+25 TO STA 20+37 RT TANGENT END TREATMENT TL-3
STA 20+37 TO STA 23+10 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

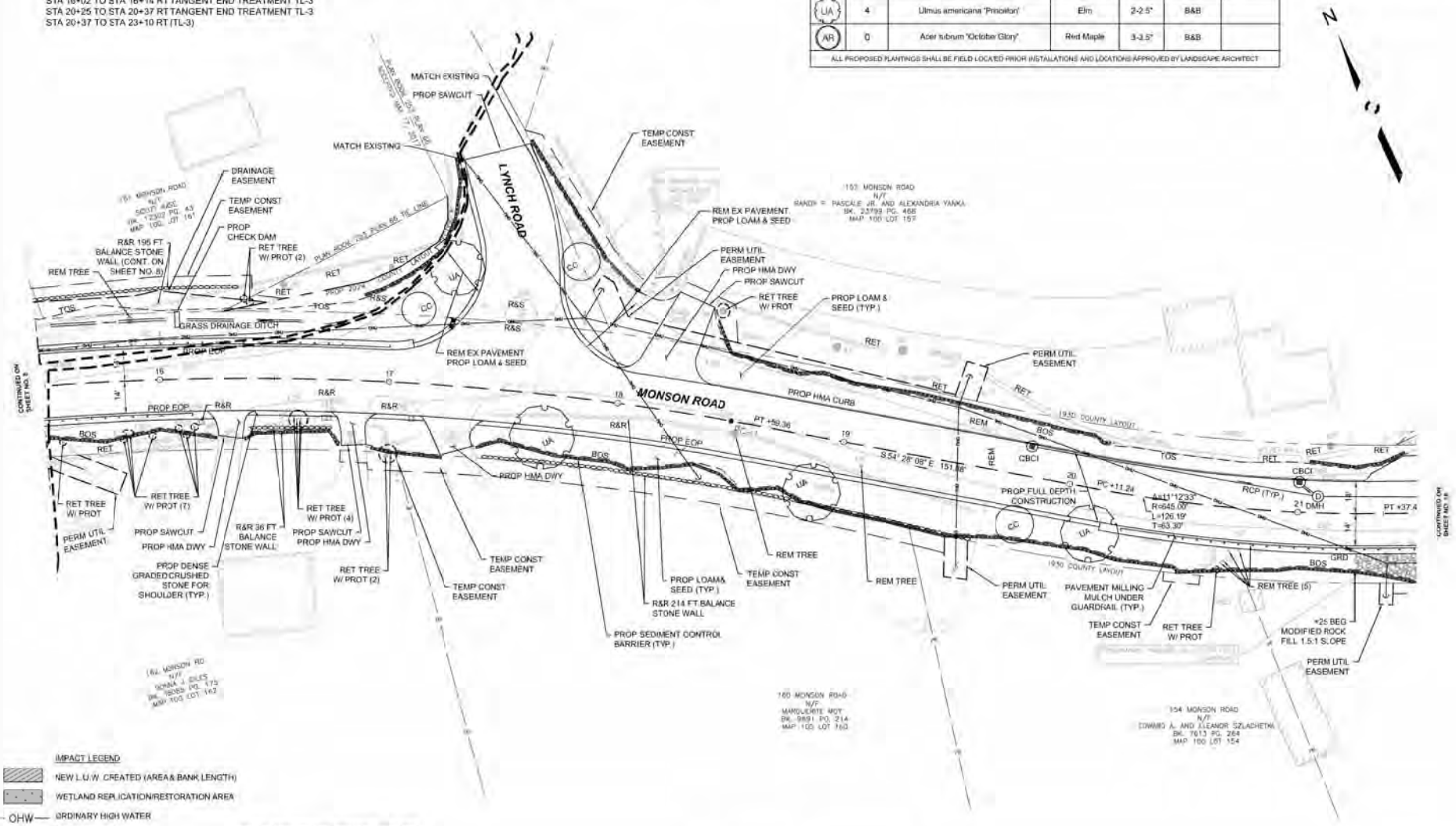
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	4	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



IMPACT LEGEND

NEW L.U.W. CREATED (AREA & BANK LENGTH)

WETLAND REPLICATION/RESTORATION AREA

OHW ORDINARY HIGH WATER

L.U.W. = LAND UNDER WATER

PERMANENT (SEE NOTE BELOW)

TEMPORARY

B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

FOR PROFILE SEE SHEET NO. 22

Proposal No. 608163 (82)12

HIGHWAY GUARD DETAILS

STA 20+37 TO STA 23+10 RT (TL-3)
STA 23+10 TO STA 23+22 RT TANGENT END TREATMENT TL-3
STA 23+86 TO STA 23+98 RT TANGENT END TREATMENT TL-3
STA 23+98 TO STA 25+61 RT (TL-3)
STA 24+25 TO STA 24+37 RT TANGENT END TREATMENT TL-3
STA 24+25 TO STA 24+37 LT TANGENT END TREATMENT TL-3
STA 24+37 TO STA 24+77 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 24+37 TO STA 24+77 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+46 TO STA 25+60 RT (TL-3)
STA 25+46 TO STA 25+79 LT (TL-3)
STA 25+60 TO STA 25+72 RT TANGENT END TREATMENT TL-3
STA 25+79 TO STA 25+91 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

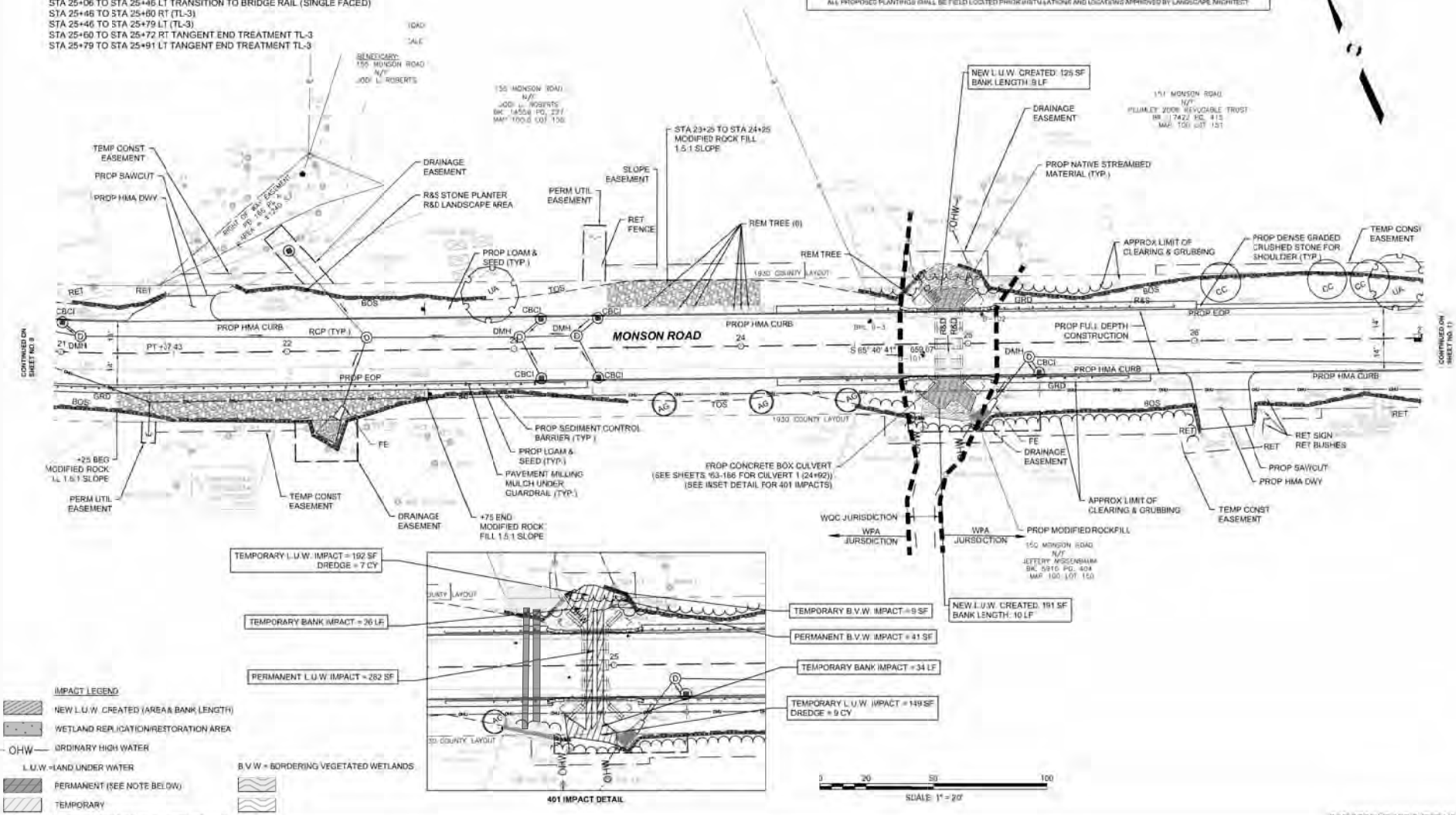
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR TO INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CONSTRUCTION PLANS



401 IMPACT DETAIL

IMPACT LEGEND
- NEW L.U.W. CREATED (AREA & BANK LENGTH)
- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- L.U.W. = LAND UNDER WATER
- PERMANENT (SEE NOTE BELOW)
- TEMPORARY
- B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 23

HIGHWAY GUARD DETAILS
STA 42+75 TO STA 42+87 RT TANGENT END TREATMENT TL-3
STA 42+87 TO STA 43+86 RT (TL-3)

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

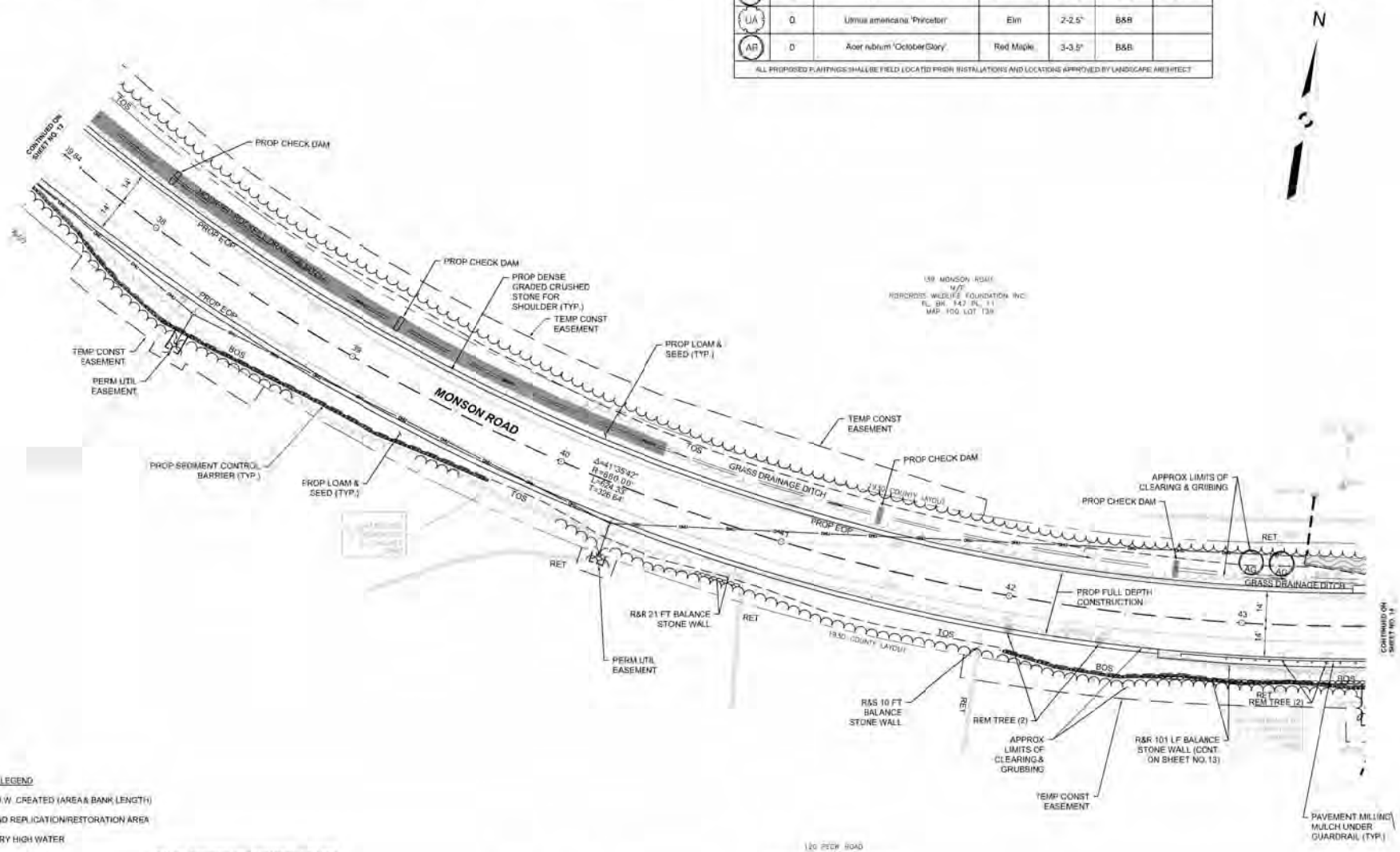
TREES	QTY. (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'OctoberGlory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

CONSTRUCTION PLANS



IMPACT LEGEND

NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT (SEE NOTE BELOW)
TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

FOR PROFILE SEE SHEET NO. 26

Proposal No. 608163(128)12

HIGHWAY GUARD DETAILS
STA 42+87 TO STA 43+86 RT (TL-3)
STA 43+86 TO STA 43+98 RT TANGENT END TREATMENT TL-3
STA 43+57 TO STA 43+70 LT TANGENT END TREATMENT TL-3
STA 43+70 TO STA 44+57 LT (TL-3)
STA 44+57 TO STA 44+70 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	6	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	2-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT.

WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

135 MONSON ROAD
N/F
NORCROSS WILDLIFE FOUNDATION, INC.
BK. 9082 PG. 212
MAP 100 MAP 135

111 MONSON ROAD
N/F
STANLEY (AND BARBARA) KUSTRA
BK. 5611 PG. 309
MAP 100 LOT 111

PERMANENT B.V.W. IMPACT = 243 SF
TEMPORARY L.U.W. IMPACT = 44 SF
TEMPORARY BANK IMPACT = 8 LF
PERMANENT L.U.W. IMPACT = 35 SF
PERMANENT BANK IMPACT = 285 LF
PERMANENT L.U.W. IMPACT = 1231 SF
PROP LOAM & SEED (TYP.)
TEMP CONST EASEMENT
12" RCP - CLASS V REM EXIST PIPE
PROP HMA DWY
APPROX LIMITS OF CLEARING & GRUBBING
FE
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP GRAV DWY
PROP HMA DWY
TEMP CONST EASEMENT
PROP GRAV DWY
RET
FE (2)
1930 COUNTY LAYOUT
1931 COUNTY LAYOUT
GRASS DRAINAGE DITCH
PROP EOP
N 81° 03' 14" E 250.18'
PROP FULL DEPTH CONSTRUCTION
PC=14+35
MONSON ROAD
Δ=15°45'55"
R=1300.00'
L=357.70'
T=179.99'
PROP HMA CURB
RCP (TYP.)
TDS
CBCI
DMH
REM
R&S
BOS
REM TREE (2)
TEMP CONST EASEMENT
PERMANENT L.U.W. IMPACT = 55 SF
PERMANENT BANK IMPACT = 14 LF
PROP 12" RCP FLARED ENDS
TEMPORARY L.U.W. IMPACT = 215 SF
R&R 103 LF BALANCE STONE WALL
APPROX LIMITS OF CLEARING & GRUBBING
PROP LOAM & SEED (TYP.)
R&S 12 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
TEMP CONST EASEMENT
DRAINAGE EASEMENT
PERMANENT B.V.W. IMPACT = 19 SF
PERMANENT L.U.W. IMPACT = 41 SF
TEMPORARY BANK IMPACT = 12 LF
PROP MODIFIED ROCKFILL
PERMANENT B.V.W. IMPACT = 31 SF
TEMPORARY L.U.W. IMPACT = 69 SF
TEMP CONST EASEMENT
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PROP SEDIMENT CONTROL BARRIER (TYP.)
DRAINAGE EASEMENT
PROP MODIFIED ROCKFILL
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 101 FT BALANCE STONE WALL (CONT. ON SHEET NO. 12)
TEMPORARY BANK IMPACT = 13 LF

CONTINUED ON SHEET NO. 15
CONTINUED FROM SHEET NO. 13

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY, INC.
BK. 2052 PG. 38
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 183
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 130

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT (SEE NOTE BELOW)
TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 26

Proposal No. 608163 (38)12

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

121 MONSON ROAD
N/F
MICHAEL P. & VIRGINIA S. LITO
Bk. 8951 Pg. 267
MAP 100 LOT 121

ACCEPTED MAY 17, 2011

ACCEPTED MAY 17, 2011

MAYNARD ROAD

R&R 132 FT BALANCE STONE WALL
TEMP CONST EASEMENT
RET CBLP
REM TREE
RET CBLP
PROP GRAV DWY
MATCH EXISTING
PROP HMA DWY
REM TREE
RET TREE W/ PROT
OHW
1971 COUNTY LAYOUT
1932 COUNTY LAYOUT
BOS
CBCI
RET CONC. POST
RET TREE W/ PROT
PROP LOAM & SEED (TYP.)
MATCH EXISTING
PROP HMA DWY
TEMP CONST EASEMENT
R&R 127 LF BALANCE STONE WALL
WETLAND RESTORATION AREA 1 = 217 SF ±
NOTE: SEE WETLAND SEED MIX ON SHEET 18b AND SEE SPECIAL PROVISION.
PROP LOAM & SEED (TYP.)
APPROX LIMITS OF CLEARING & GRUBBING
RET
CBCI
PROP HMA CURB
R&S
BOS
MONSON ROAD
PROP FULL DEPTH CONSTRUCTION
DMH
CBCI
PROP HMA CURB
R&S
BOS
RET
CBCI
DMH
CONTINUED ON SHEET NO.15
CONTINUED ON SHEET NO.17
54
55
56
57
58
59
60
14"
S89° 18' 18" E 130.61'
PC +09.11
Δ=4°26'52"
R=1680.00'
L=131.40'
T=65.73'
PT +40.51
R&R
Bnk 5-10
TP-2
RCP (TYP.)
DMH
CBCI
BOS
105
OHW
1971 COUNTY LAYOUT
RET
1932 COUNTY LAYOUT
APPROX LIMITS OF CLEARING & GRUBBING
PERM UTIL EASEMENT
TEMP CONST EASEMENT
THE PROPOSED TREELINE REPRESENTS LIMITED OVER-HEAD TREE CANOPY TRIMMING ONLY ALONG THE EXISTING OVERHEAD UTILITY LINES. NO DIRECT GROUND WETLAND IMPACTS ARE PROPOSED OR REQUIRED.
PERM UTIL EASEMENT
TEMP CONST EASEMENT
PROP SEDIMENT CONTROL BARRIER (TYP.)
PROP LOAM & SEED (TYP.)
R&R 7 FT. BALANCE STONE WALL

100 PECK ROAD
N/F
MONARDISS WILDLIFE SANCTUARY INC.
Bk. 2082 Pg. 58
Bk. 2099 Pg. 244
Bk.2158 Pg. 302
Bk. 2168 Pg. 103
Bk. 2433 Pg. 283
Bk. 2815 Pg. 564
Bk. 3184 Pg. 417
Bk. 3217 Pg. 19
MAP 100 LOT 120

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
PERMANENT (SEE NOTE BELOW)
TEMPORARY
B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 28

608163_424
Proposal No. 608163(SB)212

HIGHWAY GUARD DETAILS

STA 80+08 TO STA 80+21 RT TANGENT END TREATMENT TL-3
STA 80+21 TO STA 82+59 RT (TL-3)
STA 81+79 TO STA 81+92 LT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	2	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	4	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'Octocer Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATION AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS

N

APPROX LIMITS OF CLEARING & GRUBBING
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP LOAM & SEED (TYP.)
PROP GRAV DWY
PROP HMA DWY
PROP SAWCUT
RET TREE W/ PROT
RET TREE W/ PROT (2)
PERM DRAINAGE EASEMENT
PROP CONCRETE HEADWALL
PROP HMA CURB
MONSON ROAD
PROP FULL DEPTH CONSTRUCTION
PROP EOP
TOS
BOS
RET
CBCI
DMH
RCP (TYP.)
R&R 82 FT BALANCE STONE WALL
PROP SEDIMENT CONTROL BARRIER (TYP.)
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PAVEMENT MILLING - MUCH UNDER GUARDRAIL (TYP.)
R&R 22 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
PROP CROSSING (SEE SHEETS 167-168 CULVERT 2 (82+07))
SEE IN SET DETAIL FOR 401 IMPACTS
NEW L.U.W. CREATED: 17 SF
BANK LENGTH: 5 LF
PC +57.91
PT +65.84
N 85° 07' 15" E 380.75'
1932 COUNTY LAYOUT
1933 COUNTY LAYOUT
PROP 2024 COUNTY LAYOUT SECTION 2
END OF 1932 COUNTY LAYOUT SECTION 2 BEGINNING OF 1933 COUNTY LAYOUT
89 MONSON ROAD N/F RICHARD R. JENKINS BK. 10698 PG. 155 MAP 100 LOT 89
87 MONSON ROAD N/F ALLAN M. COOLONG BK. 10927 PG. 426 MAP 100 LOT 87
100 PECK ROAD N/F NORCROSS WILDLIFE SANCTUARY INC BK. 2062 PG. 39 BK. 2099 PG. 244 BK.2158 PG. 397 BK. 2168 PG. 192 BK. 2433 PG. 282 BK. 2815 PG. 554 BK. 3184 PG. 401 BK. 3217 PG. 19 MAP 100 LOT 120
CONTINUED ON SHEET NO. 19
CONTINUED ON SHEET NO. 31

401 IMPACT DETAIL

TEMPORARY B.V.W. IMPACT = 39 SF
PERMANENT B.V.W. IMPACT 26 SF
PERMANENT L.U.W. IMPACT = 43 SF
TEMPORARY L.U.W. IMPACT = 35 SF
TEMPORARY BANK IMPACT 6 LF
PERMANENT B.V.W. IMPACT 10 SF
TEMPORARY B.V.W. IMPACT = 15 SF
TEMPORARY B.V.W. IMPACT 19 SF
TEMPORARY L.U.W. IMPACT= 53 SF DREDGE VOLUME = 3 CY
PERMANENT B.V.W. IMPACT = 33 SF
TEMPORARY BANK IMPACT 8 LF
PERMANENT B.V.W. IMPACT = 6 SF
TEMPORARY B.V.W. IMPACT = 7 SF
OHW
1933 COUNTY LAYOUT

IMPACT LEGEND

NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
PERMANENT (SEE NOTE BELOW)
TEMPORARY
B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 32

Proposal No. 608163-122122

HIGHWAY GUARD DETAILS

STA 80+21 TO STA 82+59 RT (TL-3)
STA 82+59 TO STA 82+72 RT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)
STA 82+92 TO STA 83+04 LT TANGENT END TREATMENT TL-3
STA 84+54 TO STA 84+66 RT TANGENT END TREATMENT TL-3
STA 84+66 TO STA 85+84 RT (TL-3)
STA 85+64 TO STA 86+04 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+43 TO STA 1+83 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+83 TO STA 2+07 RT (TL-3)
STA 02+07 TO STA 02+20 RT TANGENT END TREATMENT TL-3

STA 02+20 TO STA 02+07 LT TANGENT END TREATMENT TL-3
STA 02+07 TO STA 87+79 RT (TL-3)
STA 87+79 TO STA 87+92 RT TANGENT END TREATMENT TL-3
STA 87+02 TO STA 87+42 LT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 87+42 TO STA 87+87 LT (TL-3)
STA 87+87 TO STA 88+00 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	5	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

401 IMPACT DETAIL

TEMPORARY BANK IMPACT 11 LF
TEMPORARY L.U.W. IMPACT = 90 SF
PERMANENT L.U.W. IMPACT = 108 SF
PERMANENT L.U.W. IMPACT = 216 SF
PERMANENT BANK IMPACT 18 LF
PERMANENT L.U.W. IMPACT = 195 SF
DREDGE VOLUME = 6 CY

LIMITS OF WORK
STA 88+00+.00
N 2847443.733
E 454226.983

TEMP CONST EASEMENT
DRAINAGE EASEMENT
93 MONSON ROAD N/F CHRISTINE M. GIANDIS BK. 3876 PG. 363 MAP 100 LOT 93

TEMPORARY L.U.W. IMPACT = 1031 SF
DREDGE VOLUME = 80 CY
BANK IMPACT = 54 LF
NEW L.U.W. CREATED 477 SF
BANK LENGTH 60 LF

STA 88+53.83 MONSON RD = STA 1+00.00 REED HILL ROAD
N 2847355.444
E 454111.012

PROP BOX CULVERT
(SHEETS 169-171 CULVERT 3 (86+45))
INSET DETAILS FOR 401 IMPACTS)

MATCH EXISTING
PROP PAVEMENT MILLING AND RESURFACING
25' PAVEMENT TRANSITION
R&S BOLLARD (9)
APPROX LIMITS OF CLEARING & GRUBBING
TEMP CONST EASEMENT
100 MONSON ROAD N/F DIANE L. AND DENNIS MONETTE BK. 21808 PG. 47 MAP 100 LOT 100

LIMITS OF WORK
STA 2+20.00
N 2847299.213
E 454204.815

PROP UTIL EASEMENT
TEMP CONST EASEMENT
DRAINAGE EASEMENT
25' PAVEMENT TRANSITION
PLAN BOOK 250 PLAN 70 (SHOWN GRAPHICALLY)
LAYOUT PER MGL CHAPTER 82, SECTION 2 ACCEPTED MAY 17, 2017
MATCH EXISTING
REED HILL ROAD 2+85.20
N 89° 39' 48" E 51.84'
PT +93.57

R&S BOLLARD (7)
PROP SAWCUT
PROP HMA DWY
12" RCP TYP.
TEMP CONST EASEMENT
APPROX LIMIT OF CLEARING & GRUBBING
PROP LOAM & SEED (TYP.)
PROP HMA DWY
PROP SAWCUT
MONSON ROAD
S 84° 57' 39" E 247.63'
PC +13.27
PROP FULL DEPTH CONSTRUCTION
PROP HMA CURB
PROP EOP
TOS
R&S
R&R
CONTINUED ON SHEET NO. 32
PROP LOAM & SEED (TYP.)
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 65 FT BALANCE STONE WALL
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
TEMP CONST EASEMENT
APPROX LIMIT OF OF CLEARING & GRUBBING
PROP SEDIMENT CONTROL BARRIER (TYP.)
WETLAND REPLICATION AREA 1 = 1204 SF ±
R&S 12 FT BALANCE STONE WALL
WPA JURISDICTION
BANK IMPACT = 7 LF
DRAINAGE EASEMENT
TEMPORARY L.U.W. IMPACT = 65 SF
DREDGE VOLUME = 4 CY
TEMPORARY B.V.W. IMPACT = 86 SF
PERMANENT B.V.W. IMPACT = 72 SF
TEMPORARY B.V.W. IMPACT = 24 SF
PERMANENT B.V.W. IMPACT = 176 SF
WPA JURISDICTION
NEW L.U.W. CREATED 541 SF
BANK LENGTH 68 LF
PROP SAWCUT
MATCH EXISTING
PROP PAVEMENT MILLING AND RESURFACING
TEMP CONST EASEMENT
PAVEMENT MILLING MULCH UNDER GUARDRAIL

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW — ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
PERMANENT (SEE NOTE BELOW)
TEMPORARY
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT
TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 33

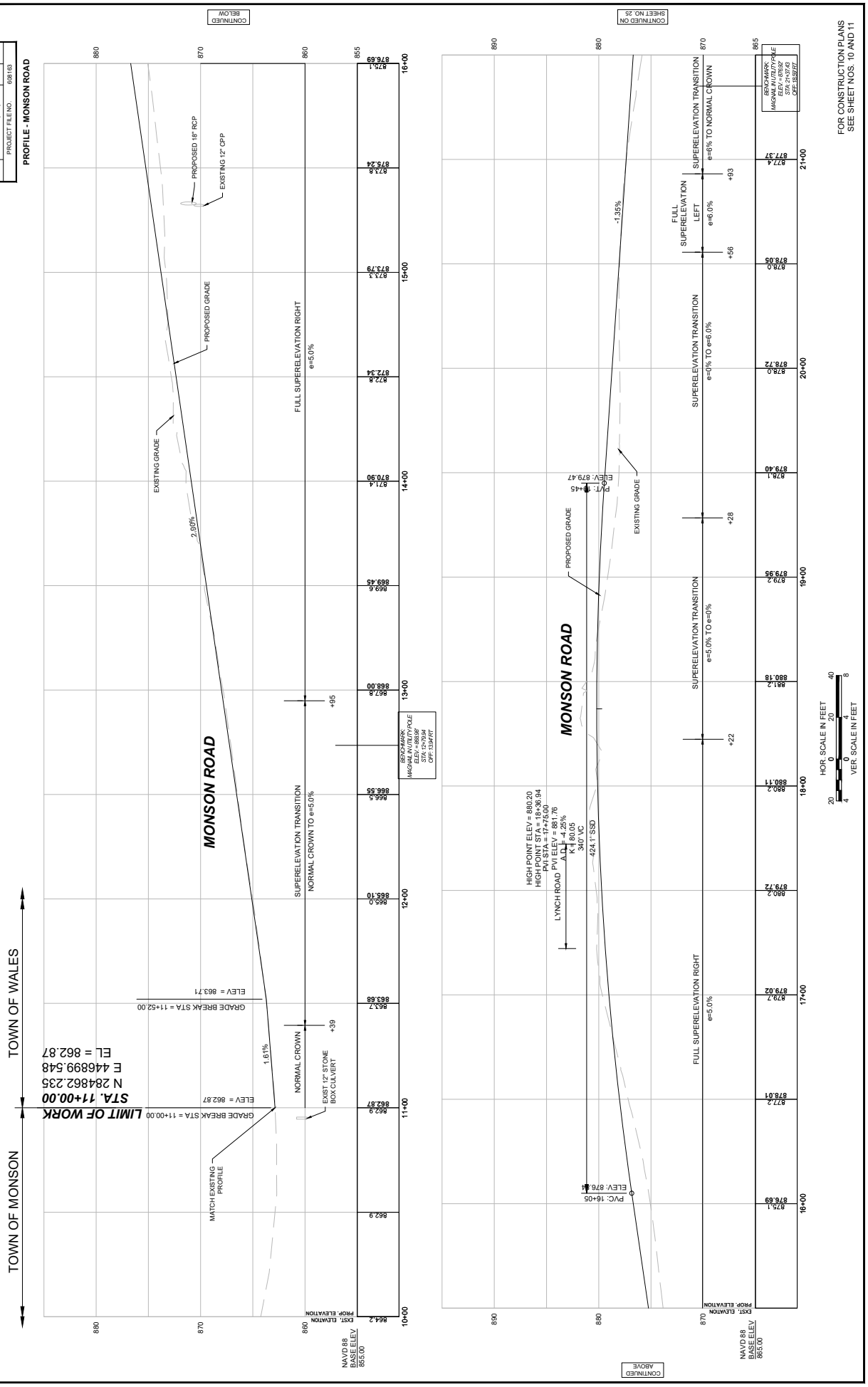
Proposal No. 608163-128212

608163_HD&PROFILE).DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



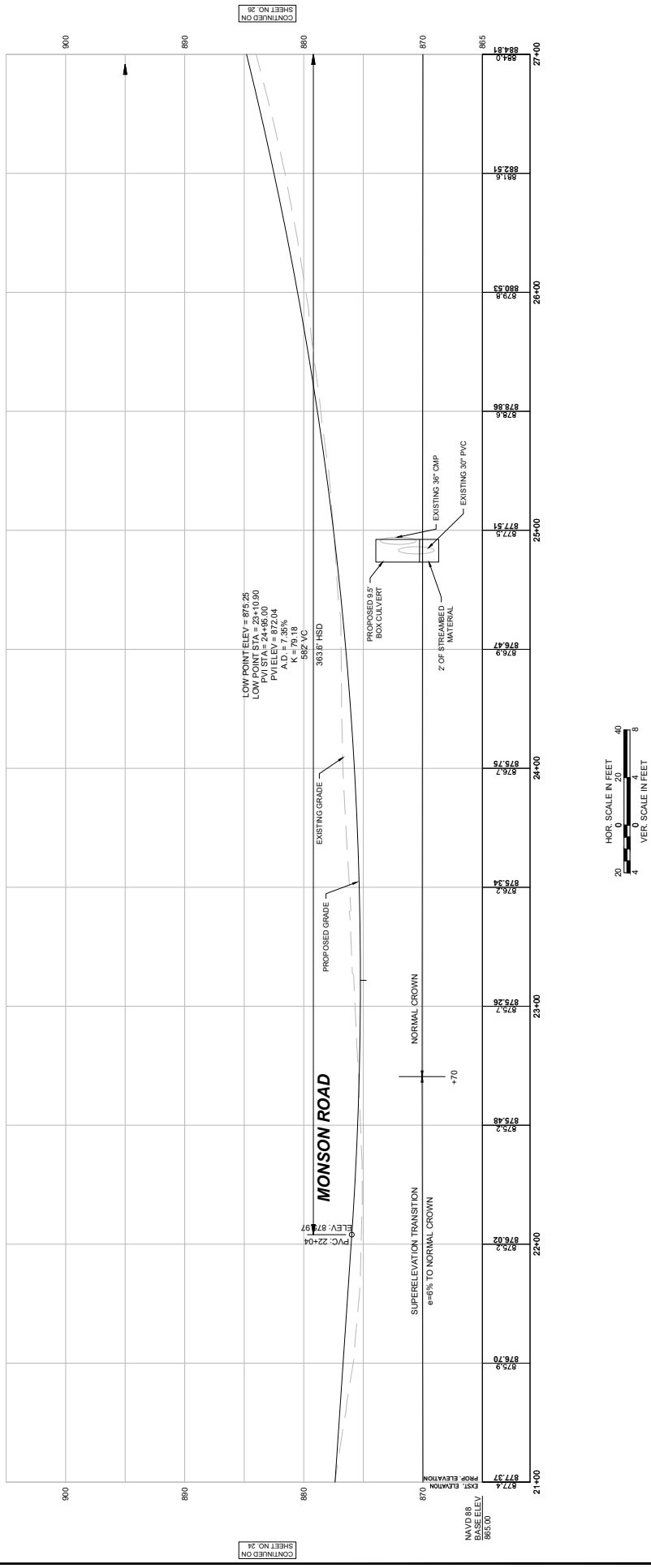
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 12

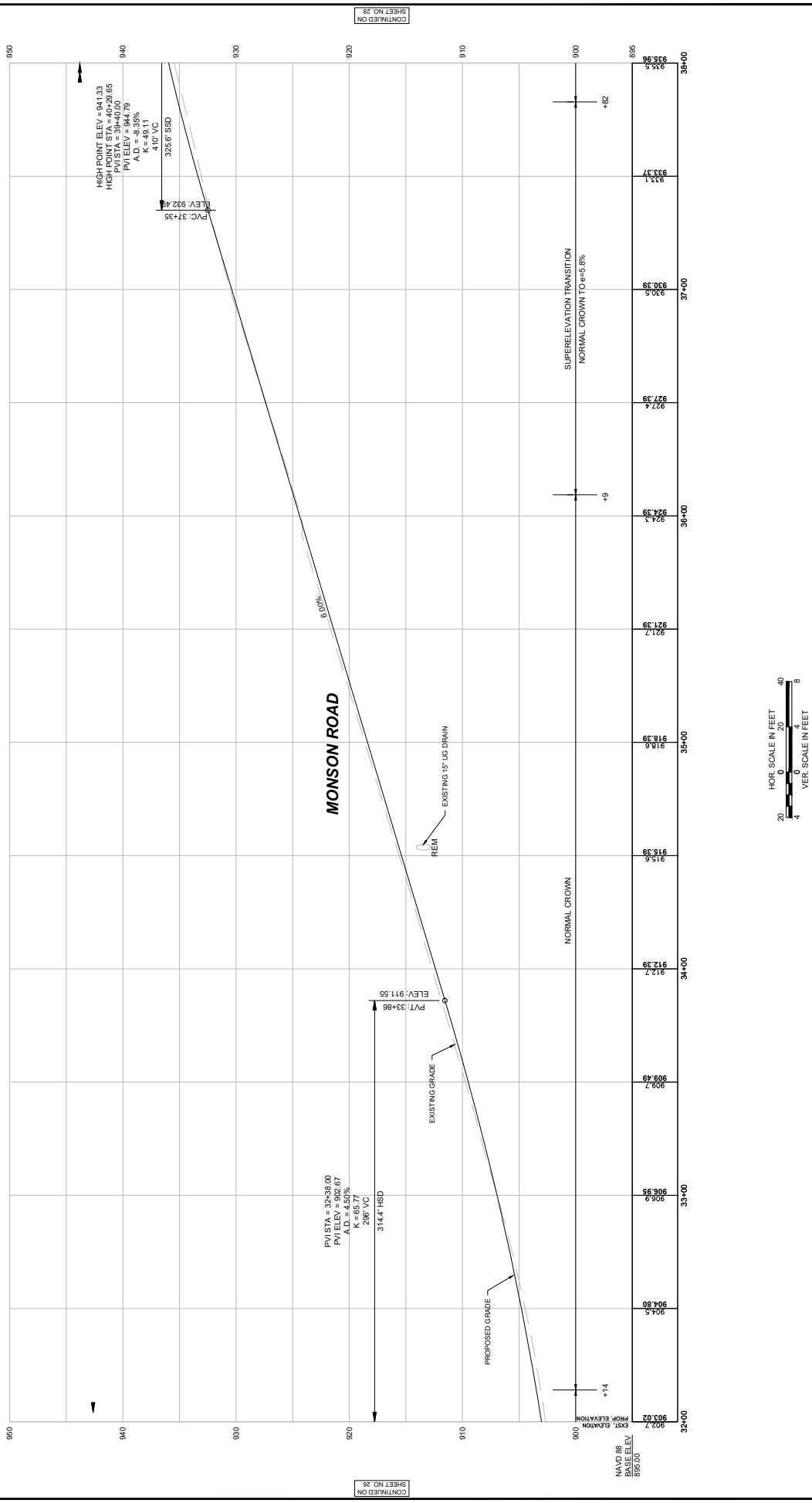


608163_HDAPROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

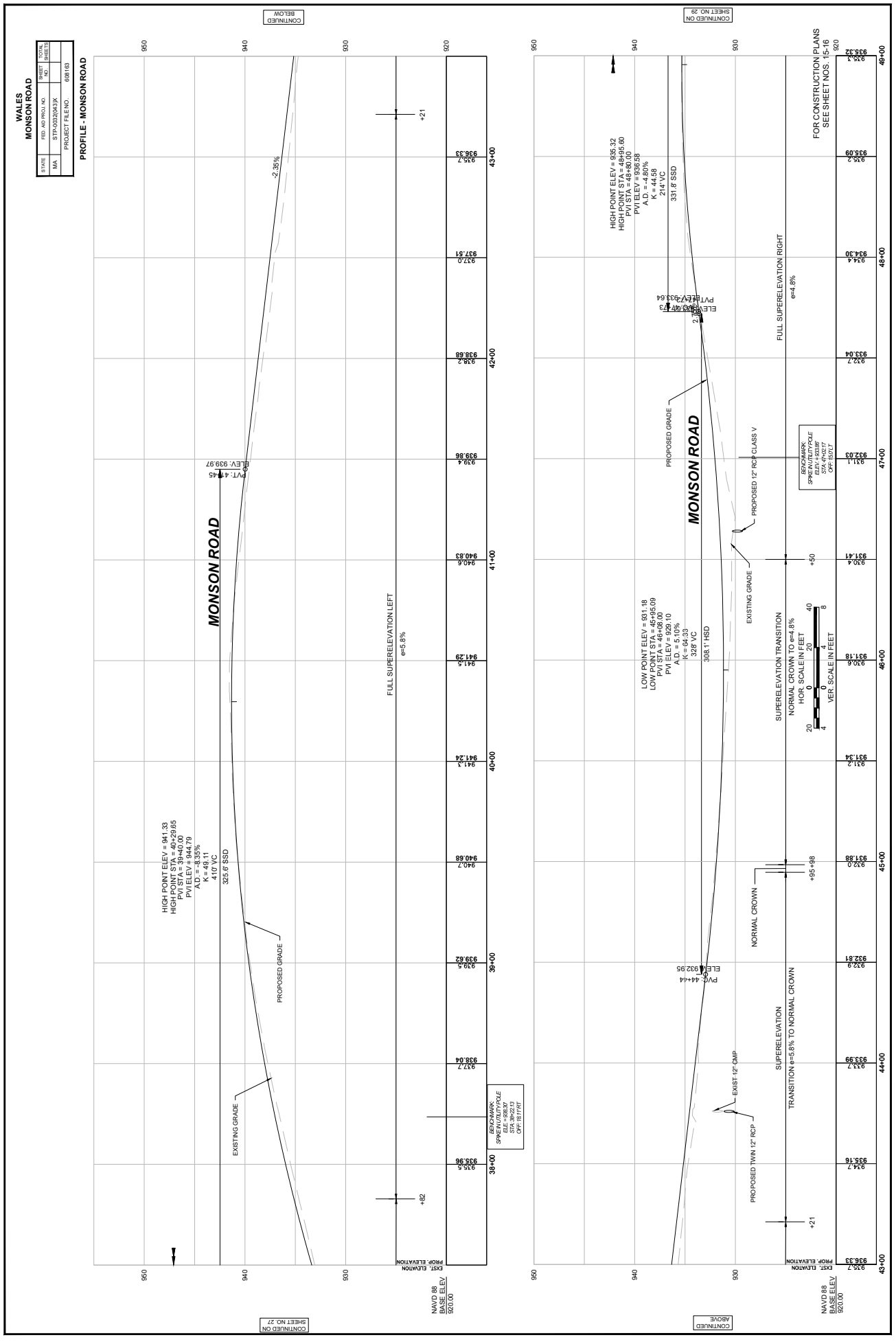
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 14


608163_HDAPROFILE.DWG Plotted on 5-Aug-2024 10:45 AM
WALES
MONSON ROAD
PROFILE - MONSON ROAD
STATE: MA
FED. AID PROJ. NO.: STP-0032(043)X
PROJECT FILE NO.: 608163
SHEET NO.:
TOTAL SHEETS:
CONTINUED BELOW
CONTINUED ON SHEET NO. 27
CONTINUED ON SHEET NO. 29
CONTINUED ABOVE
FOR CONSTRUCTION PLANS SEE SHEET NOS. 15-16
MONSON ROAD
HIGH POINT ELEV = 941.33
HIGH POINT STA = 40+29.65
PVI STA = 39+40.00
PVI ELEV = 944.79
A.D. = -8.35%
K = 49.11
410' VC
325.6' SSD
PVC: 41+45
ELEV. 939.97
-2.35%
PROPOSED GRADE
EXISTING GRADE
FULL SUPERELEVATION LEFT
e=5.8%
+82
+21
BENCHMARK
SPIKE IN UTILITY POLE
ELE. = 938.37
STA. 39+27.13
OFF: 18.11 RT
LOW POINT ELEV = 931.18
LOW POINT STA = 45+95.09
PVI STA = 46+08.00
PVI ELEV = 929.10
A.D. = 5.10%
K = 64.33
326' VC
308.1' HSD
HIGH POINT ELEV = 935.32
HIGH POINT STA = 48+95.60
PVI STA = 49+60.00
PVI ELEV = 936.68
A.D. = 4.80%
K = 44.58
214' VC
331.8' SSD
PVT: 48+47.3
ELEV. 933.64
PROPOSED GRADE
EXISTING GRADE
PROPOSED 12" RCP CLASS V
FULL SUPERELEVATION RIGHT
e=4.8%
BENCHMARK
SPIKE IN UTILITY POLE
ELEV. = 933.88'
STA. 47+02.17
OFF: 18.01 LT
SUPERELEVATION TRANSITION
NORMAL CROWN TO e=4.8%
HOR. SCALE IN FEET
0 20 40
VER. SCALE IN FEET
4 0 4 8
+95.98
+50
NORMAL CROWN
PVC: 44+44
ELEV. 932.95
EXIST. 12" CMP
PROPOSED TWIN 12" RCP
SUPERELEVATION
TRANSITION e=5.8% TO NORMAL CROWN
+21
EXIST. ELEVATION
PROP. ELEVATION
NAVD 88
BASE ELEV
920.00
938.33
937.51
938.68
939.86
941.29
941.24
940.83
940.68
939.62
938.04
935.96
935.32
934.30
933.04
932.03
931.41
931.18
931.34
932.81
933.99
935.16
935.09
934.30
933.04
932.03
931.41
930.4
931.18
930.68
932.0
932.9
933.7
934.7
935.2
935.32
935.7
935.5
937.7
939.5
941.5
940.6
939.4
938.2
937.0
935.7
38+00
39+00
40+00
41+00
42+00
43+00
44+00
45+00
46+00
47+00
48+00
49+00

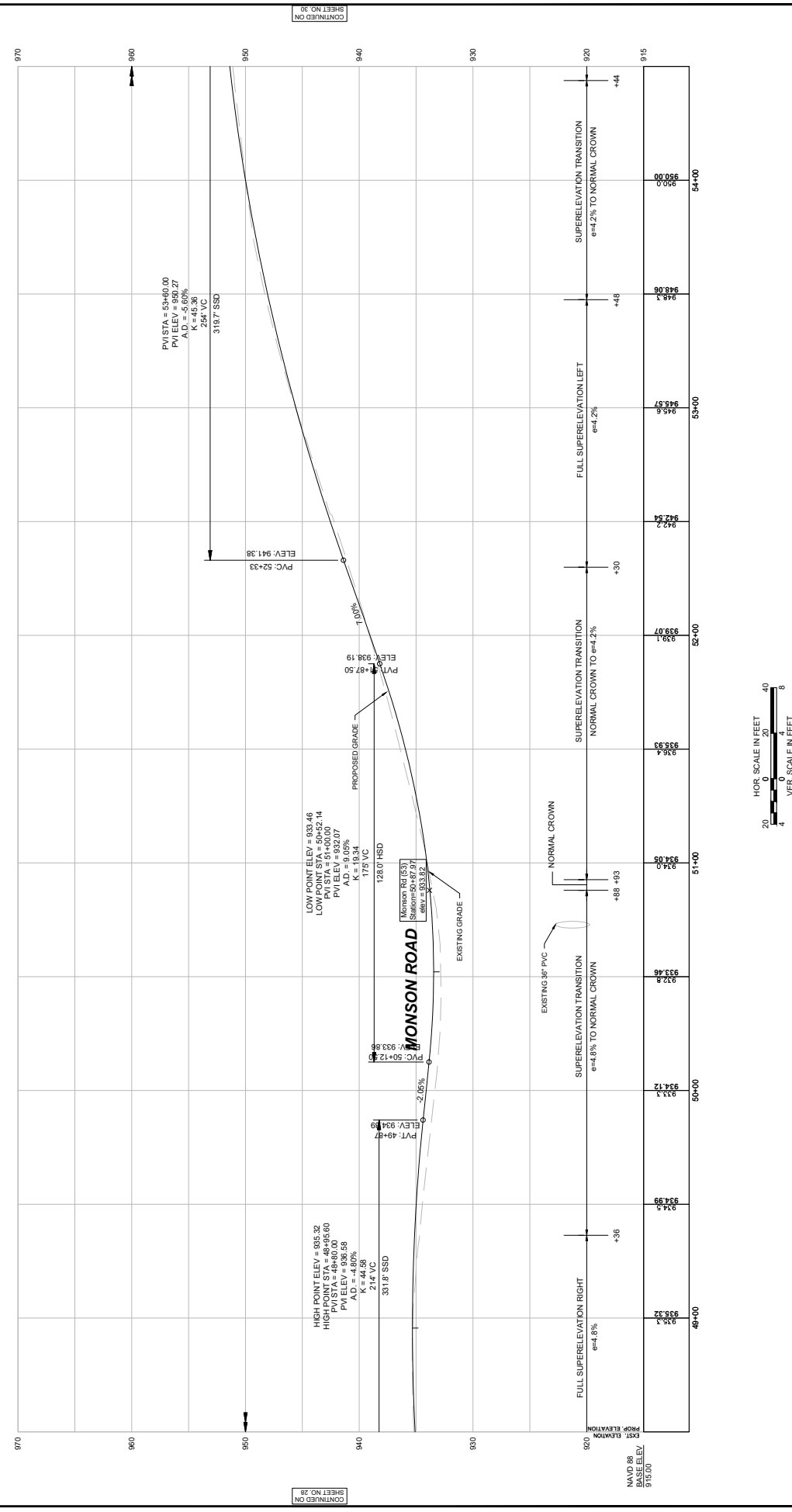
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

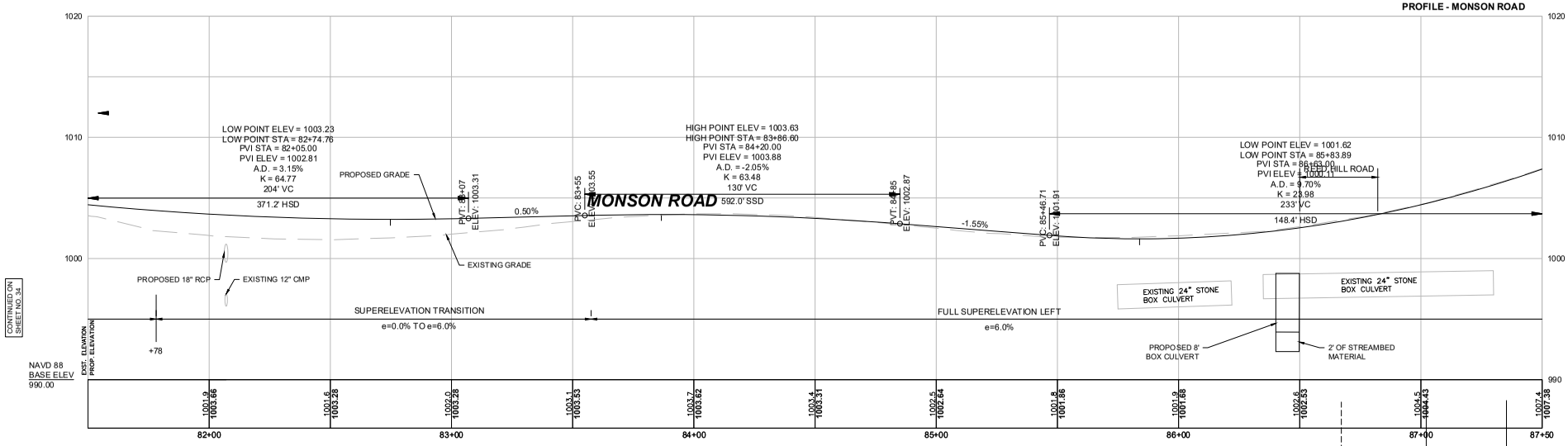
FOR CONSTRUCTION PLANS
SEE SHEET NO. 17

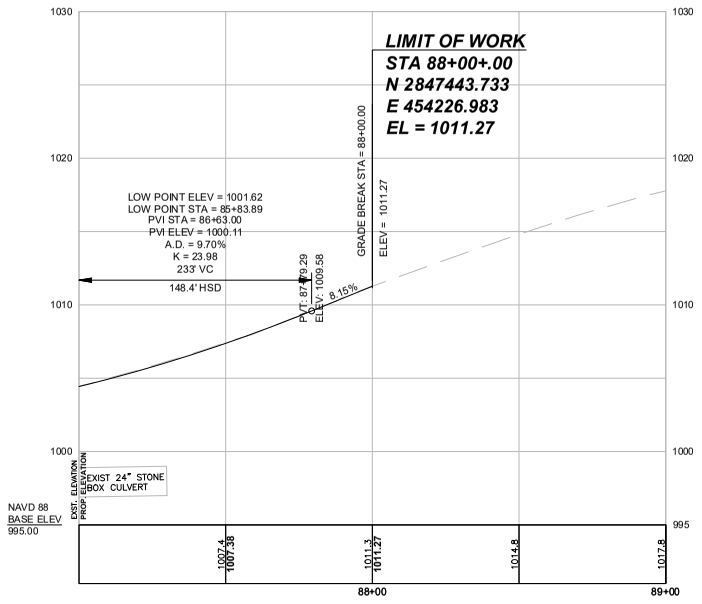


WALES
MONSON ROAD

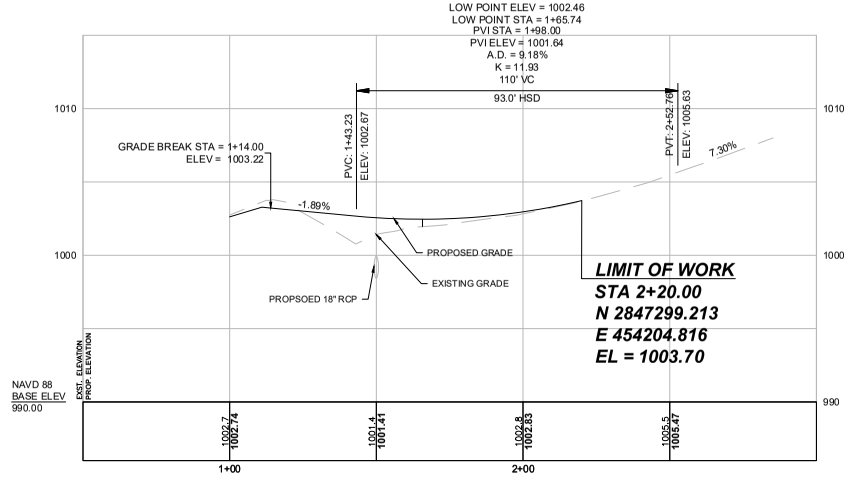
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD





MONSON ROAD



REED HILL ROAD

HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS
SEE SHEET NO. 23

608163_HD4(PROFILE).DWG Plotted on 5-Aug-2024 10:47 AM

Proposal No. 608163.1.0612

A08840.42

608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 4:29 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8

Cut: 15.21 S.F.
Fill: 30.65 S.F.

15+50

SUPERELEVATION:
BANK = 4.4%

STONE WALL
+25–+75

8:1:1

10" DEC +56

4.0:1

UP1 87–1
+65

STONE WALL
+29–+75

LAYOUT LINE

TOP OF BANK

TOP OF BANK/O.H.W

4.4%

2.0%

874.63
874.76
875.79
875.67
873.8
875.24

Cut: 64.35 S.F.
Fill: 22.57 S.F.

15+32.35

SUPERELEVATION:
BANK = 4.4%

2.0:1

874.11
874.25
873.6
874.73
875.21
875.15

Cut: 57.30 S.F.
Fill: 1.74 S.F.

15+00

SUPERELEVATION:
BANK = 4.4%

9.91%

STONE WALL
+79–+25

UP 87–18 +11

873.18
873.31
873.3
873.79
874.28
874.22

608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 3:57 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X	4	
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
8 4 0 4 8

VER. SCALE IN FEET
4 0 4 8

Cut: 33.06 S.F.
Fill: 27.18 S.F.

25+50

878.6
878.86

UFL 82-23
+32
3.0:1
2.0%
2.0%
2.0%
2.0%
2.0%
LAYOUT LINE
LAYOUT LINE

Cut: 121.15 S.F.
Fill: 0.00 S.F

25+00

877.5
877.51

TOP OF BANK
WETLAND LIMIT
LAYOUT LINE
EXIST. STONE HEADWALL
+77-+07
24" DEC +77
2.0%
2.0%
2.0%
2.0%
2.0%
TOP OF BANK
LAYOUT LINE
TOP OF BANK

24+91.52

877.4
877.31

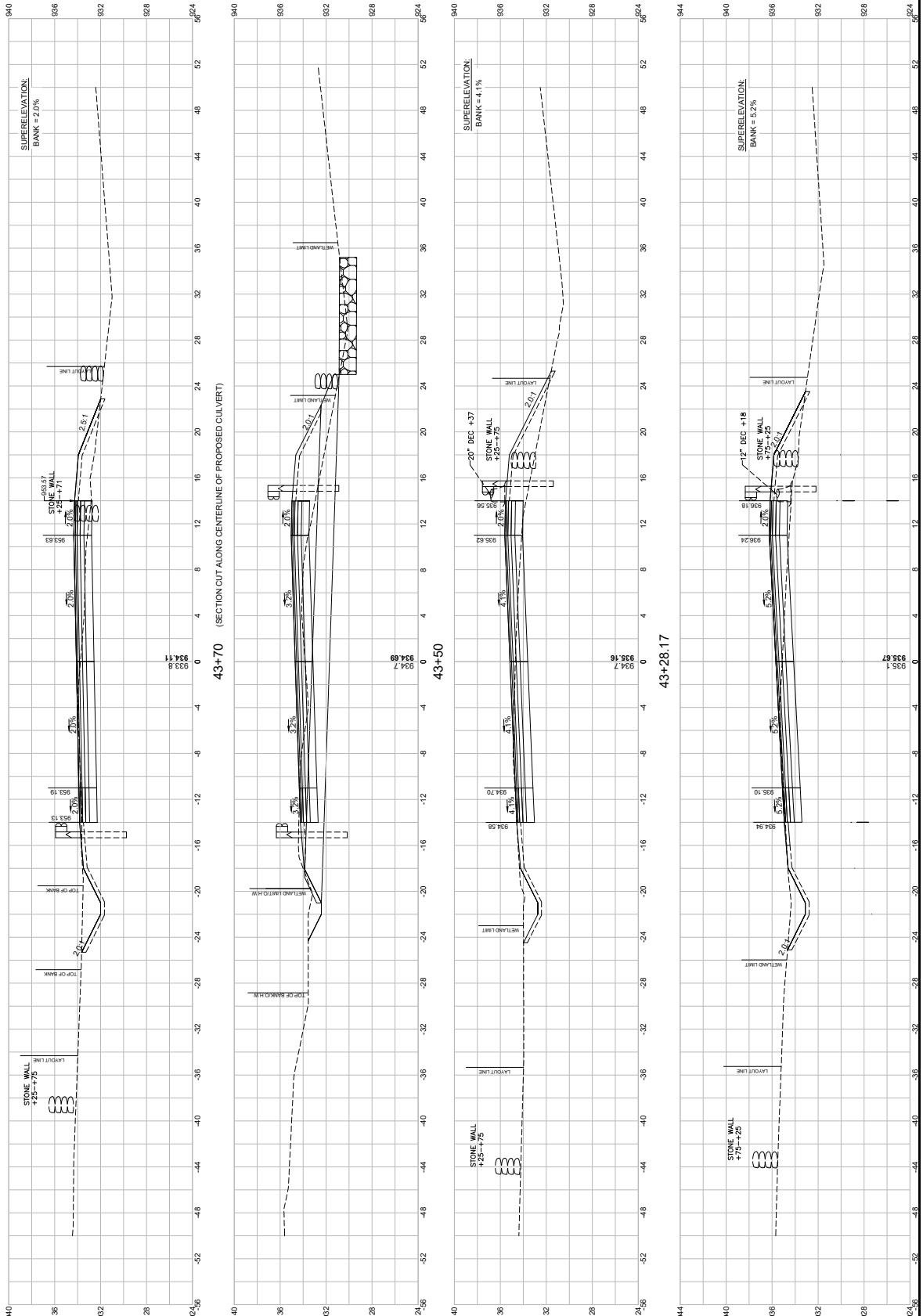
LAYOUT LINE
WETLAND LIMIT
877.03
877.09
2.0%
2.0%
2.0%
2.0%
2.0%
877.09
877.03
WETLAND LIMIT
LAYOUT LINE
6.0

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8
VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:44 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

Cut: 15.09 S.F.
Fill: 19.53 S.F.

47+00

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
931.42
931.55
4.4%
932.52
2.0%
932.46
UPI 72-33
+02
931.1
932.03
4.0:1

Cut: 85.75 S.F.
Fill: 36.70 S.F.

46+64.76

(SECTION CUT ALONG CENTERLINE OF EXISTING 12" CPP PIPE)

TOP OF BANK/O.H.W
WETLAND LIMIT
1.5:1
4.2%
2.1%
931.6
931.57

Cut: 7.89 S.F.
Fill: 32.80 S.F.

46+50

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.80
930.93
4.4%
931.84
2.0%
TOP OF BANK
4.0:1
930.4
931.41

Cut: 8.27 S.F.
Fill: 30.60 S.F.

46+44.68

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.75
930.88
4.4%
931.85
2.1%
TOP OF BANK/O.H.W
931.79
4.0:1
930.4
931.37

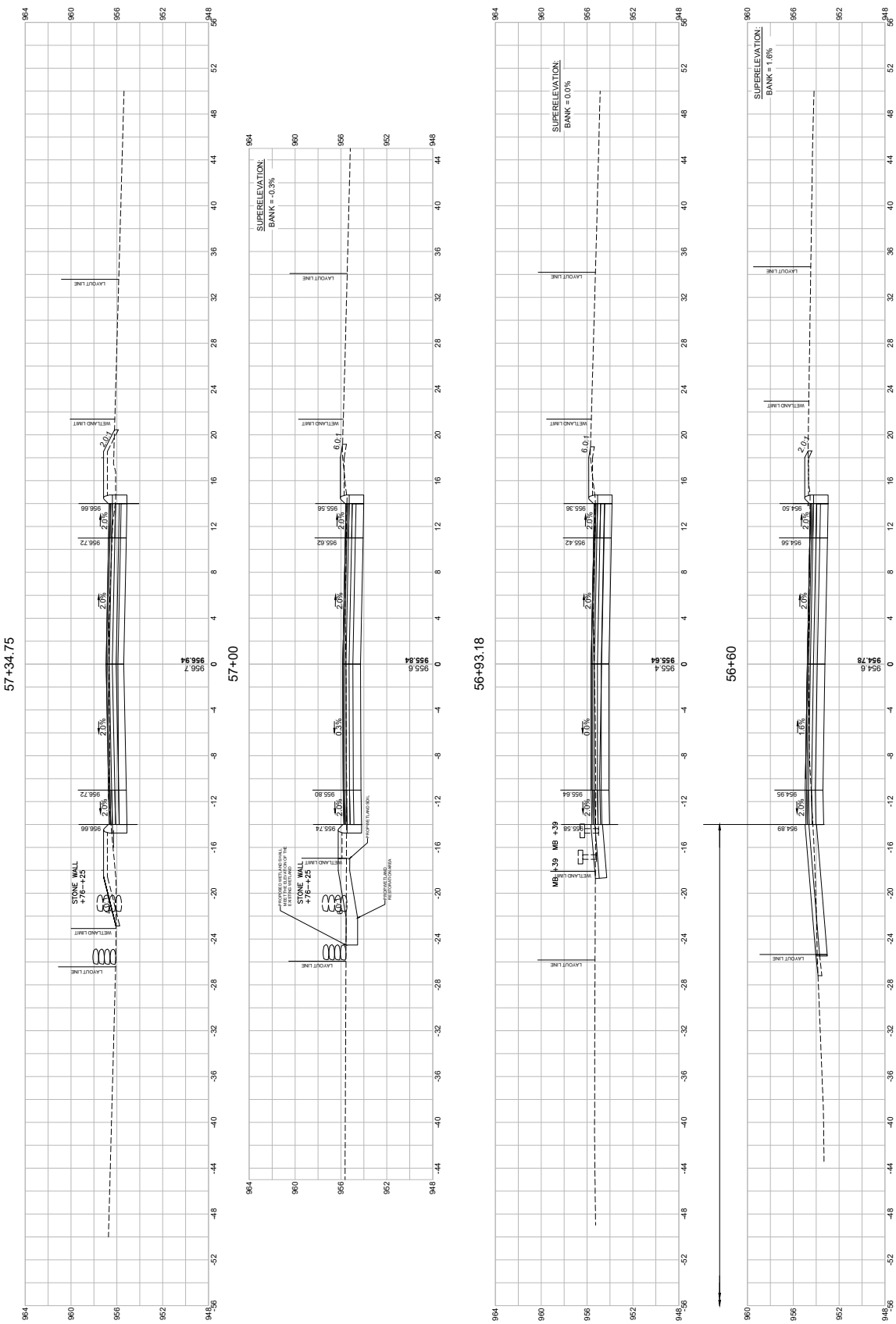
608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 4:04 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X	4	
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:25 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8

82+50

Cut: 0.26 S.F.
Fill: 36.63 S.F.

SUPERELEVATION:
BANK = 0.9%

82+30.60

Cut: 0.25 S.F.
Fill: 50.43 S.F.

SUPERELEVATION:
BANK = 0.0%

82+07.06 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

R = 560.00'
BANK = -1.1%

82+00

Cut: 0.0 S.F.
Fill: 27.77 S.F.

SUPERELEVATION:
BANK = -1.5%

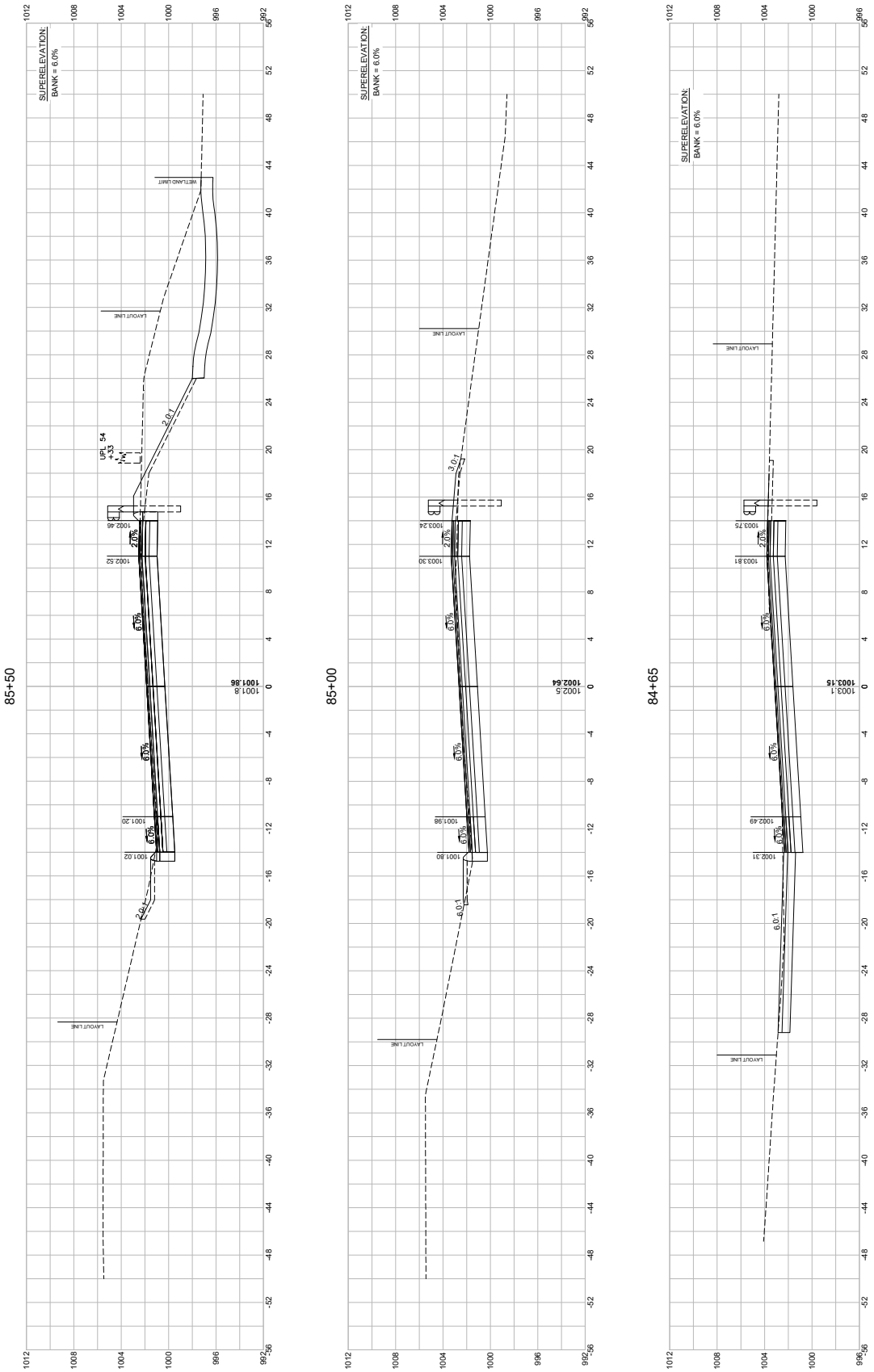
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:15 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(643)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



HOR. SCALE IN FEET

4 0 4 8

4 0 4 8

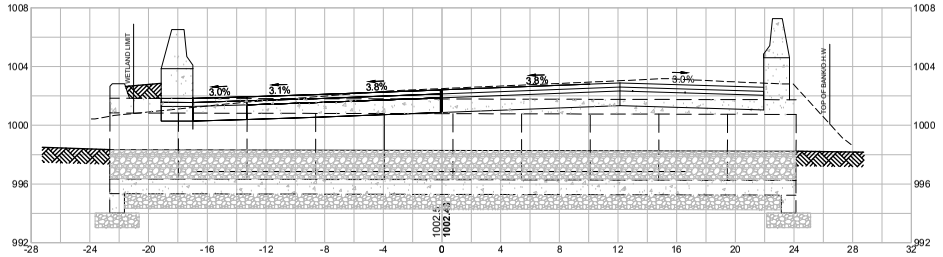
VER. SCALE IN FEET

WALES
MONSON ROAD

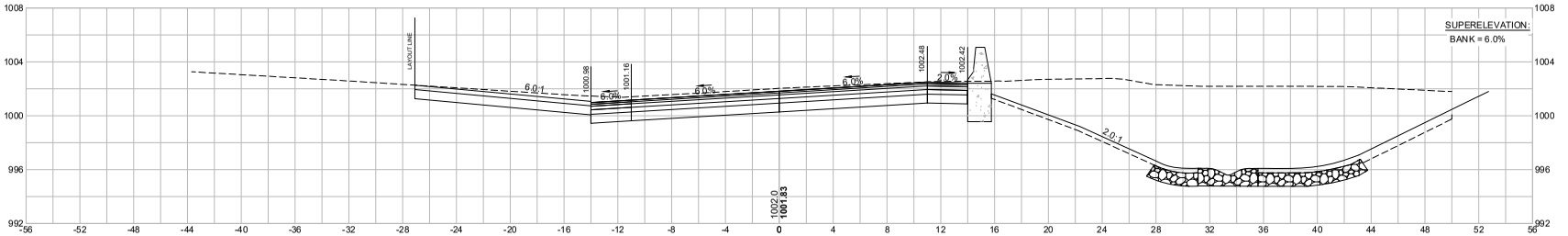
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CROSS SECTIONS

86+45.09 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

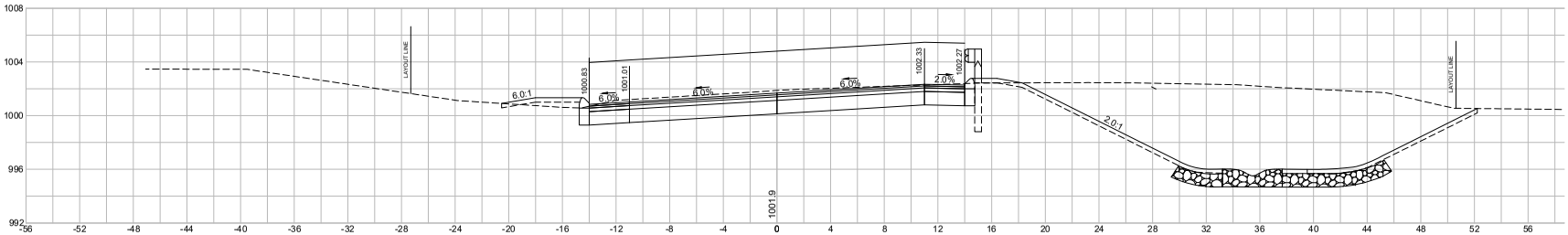


86+15



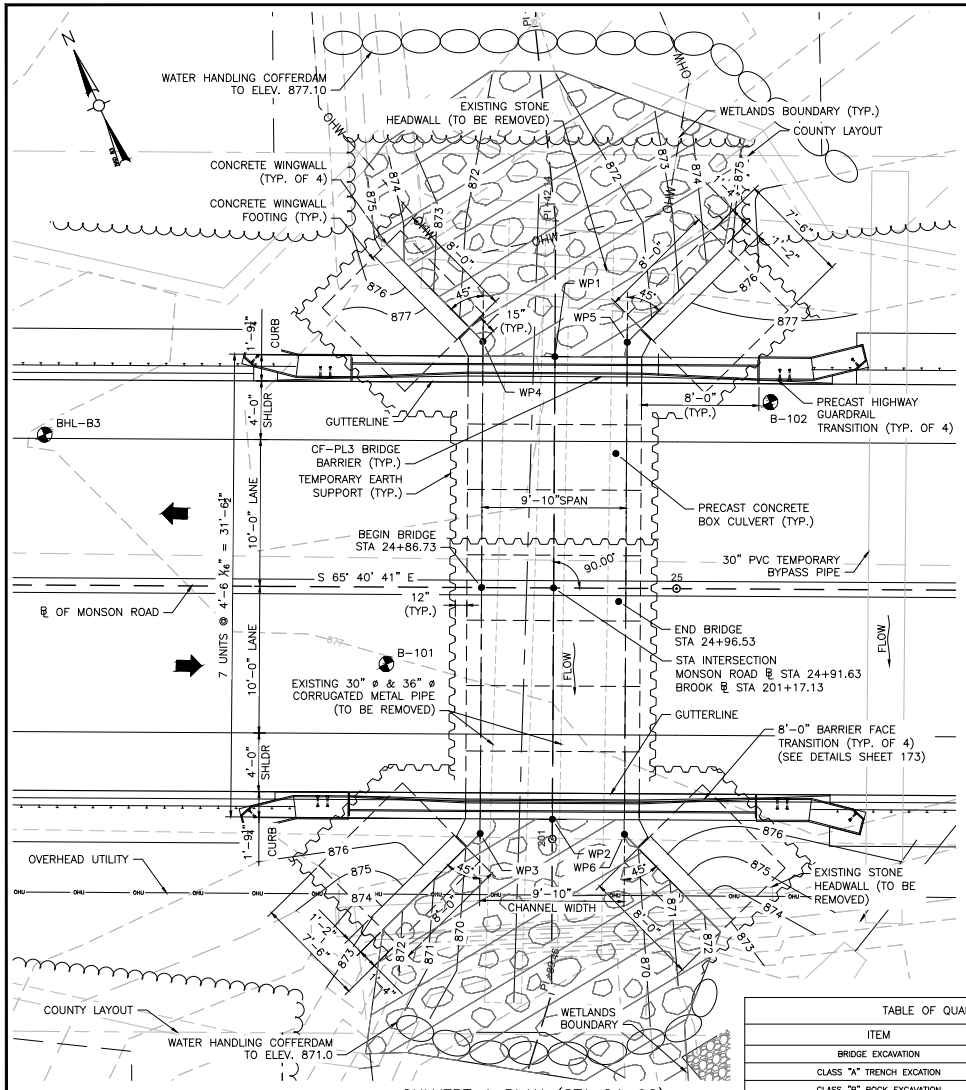
Cut: 238.87 S.F.
Fill: 0.0 S.F.

86+00



Cut: 202.10 S.F.
Fill: 4.42 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 9-Aug-2024 4:27 PM
Proposal No. 608163 (SEE 12812)
608163_440



CULVERT 1 PLAN (STA 24+92)

SCALE: 1" = 4'

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2848111.9174	448173.3849
2	2848083.1730	448160.3979
3	2848084.2791	448155.5221
4	2848114.8452	448169.3343
5	2848110.8082	448178.2683
6	2848080.2408	448164.4559

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	443
CLASS "A" TRENCH EXCATION	C.Y.	69
CLASS "B" ROCK EXCAVATION	C.Y.	30
NATURAL STREAMBED MATERIAL	C.Y.	26
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	300
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	18
PRECAST GUARDRAIL HIGHWAY TRANSITION	EA.	4
5000 PSI, ¾", 685 HP CEMENT CONCRETE	C.Y.	27
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	17050
DAMPPROOFING	S.F.	1244
PRECAST CONCRETE BOX CULVERT – SITE 1	L.S.	1
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 1	L.S.	1

DESIGN:

IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS 9TH EDITION, 2020, FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 21+38± (RT) MAGNAIL IN UTILITY POLE: EL. 876.92 FT

BENCHMARK STA 29+60± (RT) MAGNAIL IN UTILITY POLE: EL. 900.23 FT

BENCHMARK STA 29+90± (LT) MAGNAIL BRASS RIVET: EL. 901.72 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 CEMENT CONCRETE.....WINGWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S.)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

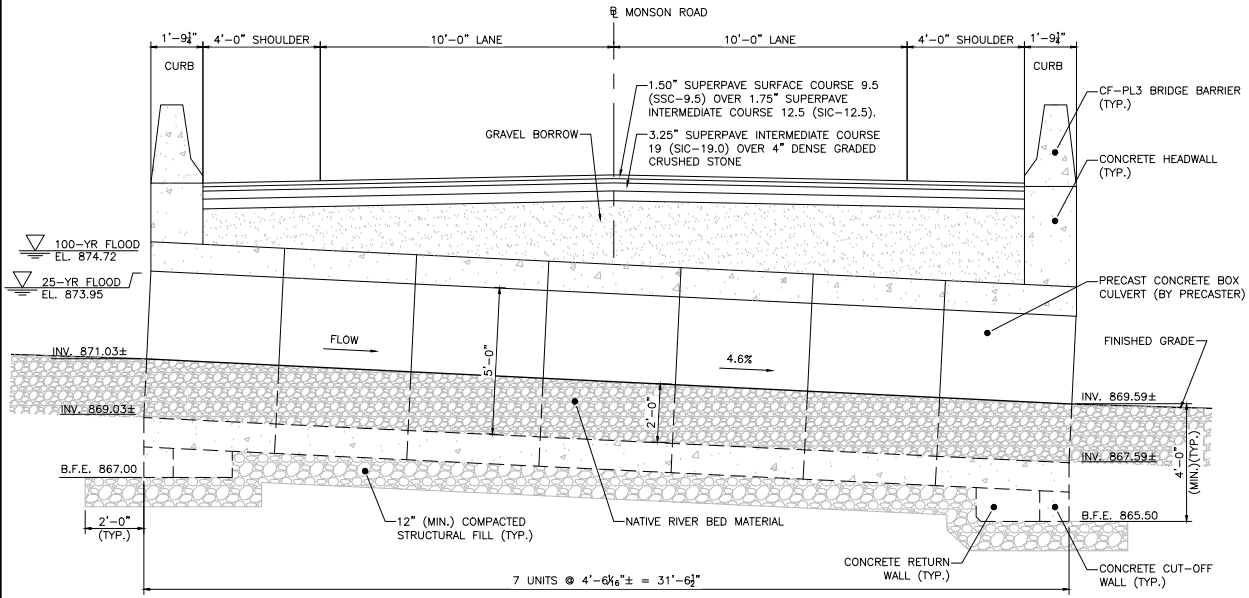
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	7.72
DESIGN FLOOD ELEVATION (FEET, NAVD)	876.1

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:14 AM
Proposal No. 608163-138212
608163_441

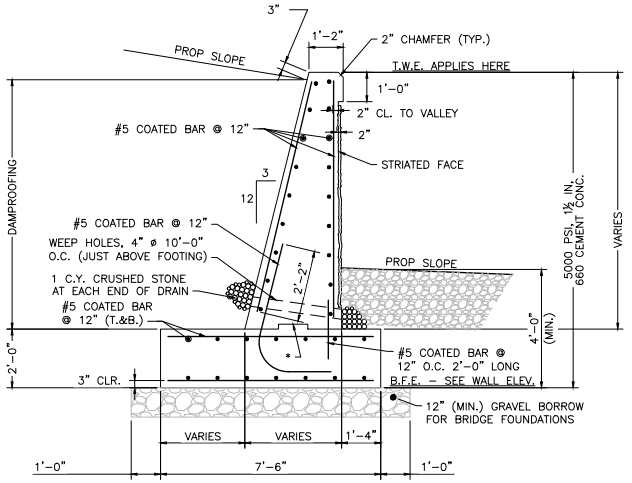
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 SECTION & DETAILS



CULVERT 1 LONGITUDINAL SECTION
SCALE: ½" = 1'-0"



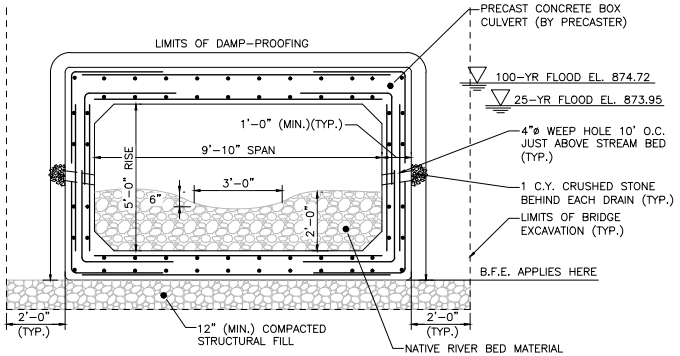
WINGWALL TYPICAL SECTION
SCALE: ½" = 1'-0"

PRECAST BOX CULVERT NOTES:

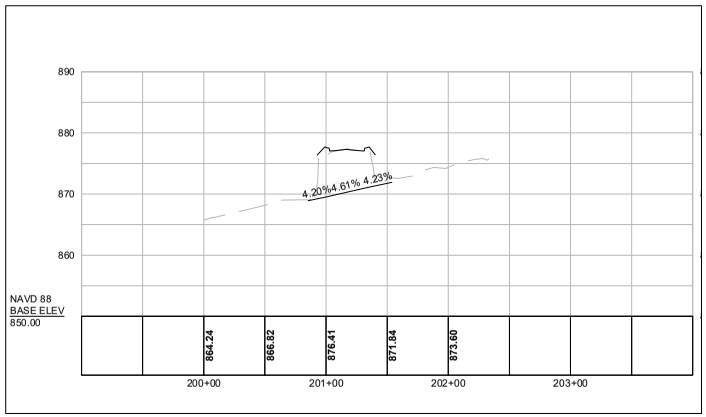
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 9'-10" WIDE, 5'-0" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO 9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

1. FOR CULVERT 1 HEADWALL ELEVATIONS, SEE SHEET NO. 165.
2. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
3. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 1 TRANSVERSE SECTION
SCALE: ½" = 1'-0"



NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

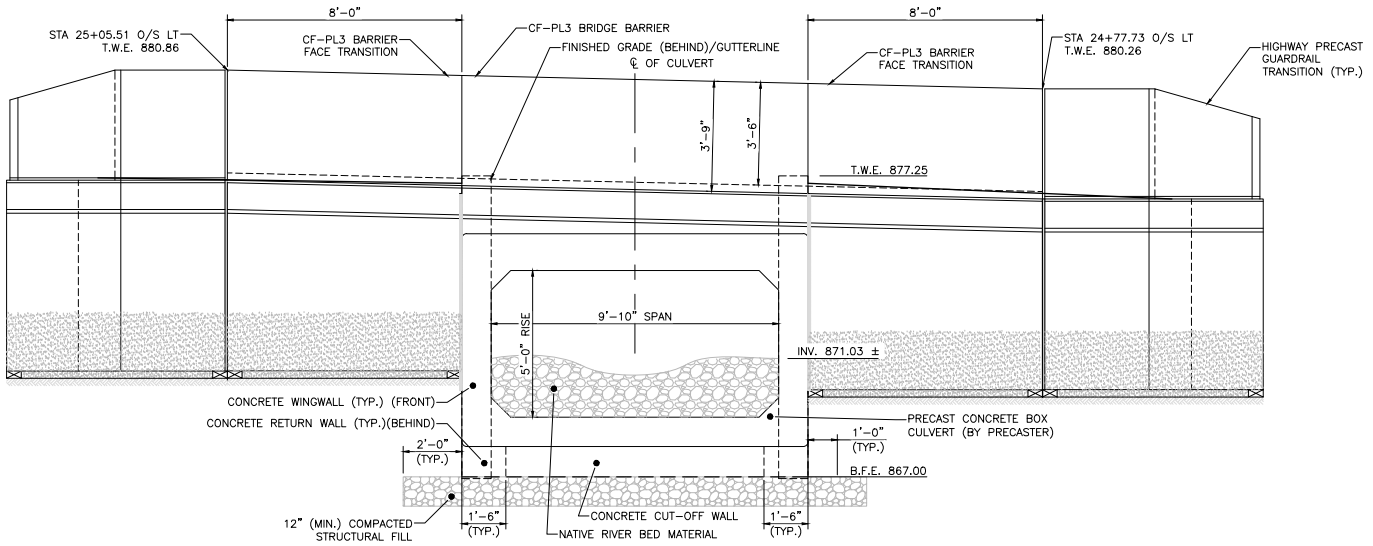
   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:15 AM
Proposal No. 608163-128/12
A08840.dgn

WALES
MONSON ROAD

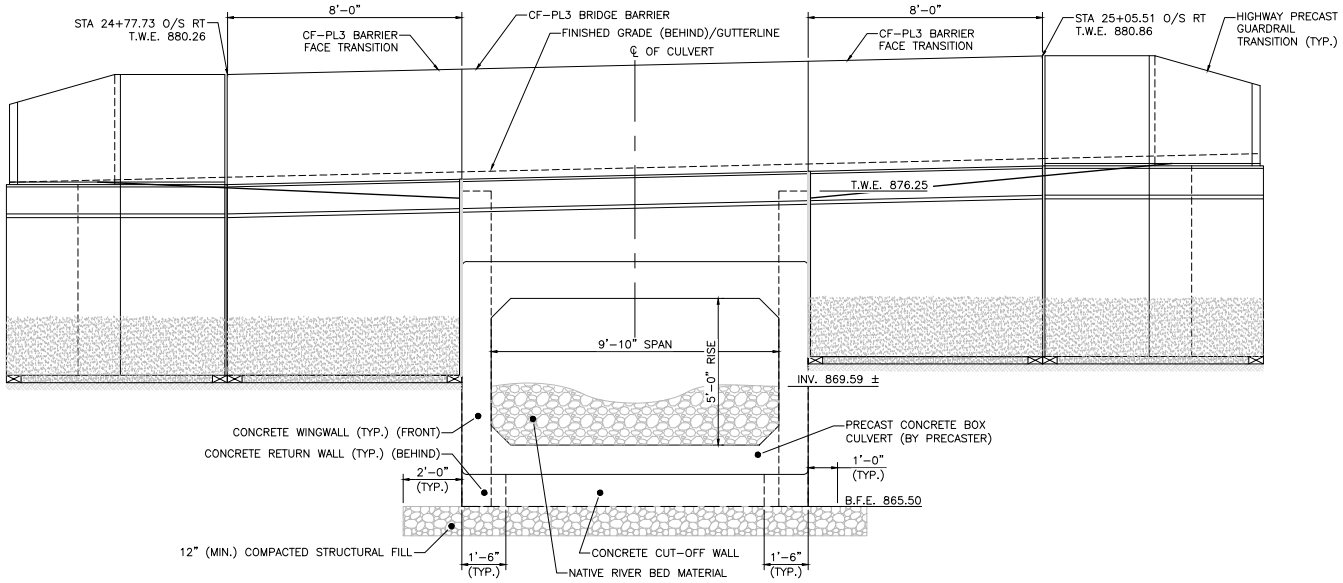
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 HEADWALL ELEVATIONS



CULVERT 1 INLET ELEVATION

SCALE: ½" = 1'-0"



CULVERT 1 OUTLET ELEVATION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

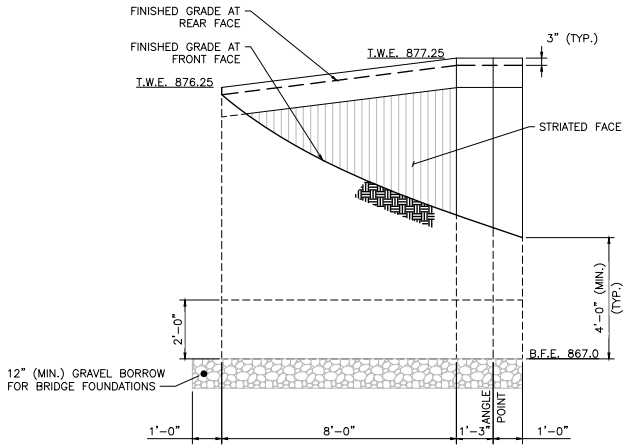
1. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
2. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:16 AM
Proposal No. 608163-132812
A08840 (45)

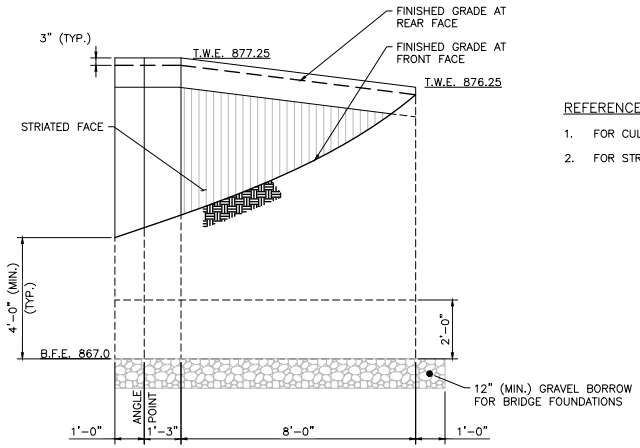
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

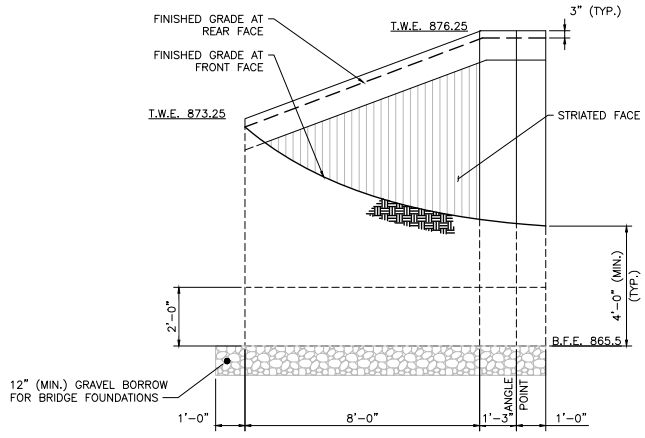
CULVERT 1 WINGWALL ELEVATIONS



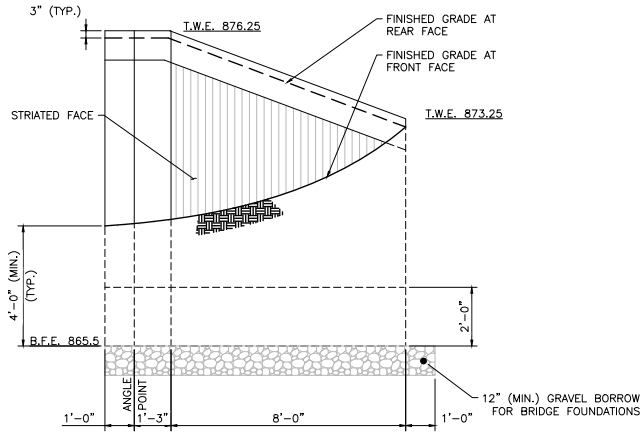
NORTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



NORTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

REFERENCE NOTES:

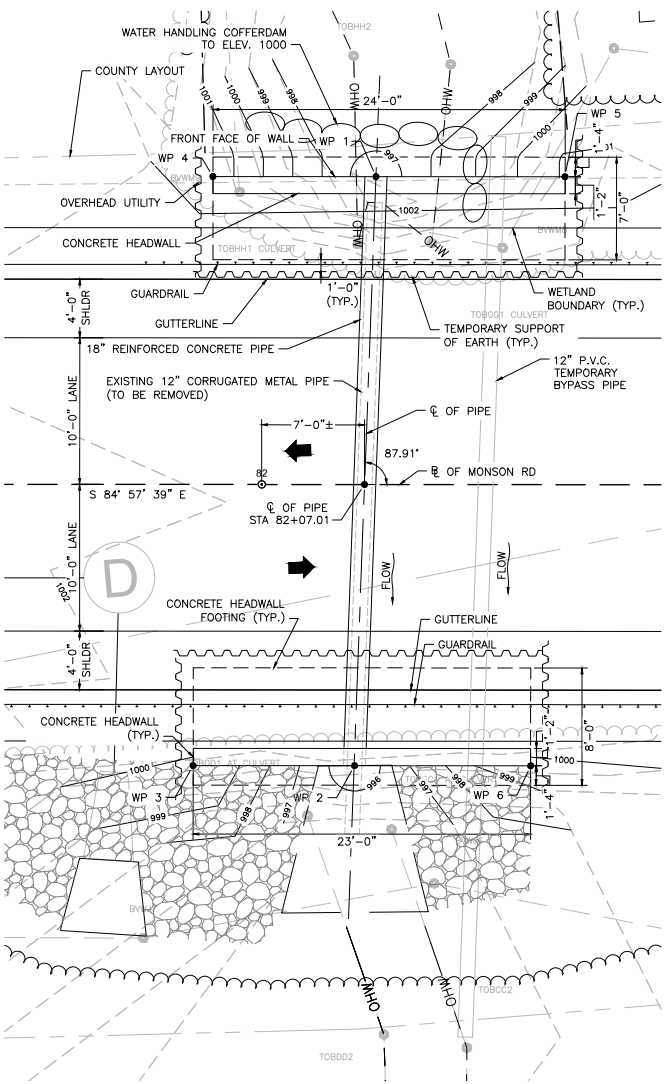
1. FOR CULVERT 1 WINGWALL SECTION, SEE SHEET NO. 164.
2. FOR STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:18 AM
A08840 454
Proposal No. 608163-12812

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 2 KEY PLAN AND NOTES



CULVERT 2 PLAN (STA 82+07)

SCALE: 1" = 4'

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 81+25± (LT) SPIKE IN UTILITY POLE: EL. 1005.74

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 HP CEMENT CONCRETE.....HEADWALLS

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING PIPES.
4. INSTALL THE PROPOSED PIPE & HEADWALLS.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE PROPOSED CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	167
CLASS "A" TRENCH EXCAVATION	C.Y.	11
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	150
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	20
5000 PSI ¾" 685 HP CEMENT CONCRETE	C.Y.	52
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	10010
DAMPPROOFING	S.F.	426
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 2	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847313.7204	453680.2286
2	2847273.8336	453675.2733
3	2847274.8008	453664.3163
4	2847314.6939	453669.1581
5	2847312.5891	453693.0567
6	2847272.7828	453687.1995

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	10.24
DESIGN FLOOD DISCHARGE (C.F.S.)	9
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	0.14
DESIGN FLOOD ELEVATION (FEET, NAVD)	996.14
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	9
BASE FLOOD ELEVATION (FEET, NAVD)	999.20
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	5
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	6.70
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.46

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:18 AM

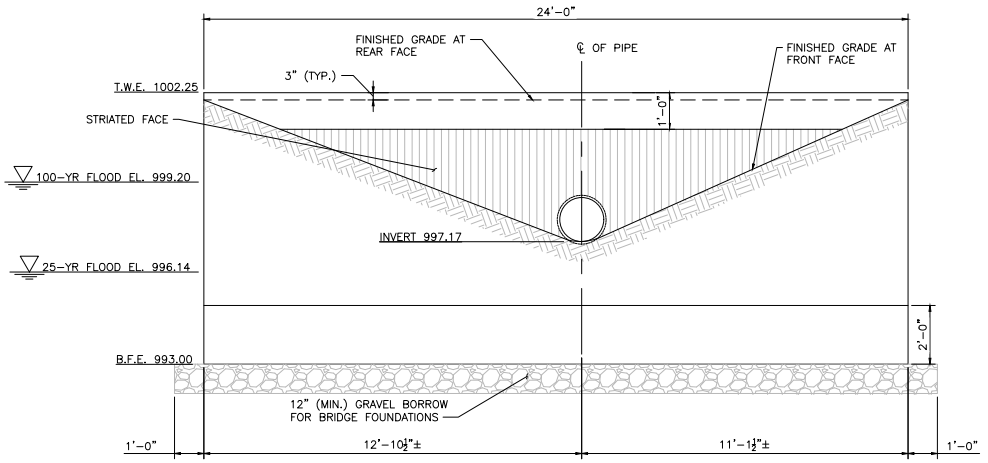
Proposal No. 608163-13612

A08840 .dgn

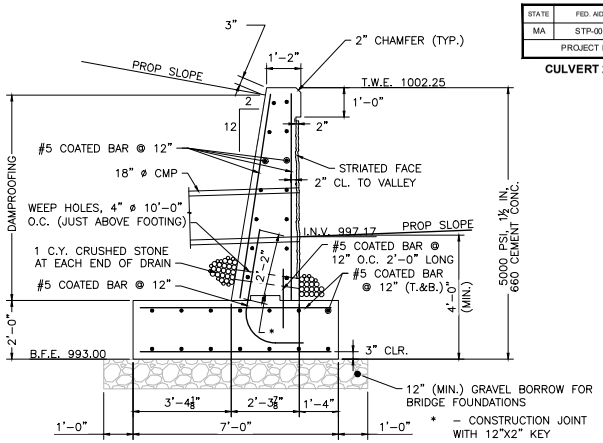
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 2 WALL DETAILS



NORTH INLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"

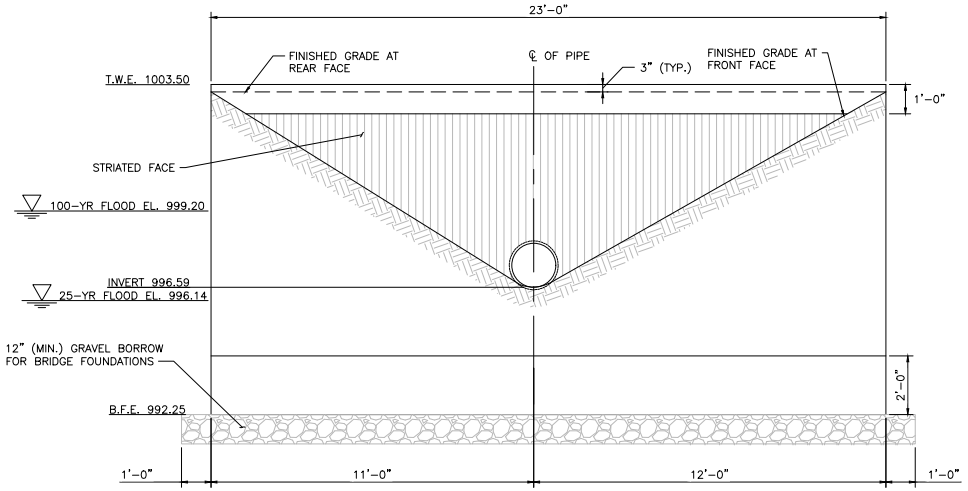


NORTH INLET HEADWALL SECTION
SCALE: ½" = 1'-0"

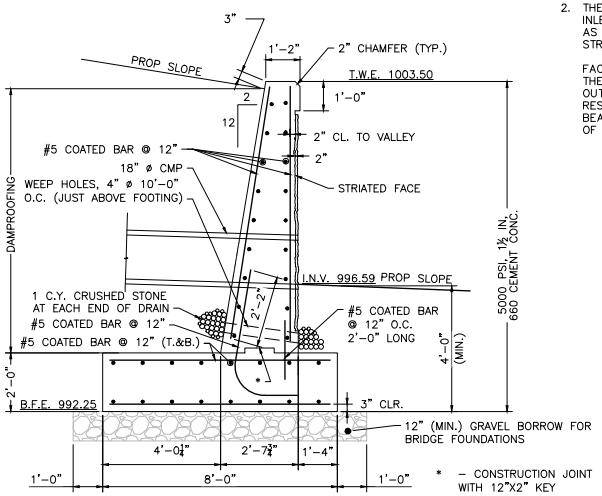
NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

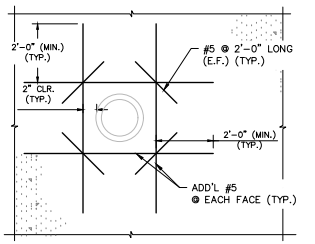
   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



SOUTH OUTLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"



SOUTH OUTLET HEADWALL SECTION
SCALE: ½" = 1'-0"

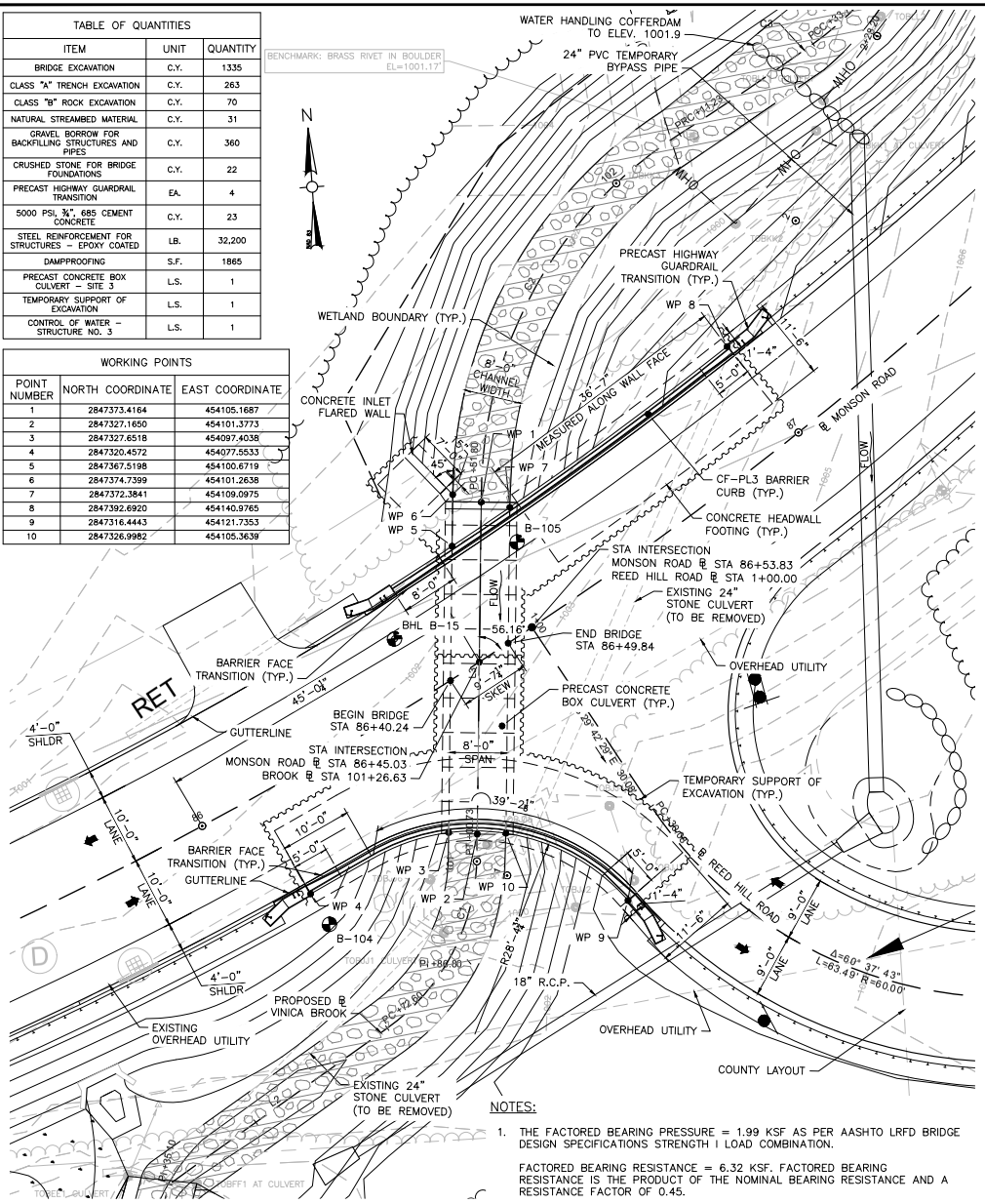


ADDITIONAL REINFORCEMENT AT PIPE
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:21 AM
Proposal No. 608163-138121
A08840 - 546

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	1335
CLASS "A" TRENCH EXCAVATION	C.Y.	263
CLASS "B" ROCK EXCAVATION	C.Y.	70
NATURAL STREAMBED MATERIAL	C.Y.	31
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	360
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	22
PRECAST HIGHWAY GUARDRAIL TRANSITION	EA.	4
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	23
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	32,200
DAMPPROOFING	S.F.	1865
PRECAST CONCRETE BOX CULVERT – SITE 3	L.S.	1
TEMPORARY SUPPORT OF EXCAVATION	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 3	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847373.4164	454105.1687
2	2847327.1650	454101.3773
3	2847327.6518	454097.4038
4	2847320.4572	454077.5533
5	2847367.5198	454100.6719
6	2847374.7399	454101.2638
7	2847372.3841	454109.0975
8	2847392.6920	454140.9765
9	2847316.4443	454121.7353
10	2847326.9982	454105.3639



CULVERT 3 PLAN (STA 86+45)

SCALE: 1" = 8'

NOTES:

1. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 87+10± (RT) SPIKE IN UTILITY POLE: EL. 1007.89 FT

BENCHMARK STA 87+20± (LT) BRASS RIVET: EL. 1001.17 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 610 CEMENT CONCRETE.....HEADWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S.)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.40
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	8.91
DESIGN FLOOD ELEVATION (FEET, NAVD)	1001.42

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 6-Aug-2024 1:14 PM

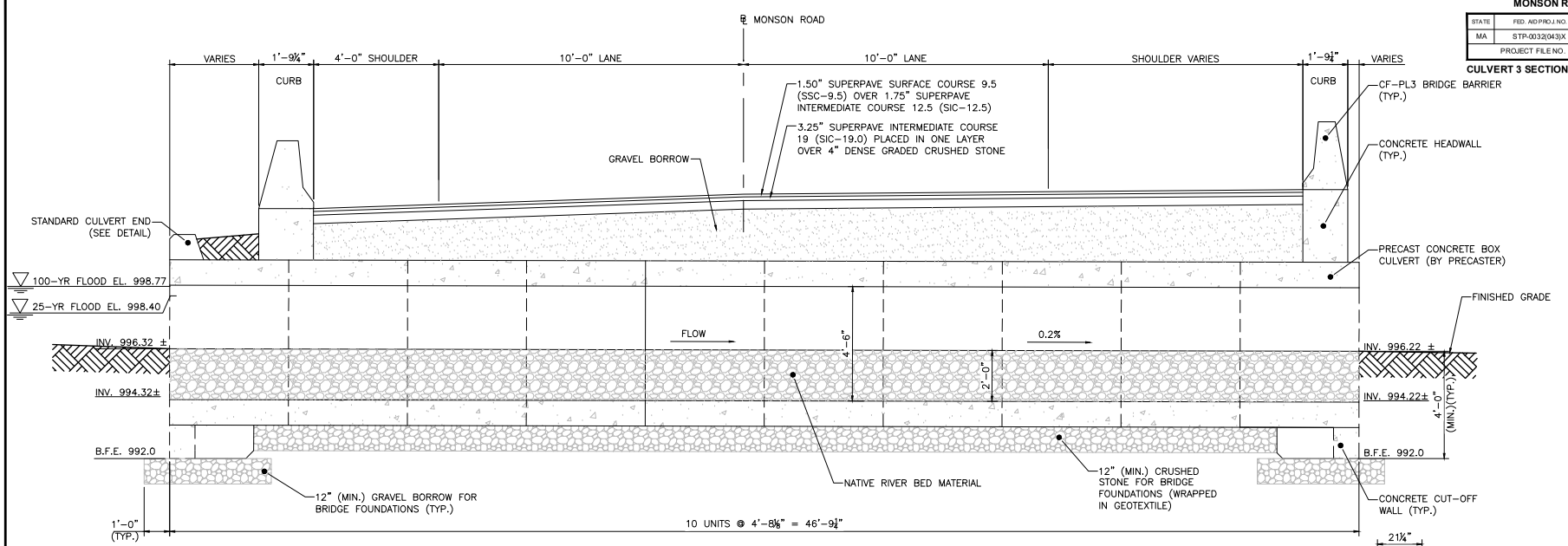
Proposal No. 608163-128121

A08840.dcf

WALES
MONSON ROAD

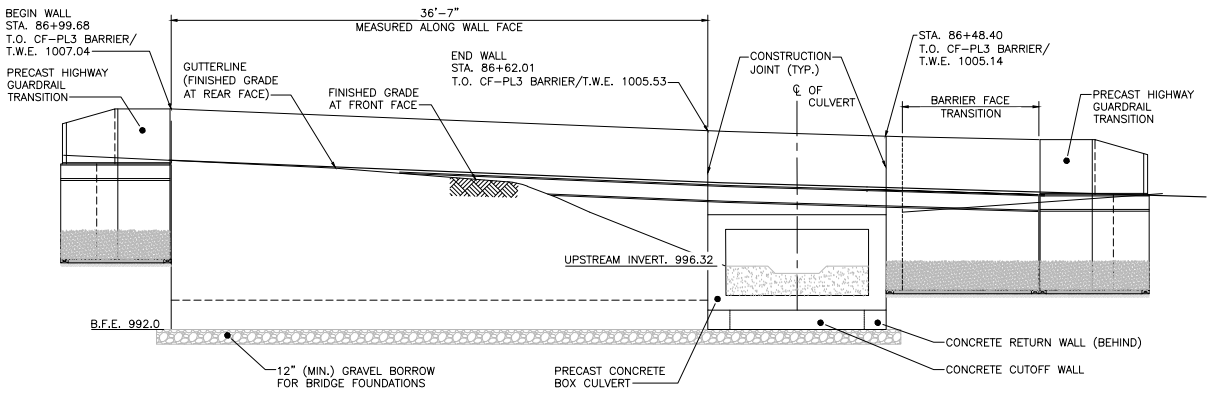
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 SECTION AND DETAILS



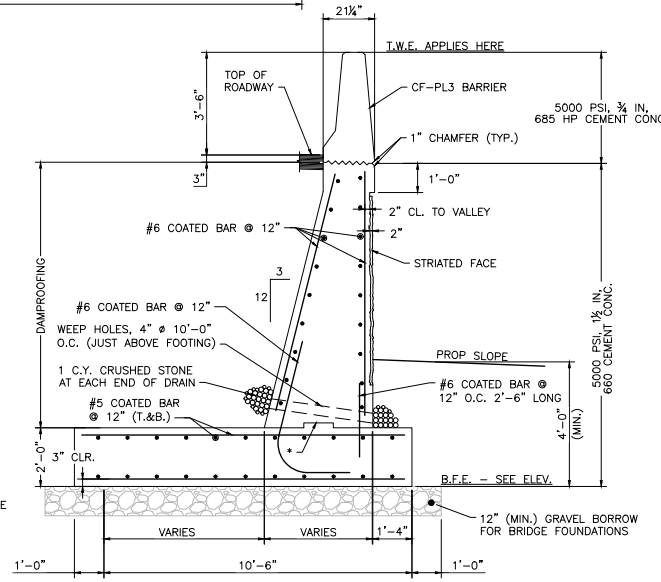
CULVERT 3 LONGITUDINAL SECTION – ALONG STREAM BASELINE

SCALE: ½" = 1'-0"



CULVERT 3 INLET NORTH ELEVATION

SCALE: ¼" = 1'-0"



RETAINING WALL SECTION

SCALE: ½" = 1'-0"

* – CONSTRUCTION JOINT WITH 12"X2" KEY

REFERENCE NOTES:

1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

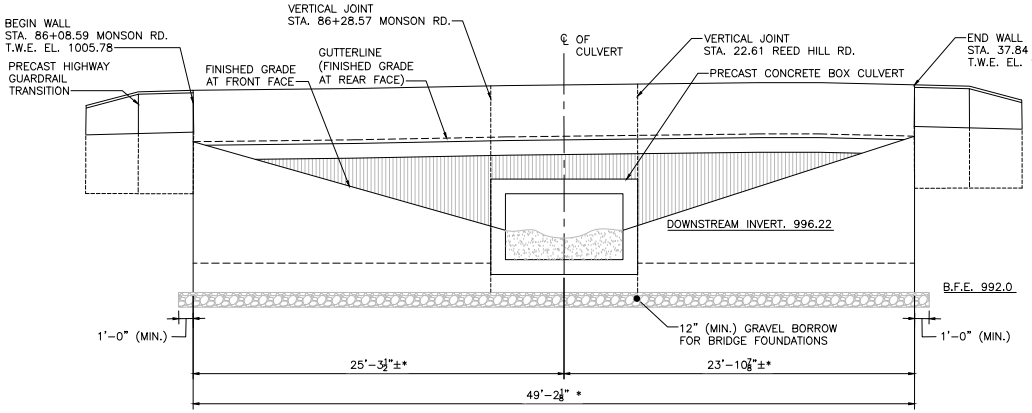
   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:23 AM
Proposal No. 608163-138212
A08840 4of4

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 3 WALL ELEVATION AND DETAILS



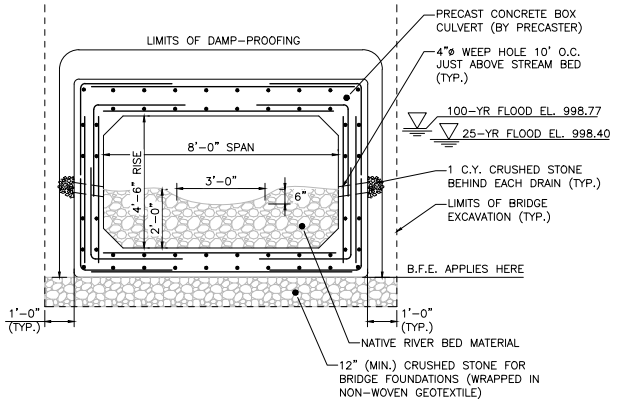
CULVERT 3 OUTLET/SOUTH ELEVATION
SCALE: ¼" = 1'-0"

PRECAST BOX CULVERT NOTES:

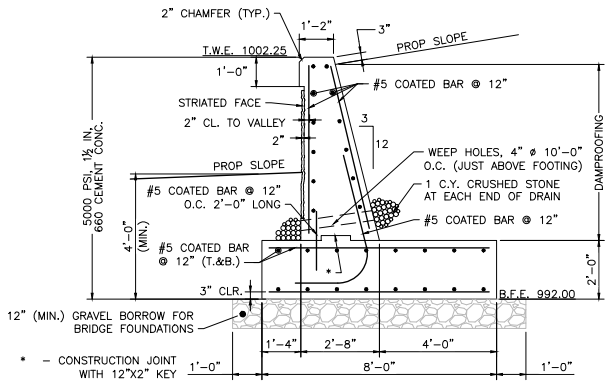
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 8'-0" WIDE, 4'-6" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

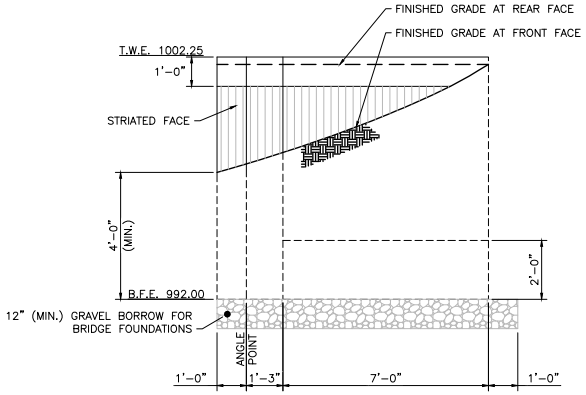
1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 3 TRANSVERSE SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - ELEVATION
SCALE: ½" = 1'-0"

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.96 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

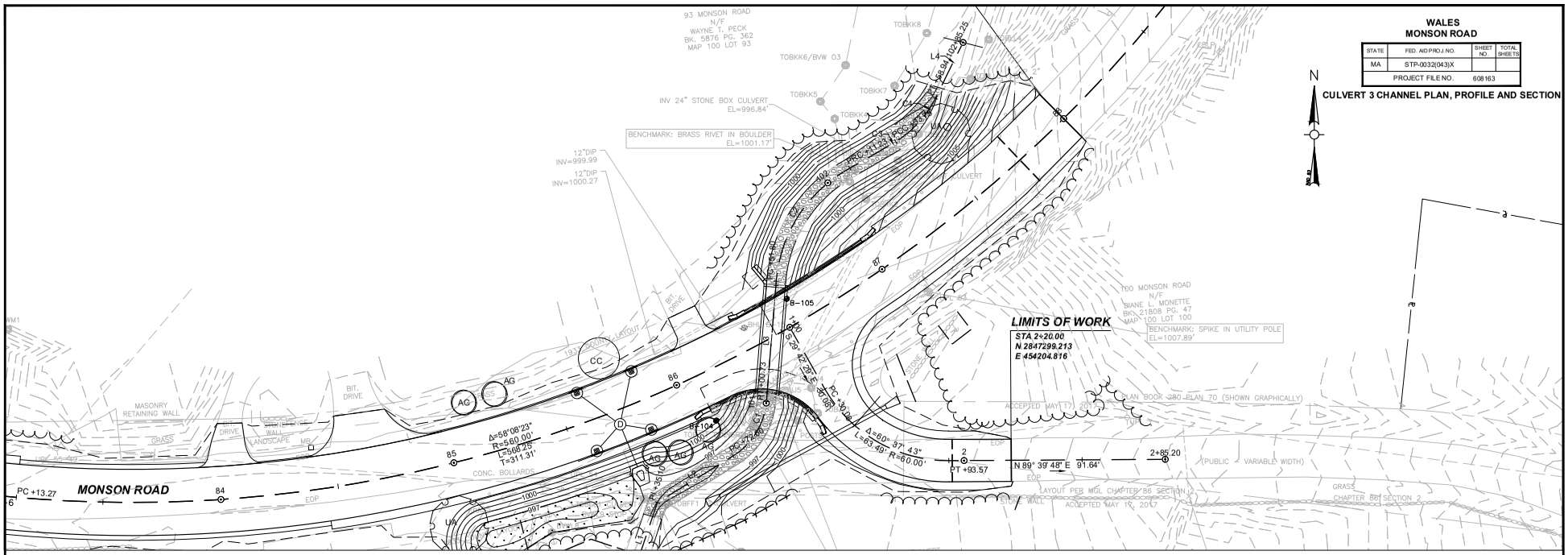
   FACTORED BEARING RESISTANCE = 5.26 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:25 AM
Proposal No. 608163-138312
A08840 .dgn

WALES
MONSON ROAD

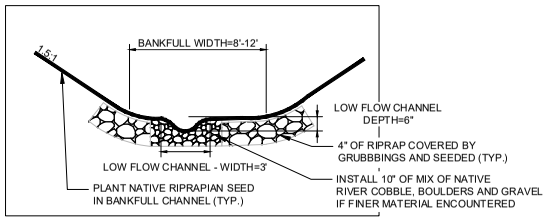
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION

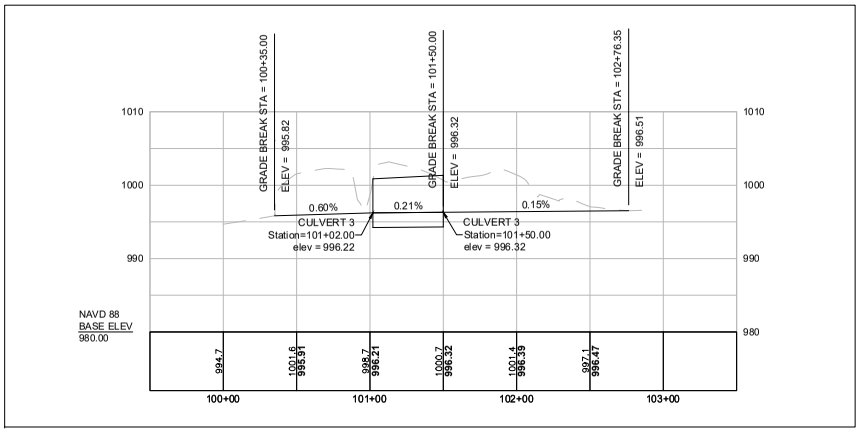


CULVERT 3 CHANNEL PLAN

0 20 40 60 80
SCALE: 1" = 20'



CULVERT 3 CHANNEL TYPICAL SECTION



CULVERT 3 CHANNEL PROFILE

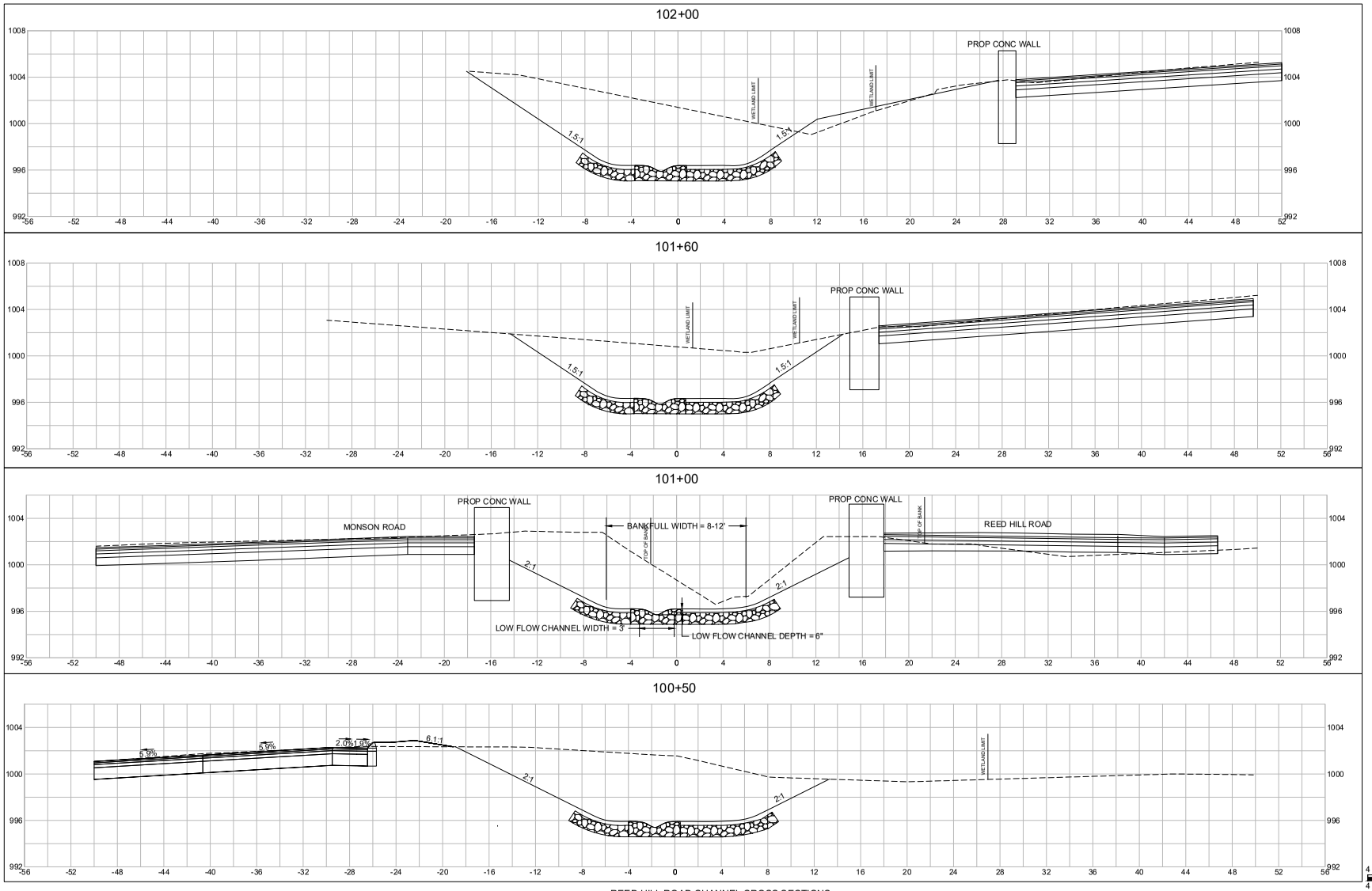
HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

608163_HD12\WATER HANDLING\.DWG Plotted on 6-Aug-2024 1:19 PM
Proposal No. 608163-132612
A08MJ-650

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS



REED HILL ROAD CHANNEL CROSS SECTIONS

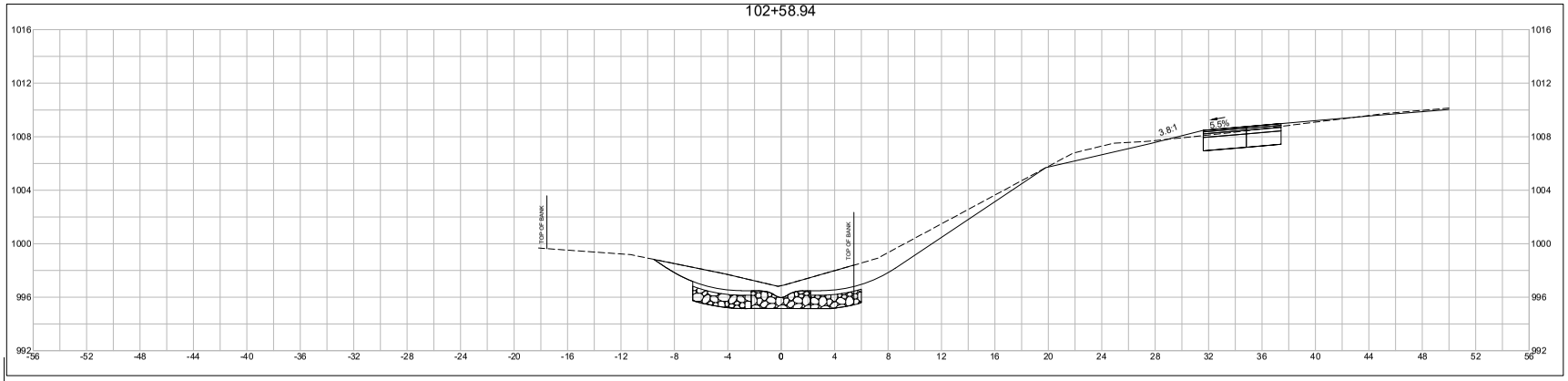
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

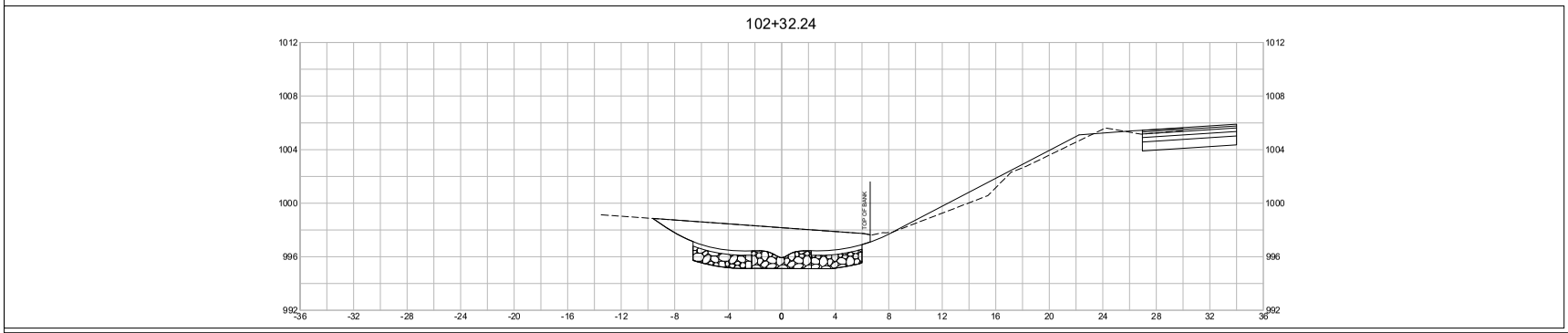
608163_JID12\WATER HANDLING\1.DWG Plotted on 5-Aug-2024 11:49 AM
Project No. 608163-1301-12
A08849.451

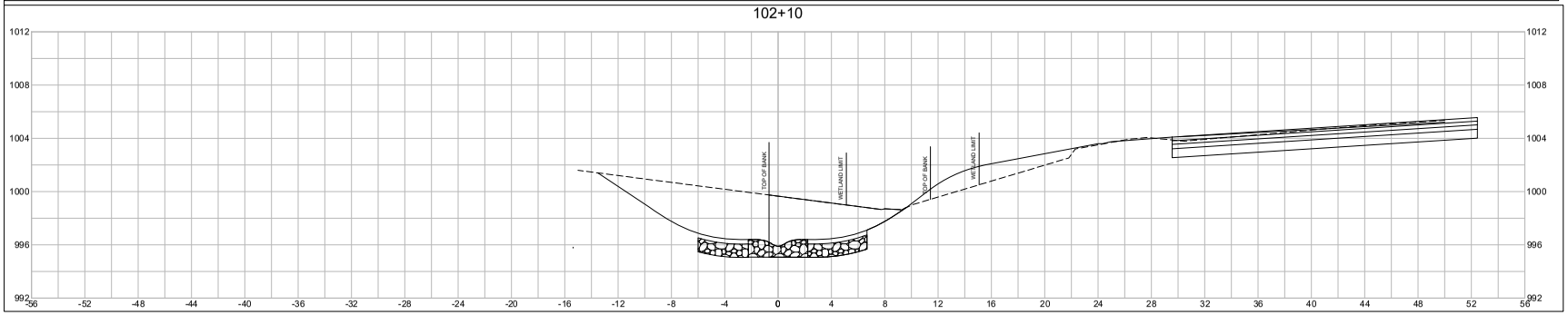
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 3 CHANNEL CROSS SECTIONS







HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

REED HILL ROAD CHANNEL CROSS SECTIONS

608163_JID12\WATER HANDLING\.DWG Plotted on 5-Aug-2024 11:50 AM

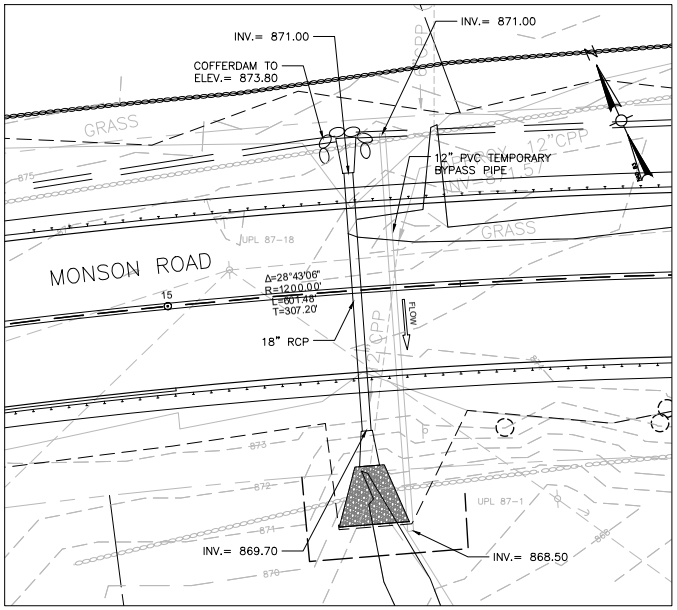
Proposal No. 608163-121212

A08849.452

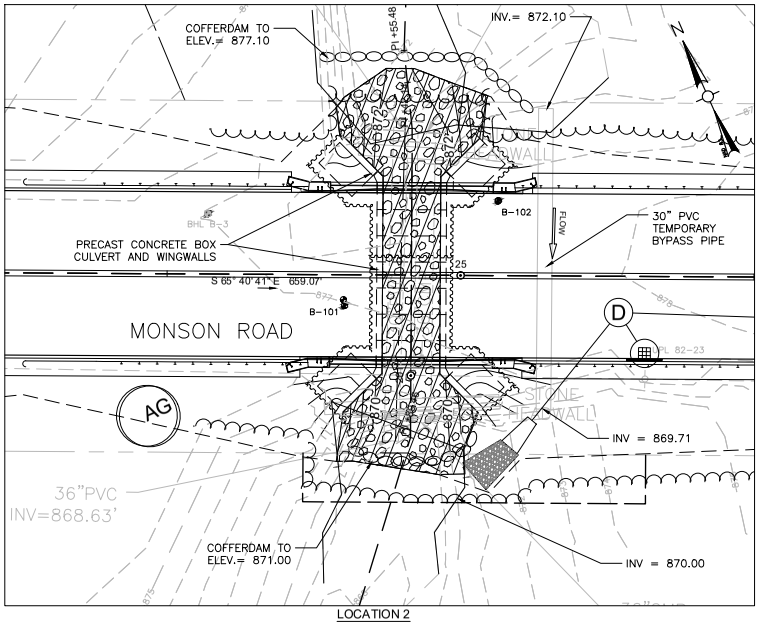
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

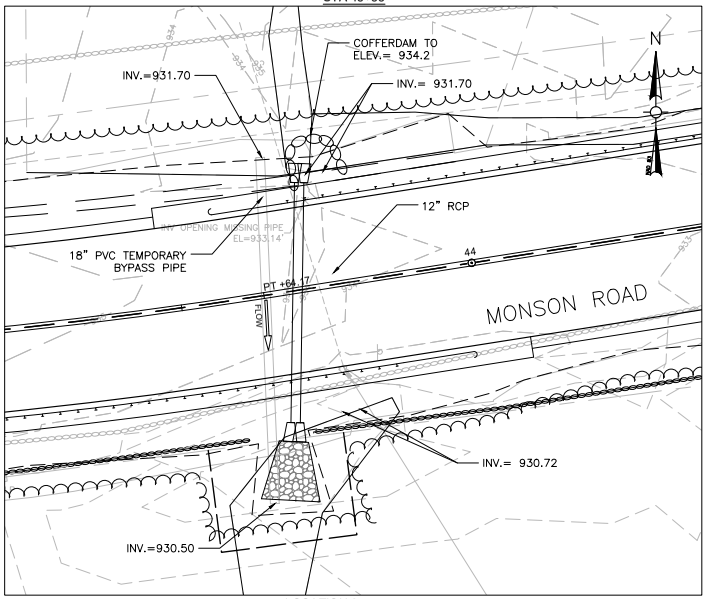
CONTROL OF WATER PLANS



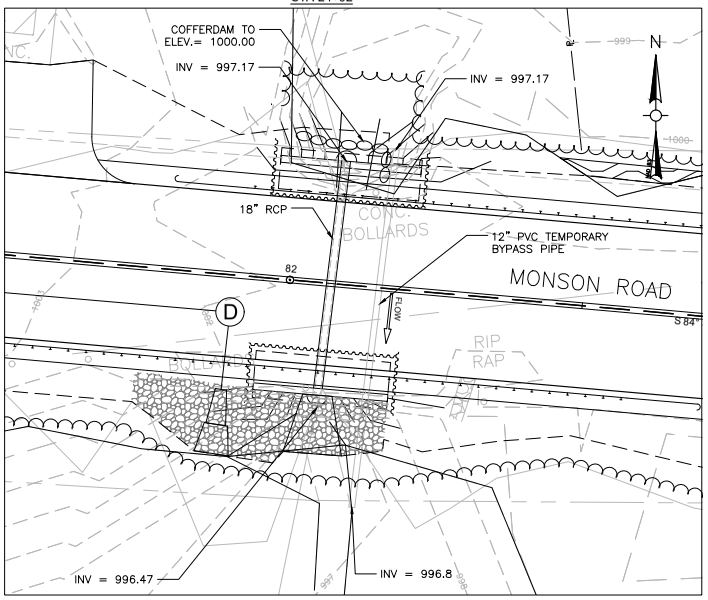
LOCATION 1
STA 15+33



LOCATION 2
STA 24+92



LOCATION 3
STA 43+76



LOCATION 4
STA 82+07

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS:

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS AND END WALLS

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE) AND INSTALL THE COFFERDAMS IN THE STREAM ON BOTH ENDS OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND ENDWALLS.
4. INSTALL THE NEW CULVERT.
5. INSTALL THE END WALLS.
6. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT. RECONFIGURE THE COFFERDAMS AROUND THE SIDE THAT WILL BE CONSTRUCTED NEXT.
7. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
8. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

0 10 20 30 40
SCALE: 1" = 10'

608163_HD12(WATER HANDLING).DWG Plotted on 5-Aug-2024 11:52 AM

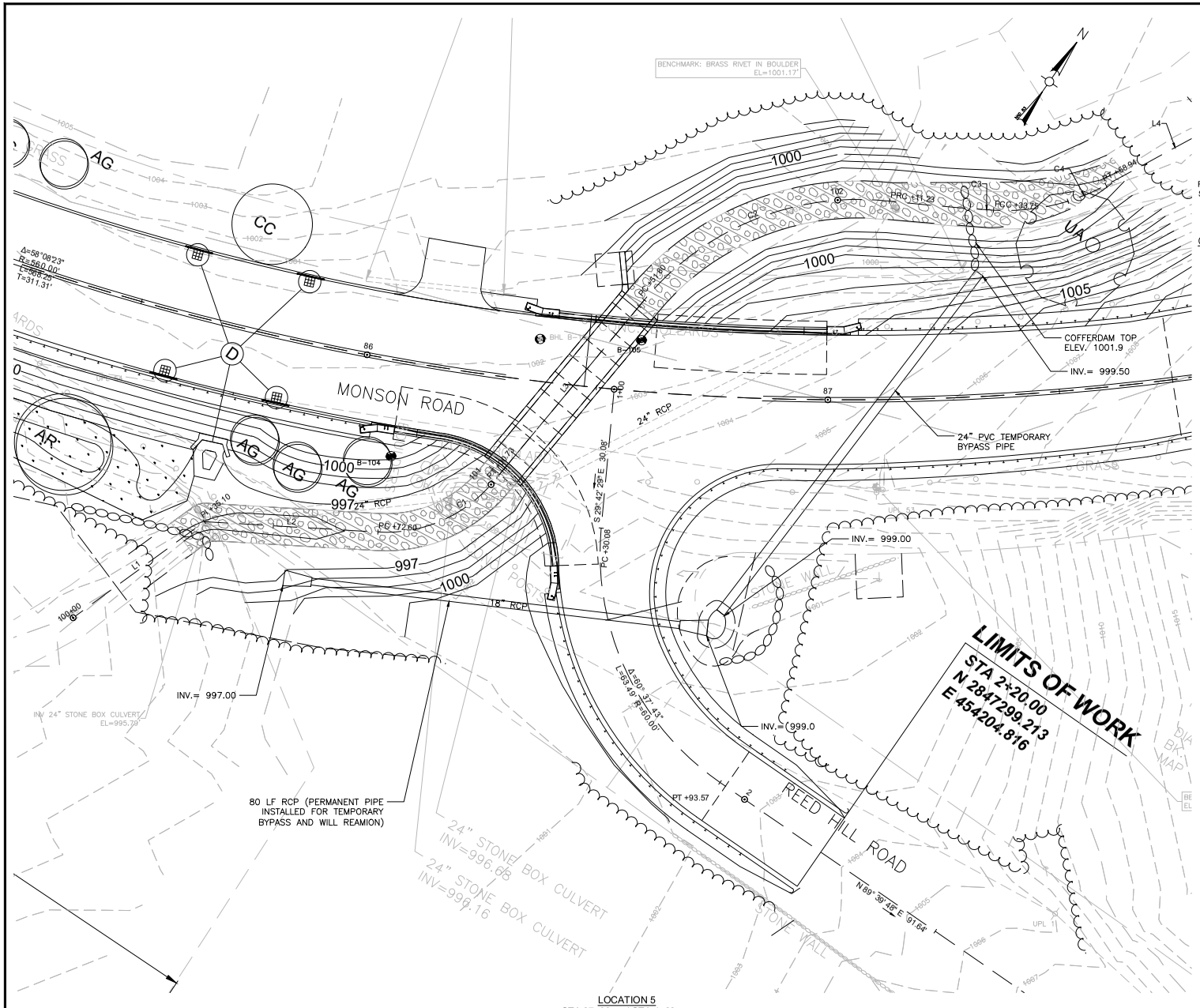
Proposal No. 608163-128212

A08840 453

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CONTROL OF WATER PLAN - CULVERT 3



LOCATION 5
STA 87+00 and STA 1+33

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

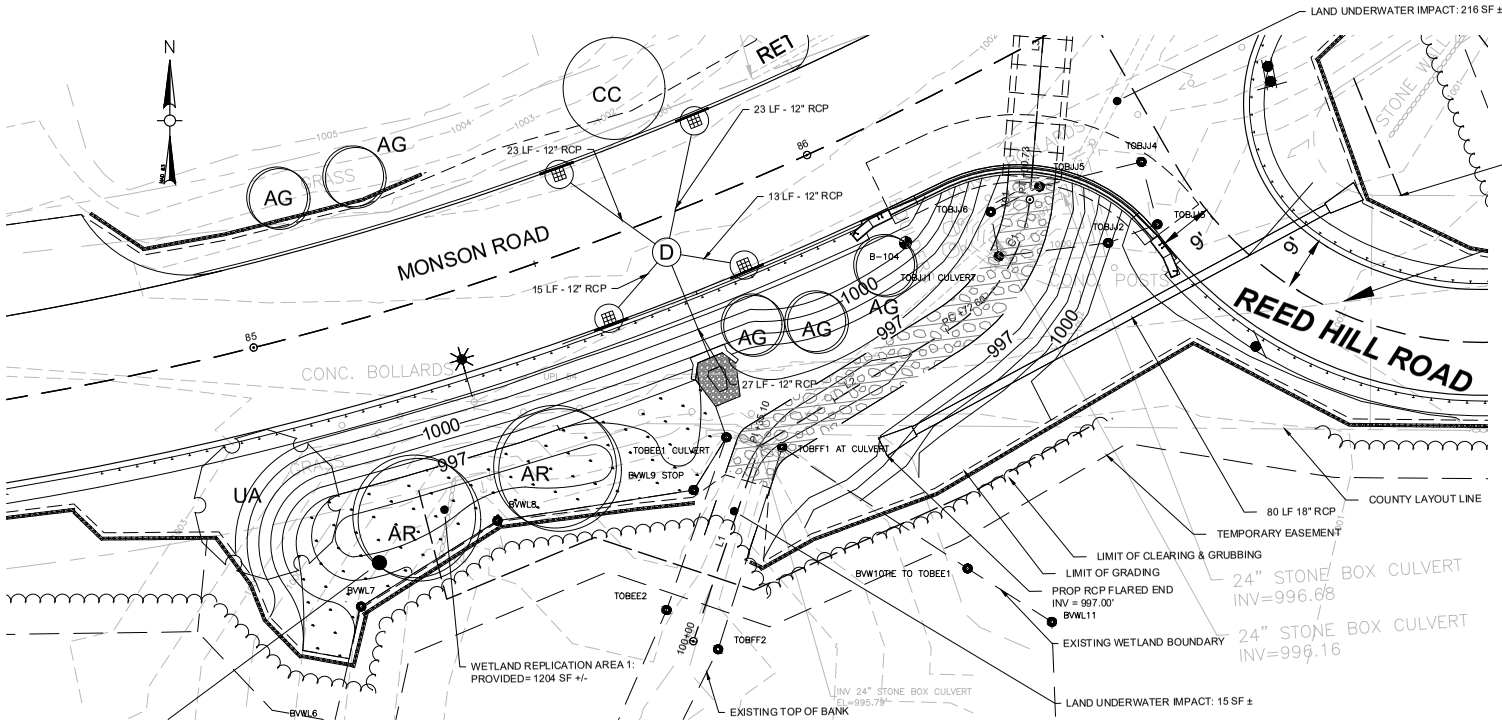
0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING.DWG Plotted on 8-Aug-2024 9:29 AM
Proposal No. 608163-128212
A08940 454

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

WETLAND REPLICATION AREA DETAIL



WETLAND REPLICATION AREA 1 GRADING PLAN

0 10 20 30 40

SCALE: 1" = 10'

WETLAND SEED MIX - OBLIGATE MIX

BOTANICAL

GRASS	COMMON NAME	%PLS BY WEIGHT
CAREX VULPINOIDEA	FOX SEDGE	26.50%
CAREX LURIDA	SHALLOW SEDGE	15.00%
SAPERGANIUM EURYCARPUM	GIANT BUR REED ECO PA	10.00%
CAREX LUPULINA	HOP SEDGE	7.00%
CAREX CRINITA	FRINGED SEDGE	6.00%
SCRIPUS CYPERINUS	WOOLGRASS	4.00%
JUNCUS EFFUSUS	SOFT RUSH	3.00%
CAREX COMOSA	BEAREDED SEDGE	3.00%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3.00%
SPARGANIUM AMERICANUM	BURRWEED	2.50%
SCIRPUS VALIDUS	BULRUSH, SOFT-STEM	2.00%
CAREX STRICTA	TUSSOCK SEDGE	1.00%
GLYCERIA CANADENISIS	MANNA GRASS	1.00%
		86.00%
VERBENA HASTATA	BLUE VERVAIN	4.00%
ASTER PUNICEUS	ASTER - SWAMP	2.00%
EUPATORIUM MACULATUM	JOE-PYE WEED	1.50%
EUPATORIUM PERFOLIATUM	BONESET	2.00%
IRIS VERSICOLOR	BLUE FLAG IRIS	2.00%
ALISMA SUBCORDATUM	MUD PLAINTAIN	1.00%
VERONIA NOVEBORACENSIS	NEW YORK IRONWEED	1.00%
BUDENS CERNUA	NODDING BURR MARIGOLD	1.00%
SOLIDAGO PATULA	ROUGHLEAF GOLDENROD	0.50%
MIMULUS RINGENS	MONKEY FLOWER	0.50%
CHELONE GLABRA	WHITE TURTLEHEAD	0.50%
		14.00%
		100.00%

SEED RATING:
SPECIES ECOTYPE SHALL BE AS NATIVE TO NEW ENGLAND REGION AS POSSIBLE. APPLY THIS MIX AT 20 LBS PLS/ACRE.

WETLAND REPLACEMENT AREA 1 NOTES:

1. A WETLAND SCIENTIST SHALL BE PROVIDED ON-SITE TO MONITOR CONSTRUCTION OF THE WETLAND MITIGATION AREA TO ENSURE COMPLIANCE WITH THE MITIGATION PLAN.
2. AT LEAST 12 INCHES OF NATURAL OR MANMADE WETIAND SOIL SHALL BE INSTALLED IN THE WETLAND REPLICATION AREA.
3. ONLY PLANT MATERIALS NATIVE AND INDIGENOUS TO THE REGION SHALL BE USED. SPECIES NOT SPECIFIED IN THE REPLICATION PLAN SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE REGULATORY AUTHORITIES. PLANT SPECIES ON THE INVASIVE SPECIES PLANT LIST IN THE CORPS MITIGATION INTRODUCTION: PERFORMANCE STANDARDS AND SUPPLEMENTARY INFORMATION DATED 2/21/01 SHALL NOT BE USED IN AND WITHIN 100 FEET OF MITIGATION SITES.
4. A SUPPLY OF DEAD AND DYING WOODY DEBRIS SHALL COVER between 5%-20% OF THE GROUND THROUGHOUT THE MITIGATION SITE AFTER THE COMPLETION OF CONSTRUCTION OF THE MITIGATION SITE. THESE MATERIALS SHOULD NOT INCLUDE INVASIVE SPECIES.
5. TEMPORARY DEVICES AND STRUCTURES TO CONTROL EROSION AND SEDIMENTATION IN AND AROUND MITIGATION SITES SHALL BE DISASSEMBLED AND PROPERLY DISPOSED OF NO LATER THAN NOVEMBER 1 THREE FULL GROWING SEASON AFTER PLANTING. SEDIMENT COLLECTED BY THESE DEVICES SHALL BE REMOVED AND PROPERLY DISPOSED OF IN A MANNER THAT PREVENT ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.

WETLAND REPLICATION AREA 1 PLANTING PLAN

SHRUBS
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM
WINTERBERRY (ILEX VERTICILLATE): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM

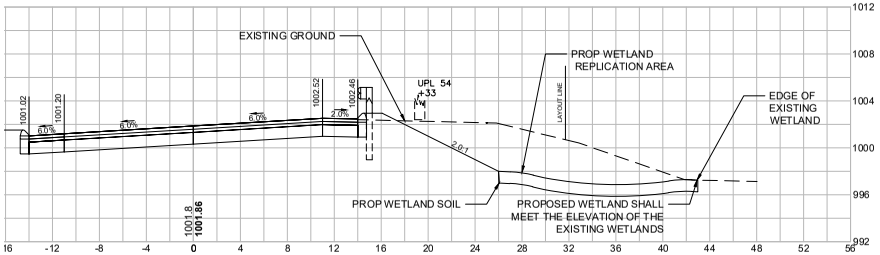
FERNS
CINNAMON FERN (OSMUNDA CINNAMOMEA): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.
SENSITIVE FERN (ONOCLEA SENSIBILIS): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.

SEED MIX
IN WETLAND REPLICATION AREA: SEE WETLAND SEED - OBLIGATE MIX - THIS SHEET
(SAME MIX TO BE USED ON PLAN SHEET 16 FOR WETLAND RESTORATION AREA 1)

FOR ALL AREA OUTSIDE AND ADJACENT TO WETLAND RESTORATION AND/OR REPLICATION AREAS PROVIDE PART SHADE ROADSIDE SEED MIX AS INDICATED ON CONSTRUCTION DETAIL SHEET 84.

TREES
OCTOBER GLORY (ACER RUBRUM): 2 TREES SPACED 25 FEET ON CENTER, WITH A 3 INCH TO 3.5 INCH CALIPER, TO PROVIDE A NATURAL PATTERN.
PRINCTON (ULMUS AMERICANA): 1 TREE WITH A 2 INCH TO 2.5 INCH CALIPER.

85+50



WETLAND REPLICATION AREA CROSS SECTION

608163_HD13\WETLAND REPLICATION.DWG Plotted on 8-Aug-2024 4:01 PM
Proposal No. 608163-132612
Addend. #2.5

THIS PAGE IS INTENTIONALLY LEFT BLANK

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

July 17, 2024

Town of Wales
3 Hollow Road
Wales, MA 01081
ATTN: John Grasso, Board of Selectmen Chair

RE: 401 WATER QUALITY CERTIFICATION
Administrative Completeness and Technical Deficiency Review
401 WQC Transmittal No: 24-WW10-0037-APP

AT: Monson Road Transportation Improvement Project
Wales, MA

Dear Mr. Grasso:

The Massachusetts Department of Environmental Protection (MassDEP) Wetlands Program Highway Unit has completed its Administrative Completeness Review of the application for the above-referenced application. The application is hereby deemed administratively complete.

MassDEP has also conducted a Technical Review of the above-referenced application, and requests that you submit the following additional information:

USACE Comments

1. Comments 5 through 7 provided by the U.S. Army Corps of Engineers on July 10, 2024, are incorporated by reference into this technical deficiency letter.

Wetlands and Waters

2. Please depict different hatching and/or shading on the plans for permanent versus temporary Bordering Vegetated Wetland (BVW) and Land Under Water (LUW) impacts.

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

3. The narrative states there will be limited tree removal within BVWs to accommodate the work. As such, the BVW replication area will need to include a commensurate amount of tree plantings.

4. It is not clear why the intermittent stream extending along the north side of Monson Road from Lynch Road to the culvert at Station 15+32 is being converted to a modified rockfill drainage ditch at its new location once the road is realigned. Unless otherwise prohibitive, the stream will need to be replicated with similar channel dimensions as the existing stream and specifications provided.

5. Please provide more detail regarding the proposed post-construction condition of the secondary intermittent on the north side of Monson Road between the culverts at Stations 43+75 and 46+60. The narrative states the stream is to remain to handle excess stormwater but as this portion of the stream is identified as being permanently impacted, it is not clear whether it will be reconstructed and/or relocated.

Stormwater

6. The Stormwater Management Report states impervious surface will increase by 0.88 acres. Section 5.0 of the Drainage Report states impervious surface will increase by 0.70 acres. Please confirm the correct net increase in impervious surface.

7. The grass and modified rockfill drainage ditches appear to be potentially suitable areas for linear conveyance Stormwater Control Measures (SCMs) such as Grassed Channels or Water Quality Swales. Unless demonstrated to be impracticable, these features will need to be converted to SCMs to better meet the Stormwater Management Standards to the maximum extent practicable, and the associated stormwater calculations revised.

8. In addition to the identified critical areas, please note there is also an Interim Wellhead Protection Area Critical Area that intersects the project east of the Monson Road intersection with Peck Road. Per Volume 1, Chapter 1 of the Massachusetts Stormwater Handbook, the use of salt for the deicing of impervious surfaces must be minimized within water supply protection areas as well as areas that drain to the three Coldwater Fishery Critical Areas. The Erosion and Sedimentation Control Plan and Pollution Prevention Plan needs to include this provision.

9. Inspection and maintenance of deep sump catch basins and any other SCMs must be in accordance with Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook. Please update the Operations and Maintenance Plan accordingly.

10. Per Section 9.1.2.k of the Environmental Protection Agency Construction General Permit that will be required for the project, dust control shall be limited to using water only and specifically avoiding other techniques such as calcium chloride. Please update Section 20 of the Erosion and Sedimentation Control Plan and Pollution Prevention Plan accordingly.

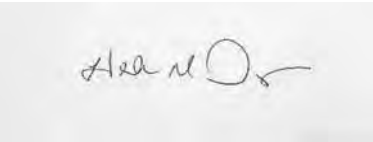
Rare Species

11. MassDEP understands coordination with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) is ongoing regarding Priority and Estimated Habitats of Rare Species at the project site. Per 314 CMR 9.06(2), no project may be permitted which will have any adverse effect on specified habitat sites of Rare Species unless the work is subject to a Conservation and Management Permit or Determination of No Take issued by NHESP. As such, NHESP coordination must be complete prior to issuance of the WQC.

Upon receipt of all requested supplemental information, MassDEP has 30 calendar days in which to issue or deny a certification.

Should you have any questions relative to this letter, please contact me at heidi.davis@mass.gov or Ryan Hale at ryan.hale@mass.gov.

Sincerely,



Heidi M. Davis
Highway Unit Supervisor

Ecc: DEP WERO – Michael McHugh
USACE – Dan Vasconcelos
USACE – Kevin Newton
MassDOT – Courtney Walker
MassDOT – Melissa Lenker
Weston & Sampson – Michael Joyce
Weston & Sampson – Rhianna Sommers
Wales Conservation Commission – Sarah Ryan, conservation@townofwales.net

THIS PAGE IS INTENTIONALLY LEFT BLANK

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

August 9, 2024

Ms. Heidi Davis
Massachusetts Department of Environmental Protection
Division of Wetlands and Waterways
100 Cambridge Street, Suite 900
Boston, MA 02114

Submitted via email to heidi.davis@mass.gov

Re: Response to Technical Review – Monson Road Transportation Improvements Project, Wales, Massachusetts (401 WQC Transmittal No. 24-WW10-0037-APP)

Dear Ms. Davis:

In response to the comments issued by the Massachusetts Department of Environmental Protection (MassDEP) on July 17, 2024 for the Monson Road Transportation Improvements Project 401 Water Quality Certificate (WQC) submitted by Weston & Sampson on behalf of the Town of Wales, Weston & Sampson is providing a written response to comments.

MassDEP's technical review comments are provided in italics below, followed by our responses in **bold** font.

USACE Comments

1. *Comments 5 through 7 provided by the U.S. Army Corps of Engineers on July 10, 2024, are incorporated by reference into this technical deficiency letter.*

   USACE Comment #5: Page 6 of the narrative and sheet number 33 of the plan set describe an intermittent channel labeled "WET N". If this is a stream with bed, bank, and Ordinary High Water (OHW), "WET N" should be considered WOTUS. If there are impacts to "WET N", please provide photos, revise the plan sheets and adjust impact calculations accordingly.

   The channel is a small, roadside drainage ditch. The Applicant believes that the area does not meet the definition of Waters of the U.S. (WOTUS) pursuant to 33 CFR Part 328 which states, in part, "where a feature satisfies the terms of an exclusion, it is excluded from jurisdiction even where the feature would otherwise be jurisdictional under paragraphs (a)(2) through (5) of this rule…". The list of exclusions includes:

   (3) Ditches (including roadside ditches) excavated wholly in and draining only dry land and that do not carry a relatively permanent flow of water.

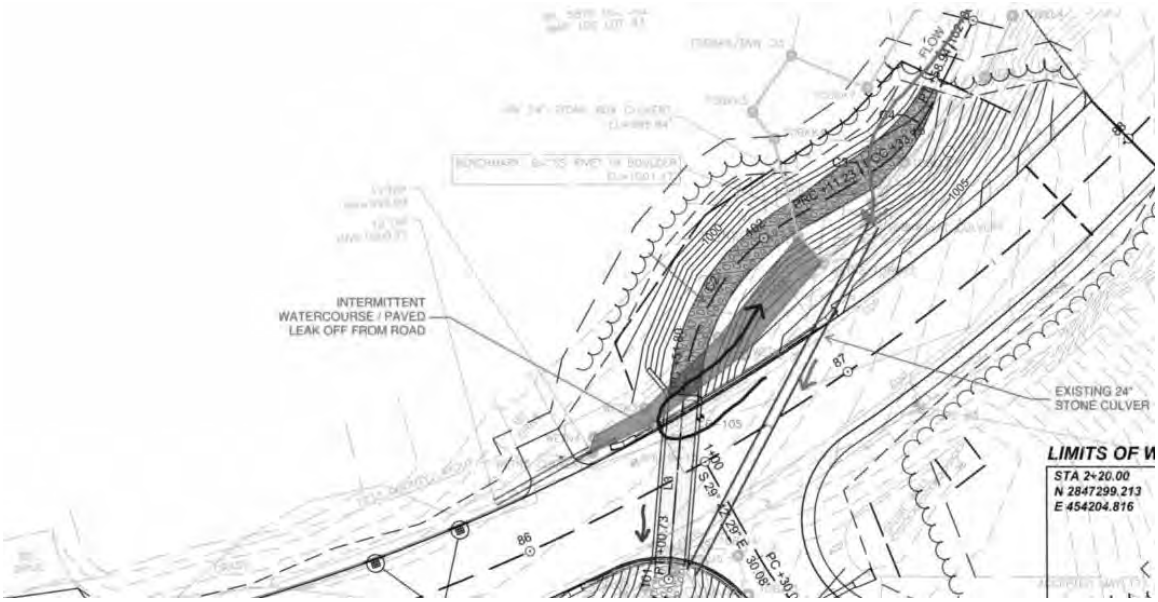
   The drainage channel in question (labeled "WET N" on the plans) is a roadside ditch that collects runoff from Monson Road. The channel meets the above definition as it was excavated in dry land and drains dry land (the roadway). It does not carry a permanent flow of water, and was dry at the time of the delineation.

This channel was discussed in a meeting with the U.S. Army Corps of Engineers (Mr. Kevin Newton and Mr. Dan Vasconcelos) and MassDEP (Ms. Heidi Davis and Mr. Ryan Hale) on July 23, 2024. As discussed, the drainage ditch in question originates in an upland area, does not contain wetland vegetation or hydric soils, and has no visible Ordinary High Water mark (OHWM). This channel was excavated in an upland area for stormwater drainage purposes and is maintained by the Town as needed.

Photos of this drainage ditch are included below.

The sediment shown in the photo is deposited sediment from roadway runoff.

The inverts of the 12" pipe under the adjacent driveway shows the direction of flow back toward the pipe and actual watercourse (see image below).



The roadside ditch collects runoff from the road. The observed banks are more due to erosion than actual watercourse patterns. The paved leaked off was cut in by the Town and periodically paved to allow the roadway runoff to drain off the road and toward the watercourse and 24" stone culvert. The invert of the 24" pipe under Monson Road is approximately 4-5' lower than the beginning of the paved leaked off.

Regarding a question from Ms. Davis during the July 23rd meeting, the existing drainage area contributing to the drainage ditch across from Reed Hill Road is approximately 16,760 SF or 0.38 acres. This area mainly consists of roadway drainage coming down the hill and eventually entering the existing paved leak-off. Approximately 2,200 SF (0.05AC) is pervious area (grass/woods).

USACE Comment #6: Detailed cross-section and profile views were provided for STA 24+92, 82+07, and 86+45. Please provide cross section and profile views for the other three stream crossings (STA 15+32, 43+75, and 46+60).

Cross section views of the crossings at STA 15+32, 43+75, and 46+60 have been provided in the revised plan set. As discussed, these shallow, small watercourses do not represent perpendicular stream crossings, and therefore longitudinal profiles have not been provided.

USACE Comment #7: Please include OHW elevation within each culvert cross-section and profile view.

The field delineated OHW limits have been shown on the cross sections at the locations where they were field delineated.

2. *Please depict different hatching and/or shading on the plans for permanent versus temporary Bordering Vegetated Wetland (BVW) and Land Under Water (LUW) impacts.*

   The plans have been updated to use different colors for the proposed permanent and temporary impacts to BVW and LUW. The revised plan set is included in Appendix A.

3. *The narrative states there will be limited tree removal within BVWs to accommodate the work. As such, the BVW replication area will need to include a commensurate amount of tree plantings.*

   Given that many of the impact areas are small, we recommend that the wetland replication area depicted on the plans be the location where commensurate tree plantings be required. Weston & Sampson has updated this planting plan and included it in this revised submittal. Two red maple (*Acer rubrum*) trees have been added to the planting plan for the 1,204 SF replication area.

4. *It is not clear why the intermittent stream extending along the north side of Monson Road from Lynch Road to the culvert at Station 15+32 is being converted to a modified rockfill drainage ditch at its new location once the road is realigned. Unless otherwise prohibitive, the stream will need to be replicated with similar channel dimensions as the existing stream and specifications provided.*

   Originally, a modified rockfill drainage ditch was proposed at this location because the average longitudinal slope was over 3% which, as dictated by MassDOT design guide, requires a rockfill lining. After we extended the portion of the swale which runs adjacent to the roadway up to Lynch Road to receive the watercourse, the average longitudinal slope was reduced to less than 3%. The calculations for shear stress were performed again, and confirmed that a conversion to grass lining would be acceptable. The crossing at STA 15+32 has been revised to be a vegetated channel rather than a modified rockfill drainage ditch (please refer to the attached updated plan set). The drainage report has also been updated to reflect this change.

5. *Please provide more detail regarding the proposed post-construction condition of the secondary intermittent on the north side of Monson Road between the culverts at Stations 43+75 and 46+60. The narrative states the stream is to remain to handle excess stormwater but as this portion of the stream is identified as being permanently impacted, it is not clear whether it will be reconstructed and/or relocated.*

   The channel at this location will be relocated slightly north as a result of the project, but will remain a vegetated channel with restored bed and bank post-construction. The channel will be seeded with an appropriate seed mix and shaped so that it has bed and bank similar to that of the current channel under existing conditions.

6. *The Stormwater Management Report states impervious surface will increase by 0.88 acres. Section 5.0 of the Drainage Report states impervious surface will increase by 0.70 acres. Please confirm the correct net increase in impervious surface.*

   The correct net increase in impervious area is 0.88 acres. The Drainage Report has been corrected, and the updated version is attached.

7. *The grass and modified rockfill drainage ditches appear to be potentially suitable areas for linear conveyance Stormwater Control Measures (SCMs) such as Grassed Channels or Water Quality Swales. Unless demonstrated to be impracticable, these features will need to be converted to SCMs to better meet the Stormwater Management Standards to the maximum extent practicable, and the associated stormwater calculations revised.*

   The conversion of the proposed conveyance swales into linear stormwater control measures was further investigated to determine the practicability of modifying the design at this stage of the project.

   There are three locations along the corridor with proposed swales that have less than the maximum 5% longitudinal slope: Sta. 15+30 modified rockfill swale, Sta. 43+70 natural grass swale, and Sta. 73+23 modified rockfill swale. The currently proposed swale designs consist of a 1'-wide bottom with 2:1 side slopes and 9"-high check dams at varied spacing. Modified rockfill is proposed in the swales with a longitudinal slope of 3% or greater to help reduce erosion and velocity.

   In order to satisfy the requirements for a linear infiltration practice, as defined in MassDOT's 2023 Stormwater Design Guide, the minimum size of the swale would need to consist of a 2'-wide bottom with 3:1 side slopes. This is consistent with MassDEP's Stormwater Handbook. In addition, the calculated Water Quality Volume (WQV) for the swale's drainage area would need to be completely detained in between the check dams to promote infiltration into the soils over a 72-hour period.

   Due to the large drainage areas that are contributing to the swales, the WQVs are not able to be fully detained within the swales between the check dams as they are currently proposed. The most practical location for a linear infiltration practice is at Sta. 43+70 with a WQV of 860 ft^3. The total storage volume as currently proposed is approximately 370 ft^3. If the swale were to be upsized to the minimum design criteria, and the check dam design was revised to be 1-ft in height, the total storage volume could be increased to approximately 1,000 ft^3. Unfortunately, the larger sized swale would cause multiple issues for project delivery, right of way impacts, wetland impacts, and utility relocation. The proposed grading for the upsized swale at this location would be pushed a minimum of 5-ft further from the roadway and onto private property which would require a permanent drainage easement. In addition, the larger swale would force a utility pole to be relocated and there would be additional dredging within a BVW. Also, the larger check dams would not allow for proper freeboard to the roadway in some cases and MassDOT's safety criteria in their engineering directives for check dams and SCMs in the clear zone (E-20-003) would not be met.

   At each of the locations listed above, the currently proposed swale would need to be upsized to accommodate storage of the full WQV and to adhere to the standards laid out by MassDEP and in MassDOT's Stormwater Design Guide. At this stage of the project, with the Right of Way acquisition process currently underway and a very tight deadline to bid the project, there is no flexibility to propose additional easements due to revising swale designs. The currently designed natural grass swales will still detain a portion of the WQV and will promote infiltration and recharge to the maximum extent practicable, but they cannot be formally considered stormwater control or water quality measures.

8. *In addition to the identified critical areas, please note there is also an Interim Wellhead Protection Area Critical Area that intersects the project east of the Monson Road intersection with Peck Road. Per Volume 1, Chapter 1 of the Massachusetts Stormwater Handbook, the use of salt for the deicing of impervious surfaces must be minimized within water supply protection areas as well as areas that drain to the three Coldwater Fishery Critical Areas. The Erosion and Sedimentation Control Plan and Pollution Prevention Plan needs to include this provision.*

   The Erosion and Sedimentation Control Plan and Pollution Prevention Plan have been updated to include this provision. The revised Erosion and Sedimentation Control Plan and Pollution Prevention Plan are attached.

9. *Inspection and maintenance of deep sump catch basins and any other SCMs must be in accordance with Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook. Please update the Operations and Maintenance Plan accordingly.*

   The Operations and Maintenance Plan has been updated accordingly and is attached.

10. *Per Section 9.1.2.k of the Environmental Protection Agency Construction General Permit that will be required for the project, dust control shall be limited to using water only and specifically avoiding other techniques such as calcium chloride. Please update Section 20 of the Erosion and Sedimentation Control Plan and Pollution Prevention Plan accordingly.*

    The Erosion and Sedimentation Control Plan and Pollution Prevention Plan have been updated to include this provision. The revised Erosion and Sedimentation Control Plan and Pollution Prevention Plan are attached.

11. *MassDEP understands coordination with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) is ongoing regarding Priority and Estimated Habitats of Rare Species at the project site. Per 314 CMR 9.06(2), no project may be permitted which will have any adverse effect on specified habitat sites of Rare Species unless the work is subject to a Conservation and Management Permit or Determination of No Take issued by NHESP. As such, NHESP coordination must be complete prior to issuance of the WQC.*

    The project received a No Take determination from the Natural Heritage and Endangered Species Program (NHESP) on July 1, 2024 (NHESP File No. 24-18601). A copy of the NHESP determination is included in Appendix C.

If you have any questions regarding this submittal, please contact me at 978-548-6301.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Michael Joyce, P.E.
Senior Team Leader - Transportation

cc: Wales Board of Selectmen
Courtney Walker, MassDOT
Melissa Lenker, MassDOT
Kimberly Sloan, MassDOT
Ryan Hale, MassDEP
Tyler Lewis, MassDEP
Kevin Newton, USACE

List of Appendices:

Appendix A: Revised Permit Drawings
Appendix B: Revised Stormwater Report
Appendix C: NHESP No Take Determination

Appendix A

Updated 401 WQC Permit Drawings

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE TOWN OF

WALES

HAMPDEN COUNTY

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-		
PROJECT FILE NO.	608163		

TITLE SHEET & INDEX

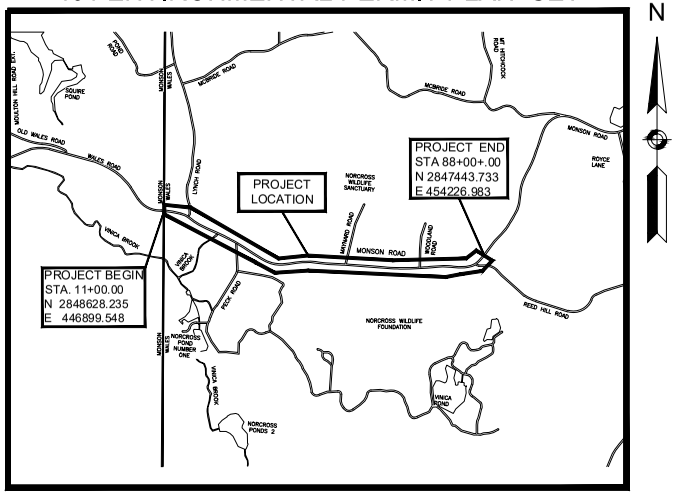
THESE PLANS ARE SUPPLEMENTED BY THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2024, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

100% SUBMITTAL

401 ENVIRONMENTAL PERMIT PLAN SET

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND, ABBREVIATIONS & GENERAL NOTES
4	TYPICAL SECTIONS
5-12	CONSTRUCTION PLANS
13-18	PROFILES
19-26	CROSS SECTIONS
27-35	STRUCTURAL PLANS
36	CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION
37-38	CULVERT 3 CHANNEL CROSS SECTIONS
39-40	TEMPORARY WATER HANDLING PLAN
41	WETLAND REPLICATION AREA DETAIL



LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

August 2024

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

COMMONWEALTH OF MASSACHUSETTS
SCOTT R. BRUSO
STRUCTURAL
No. 48661
REGISTERED PROFESSIONAL ENGINEER

Weston & Sampson
712 Brook Street, Suite 103
Rocky Hill, CT 06067
860.513.1473
www.westonandsampson.com

DATE	DESCRIPTION	REV #

massDOT
Massachusetts Department of Transportation
Highway Division

APPROVED

CHIEF ENGINEER ____ DATE ____

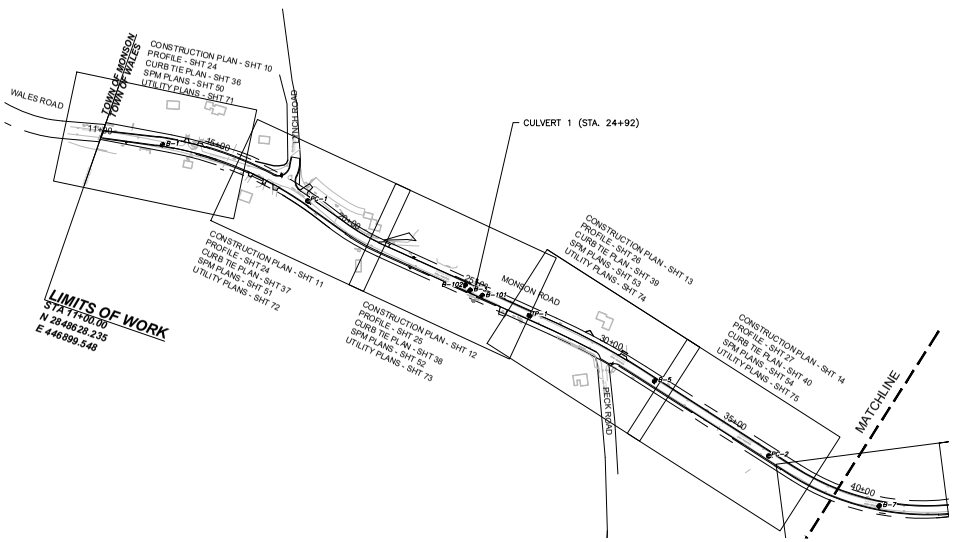
608163_HDI\TITLE_LEGEND_KEY & TYPICAL SECTIONS\401.DWG Plotted on 8-Aug-2024 11:59 AM

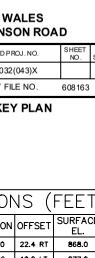
Project No. 608163.132127

ADB40_469

NOTES:

1. BENCH MARK:
   MAGNAIL U.P.L. LOCATED EAST OF NORTH STREET AT STATION 12+79.94 AND EL. 869'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 21+37.43 AND EL. 877'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 29+56.65 AND EL 900'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 29+94.76 AND EL 902'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 38+22.13 AND EL 938'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 56+22.73 AND EL 957'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 65+94.25 AND EL 1007'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 74.95.16 AND EL 1022'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 81+31.62 AND EL 1006'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 87+05.97 AND EL 1008'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 87+15.35 AND EL 1001'





0 200 400 600 800

SCALE: 1" = 200'

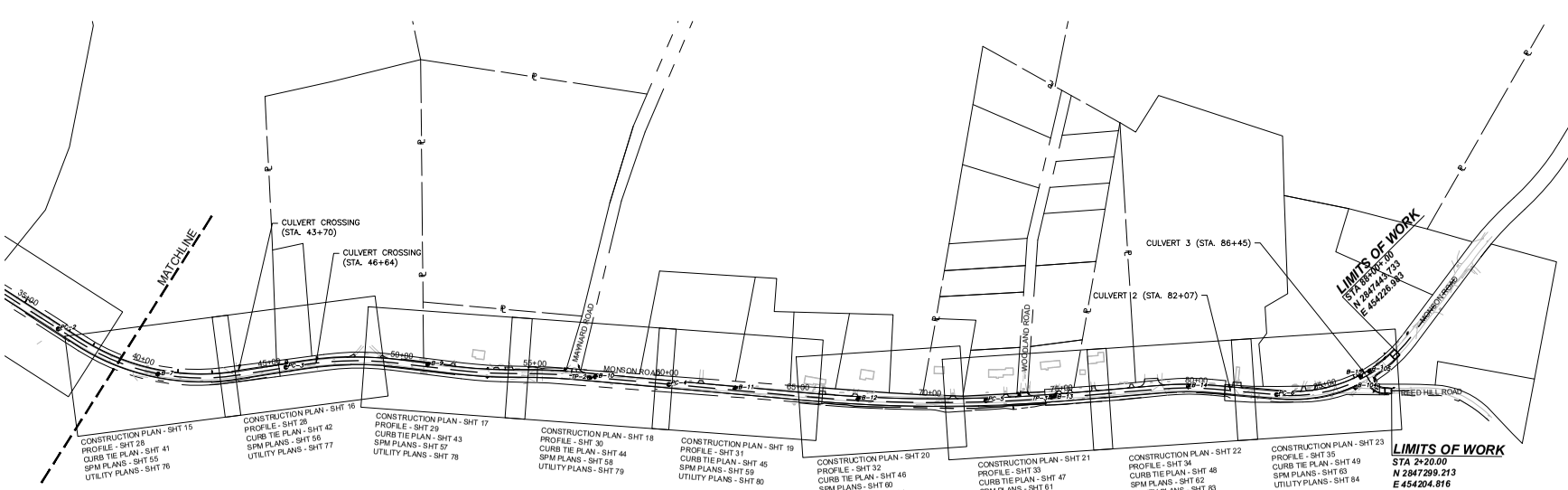
WALES
MONSON ROAD

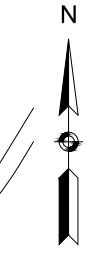
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

KEY PLAN

BORING LOCATIONS (FEET)

BORING	NORTHING	EASTING	STATION	OFFSET	SURFACE EL.	H.B.E.
B-1	2,848,584	447,074	12+80	22.4 RT	868.0	861.5
B-3	2,848,121	448,154	24+56	10.0 LT	877.0	865.2
B-5	2,847,789	448,792	31+89	10.8 LT	902.0	897.5
B-7	2,847,423	449,318	38+27	18.1 RT	941.0	937.0
B-9	2,847,397	450,584	51+05	9.6 LT	933.0	916.5
B-10	2,847,355	451,197	57+19	6.7 LT	956.0	951.5
B-11	2,847,315	451,727	62+51	14.1 LT	989.0	984.5
B-12	2,847,272	452,354	68+80	16.0 LT	1011.0	1007.0
B-13	2,847,294	452,969	74+98	19.4 LT	1019.0	1014.5
B-14	2,847,322	453,443	79+72	12.1 LT	1009.0	1004.5
B-15	2,847,355	454,092	86+37	9.1 LT	1002.0	999.1
B-101	2,848,098	448,155	24+80	4.2 RT	877.1	861.9
B-102	2,848,103	448,186	25+06	12.85 LT	877.5	849.0
B-104	2,847,316	454,080	86+09	20.6 RT	1002.4	974.4
B-105	2,847,367	454,110	85+59	11.0 RT	1001.8	987.7





0 200 400 600 800

SCALE: 1" = 200'

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-138127
AGENDA #7D

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
	CBCI	CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
OHU		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
		CHAIN LINK OR METAL FENCE
		WOOD FENCE
		EROSION AND SEDIMENT CONTROL BARRIER
		TREE LINE
		LIMITS OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT AREA BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
		SIGN AND POST
		SIGN AND DOUBLE POST

ABBREVIATIONS

GENERAL	
AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CBCI-DB	DOUBLE GRATE CATCH BASIN W/ CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN

ABBREVIATIONS (cont.)

GENERAL	
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCCE	REINFORCED CONCRETE CULVERT END
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STA
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
SWTU	STORMWATER TREATMENT UNIT
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
	SL	12"-WIDE STOP LINE
	SWL	6"-WIDE SOLID WHITE LINE
	DBYL	DOUBLE YELLOW LINE (2 - 6"-WIDE YELLOW LINES)

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

LEGEND, ABBREVIATIONS & GENERAL NOTES

GENERAL NOTES:

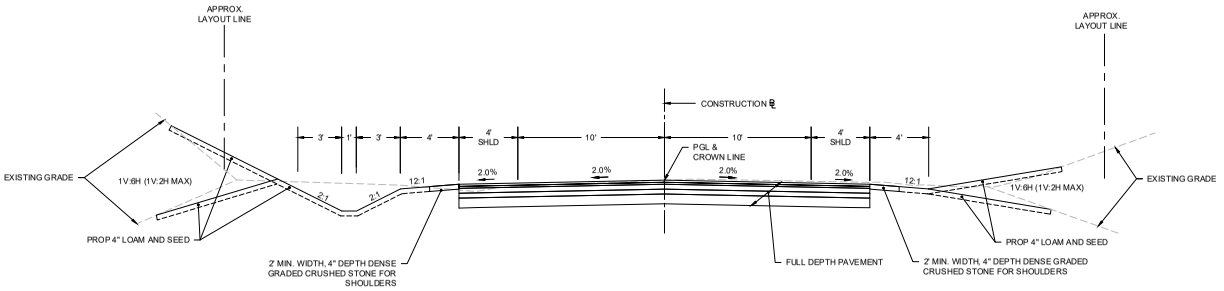
1. TOPOGRAPHICAL INFORMATION BASED ON AN ON-THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ON DECEMBER 2017 AND SUPPLEMENTED BY CHAPPELL ENGINEERING IN OCTOBER 2023. WETLAND FLAGGING WAS PERFORMED BY WESTON & SAMPSON IN NOVEMBER 2020 AND REFLAGGED IN SEPTEMBER OF 2023.
2. THE HORIZONTAL COORDINATES ARE BASED ON NAD 83, THE VERTICAL DATUM IS NAVD 88.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL DIG TEST PITS WITH THE LOCATIONS BEING APPROVED BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK TO EXACTLY LOCATE EXISTING UTILITIES.
4. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY OWNER. ANY ALTERATIONS SHALL BE INCIDENTAL TO THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY SUPPORT OF ALL UTILITIES TO REMAIN IN PLACE AND SHALL DESCRIBE IN WRITING, TO THE SATISFACTION OF THE ENGINEER, HIS METHOD OF TEMPORARY SUPPORT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. THE TERM "PROPOSED (PROP)" INDICATES WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET (R&R)".
8. ALL EXISTING STATE, COUNTY AND TOWN LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
9. ALL EXCESS MATERIAL FROM ROADWAY RECONSTRUCTION OR THE EXCAVATION PROCESS SHALL BE REUSED ON SITE OR REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL AND PROPER MANNER.
10. THE CONTRACTOR SHALL CALL DIGSAFE AT 1-888-344-7233 AT LEAST 72 HOURS, SATURDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE TOWN PRIOR TO EXCAVATION.
11. JOINTS BETWEEN HOT MIX ASPHALT TRENCH PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.
12. IF DEEMED NECESSARY DUE TO THE WORK, THE CONTRACTOR SHALL COORDINATE WITH THE TOWN OF WALES HIGHWAY DEPARTMENT, THE WALES FIRE DEPARTMENT, AND THE ENGINEER FOR APPROVAL OF SHUTTING DOWN ANY EXISTING WATER MAINS AND SHALL ALSO OBTAIN APPROVAL FOR DISRUPTING ANY EXISTING SEWER FLOWS.
13. THE CONTRACTOR SHALL BE AWARE THAT ONLY TOWN PERSONNEL ARE ALLOWED TO OPERATE WATER GATES AND HYDRANTS. ANY REQUESTS TO OPERATE THE GATES SHALL BE COORDINATED THROUGH THE ENGINEER.
14. THE CONTRACTOR SHALL COORDINATE ANY WORK FOR THE PROJECT WITH ALL ADJACENT/CONCURRENT PROJECTS AND CONTRACTORS.
15. THE CONTRACTOR SHALL INSTALL PRIOR TO COMMENCEMENT OF WORK, MAINTAIN, AND REMOVE AT THE END OF THE PROJECT INLET SEDIMENT CONTROL BAGS IN ALL CATCH BASINS, WITHIN OR ADJACENT TO THE PROJECT LIMITS. THE CONTRACTOR SHALL ALSO MAINTAIN SILT FENCE AND COMPOST FILTER TUBES AS SHOWN ON THE PLANS THROUGHOUT THE DURATION OF THE PROJECT AND REMOVE AT THE END.
16. ANY GRASS AREAS DISTURBED BY THE WORK SHALL BE RESTORED WITH LOAM AND SEED.
17. ANY LANDSCAPED AREAS DISTURBED BY THE WORK SHALL BE RESTORED TO EXISTING CONDITIONS WITH EXISTING OR NEW GROUND COVER MATERIALS AS DIRECTED BY THE ENGINEER. ANY PLANTS, SHRUBS, OR FLOWERS DISTURBED BY THE WORK SHALL BE RESET TO EXISTING CONDITIONS OR REPLACED WITH NEW PLANTS, SHRUBS, OR FLOWERS AS DIRECTED BY THE ENGINEER. ALL WORK TO RESTORE LANDSCAPE AREAS, NEW GROUND COVER MATERIALS, NEW PLANTS, NEW SHRUBS, OR NEW FLOWERS REQUIRED BY THE ENGINEER SHALL BE INCIDENTAL TO THE PROJECT.
18. CONTRACTOR TO COORDINATE WITH UTILITY POLE OWNERS IN AREAS WHERE UNDERGROUND UTILITY WORK IS WITHIN CLOSE PROXIMITY AND POSSIBLE UTILITY POLE SHORING IS REQUIRED WHILE INSTALLING PROPOSED UTILITIES.
19. RAISE AND ADJUST FRAMES AND GRATES, FRAMES AND COVERS AND GATE BOXES PRIOR TO PAVEMENT OVERLAY, IF REQUIRED.
20. CONTRACTOR IS RESPONSIBLE FOR REPLACING ANY PROPERTY PINS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION, TO THEIR LOCATION JUST PRIOR TO CONSTRUCTION.
21. ALL TRAFFIC SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS OTHERWISE NOTED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
22. CONTRACTOR TO ESTABLISH TEMPORARY BENCHMARKS EVERY 1000 FEET BASED ON THE PERMANENT BENCHMARKS LOCATED AT STA 29+85.04, 24.73 LEFT AND STA 87+27.18, 41.17 LEFT OR AS REQUIRED BY THE ENGINEER.
23. CONTRACTOR TO PROVIDE ADDITIONAL TRAVERSE POINTS AND TRAVERSE LINES IN THE VICINITY OF EXISTING TRAVERSE POINTS WHERE THE EXISTING TRAVERSE POINT IS LOCATED IN "SOFT GROUND" OR AS REQUIRED BY THE ENGINEER.
24. ALL EXISTING STONE WALLS PROPOSED FOR RELOCATION SHALL NOT BE REMOVED FROM THE IMMEDIATE AREA SHOWN ON THE PLANS.

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-128112
A0848.451

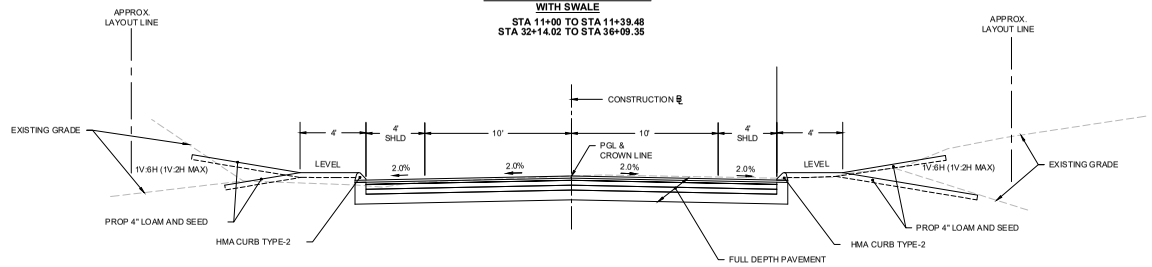
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

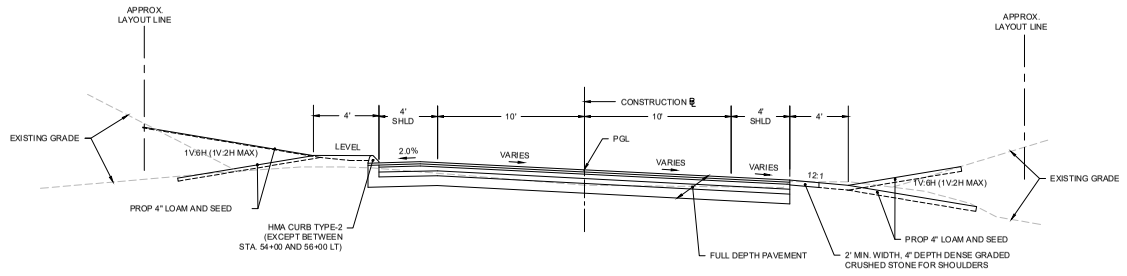
TYPICAL SECTIONS



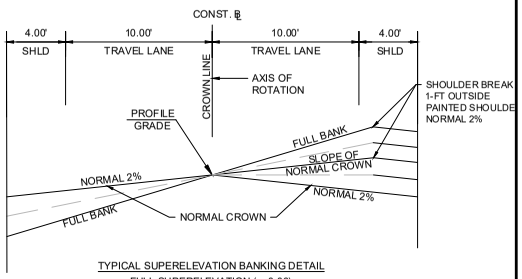
MONSON ROAD TYPICAL SECTION
WITH SWALE
STA 11+00 TO STA 11+39.48
STA 32+14.02 TO STA 36+09.35



MONSON ROAD TYPICAL SECTION
WITH CURBING
STA 22+70.43 TO STA 26+98.72
STA 57+46.79 TO STA 64+41.04
STA 75+70.50 TO STA 77+39.51



MONSON ROAD TYPICAL SECTION
FULL SUPERELEVATION AND TRANSITIONS
STA 11+39.48 TO STA 22+70.43
STA 26+98.72 TO STA 32+14.02
STA 36+09.35 TO STA 57+46.79
STA 64+41.04 TO STA 75+70.50
STA 77+39.51 TO STA 88+00



TYPICAL SUPERELEVATION BANKING DETAIL
FULL SUPERELEVATION (e=0.06)
N.T.S.

PAVEMENT NOTES

PROPOSED PAVEMENT MILLING AND OVERLAY:

1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.50" PAVEMENT MILLING

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).

BASE COURSE: 3.25" SUPERPAVE INTERMEDIATE COURSE 19 (SIC-19.0) PLACED IN ONE LAYER.

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT A RATE OF 0.07 TO 0.09 GAL/SY OVER MILLED SURFACES AND 0.06 TO 0.08 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY :

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2.50" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5)

FOUNDATION: 8" GRAVEL BORROW, TYPE B

PROPOSED GRAVEL DRIVEWAY:

8" GRAVEL BORROW, TYPE B

PROPOSED CEMENT CONCRETE WALK

4" CEMENT CONCRETE OVER

8" GRAVEL BORROW, TYPE B

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-136127
A08840 .dZ

HIGHWAY GUARD DETAILS

STA 14+65 TO STA 14+78 LT TANGENT END TREATMENT TL-3
STA 14+78 TO STA 16+88 LT (TL-3)
STA 14+50 TO STA 14+63 RT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+C2 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	QTY (MASTER TOTAL)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	13	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	27	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	13	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

401 PERMIT IMPACT NUMBERS

	L.U.W. IMPACT	B.V.W IMPACTS	BANK IMPACTS	DREDGE
PERMANENT IMPACTS	4454 SF	653 SF	783 LF	90 CY
TEMPORARY IMPACTS	194 SF	199 SF	0 LF	N/A

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

LIMITS OF WORK
STA 11+00.00
N 2848628.235
E 446899.548

TOWN OF MONSON
TOWN OF WALES

324 WALES RD
MONSON, MA
N/F
LYNNETTE M. BIGGS
BK. 16452 PG. 495
MAP 159 LOT 002

167 MONSON ROAD
N/F
LYNNETTE M. BIGGS
BK. 16452 PG. 495
MAP 100 PG. 167

165 MONSON ROAD
N/F
LYNDA ST. GERMAIN
BK. 9559 PG. 79
MAP 100 LOT 165

163 MONSON ROAD
N/F
SHAWN M WHITE
BK. 20859 PG. 312
MAP 100 LOT 163

R&R 20 FT STONE WALL
R&S 2 BOULDERS
R&D LANSCAPING
RET BUSHES
R&R MAILBOX
PROP GRAV DWY
PROP HMA DWY
REM TREE (3)
PROP HMA CURB
PROP CHECK DAM
PROP LOAM & SEED (TYP.)
PROP ROCKFILL
PROP CHECK DAM
REM TREE (4)
REM TREE (14)
TEMP CONST EASEMENT
PROP HMA DWY
R&S 85 LF BALANCE STONE WALL
DRAINAGE EASEMENT
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PERMANENT L.U.W. IMPACT = 591 SF
R&R 105 LF BALANCE STONE WALL (CONT. ON SHEET NO. 9)
BANK IMPACT = 255 LF
REM TREE
GRASS DRAINAGE DITCH
1930 COUNTY LAYOUT
MATCH EXISTING
TOS
RET
PROP EOP
PC +57.89
PROP FULL DEPTH CONSTRUCTION
R&R
MONSON ROAD
Δ=28°43'06"
R=1200.00'
L=601.58'
T=307.59'
PROP HMA CURB
WALES ROAD
10+00
S 83° 11' 15" E 100.10'
S 83° 11' 15" E 157.79'
PROP SAWCUT
R&S
BOS
GRD
REM
FE
PRC
CONTINUED ON SHEET NO. 9
OHW
MATCH EXISTING
APPROX LIMIT OF CLEARING & GRUBBING
RET TREE W/ PROT
PERM UTIL EASEMENT
PROP LOAM & SEED (TYP.)
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PROP SEDIMENT CONTROL BARRIER (TYP.)
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
PROP HMA DWY
PROP GRAV DWY
PERMANENT L.U.W. IMPACT= 40 SF
BANK IMPACT = 10 LF
PERMANENT L.U.W. IMPACT= 15 SF
DREDGE VOLUME = 1 CY
PROP ROCKFILL
REM 25 FT STONE WALL WITHIN DRAINAGE EASEMENT
WPA JURSDICTION
DRAINAGE EASEMENT
WQC JURISDICTION
RET TREE W/ PROT.
RET TREE W/ PROT (7)
PERM UTIL EASEMENT
WPA JURSDICTION

WALES ROAD, MONSON
N/F
THE NORCROSS WILDLIFE FOUNDATION INC
BK. 9529 PG. 478
MAP 159 PG. 02C

WALES ROAD, MONSON
N/F
THE NORCROSS WILDLIFE FOUNDATION INC
BK. 9529 PG. 478
MAP 159 PG. 02C

170 MONSON ROAD
N/F
MICHAEL P. THIBEAULT
BK. 16309 PG. 348
MAP 100 PG. 170

162 MONSON RD
N/F
CONNA J. GILES
BK. 15085 PG. 175
MAP 100 LOT 162

IMPACT LEGEND

WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W.=LAND UNDER WATER
PERMANENT
TEMPORARY
B.V.W.=VEGETATED WETLANDS
PERMANENT
TEMPORARY

0 20 50 100

FOR PROFILE SEE SHEET NO. 22

608163_HDSCONSTRUCTION PLANS\401_404.DWG Plotted on 9-Aug-2024 5:35 PM
Approved No. 608163-130612
Addendum #3

HIGHWAY GUARD DETAILS

STA 14+78 TO STA 16+88 LT (TL-3)
STA 16+88 TO STA 17+00 LT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)
STA 16+02 TO STA 16+14 RT TANGENT END TREATMENT TL-3
STA 20+25 TO STA 20+37 RT TANGENT END TREATMENT TL-3
STA 20+37 TO STA 23+10 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

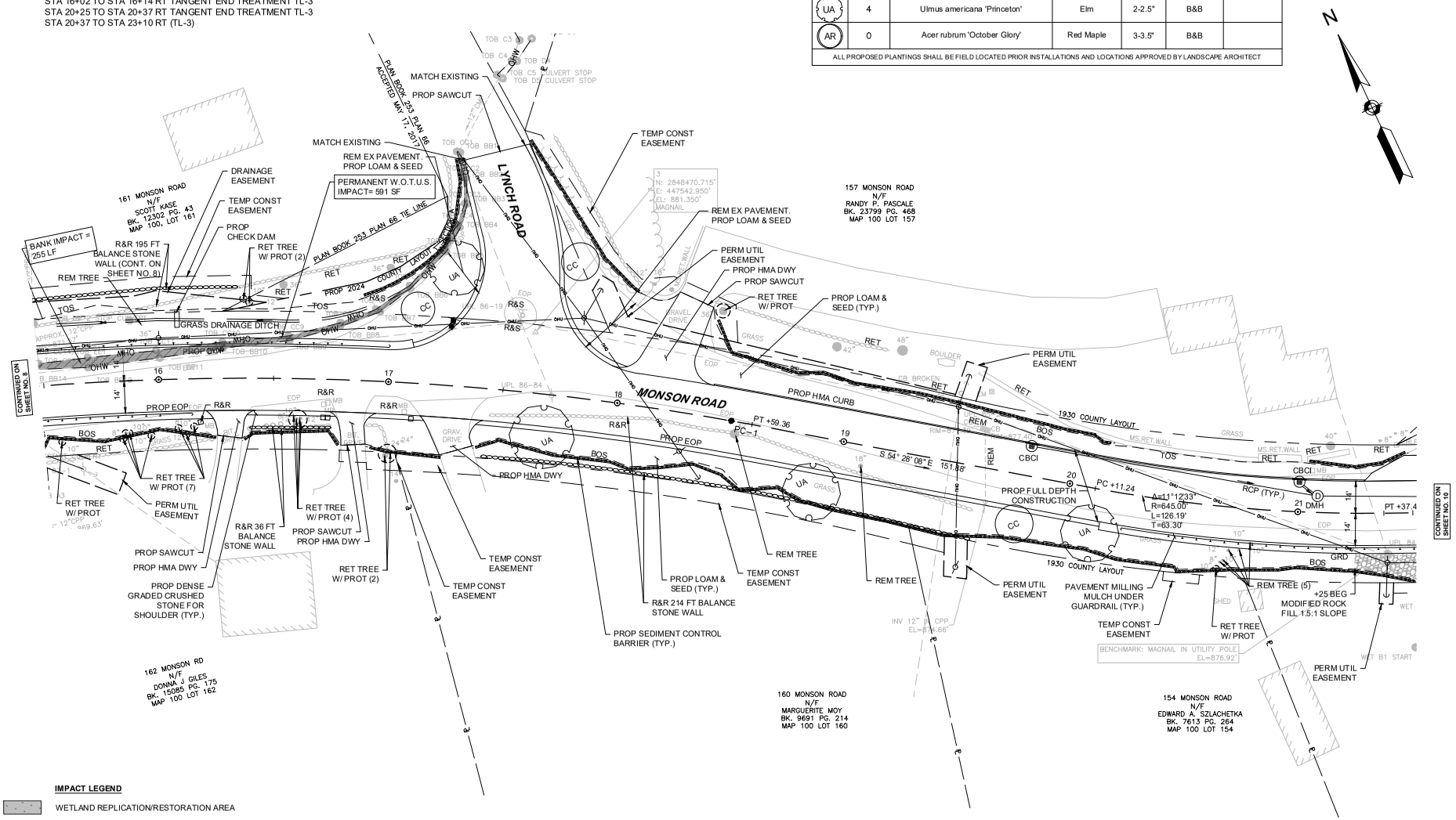
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	4	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



IMPACT LEGEND

- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- W.O.T.U.S.=WATERS OF THE UNITED STATES
- PERMANENT
- TEMPORARY
- V.W.=VEGETATED WETLANDS
- PERMANENT
- TEMPORARY

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 22

608163_HDI\CONSTRUCTION PLANS\H04.DWG Plotted on 9-Aug-2024 4:02 PM

Proposal No. 608163 (S)(1)(2)

ADDEND. #2/4

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

HIGHWAY GUARD DETAILS

STA 20+37 TO STA 23+10 RT (TL-3)
STA 23+10 TO STA 23+22 RT TANGENT END TREATMENT TL-3
STA 23+86 TO STA 23+98 RT TANGENT END TREATMENT TL-3
STA 23+98 TO STA 25+61 RT (TL-3)
STA 24+25 TO STA 24+37 RT TANGENT END TREATMENT TL-3
STA 24+25 TO STA 24+37 LT TANGENT END TREATMENT TL-3
STA 24+37 TO STA 24+77 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 24+37 TO STA 24+77 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+46 TO STA 25+60 RT (TL-3)
STA 25+46 TO STA 25+79 LT (TL-3)
STA 25+60 TO STA 25+72 RT TANGENT END TREATMENT TL-3
STA 25+79 TO STA 25+91 LT TANGENT END TREATMENT TL-3

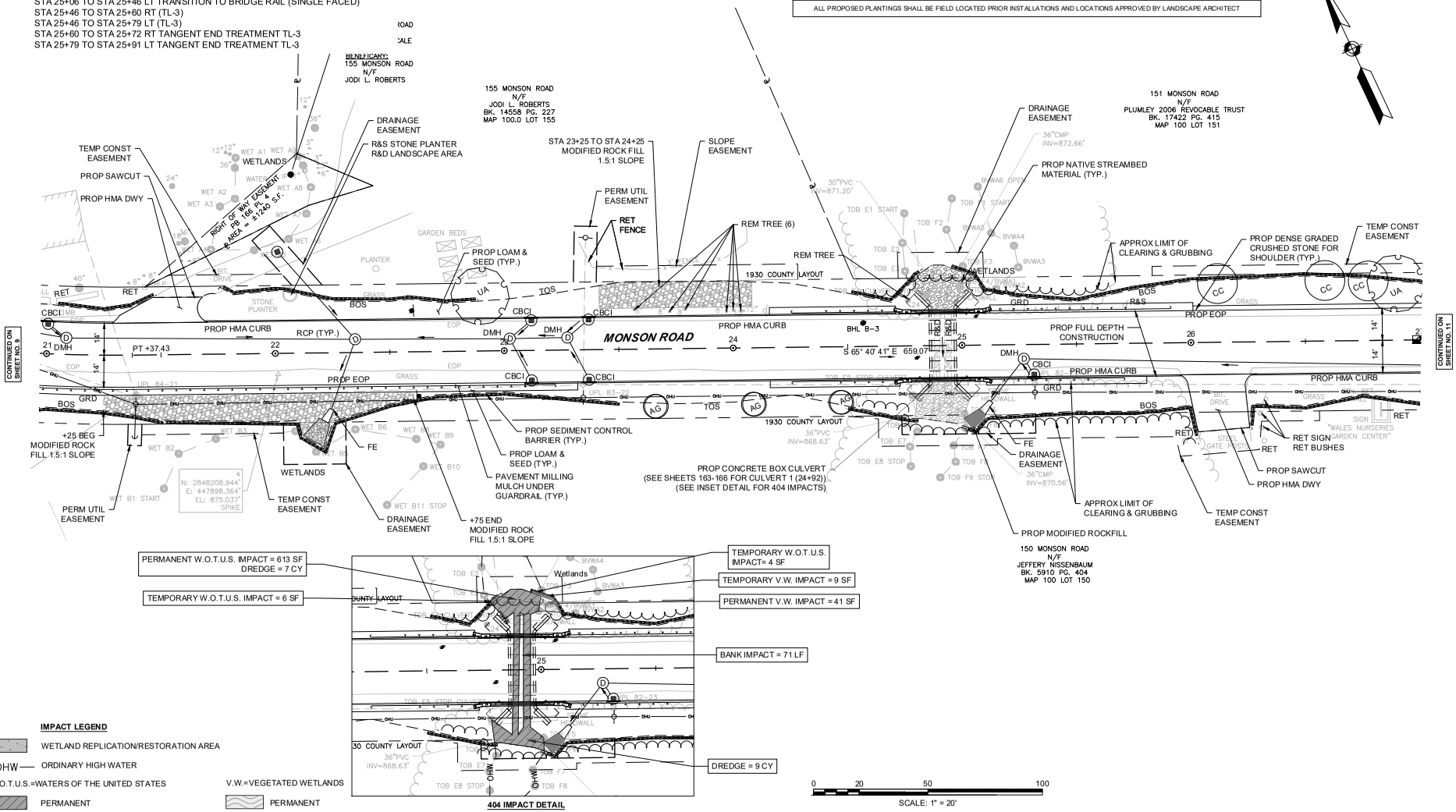
TRAFFIC SIGNAL CONDUIT

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS



404 IMPACT DETAIL

IMPACT LEGEND

- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- W.O.T.U.S.=WATERS OF THE UNITED STATES
- V.W.=VEGETATED WETLANDS
- PERMANENT
- TEMPORARY
- PERMANENT
- TEMPORARY

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 23

608163_HDI\CONSTRUCTION PLANS\404.DWG Plotted on 9-Aug-2024 4:03 PM
Proposal No. 608163-132612
A08MJ .4/5

HIGHWAY GUARD DETAILS
STA 42+75 TO STA 42+87 RT TANGENT END TREATMENT TL-3
STA 42+87 TO STA 43+86 RT (TL-3)

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

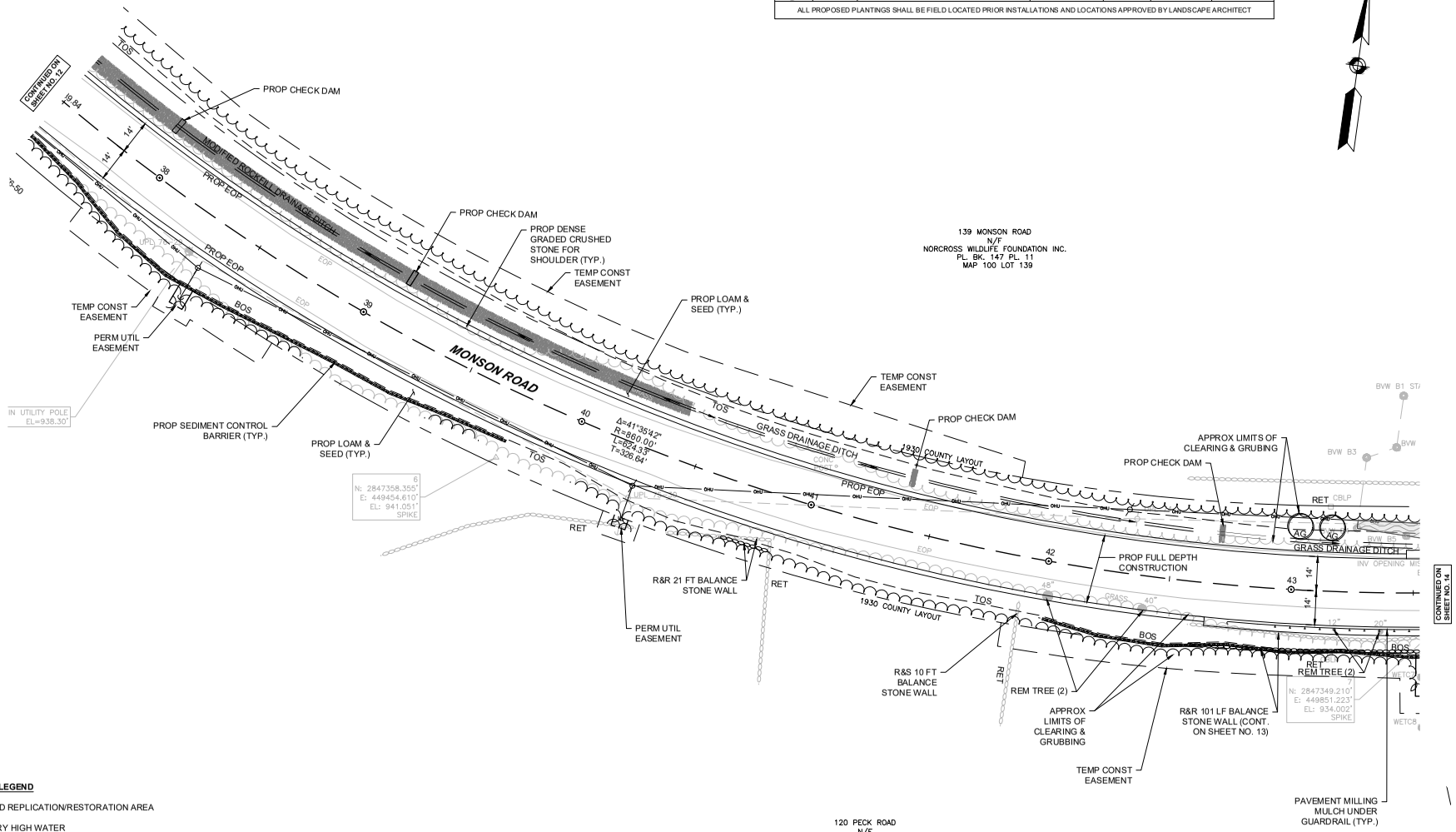
ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CONSTRUCTION PLANS

N



IMPACT LEGEND

- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- W.O.T.U.S.=WATERS OF THE UNITED STATES
  - PERMANENT
  - TEMPORARY
- V.W.=VEGETATED WETLANDS
  - PERMANENT
  - TEMPORARY

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 26

608163_HDI\CONSTRUCTION PLANS\H04.DWG Plotted on 9-Aug-2024 4:03 PM
Proposal No. 608163 13212
A08840 .4/5

HIGHWAY GUARD DETAILS
STA 42+87 TO STA 43+86 RT (TL-3)
STA 43+86 TO STA 43+98 RT TANGENT END TREATMENT TL-3
STA 43+57 TO STA 43+70 LT TANGENT END TREATMENT TL-3
STA 43+70 TO STA 44+57 LT (TL-3)
STA 44+57 TO STA 44+70 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	6	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

135 MONSON ROAD
N/F
NORCROSS WILDLIFE FOUNDATION INC.
BK. 9662 PG. 213
MAP 100 MAP 135

131 MONSON ROAD
N/F
BARBARA KUSTRA
BK. 5611 PG. 359
MAP 100 LOT 131

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

PERMANENT W.O.T.U.S. IMPACT = 35 SF
PERMANENT V.W. IMPACT = 243 SF
BANK IMPACT = 291 LF
PERMANENT W.O.T.U.S. IMPACT = 1275 SF
GRASS DRAINAGE DITCH
PROP LOAM & SEED (TYP.)
12" RCP - CLASS V REM EXIST PIPE
PROP HMA DWY
APPROX LIMITS OF CLEARING & GRUBBING
TEMP CONST EASEMENT
FE (2)
FE
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP GRAV DWY
TEMP CONST EASEMENT
PROP GRAV DWY
PROP HMA DWY
WETLANDS
1930 COUNTY LAYOUT
1931 COUNTY LAYOUT
GRASS DRAINAGE DITCH
INV OPENING MISSING PIPE EL=933.14'
LOCKED CULVERT
PROP EOP
12"CMP INV=933.41
12"CMP INV=930.20
INV 12" CPP FL=928.25'
R&R
R&S
PC-3
PC +14.35
N 81° 03' 14" E 250.18'
PROP FULL DEPTH CONSTRUCTION
MONSON ROAD
Δ=15°45'55"
R=1300.00'
L=357.70'
T=179.99'
PROP HMA CURB
RCP (TYP.)
TOS
CBCI
DMH
CONTINUED ON SHEET NO. 13
CONTINUED ON SHEET NO. 15
REM TREE (2)
N: 2847349.210'
E: 449851.223'
EL: 934.002'
SPIKE
TEMP CONST EASEMENT
BANK IMPACT = 30 LF
PROP 12" RCP FLARED ENDS
TEMPORARY W.O.T.U.S. IMPACT= 46 SF
PERMANENT W.O.T.U.S. IMPACT= 166 SF
DRAINAGE EASEMENT
PROP MODIFIED ROCKFILL
12"CMP INV=931.27
R&R 103 LF BALANCE STONE WALL
APPROX LIMITS OF CLEARING & GRUBBING
PROP LOAM & SEED (TYP.)
R&S 12 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
TEMP CONST EASEMENT
DRAINAGE EASEMENT
PERMANENT V.W. IMPACT = 15 SF
PERMANENT W.O.T.U.S. IMPACT= 41 SF
BANK IMPACT = 12 LF
PROP MODIFIED ROCKFILL
PERMANENT V.W. IMPACT = 31 SF
PERMANENT W.O.T.U.S. IMPACT= 64 SF
TEMPORARY W.O.T.U.S. IMPACT = 5 SF
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PROP SEDIMENT CONTROL BARRIER (TYP.)
TEMP CONST EASEMENT
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 101 FT BALANCE STONE WALL (CONT. ON SHEET NO. 12)
TEMPORARY W.O.T.U.S. IMPACT= 38 SF

IMPACT LEGEND
WETLAND REPLICATION/RESTORATION AREA
OHW — ORDINARY HIGH WATER
W.O.T.U.S.=WATERS OF THE UNITED STATES
V.W.=VEGETATED WETLANDS
PERMANENT
TEMPORARY
PERMANENT
TEMPORARY

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 26

608163_HDI\CONSTRUCTION PLANS\H34.DWG Plotted on 9-Aug-2024 4:03 PM
Proposal No. 608163-132612
Addfile: 457

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CONSTRUCTION PLANS

N

121 MONSON ROAD
N/F
MICHAEL P. & VIRGINIA S. LATO
BK. 5961 PG. 267
MAP 100 LOT 121

PERMANENT V.W. IMPACT = 217 SF ±
WETLAND RESTORATION AREA 1 =217 SF ±
NOTE: SEE WETLAND SOIL AND SEED MIX ON SHEET 180 AND SPECIAL PROVISION FOR ITEM 755.35

TEMPORARY V.W. IMPACT = 74 SF

TEMPORARY V.W. IMPACT = 6 SF ±

MAYNARD ROAD — ACCEPTED MAY 17, 2017

MONSON ROAD

R&R 132 FT BALANCE STONE WALL
RET CBLP
REM TREE
TEMP CONST EASEMENT
RET TREE W/ PROT
PROP GRAV DWY
MATCH EXISTING
PROP HMA DWY
RET CONC. POST
PROP LOAM & SEED (TYP.)
TEMP CONST EASEMENT
R&R 127 LF BALANCE STONE WALL
APPROX LIMITS OF CLEARING & GRUBBING
PROP FULL DEPTH CONSTRUCTION
PROP HMA CURB
1931 COUNTY LAYOUT
1932 COUNTY LAYOUT
S 89° 18' 18" E 130.61'
PC +09.11
Δ=4°28'52"
R=1680.00'
L=131.40'
T=65.73'
PT +40.51
BHL B-10
TP-2
RCP (TYP.)
12"CMP. INV=949.28'
12"CMP. INV=949.90'
CBCI
DMH
BOS
TOS
EOP
GRASS
GRAV. ROAD
CONTINUED ON SHEET NO. 15
CONTINUED ON SHEET NO. 17
PERM UTIL EASEMENT
TEMP CONST EASEMENT
THE PROPOSED TREELINE REPRESENTS LIMITED OVERHEAD TREE CANOPY TRIMMING ONLY ALONG THE EXISTING OVERHEAD UTILITY LINES. NO DIRECT GROUND WETLAND IMPACTS ARE PROPOSED OR REQUIRED
PROP SEDIMENT CONTROL BARRIER (TYP.)
BENCHMARK: SPIKE IN UTILITY POLE EL=956.75'
APPROX LIMITS OF CLEARING & GRUBBING
R&R 7 FT BALANCE STONE WALL

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

IMPACT LEGEND

- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- W.O.T.U.S.=WATERS OF THE UNITED STATES
  - PERMANENT
  - TEMPORARY
- V.W.=VEGETATED WETLANDS
  - PERMANENT
  - TEMPORARY

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 28

608163_HDI\CONSTRUCTION PLANS\454.DWG Plotted on 9-Aug-2024 4:03 PM
Proposal No. 608163-128112
A0040 .478

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

HIGHWAY GUARD DETAILS

STA 80+08 TO STA 80+21 RT TANGENT END TREATMENT TL-3
STA 80+21 TO STA 82+59 RT (TL-3)
STA 81+79 TO STA 81+92 LT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

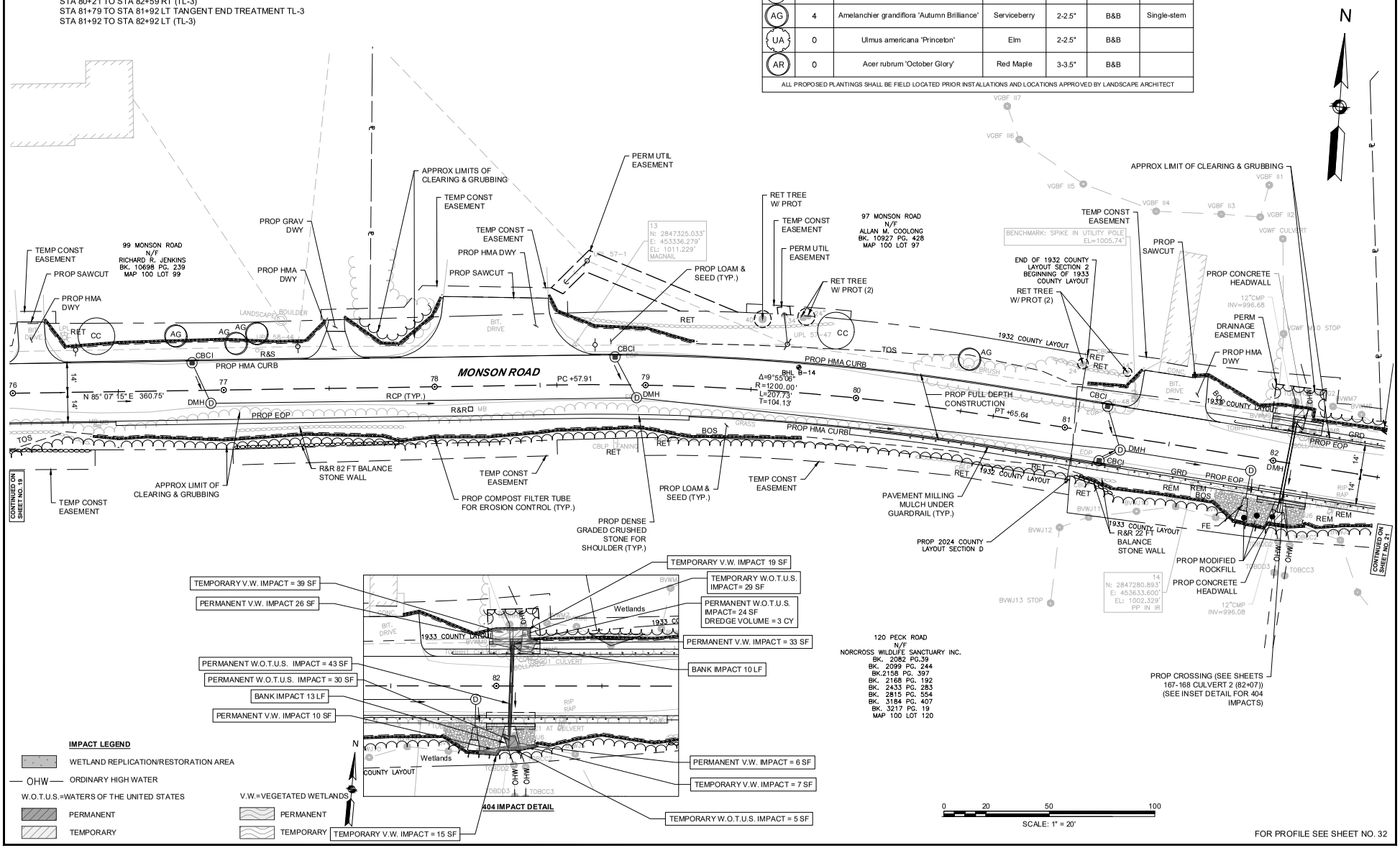
DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	2	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	4	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT



608163_HDI\CONSTRUCTION PLANS\404.DWG Plotted on 9-Aug-2024 4:04 PM

Proposal No. 608163 (132121)

A0040 of 479

HIGHWAY GUARD DETAILS

STA 80+21 TO STA 82+59 RT (TL-3)
STA 82+59 TO STA 82+72 RT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)
STA 82+92 TO STA 83+04 LT TANGENT END TREATMENT TL-3
STA 84+54 TO STA 84+66 RT TANGENT END TREATMENT TL-3
STA 84+66 TO STA 85+64 RT (TL-3)
STA 85+64 TO STA 86+04 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+43 TO STA 1+83 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+83 TO STA 2+07 RT (TL-3)
STA 02+07 TO STA 02+20 RT TANGENT END TREATMENT TL-3
STA 02+20 TO STA 02+07 LT TANGENT END TREATMENT TL-3
STA 02+07 TO STA 87+79 RT (TL-3)
STA 87+79 TO STA 87+92 RT TANGENT END TREATMENT TL-3
STA 87+02 TO STA 87+42 LT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 87+42 TO STA 87+87 LT (TL-3)
STA 87+87 TO STA 88+00 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	5	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CONSTRUCTION PLANS

N

NOTE:
THIS INTERMITTENT WATERCOURSE IS A NON-JURISDICTIONAL DRAINAGE DITCH SLOPING DOWN TO CONVEY ROADWAY RUNOFF TO THE WATERCOURSE. THE EXCAVATION IN THIS AREA IS NOT CONSIDERED DREDGE.

BANK IMPACT 19 LF

PERMANENT W.O.T.U.S. IMPACT = 108 SF

PERMANENT W.O.T.U.S. IMPACT= 216 SF

PERMANENT W.O.T.U.S. IMPACT= 158 SF
DREDGE VOLUME = 6 CY

404 IMPACT DETAIL

TEMPORARY V.W. IMPACT = 54 SF

PERMANENT V.W. IMPACT 21 SF±

TEMP CONST EASEMENT

APPROX LIMIT OF CLEARING & GRUBBING

PROP LOAM & SEED (TYP.)

PROP HMA DWY

PROP SAWCUT

PROP HMA CURB

PROP FULL DEPTH CONSTRUCTION

PROP LOAM & SEED (TYP.)

PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)

R&R 85 FT BALANCE STONE WALL

PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)

TEMP CONST EASEMENT

APPROX LIMIT OF OF CLEARING & GRUBBING

PROP SEDIMENT CONTROL BARRIER (TYP.)

WETLAND REPLICATION AREA 1 = 1204 SF

R&S 12 FT BALANCE STONE WALL

IMPACT LEGEND

WETLAND REPLICATION/RESTORATION AREA
OHW — ORDINARY HIGH WATER
W.O.T.U.S.=WATERS OF THE UNITED STATES
PERMANENT
TEMPORARY
V.W.=VEGETATED WETLANDS
PERMANENT
TEMPORARY

LIMITS OF WORK
STA 88+00+.00
N 2847443.733
E 454226.983

TEMP CONST EASEMENT
DRAINAGE EASEMENT
93 MONSON ROAD
N/F
WAYNE T. PECK
BK. 5876 PG. 362
MAP 100 LOT 93

PERMANENT W.O.T.U.S. IMPACT = 970 SF
TEMPORARY W.O.T.U.S. IMPACT = 61 SF
DREDGE VOLUME = 60 CY

BANK IMPACT = 65 LF

MATCH EXISTING

PROP PAVEMENT MILLING AND RESURFACING

PROP BOX CULVERT
(SEE SHEETS 169-171 CULVERT 3 (86+45))
(SEE INSET DETAIL FOR 404 IMPACTS)

R&S BOLLARD (7)

R&S BOLLARD (9)

APPROX LIMITS OF CLEARING & GRUBBING

TEMP CONST EASEMENT

100 MONSON ROAD
N/F
DIANE L. MONETTE
BK. 21808 PG. 47
MAP 100 LOT 100

LIMITS OF WORK
STA 2+20.00
N 2847299.213
E 454204.816

DRAINAGE EASEMENT

PROP UTIL EASEMENT

TEMP CONST EASEMENT

PLAN BOOK 280 PLAN 70 (SHOWN GRAPHICA

ACCEPTED MAY 17, 2017

MATCH EXISTING

REED HILL ROAD 2+85.20
N 89° 39' 48" E 91.64'

LAYOUT PER MGL CHAPTER 86 SECTION 2
ACCEPTED MAY 17, 2017

PROP SAWCUT
MATCH EXISTING
PROP PAVEMENT MILLING AND RESURFACING

DRAINAGE EASEMENT

TEMP CONST EASEMENT
PAVEMENT MILLING MULCH UNDER GUARDRAIL

TEMPORARY V.W. IMPACT = 24 SF

PERMANENT V.W. IMPACT = 176 SF

BANK IMPACT = 7 LF

PERMANENT W.O.T.U.S. IMPACT= 65 SF
DREDGE VOLUME = 4 CY

TEMPORARY V.W. IMPACT = 86 SF

PERMANENT V.W. IMPACT = 72 SF

MONSON ROAD

CONTINUED ON SHEET NO. 29

FOR PROFILE SEE SHEET NO. 33

SCALE: 1" = 20'

608163_HDJ\CONSTRUCTION PLANS\404.DWG Plotted on 9-Aug-2024 4:04 PM

Proposal No. 608163 (SU12)

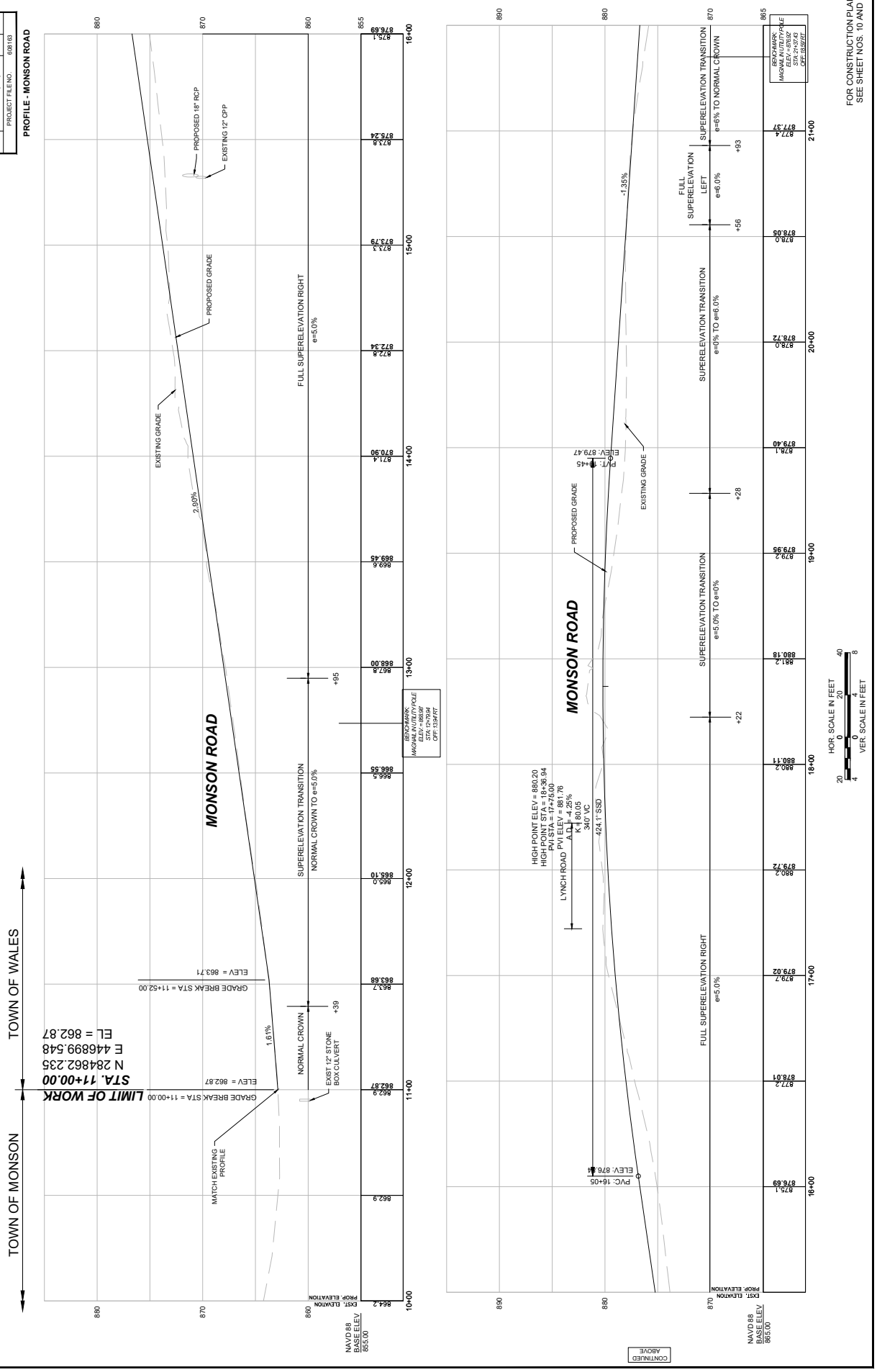
Addendum #1

608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NOS. 10 AND 11

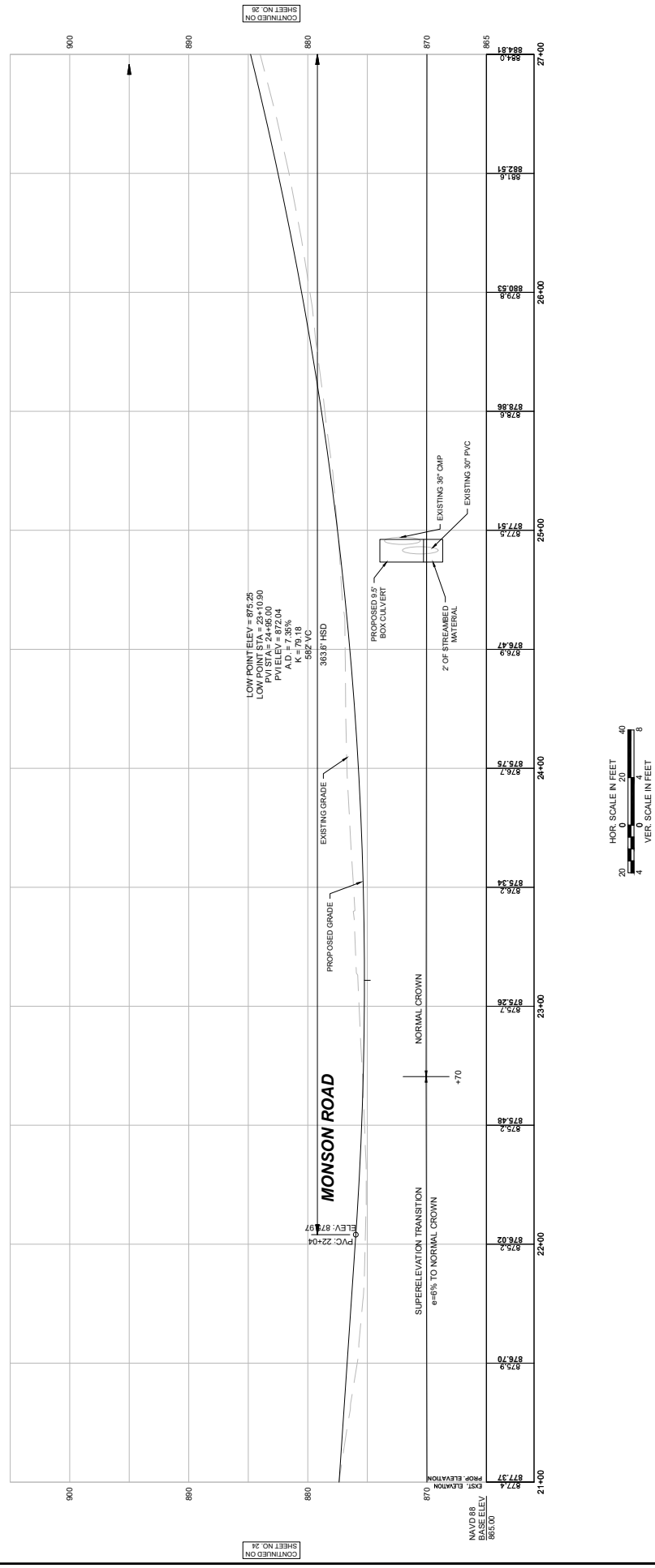
608163_HD4\PROFILE).DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 12

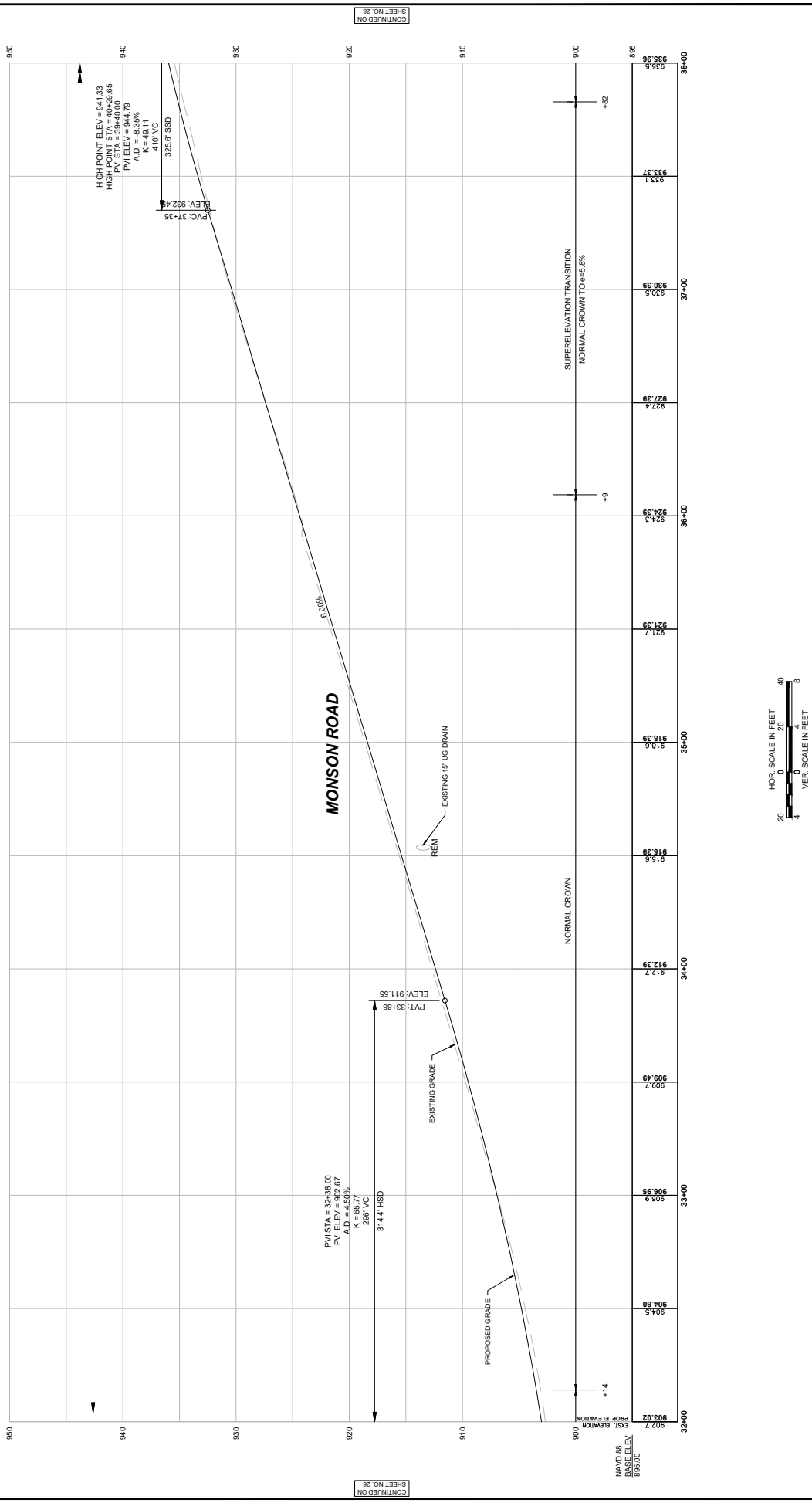


608163_HDAPROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



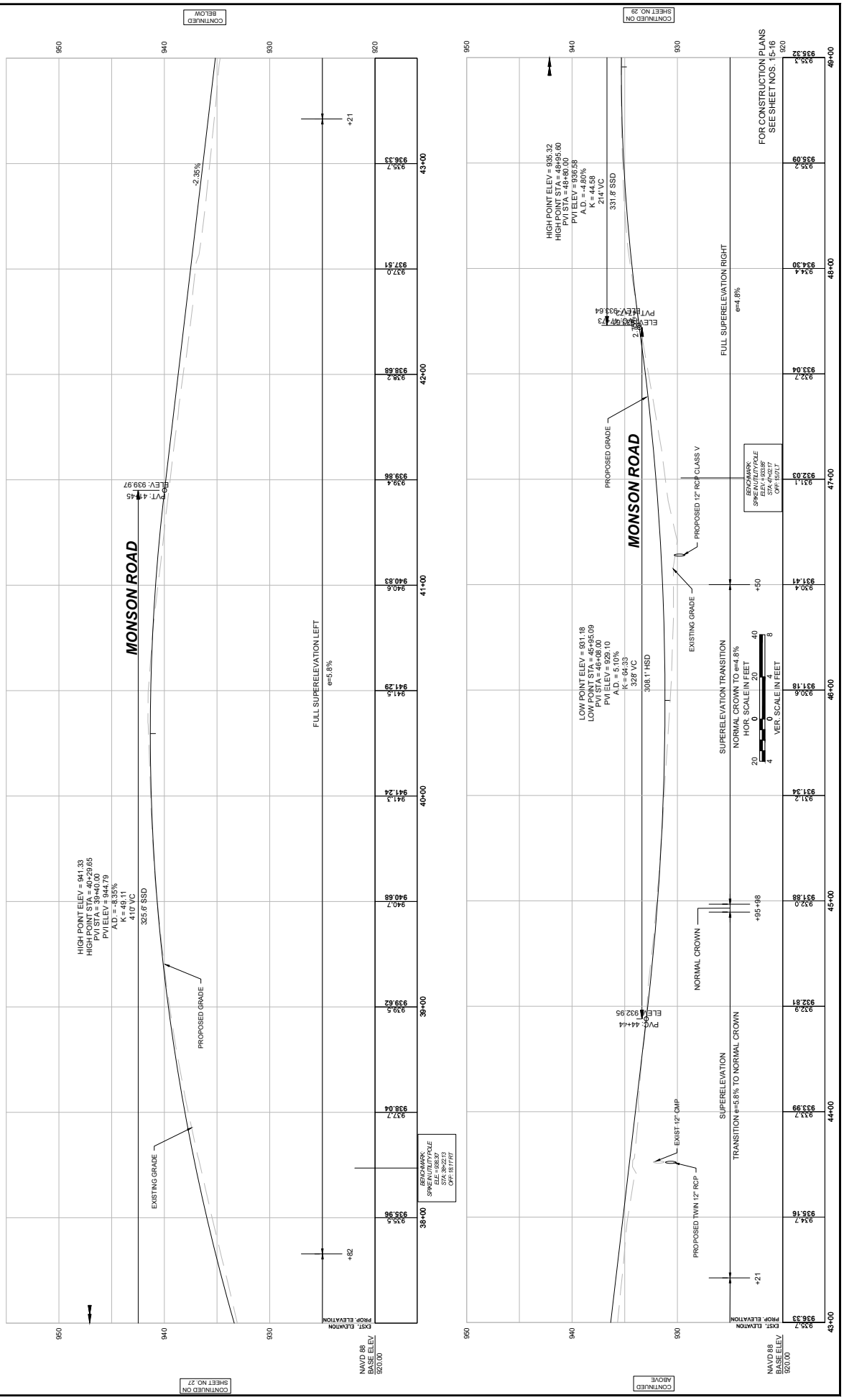
FOR CONSTRUCTION PLANS
SEE SHEET NO. 14

608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



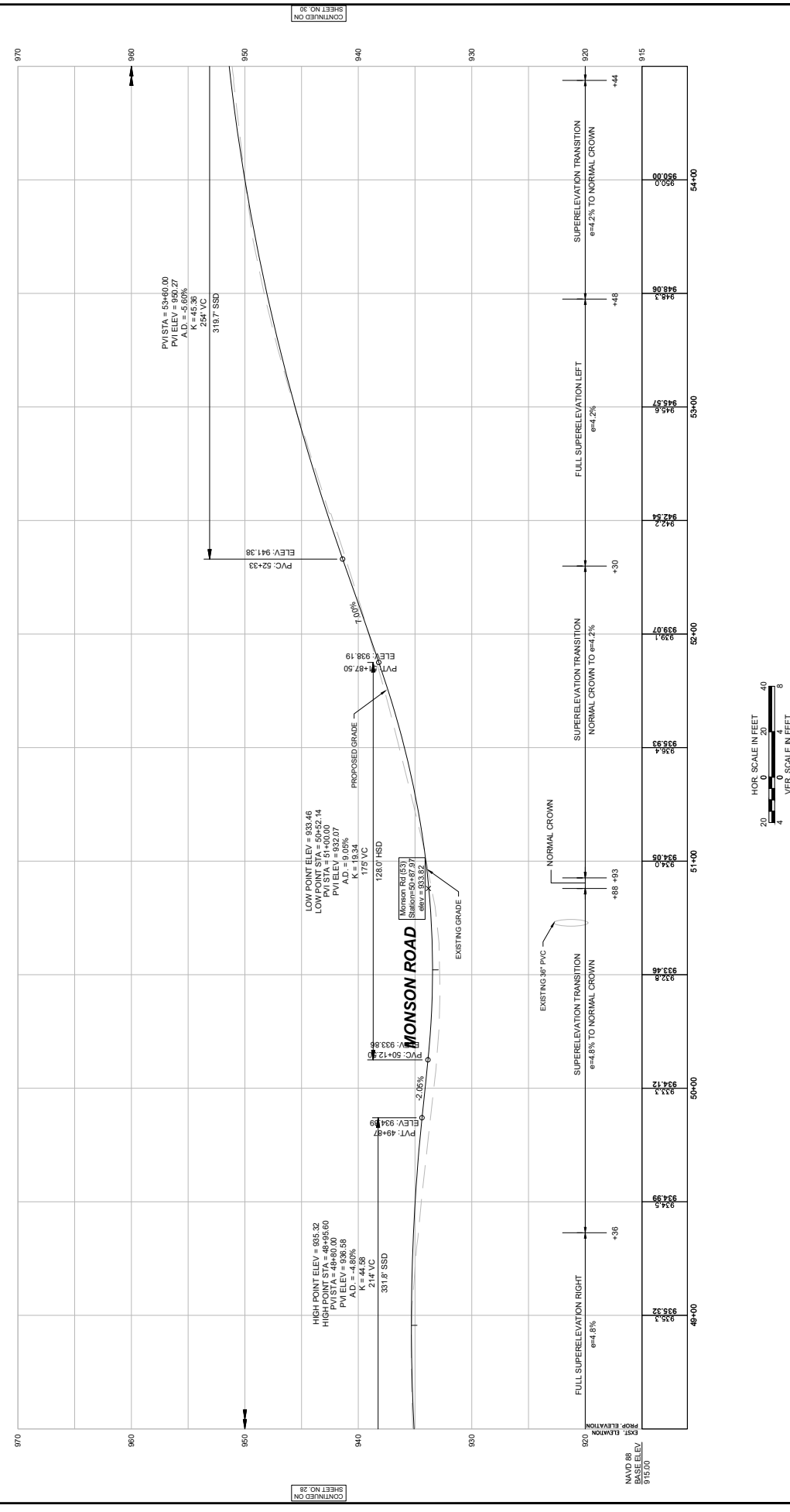
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 17

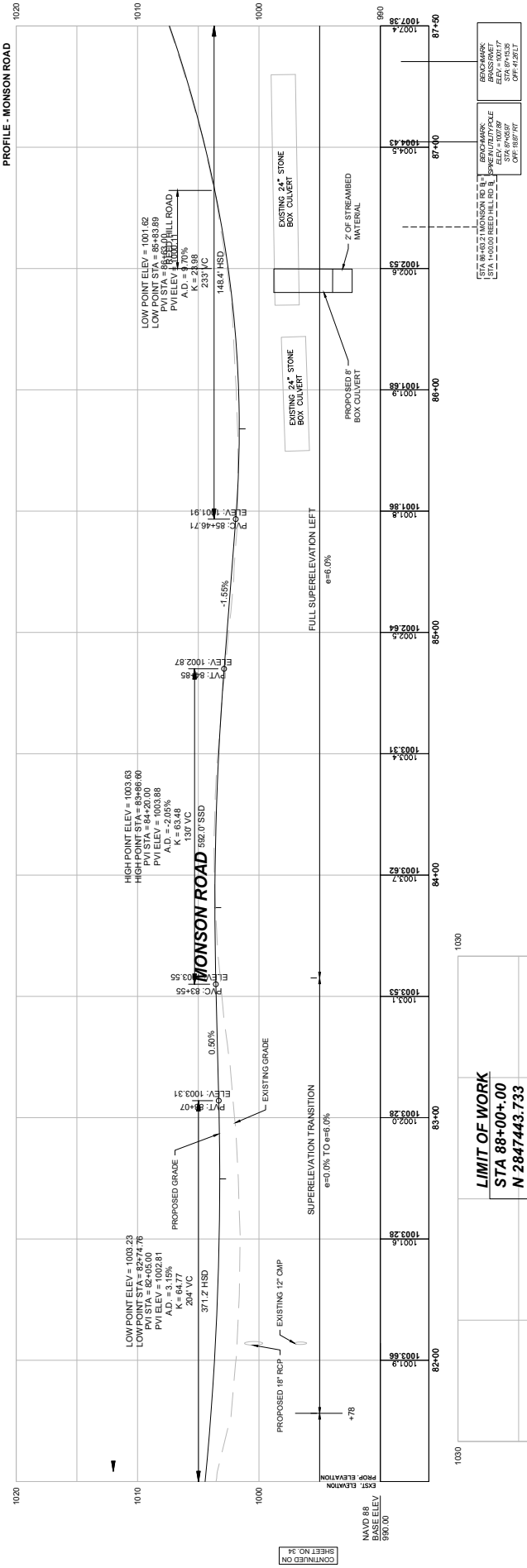


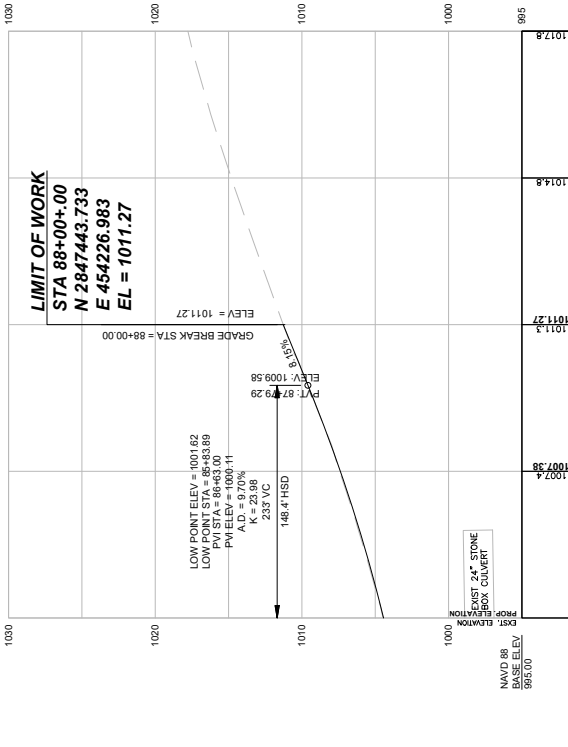
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:47 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD





HOR. SCALE IN FEET
0 20 40
VER. SCALE IN FEET
0 4 8

FOR CONSTRUCTION PLANS
SEE SHEET NO. 23

608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:29 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8

15+50

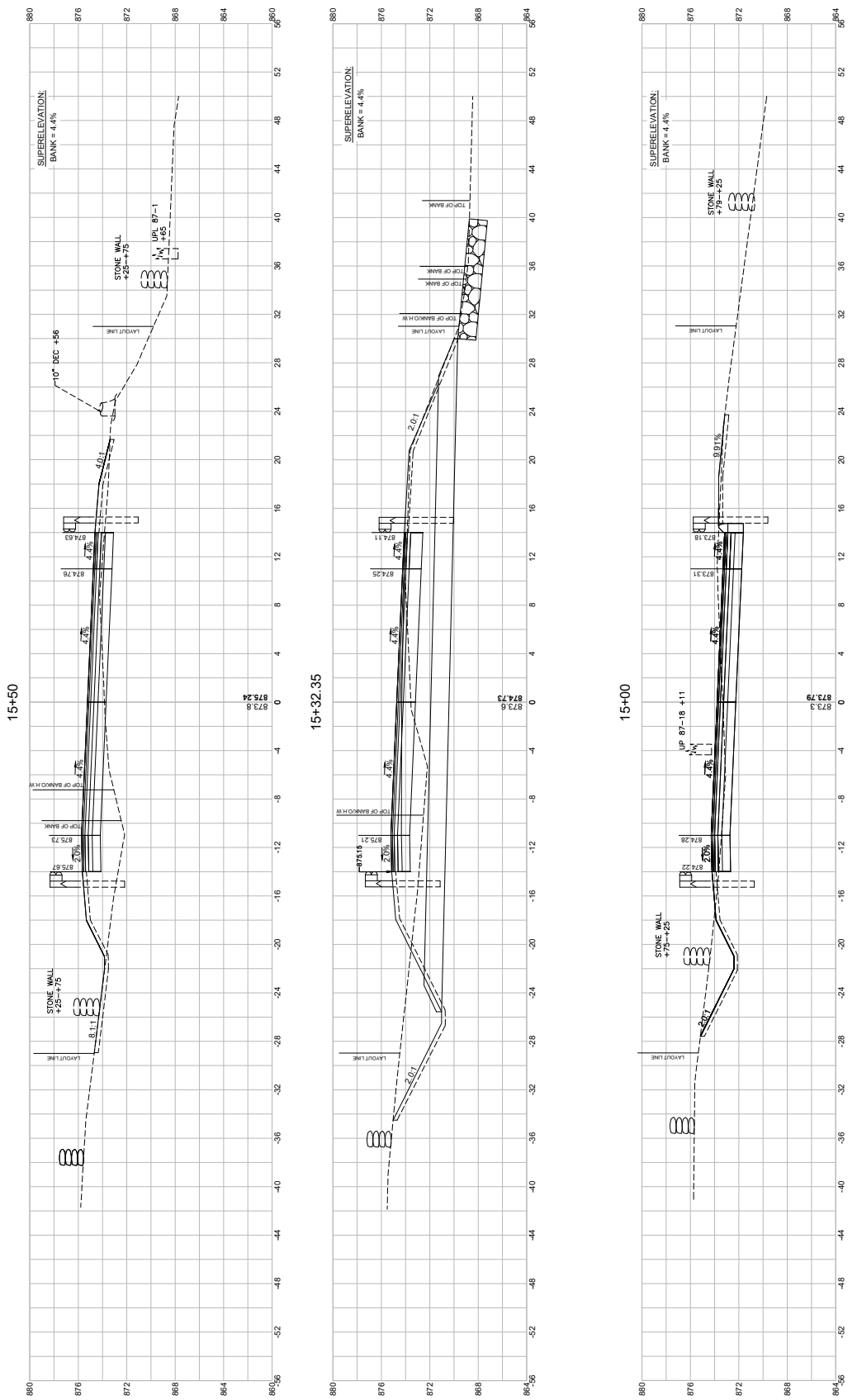
Cut: 15.21 S.F.
Fill: 30.65 S.F.

15+32.35

Cut: 64.35 S.F.
Fill: 22.57 S.F.

15+00

Cut: 57.30 S.F.
Fill: 1.74 S.F.



608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 3:57 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X	4	
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 8 4 0 4 8
VER. SCALE IN FEET 4 0 4

Cut: 33.06 S.F.
Fill: 27.18 S.F.

25+50

878.6
878.86

UFL 82-23
+32
3.0:1
2.0%
2.0%
2.0%
2.0%
CL
LAYOUT LINE
LAYOUT LINE

Cut: 121.15 S.F.
Fill: 0.00 S.F

25+00

877.5
877.51

TOP OF BANK
WETLAND LIMIT
LAYOUT LINE
EXIST. STONE HEADWALL
+77-+07
2.0%
2.0%
2.0%
2.0%
24" DEC +77
TOP OF BANK
LAYOUT LINE
TOP OF BANK

24+91.52

877.4
877.31

WETLAND LIMIT
LAYOUT LINE
877.03
877.09
2.0%
2.0%
2.0%
2.0%
877.09
877.03
WETLAND LIMIT
LAYOUT LINE
6.0

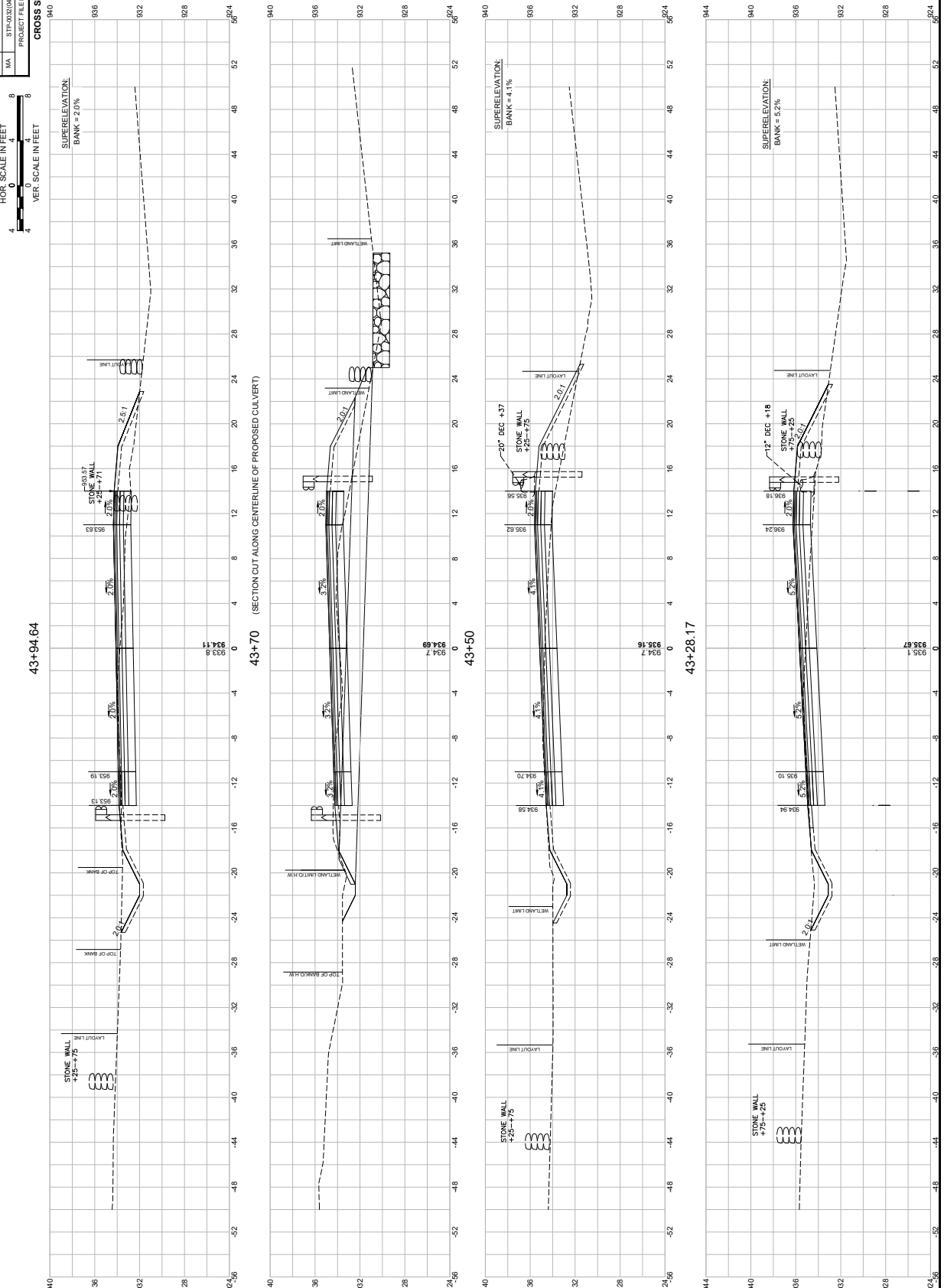
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:44 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(643)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

Cut: 15.09 S.F.
Fill: 19.53 S.F.

47+00

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
931.42
931.55
4.4%
902.52
2.0%
902.46
UPI 72-33
+02
1.0:1
932.03
931.1

Cut: 85.75 S.F.
Fill: 36.70 S.F.

46+64.76

(SECTION CUT ALONG CENTERLINE OF EXISTING 12" CPP PIPE)

TOP OF BANK/O.H.W
WETLAND LIMIT
1.5:1
4.2%
2.1%
931.57
931.6

Cut: 7.89 S.F.
Fill: 32.80 S.F.

46+50

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.80
930.93
4.4%
931.84
2.0%
TOP OF BANK
1.0:1
931.30
930.4
931.41

Cut: 8.27 S.F.
Fill: 30.60 S.F.

46+44.68

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.75
930.88
4.4%
931.79
2.1%
TOP OF BANK/O.H.W
1.0:1
931.85
930.4
931.37

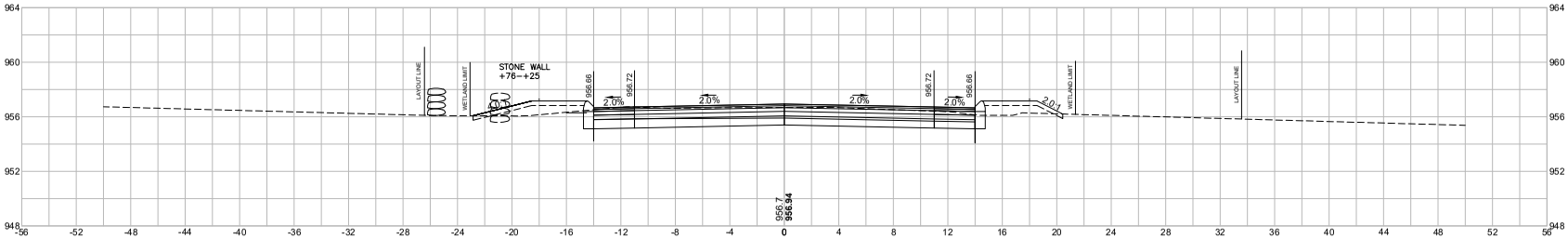
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

CROSS SECTIONS

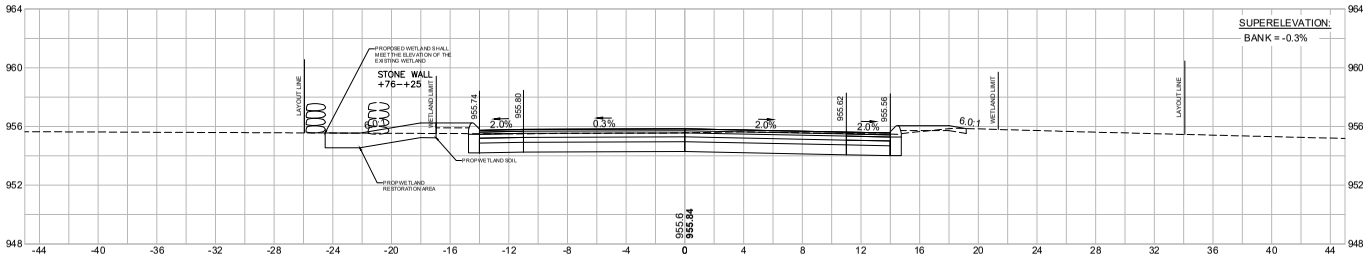
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

57+34.75



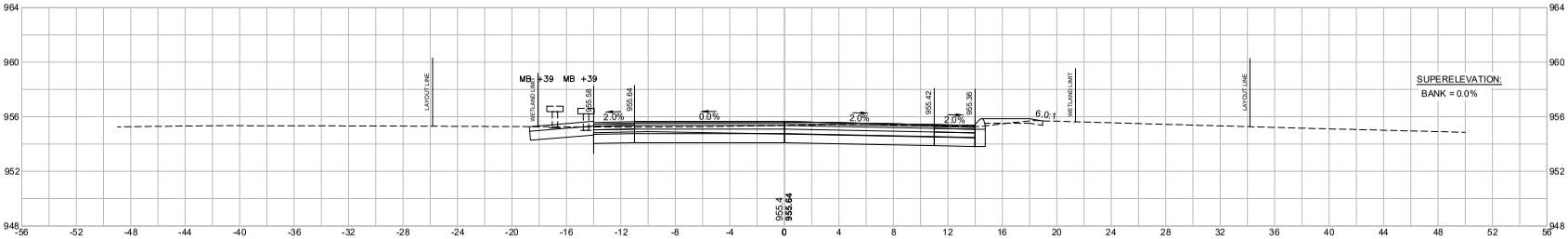
Cut: 39.6 S.F.
Fill: 10.37 S.F.

57+00



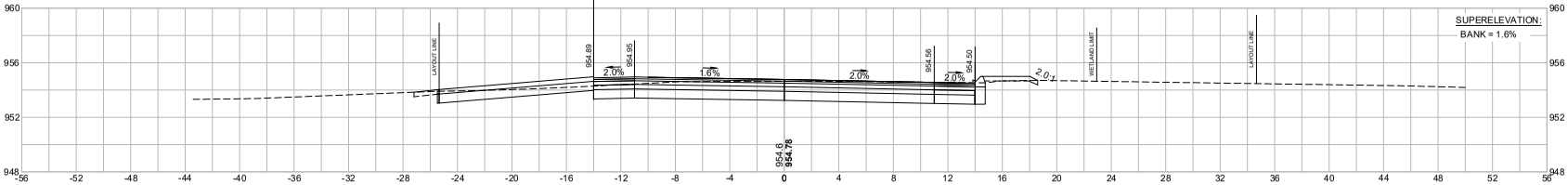
Cut: 40.32 S.F.
Fill: 5.17 S.F.

56+93.18



Cut: 41.77 S.F.
Fill: 1.19 S.F.

56+60



Cut: 46.38 S.F.
Fill: 1.33 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 9-Aug-2024 4:04 PM

Proposal No. 608163-132612

A08840 .491

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:25 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8

82+50

Cut: 0.26 S.F.
Fill: 36.63 S.F.

SUPERELEVATION:
BANK = 0.9%

82+30.60

Cut: 0.25 S.F.
Fill: 50.43 S.F.

SUPERELEVATION:
BANK = 0.0%

82+07.06 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

R = 560.00'
BANK = -1.1%

82+00

Cut: 0.0 S.F.
Fill: 27.77 S.F.

SUPERELEVATION:
BANK = -1.5%

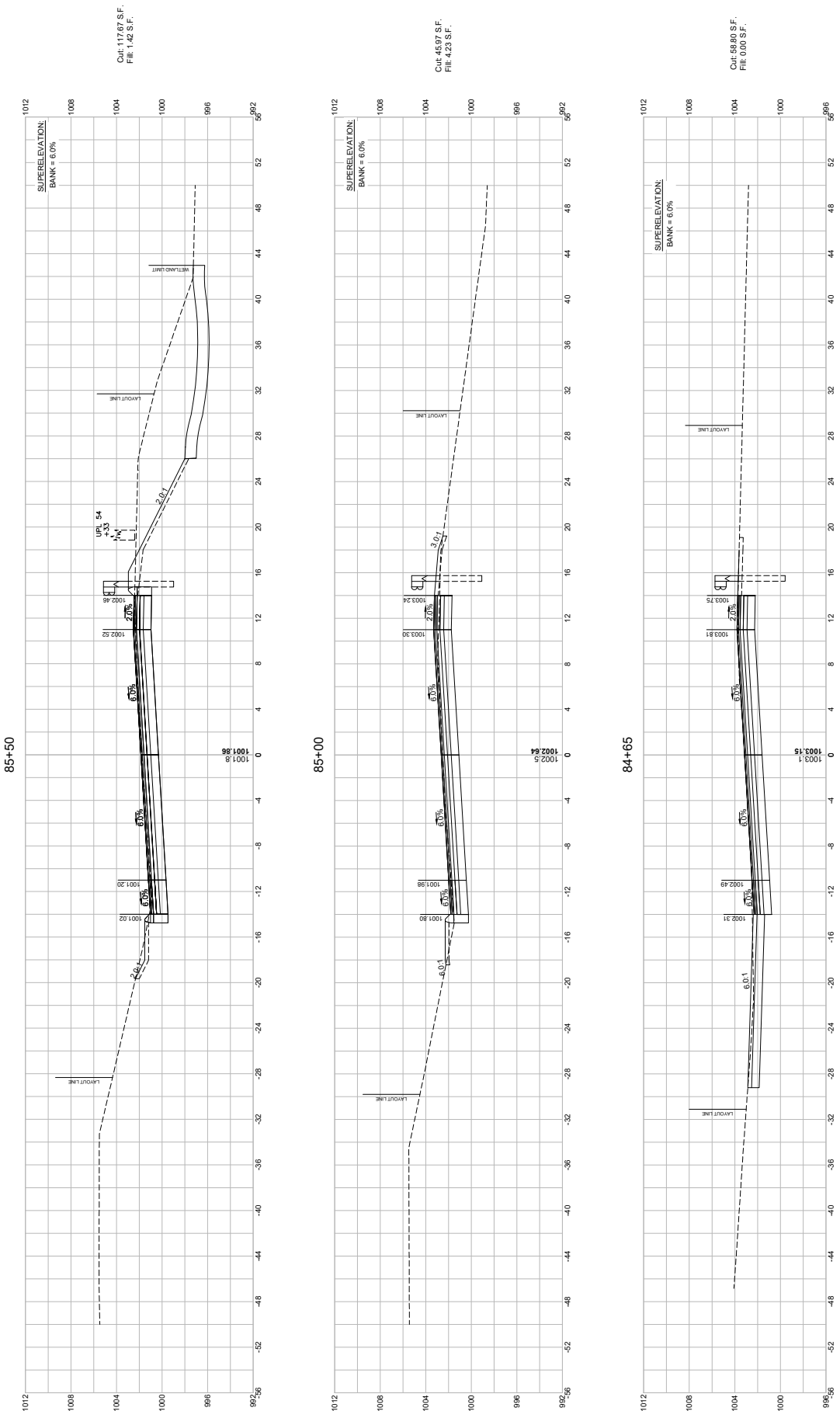
608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:15 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(643)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8



HOR. SCALE IN FEET

4 0 4 8

4 0 4 8

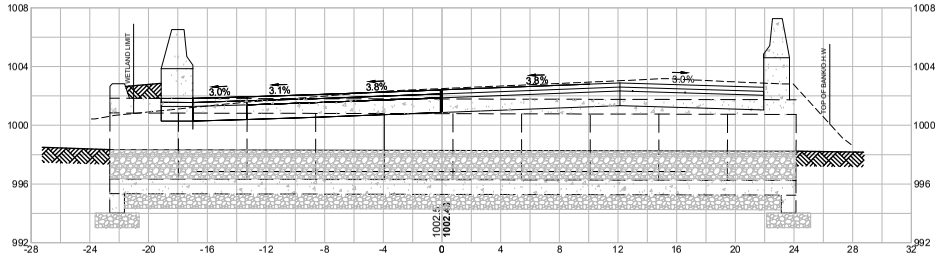
VER. SCALE IN FEET

WALES
MONSON ROAD

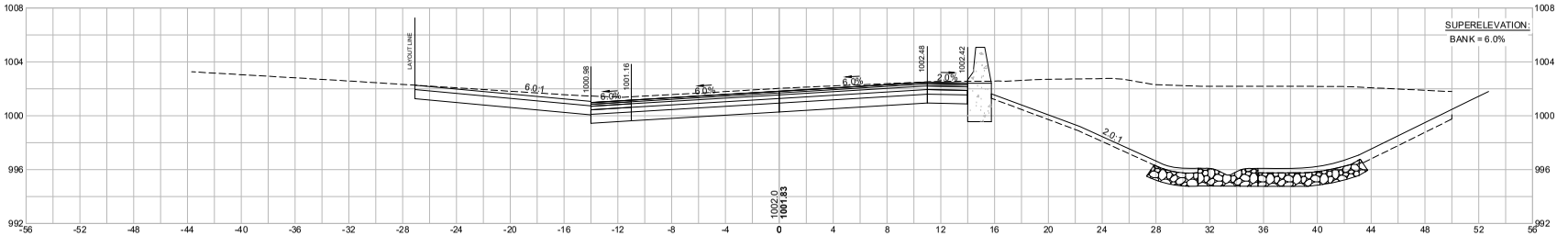
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CROSS SECTIONS

86+45.09 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

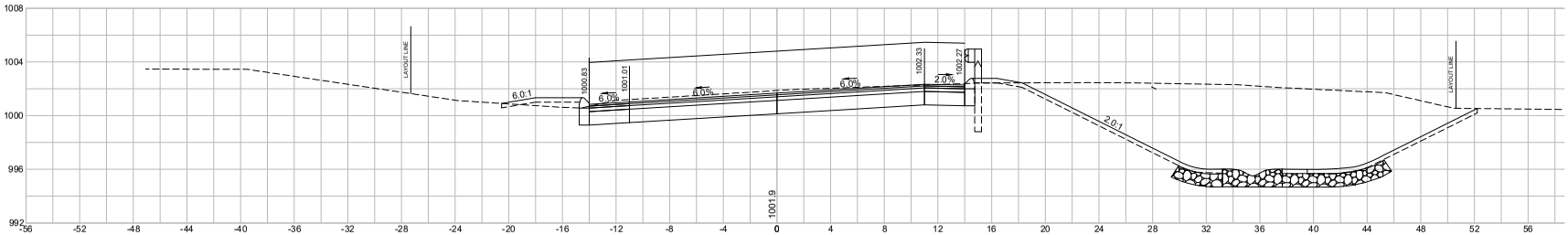


86+15



Cut: 238.87 S.F.
Fill: 0.0 S.F.

86+00

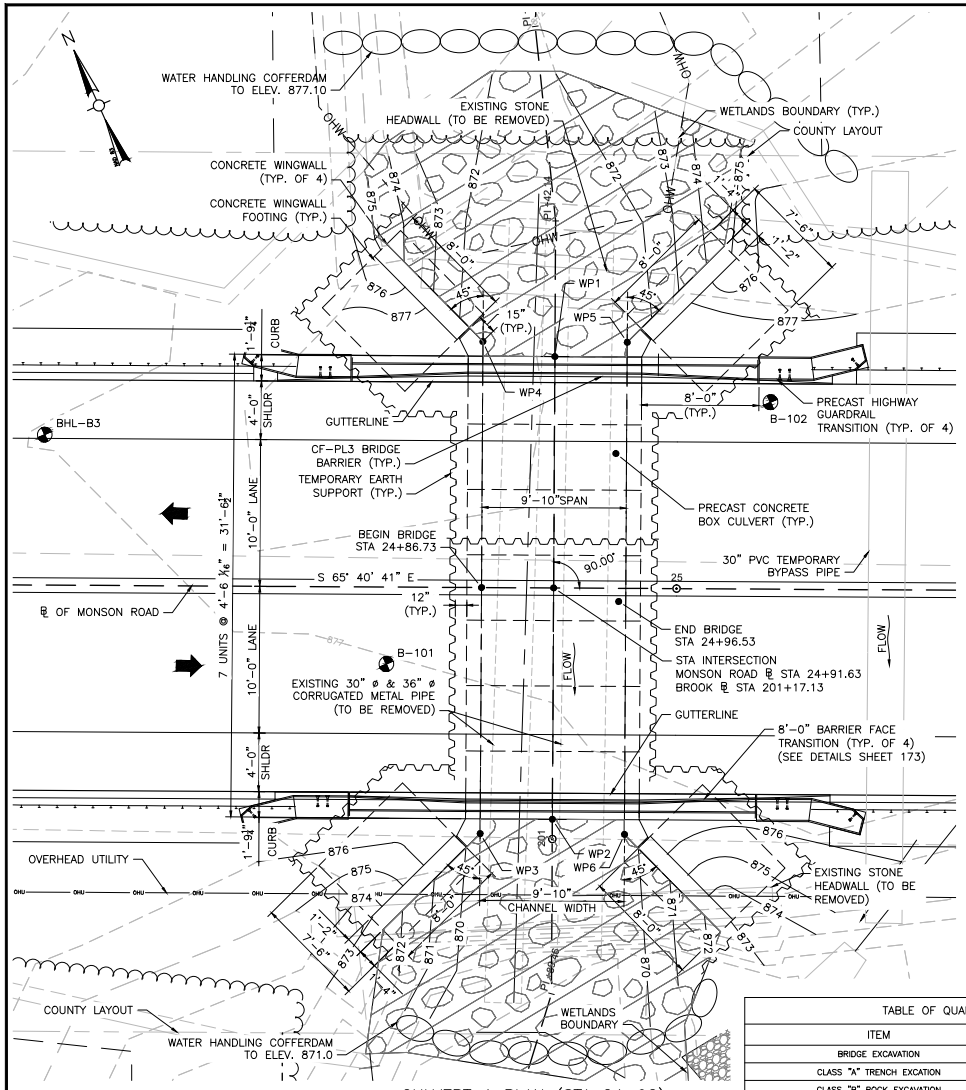


Cut: 202.10 S.F.
Fill: 4.42 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 9-Aug-2024 4:27 PM

Proposal No. 608163 12812

ADDED .ASH



CULVERT 1 PLAN (STA 24+92)

SCALE: 1" = 4'

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2848111.9174	448173.3849
2	2848083.1730	448160.3979
3	2848084.2791	448155.5221
4	2848114.8452	448169.3343
5	2848110.8082	448178.2683
6	2848080.2408	448164.4559

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	443
CLASS "A" TRENCH EXCATION	C.Y.	69
CLASS "B" ROCK EXCAVATION	C.Y.	30
NATURAL STREAMBED MATERIAL	C.Y.	26
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	300
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	18
PRECAST GUARDRAIL HIGHWAY TRANSITION	EA.	4
5000 PSI, ¾", 685 HP CEMENT CONCRETE	C.Y.	27
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	17050
DAMPPROOFING	S.F.	1244
PRECAST CONCRETE BOX CULVERT – SITE 1	L.S.	1
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 1	L.S.	1

DESIGN:

IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS 9TH EDITION, 2020, FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 21+38± (RT) MAGNAIL IN UTILITY POLE: EL. 876.92 FT

BENCHMARK STA 29+60± (RT) MAGNAIL IN UTILITY POLE: EL. 900.23 FT

BENCHMARK STA 29+90± (LT) MAGNAIL BRASS RIVET: EL. 901.72 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 CEMENT CONCRETE.....WINGWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S.)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

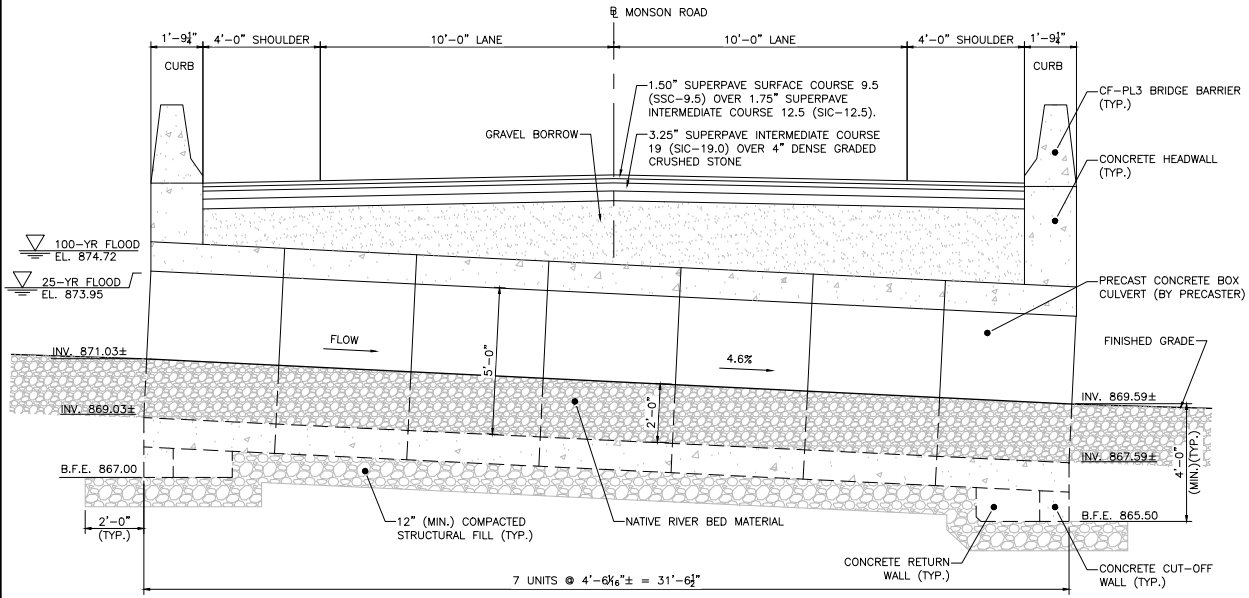
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	7.72
DESIGN FLOOD ELEVATION (FEET, NAVD)	876.1

608163_HD1\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:14 AM
Proposal No. 608163-128127
608163_HD1\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:14 AM

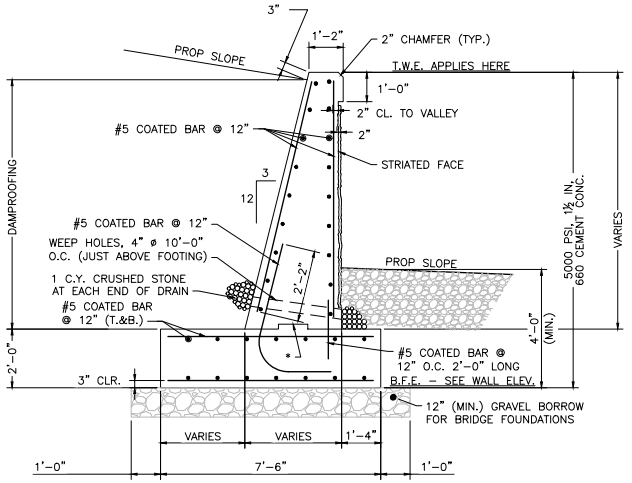
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 SECTION & DETAILS



CULVERT 1 LONGITUDINAL SECTION
SCALE: ½" = 1'-0"



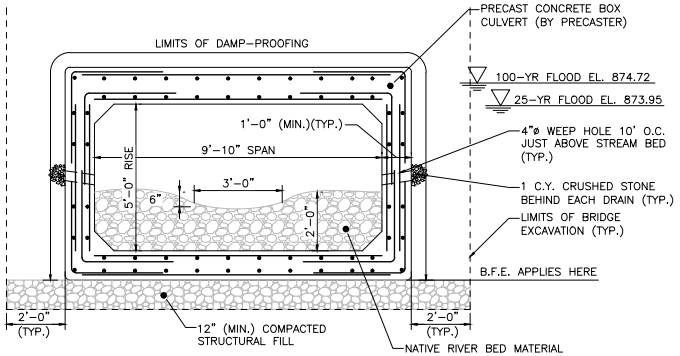
WINGWALL TYPICAL SECTION
SCALE: ½" = 1'-0"

PRECAST BOX CULVERT NOTES:

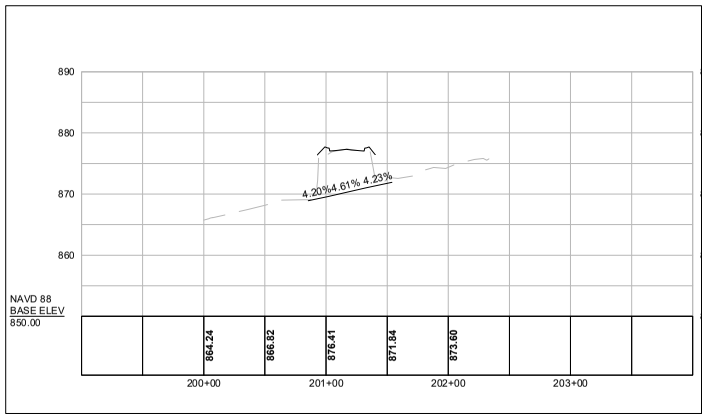
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 9'-10" WIDE, 5'-0" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO 9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

1. FOR CULVERT 1 HEADWALL ELEVATIONS, SEE SHEET NO. 165.
2. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
3. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 1 TRANSVERSE SECTION
SCALE: ½" = 1'-0"



NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

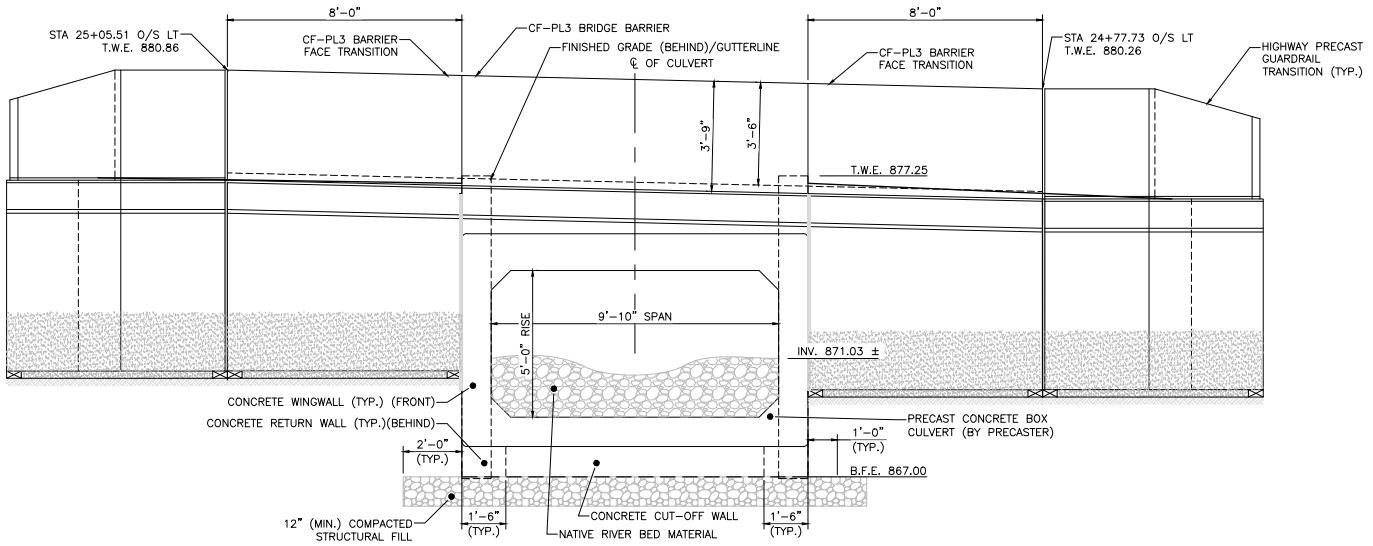
   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:15 AM
Proposal No. 608163-136112
A08840-456

WALES
MONSON ROAD

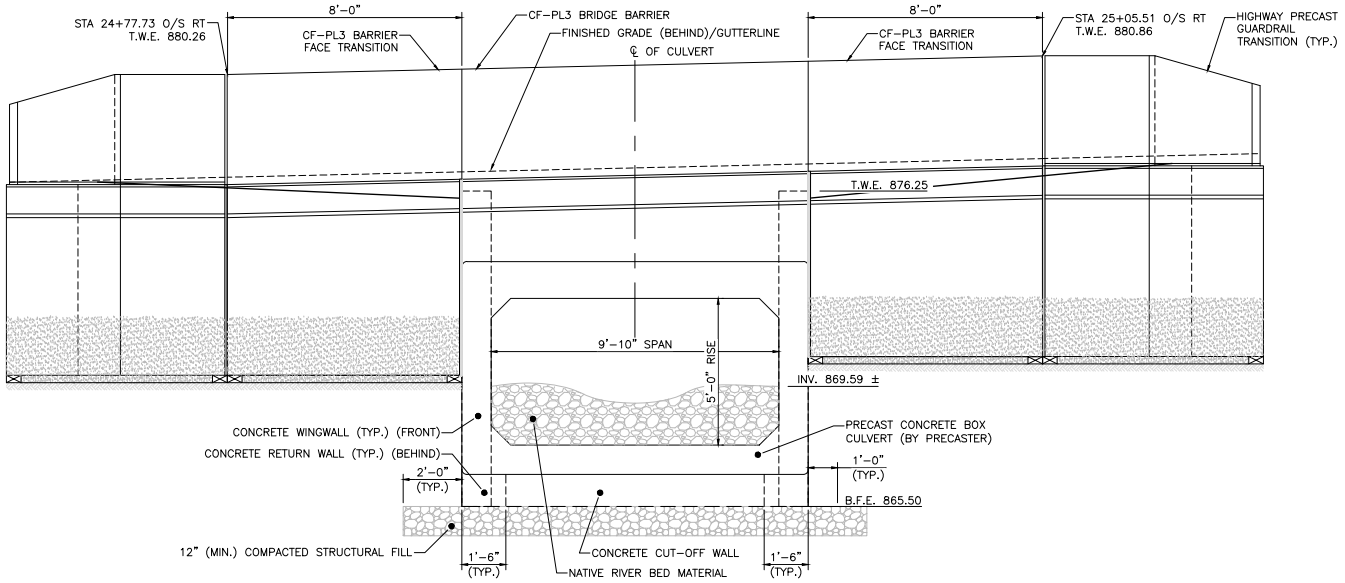
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 HEADWALL ELEVATIONS



CULVERT 1 INLET ELEVATION

SCALE: ½" = 1'-0"



CULVERT 1 OUTLET ELEVATION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

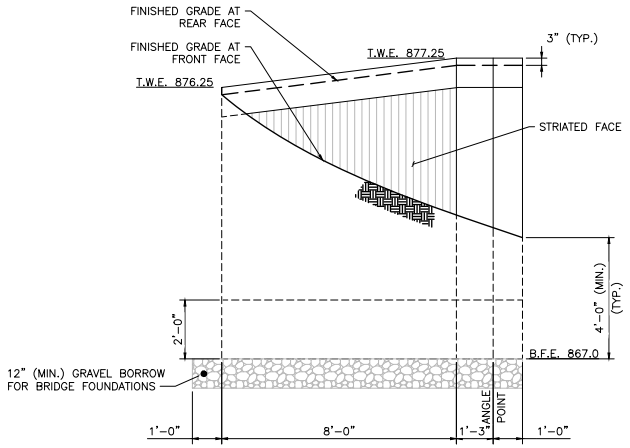
1. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
2. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:16 AM
Proposal No. 608163-132812
AQUA® 487

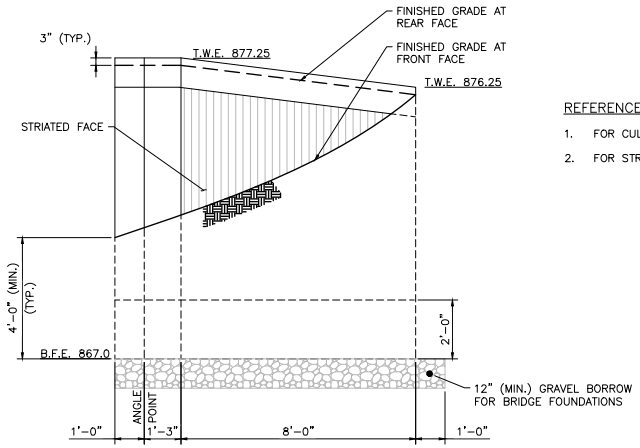
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

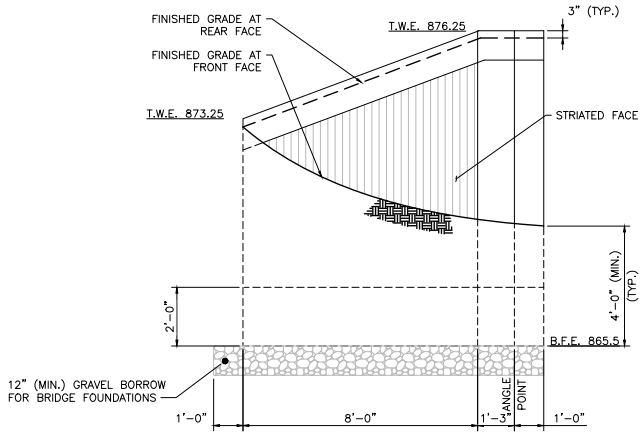
CULVERT 1 WINGWALL ELEVATIONS



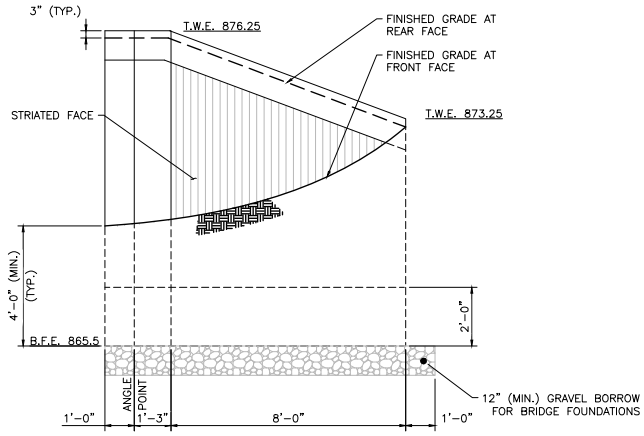
NORTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



NORTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

REFERENCE NOTES:

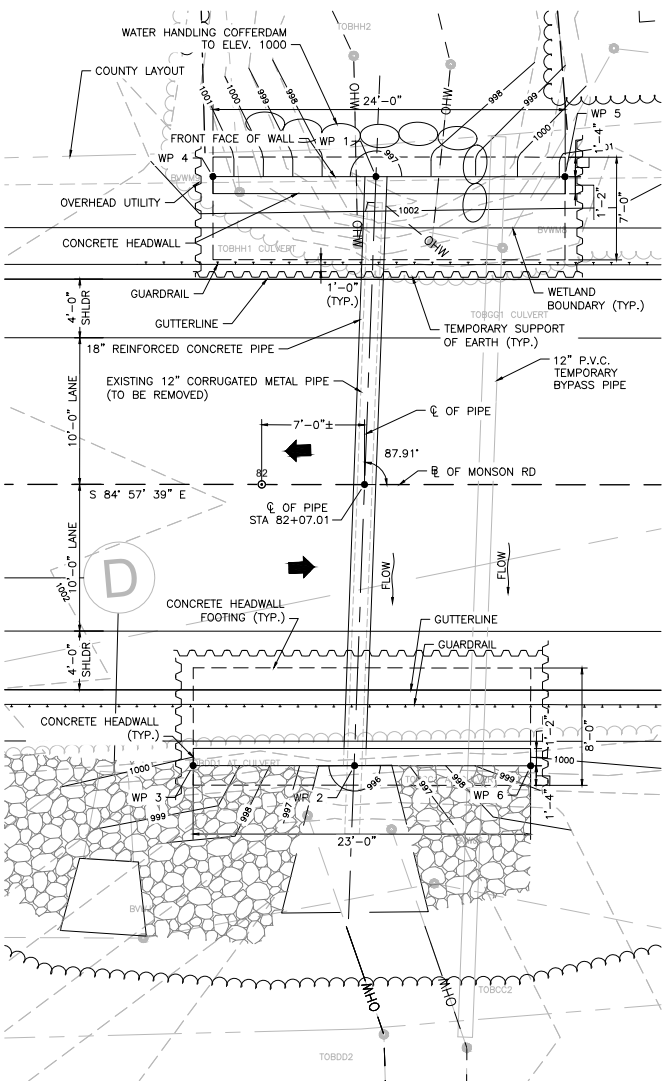
1. FOR CULVERT 1 WINGWALL SECTION, SEE SHEET NO. 164.
2. FOR STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:18 AM
Proposal No. 608163-13E1-212
A08840 438

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 2 KEY PLAN AND NOTES



CULVERT 2 PLAN (STA 82+07)

SCALE: 1" = 4'

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 81+25± (LT) SPIKE IN UTILITY POLE: EL. 1005.74

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 HP CEMENT CONCRETE.....HEADWALLS

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING PIPES.
4. INSTALL THE PROPOSED PIPE & HEADWALLS.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE PROPOSED CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	167
CLASS "A" TRENCH EXCAVATION	C.Y.	11
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	150
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	20
5000 PSI ¾" 685 HP CEMENT CONCRETE	C.Y.	52
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	10010
DAMPPROOFING	S.F.	426
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 2	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847313.7204	453680.2286
2	2847273.8336	453675.2733
3	2847274.8008	453664.3163
4	2847314.6939	453669.1581
5	2847312.5891	453693.0567
6	2847272.7828	453687.1995

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	10.24
DESIGN FLOOD DISCHARGE (C.F.S.)	9
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	0.14
DESIGN FLOOD ELEVATION (FEET, NAVD)	996.14
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	9
BASE FLOOD ELEVATION (FEET, NAVD)	999.20
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

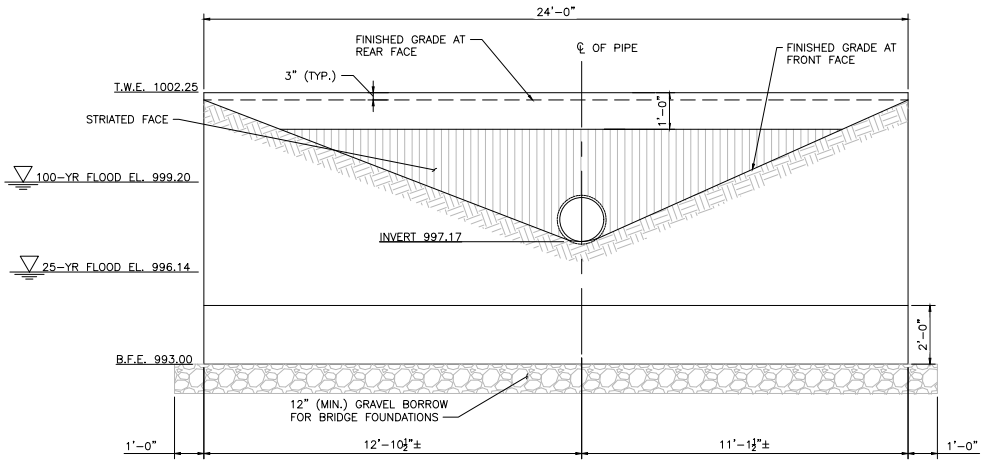
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	5
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	6.70
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.46

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:18 AM
Proposal No. 608163-128312
608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:18 AM

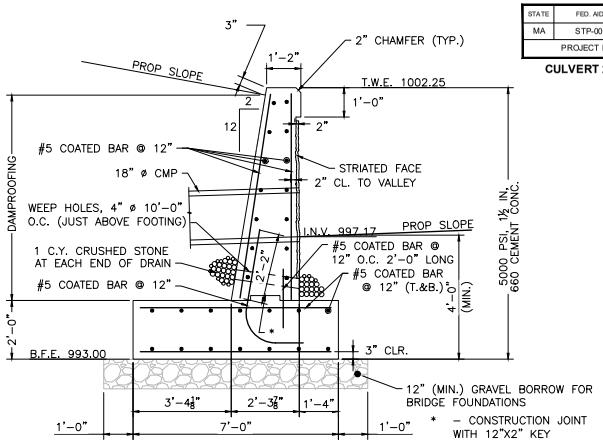
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 2 WALL DETAILS



NORTH INLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"

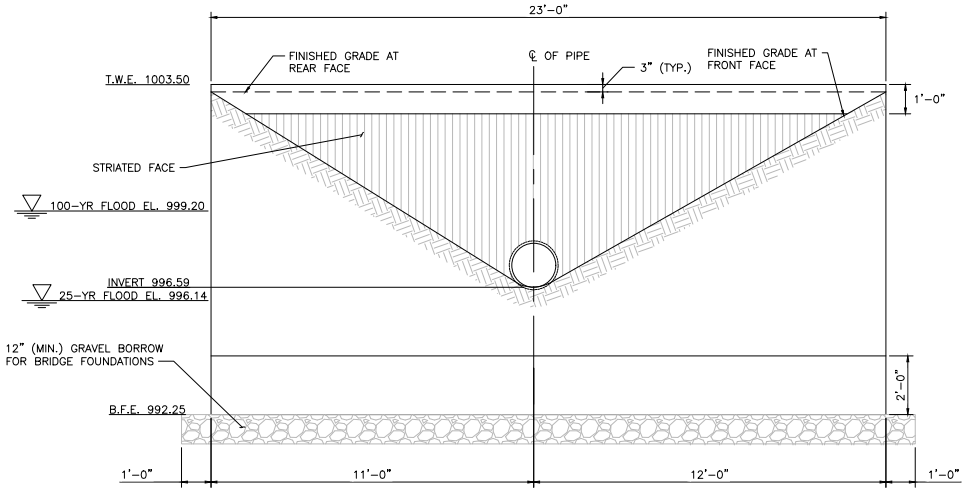


NORTH INLET HEADWALL SECTION
SCALE: ½" = 1'-0"

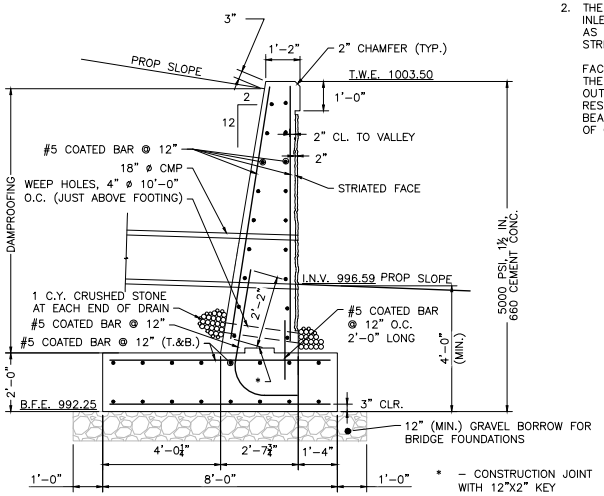
NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

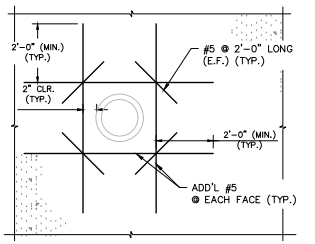
   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



SOUTH OUTLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"



SOUTH OUTLET HEADWALL SECTION
SCALE: ½" = 1'-0"

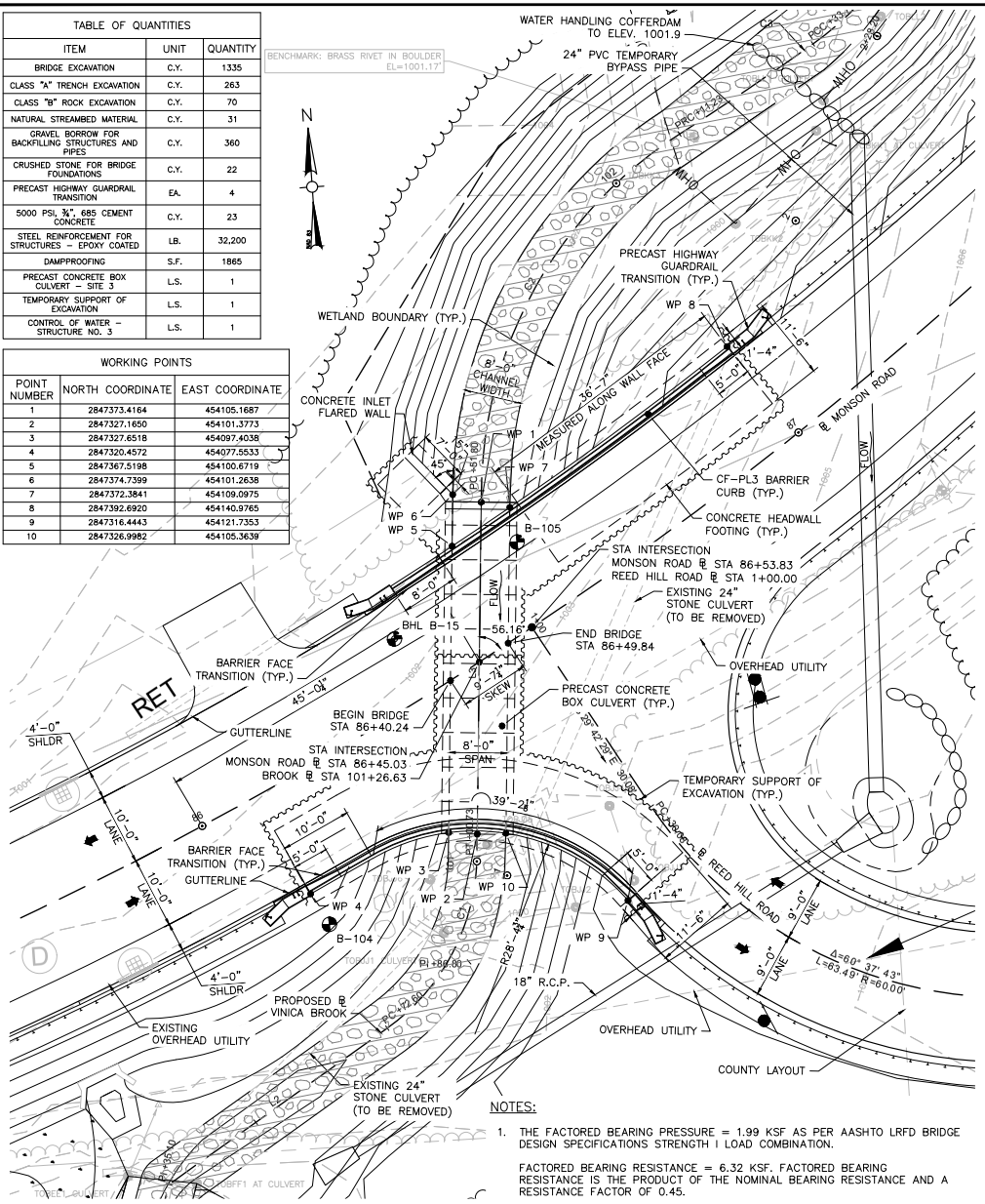


ADDITIONAL REINFORCEMENT AT PIPE
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:21 AM
Proposal No. 608163-128121
A0848-J-100

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	1335
CLASS "A" TRENCH EXCAVATION	C.Y.	263
CLASS "B" ROCK EXCAVATION	C.Y.	70
NATURAL STREAMBED MATERIAL	C.Y.	31
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	360
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	22
PRECAST HIGHWAY GUARDRAIL TRANSITION	EA.	4
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	23
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	32,200
DAMPPROOFING	S.F.	1865
PRECAST CONCRETE BOX CULVERT – SITE 3	L.S.	1
TEMPORARY SUPPORT OF EXCAVATION	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 3	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847373.4164	454105.1687
2	2847327.1650	454101.3773
3	2847327.6518	454097.4038
4	2847320.4572	454077.5533
5	2847367.5198	454100.6719
6	2847374.7399	454101.2638
7	2847372.3841	454109.0975
8	2847392.6920	454140.9765
9	2847316.4443	454121.7353
10	2847326.9982	454105.3639



CULVERT 3 PLAN (STA 86+45)

SCALE: 1" = 8'

NOTES:

1. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 87+10± (RT) SPIKE IN UTILITY POLE: EL. 1007.89 FT

BENCHMARK STA 87+20± (LT) BRASS RIVET: EL. 1001.17 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 610 CEMENT CONCRETE.....HEADWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S.)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.40
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

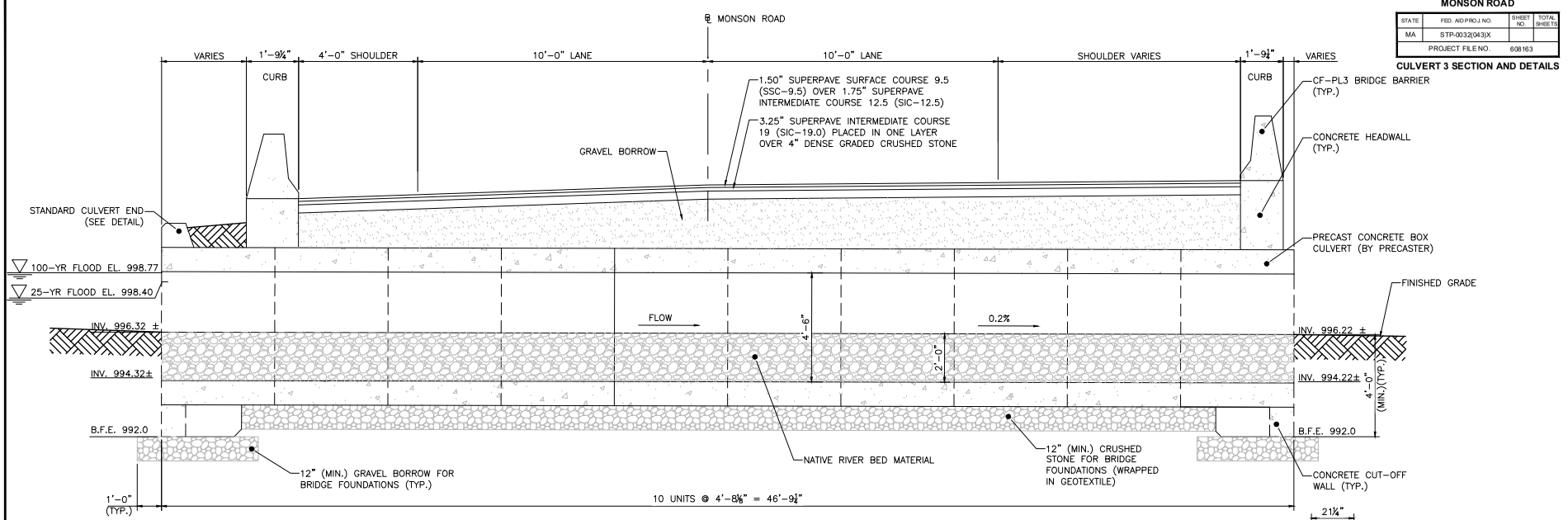
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	8.91
DESIGN FLOOD ELEVATION (FEET, NAVD)	1001.42

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 6-Aug-2024 1:14 PM
Proposal No. 608163-128127
A08840 -701

WALES
MONSON ROAD

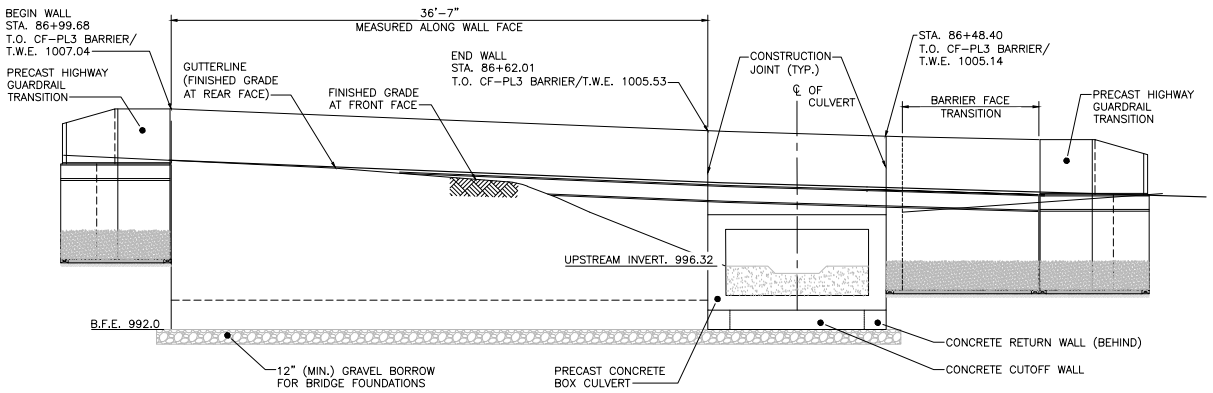
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 SECTION AND DETAILS



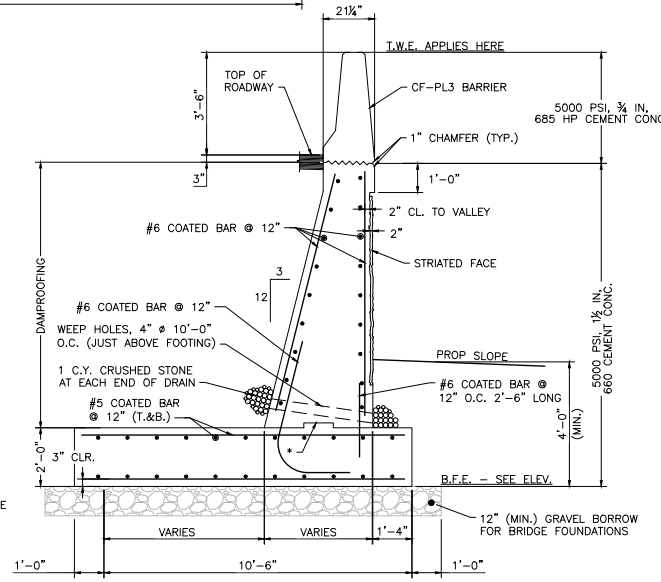
CULVERT 3 LONGITUDINAL SECTION – ALONG STREAM BASELINE

SCALE: ½" = 1'-0"



CULVERT 3 INLET NORTH ELEVATION

SCALE: ¼" = 1'-0"



* – CONSTRUCTION JOINT WITH 12"X2" KEY

RETAINING WALL SECTION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

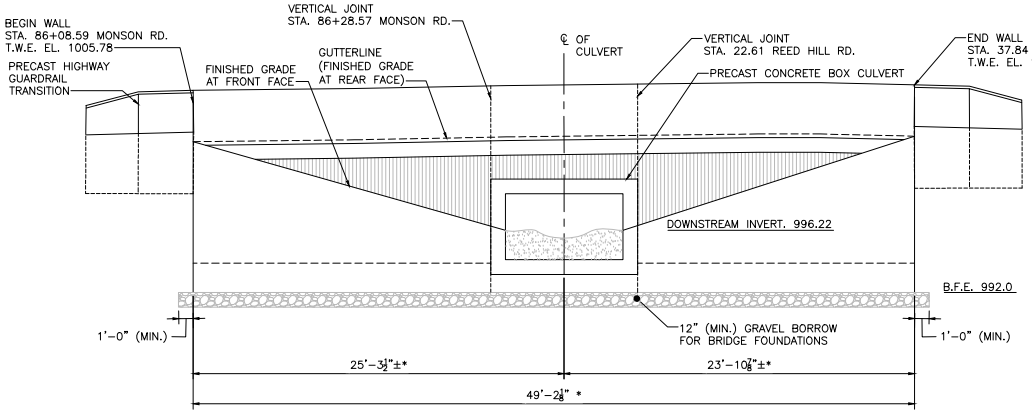
   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD1\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:23 AM
Proposal No. 608163-138112
A0848-702

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 3 WALL ELEVATION AND DETAILS



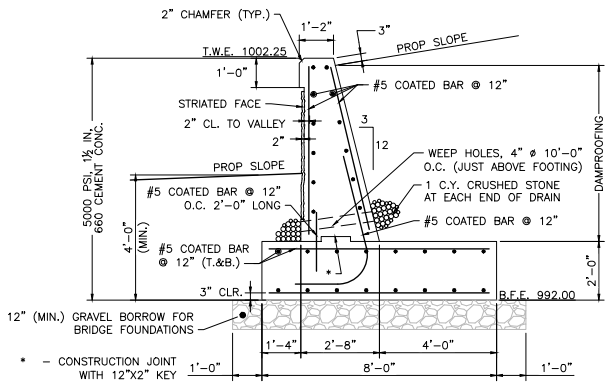
CULVERT 3 OUTLET/SOUTH ELEVATION
SCALE: ¼" = 1'-0"

PRECAST BOX CULVERT NOTES:

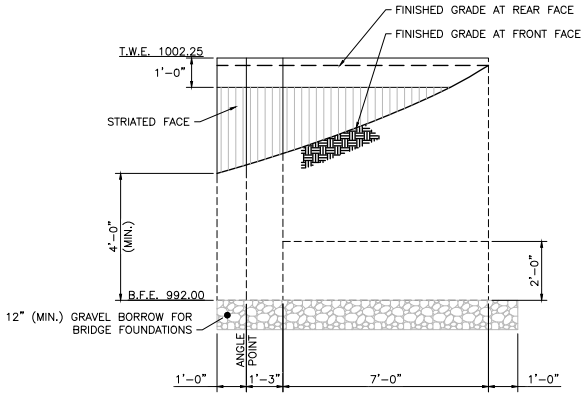
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 8'-0" WIDE, 4'-6" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

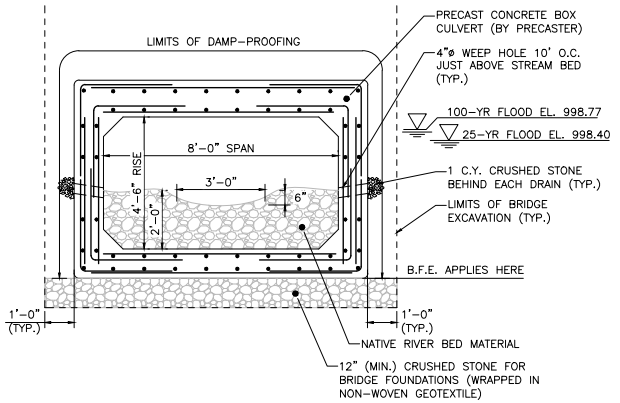
1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 3 INLET FLARED WALL - SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - ELEVATION
SCALE: ½" = 1'-0"



CULVERT 3 TRANSVERSE SECTION
SCALE: ½" = 1'-0"

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.96 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

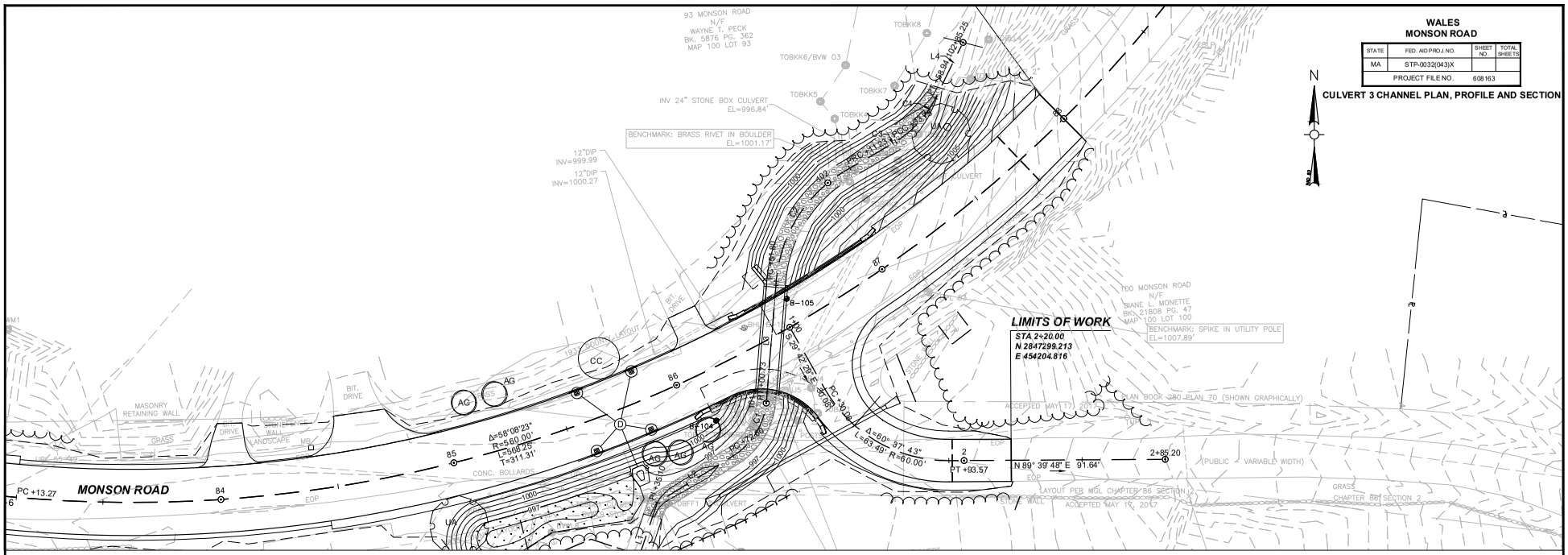
   FACTORED BEARING RESISTANCE = 5.26 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:25 AM
Proposal No. 608163-128312
A0848-703

WALES
MONSON ROAD

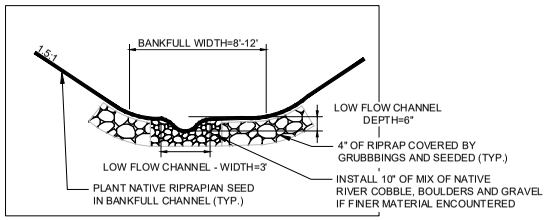
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION

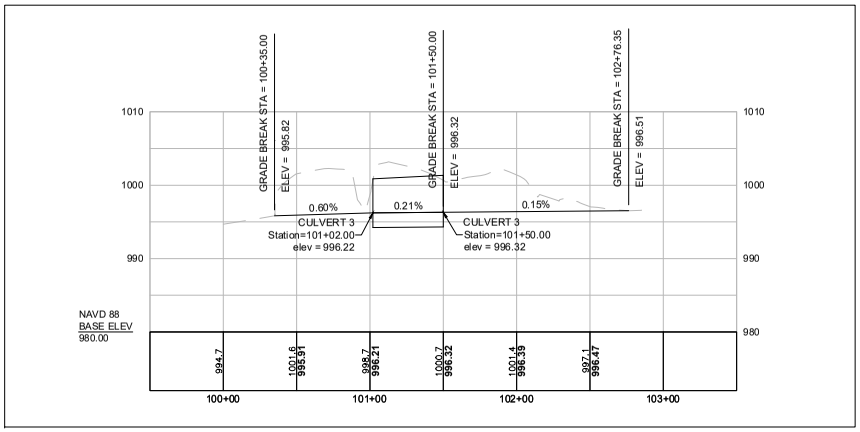


CULVERT 3 CHANNEL PLAN

0 20 40 60 80
SCALE: 1" = 20'



CULVERT 3 CHANNEL TYPICAL SECTION



CULVERT 3 CHANNEL PROFILE

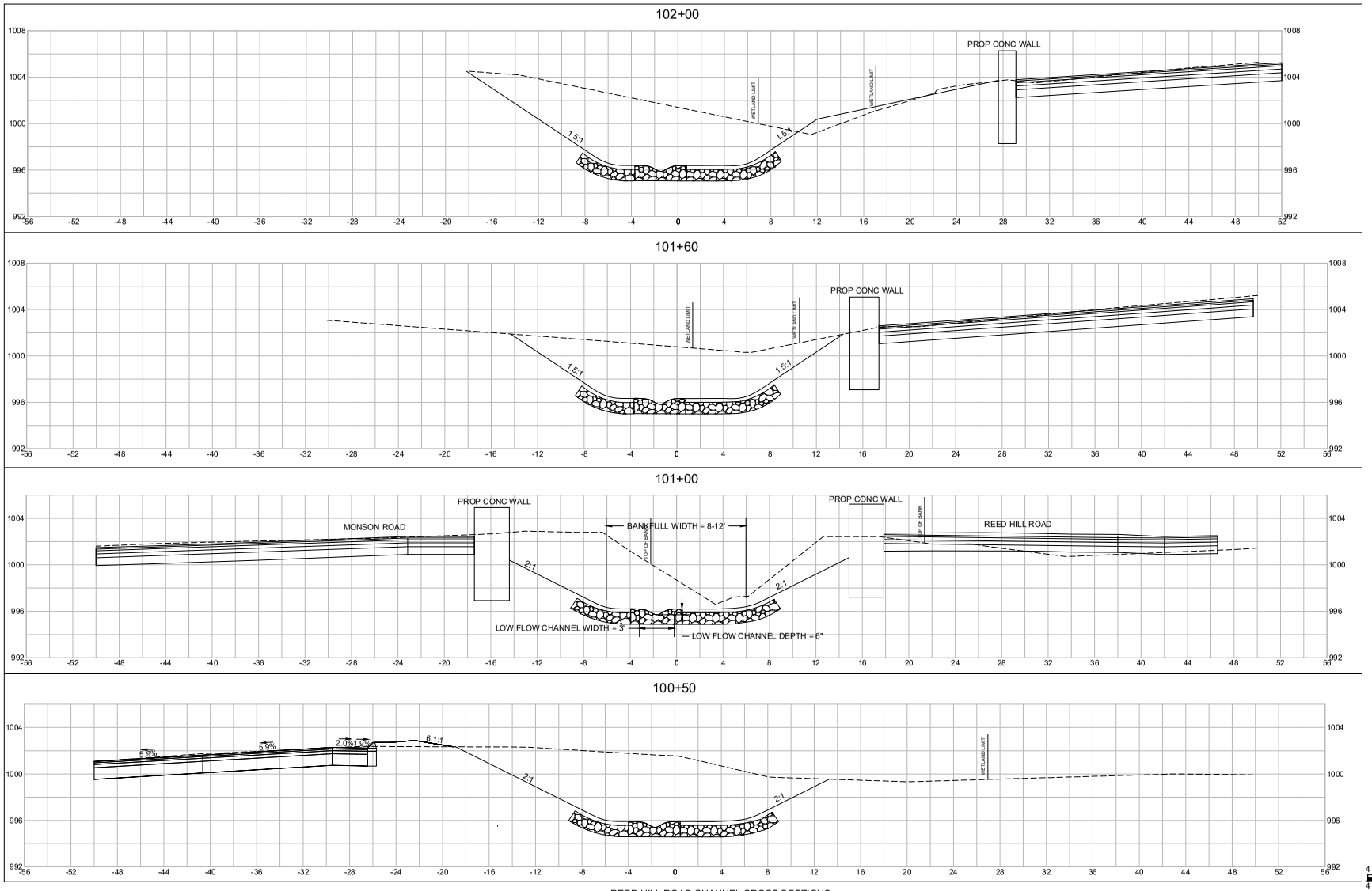
HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

608163_HD12\WATER HANDLING\.DWG Plotted on 6-Aug-2024 1:19 PM
Proposal No. 608163-132612
ADDEND. - 704

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS



REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

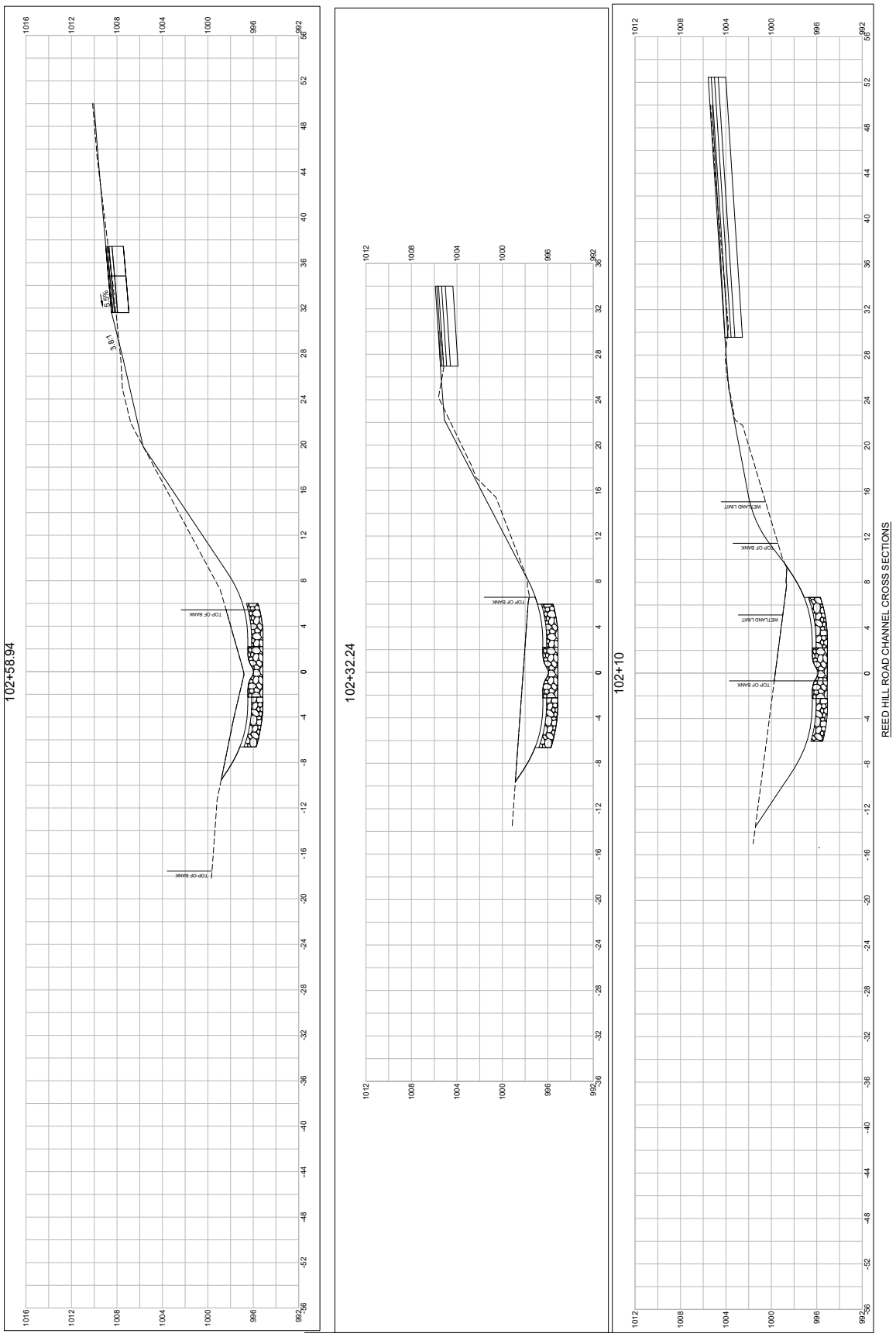
608163_JID12\WATER HANDLING\1.DWG Plotted on 5-Aug-2024 11:49 AM
Project No. 608163-13E12
A0BWG - 7/5

608163_HD12WATER HANDLING.DWG Plotted on 5-Aug-2024 11:50 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

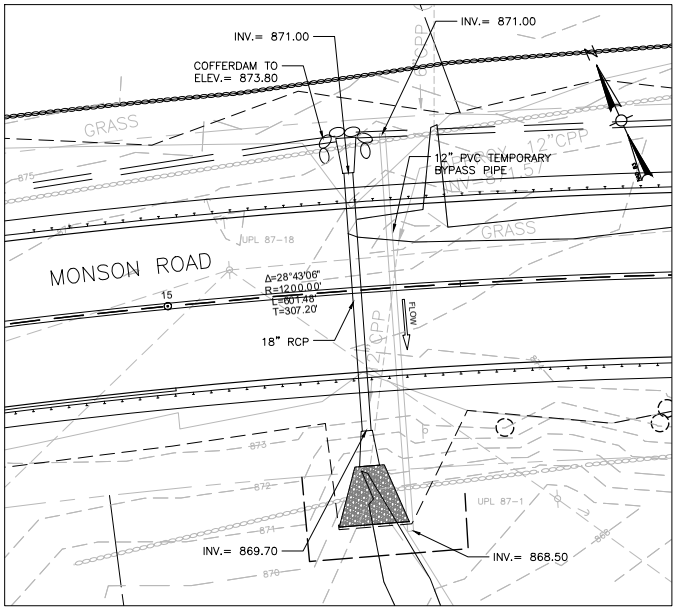
CULVERT 3 CHANNEL CROSS SECTIONS



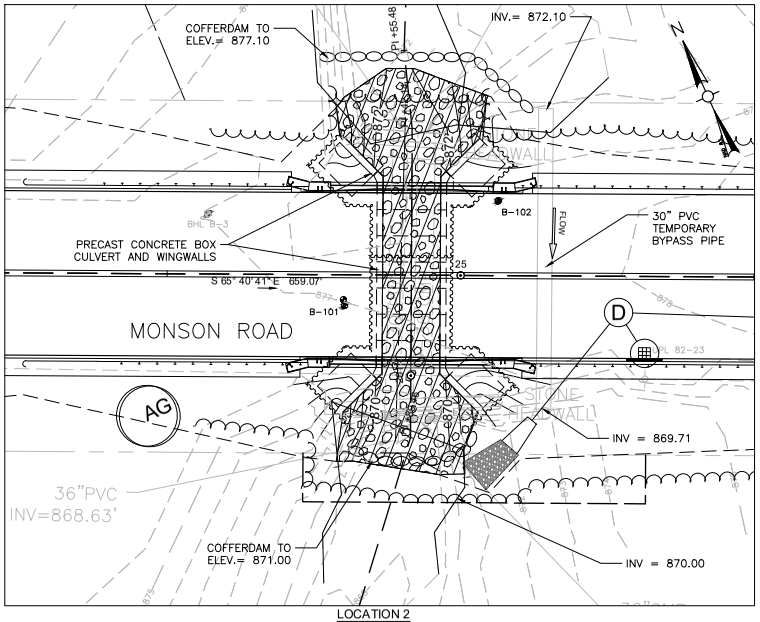
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONTROL OF WATER PLANS



LOCATION 1
STA 15+33



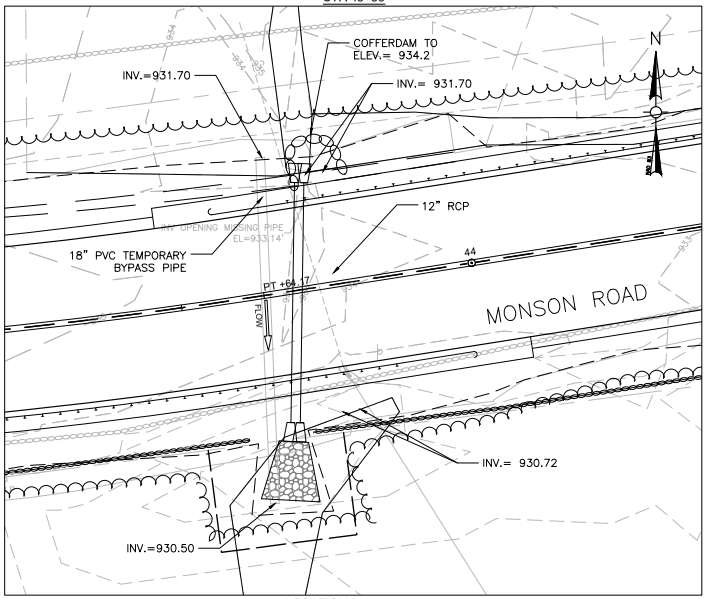
LOCATION 2
STA 24+92

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

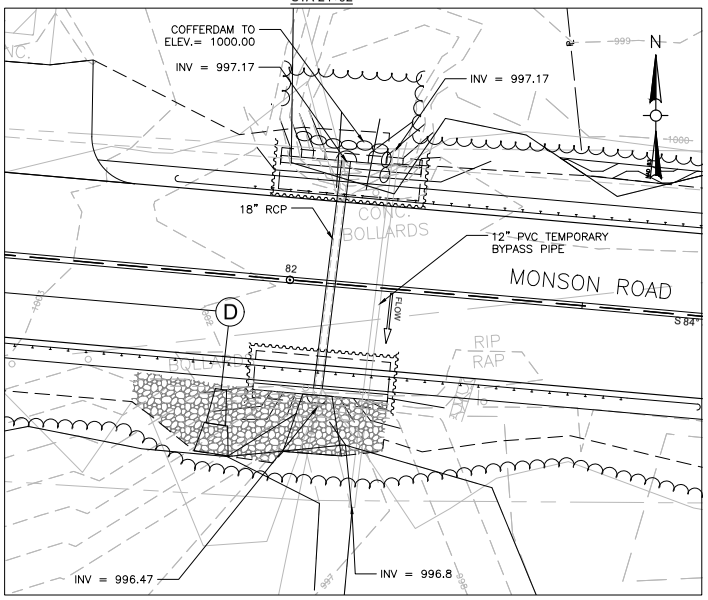
CONTROL OF WATER SEQUENCE FOR CULVERTS:

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.



LOCATION 3
STA 43+76



LOCATION 4
STA 82+07

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS AND END WALLS

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE) AND INSTALL THE COFFERDAMS IN THE STREAM ON BOTH ENDS OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND ENDWALLS.
4. INSTALL THE NEW CULVERT.
5. INSTALL THE END WALLS.
6. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT. RECONFIGURE THE COFFERDAMS AROUND THE SIDE THAT WILL BE CONSTRUCTED NEXT.
7. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
8. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING\.DWG Plotted on 5-Aug-2024 11:52 AM

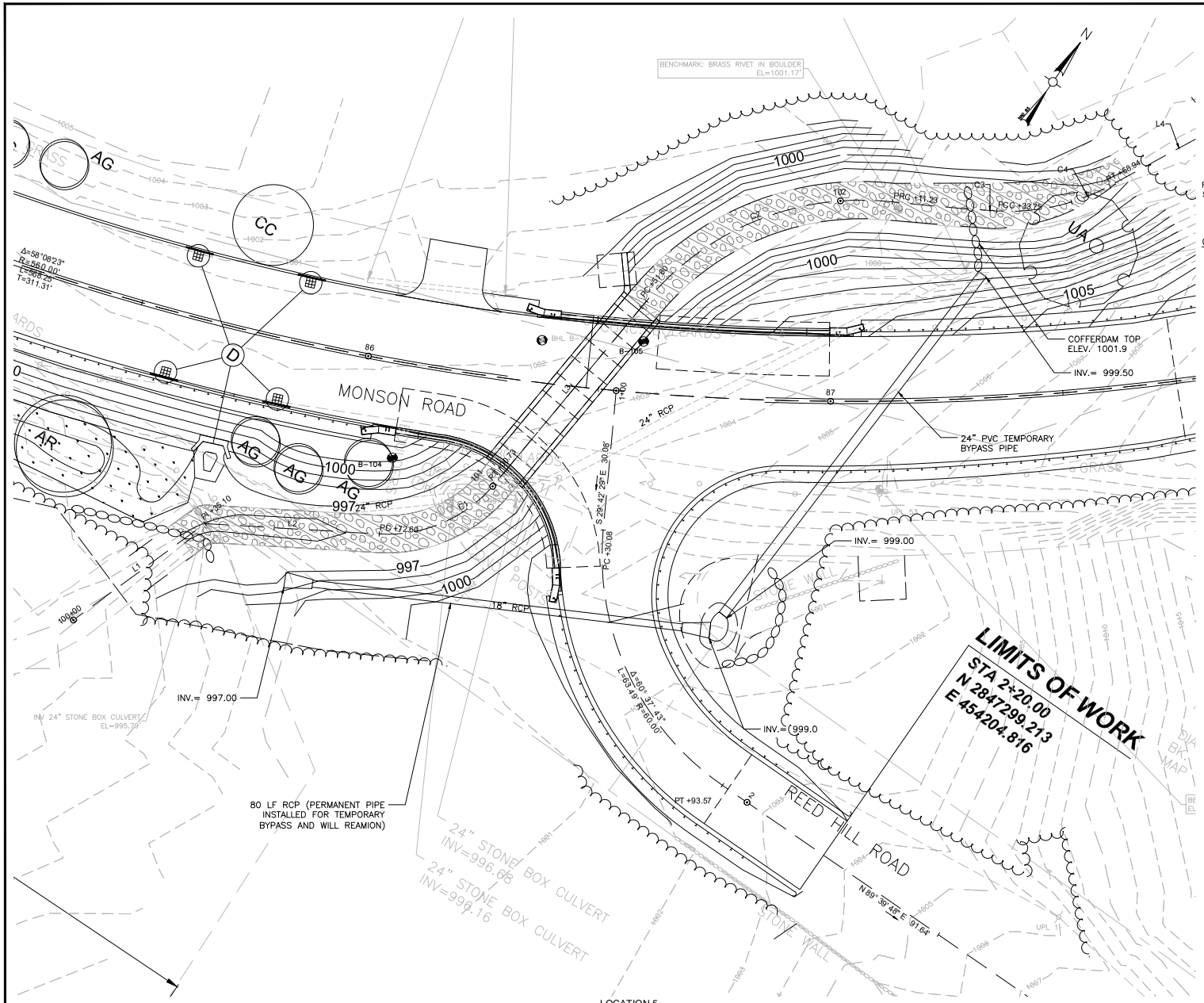
Proposal No. 608163-128212

A0884 - 707

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONTROL OF WATER PLAN - CULVERT 3



LOCATION 5
STA 87+00 and STA 1+33

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

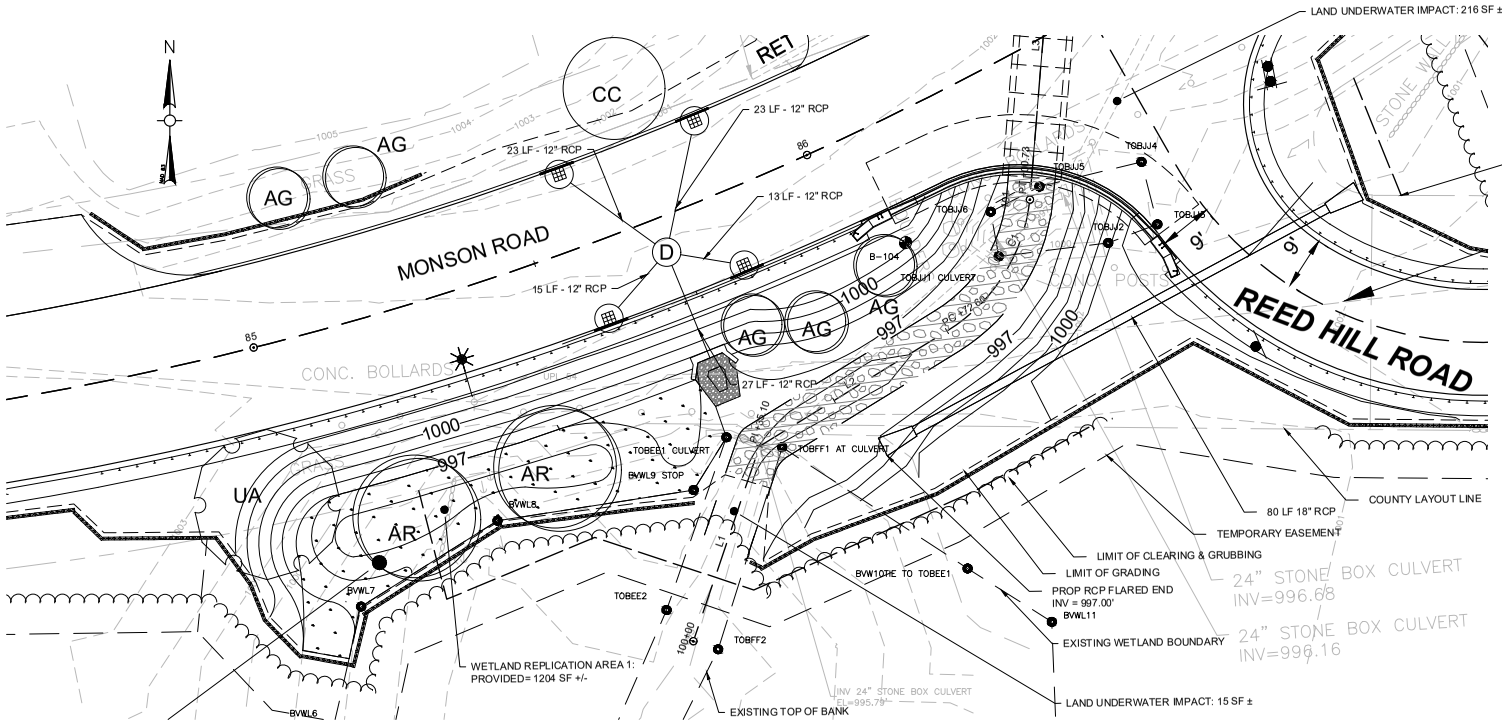
0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING.DWG Plotted on 8-Aug-2024 9:29 AM
Proposal No. 608163-128212
Addendum - 08

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

WETLAND REPLICATION AREA DETAIL



WETLAND REPLICATION AREA 1 GRADING PLAN

0 10 20 30 40

SCALE: 1" = 10'

WETLAND SEED MIX - OBLIGATE MIX

BOTANICAL

GRASS	COMMON NAME	%PLS BY WEIGHT
CAREX VULPINOIDEA	FOX SEDGE	26.50%
CAREX LURIDA	SHALLOW SEDGE	15.00%
SAPERGANIUM EURYCARPUM	GIANT BUR REED ECO PA	10.00%
CAREX LUPULINA	HOP SEDGE	7.00%
CAREX CRINITA	FRINGED SEDGE	6.00%
SCRIPUS CYPERINUS	WOOLGRASS	4.00%
JUNCUS EFFUSUS	SOFT RUSH	3.00%
CAREX COMOSA	BEAREDED SEDGE	3.00%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3.00%
SPARGANIUM AMERICANUM	BURRWEED	2.50%
SCIRPUS VALIDUS	BULRUSH, SOFT-STEM	2.00%
CAREX STRICTA	TUSSOCK SEDGE	1.00%
GLYCERIA CANADENISIS	MANNA GRASS	1.00%
		86.00%
VERBENA HASTATA	BLUE VERVAIN	4.00%
ASTER PUNICEUS	ASTER - SWAMP	2.00%
EUPATORIUM MACULATUM	JOE-PYE WEED	1.50%
EUPATORIUM PERFOLIATUM	BONESET	2.00%
IRIS VERSICOLOR	BLUE FLAG IRIS	2.00%
ALISMA SUBCORDATUM	MUD PLAINTAIN	1.00%
VERONIA NOVEBORACENSIS	NEW YORK IRONWEED	1.00%
BUDENS CERNUA	NODDING BURR MARIGOLD	1.00%
SOLIDAGO PATULA	ROUGHLEAF GOLDENROD	0.50%
MIMULUS RINGENS	MONKEY FLOWER	0.50%
CHELONE GLABRA	WHITE TURTLEHEAD	0.50%
		14.00%
		100.00%

SEED RATING:
SPECIES ECOTYPE SHALL BE AS NATIVE TO NEW ENGLAND REGION AS POSSIBLE. APPLY THIS MIX AT 20 LBS PLS/ACRE.

WETLAND REPLACEMENT AREA 1 NOTES:

1. A WETLAND SCIENTIST SHALL BE PROVIDED ON-SITE TO MONITOR CONSTRUCTION OF THE WETLAND MITIGATION AREA TO ENSURE COMPLIANCE WITH THE MITIGATION PLAN.
2. AT LEAST 12 INCHES OF NATURAL OR MANMADE WETIAND SOIL SHALL BE INSTALLED IN THE WETLAND REPLICATION AREA.
3. ONLY PLANT MATERIALS NATIVE AND INDIGENOUS TO THE REGION SHALL BE USED. SPECIES NOT SPECIFIED IN THE REPLICATION PLAN SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE REGULATORY AUTHORITIES. PLANT SPECIES ON THE INVASIVE SPECIES PLANT LIST IN THE CORPS MITIGATION INTRODUCTION: PERFORMANCE STANDARDS AND SUPPLEMENTARY INFORMATION DATED 2/21/01 SHALL NOT BE USED IN AND WITHIN 100 FEET OF MITIGATION SITES.
4. A SUPPLY OF DEAD AND DYING WOODY DEBRIS SHALL COVER between 5%-20% OF THE GROUND THROUGHOUT THE MITIGATION SITE AFTER THE COMPLETION OF CONSTRUCTION OF THE MITIGATION SITE. THESE MATERIALS SHOULD NOT INCLUDE INVASIVE SPECIES.
5. TEMPORARY DEVICES AND STRUCTURES TO CONTROL EROSION AND SEDIMENTATION IN AND AROUND MITIGATION SITES SHALL BE DISASSEMBLED AND PROPERLY DISPOSED OF NO LATER THAN NOVEMBER 1 THREE FULL GROWING SEASON AFTER PLANTING. SEDIMENT COLLECTED BY THESE DEVICES SHALL BE REMOVED AND PROPERLY DISPOSED OF IN A MANNER THAT PREVENT ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.

WETLAND REPLICATION AREA 1 PLANTING PLAN

SHRUBS
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM
WINTERBERRY (ILEX VERTICILLATE): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM

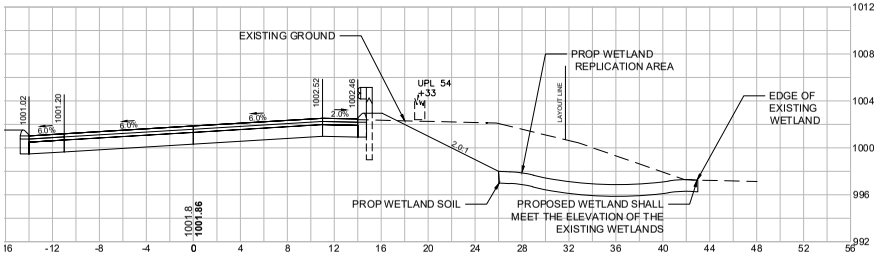
FERNS
CINNAMON FERN (OSMUNDA CINNAMOMEA): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.
SENSITIVE FERN (ONOCLEA SENSIBILIS): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.

SEED MIX
IN WETLAND REPLICATION AREA: SEE WETLAND SEED - OBLIGATE MIX - THIS SHEET
(SAME MIX TO BE USED ON PLAN SHEET 16 FOR WETLAND RESTORATION AREA 1)

FOR ALL AREA OUTSIDE AND ADJACENT TO WETLAND RESTORATION AND/OR REPLICATION AREAS PROVIDE PART SHADE ROADSIDE SEED MIX AS INDICATED ON CONSTRUCTION DETAIL SHEET 84.

TREES
OCTOBER GLORY (ACER RUBRUM): 2 TREES SPACED 25 FEET ON CENTER, WITH A 3 INCH TO 3.5 INCH CALIPER, TO PROVIDE A NATURAL PATTERN.
PRINCTON (ULMUS AMERICANA): 1 TREE WITH A 2 INCH TO 2.5 INCH CALIPER.

85+50



WETLAND REPLICATION AREA CROSS SECTION

608163_HD13\WETLAND REPLICATION.DWG Plotted on 8-Aug-2024 4:01 PM
Proposal No. 608163-132612
608163 - 709

Appendix B

Updated Stormwater Report

WESTON & SAMPSON ENGINEERS, INC.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

August 2024

TOWN OF
Wales
MASSACHUSETTS

STORMWATER MANAGEMENT REPORT
Monson Road Reconstruction
Project File No.608163

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF ATTACHMENTS ii

1.0 INTRODUCTION 1

2.0 DESIGN METHODOLOGIES 1

3.0 EXISTING DRAINAGE CONDITIONS 2

4.0 PROPOSED DRAINAGE CONDITIONS 2

5.0 THE STORMWATER MANAGEMENT STANDARDS 3

6.0 EROSION & SEDIMENTATION CONTROL MEASURES 7

7.0 SUMMARY 8

REGISTERED PROFESSIONAL ENGINEER'S CERTIFICATION 8

LIST OF ATTACHMENTS

Attachment A ..... Figures

Attachment B ..... Stormwater Checklist

Attachment C ..... Drainage Report

Attachment D ..... Operation and Maintenance Plan

Attachment E …….. Erosion and Sedimentation Control Plan and Pollution Prevention Plan

1.0 INTRODUCTION

This Stormwater Management Report has been developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. See Attachment A for a Locus Map of the Project Location. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has an open "country" drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 4.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project site is considered to be categorized as a redevelopment project according to the definition within volume 2, chapter 3 of the Massachusetts Stormwater Handbook. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

The drainage requirements are summarized in the Stormwater Checklist found in Attachment B.

2.0 DESIGN METHODOLOGIES

The survey performed for this project has been used in conjunction with the Mass GIS LIDAR Data to delineate drainage area limits for this project. The watershed area for each structure (both existing and proposed) was finalized based on a detailed field investigation.

The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design. Rational Method is used for determining runoff peak flows and design spreads of the road drainage system for a 10-year frequency design storm. The storm drainage systems were evaluated and designed using *Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2023*. An IDF curve for the project site was derived to depict the current precipitation intensities as summarized in the NOAA Atlas 14 Precipitation Data.

A proposed drainage area spreadsheet was composed to compute total areas and C-values for each catch basin. The runoff coefficients used are 0.9 for paved areas, 0.3 for grassy areas and 0.2 for unimproved areas (woods). A minimum time of concentration of 5 minutes was used for paved areas.

The hydraulic flow capacity of each drainage system was determined through gutter flow, storm sewer design, and hydraulic grade line analyses. The results of these calculations are presented using the Hydraflow Storm Sewers Program (see Attachment C for Drainage Report).

The culverts that cross Monson Road are designed for a 25-year frequency design storm because Monson Road is a Rural Major Collector. The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. The HY-8 Reports are included in the Drainage Report in Attachment C.

3.0 EXISTING DRAINAGE CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.2 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.9 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Nine culvert crossings convey brooks (unnamed except for the crossing at 50+72 which is locally known as either Dunham or Schoolhouse Brook) under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+32, Sta. 24+92, Sta. 43+75, Sta. 46+60, Sta. 50+72, Sta 82+07, Sta 86+00, and Sta. 87+00. These brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Attachment C for Drainage Report and HY-8 output.

4.0 PROPOSED DRAINAGE CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. The proposed impervious area within the project limits is 5.1 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.0 acres. 0.88 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. Based on site investigations, historical records, and GIS data, the proposed drainage areas were determined which can be found in the Drainage Report in Attachment C.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Four swales will have grass linings, and two swales will have modified rockfill linings. See Attachment C for the Drainage Report that describes each swale and contains swale design calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

Seven closed storm sewer systems are proposed along Monson Road. See Attachment C for the Drainage Report that describes each system and contains Hydraflow Storm Sewer Reports. These

systems shall outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Attachment C for the Drainage Report which contains the proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 2 Design Methodologies. The 12" CPP culvert at STA 15+32 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9-ft,10-in and rise 5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+75 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+60 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain and the 12" CMP crossing at STA 55+20 will also remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, two separate sections of 24" stone box culvert which cross diagonally under Monson Road and Reed Hill Road near Sta. 86+00 and Sta. 87+00, respectively, will be replaced by a concrete box culvert of span 8 ft and rise 4.5 ft at Sta. 86+45. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50. The box culverts proposed at Sta. 24+92 and 86+45 will both be submerged 2-ft to allow for the placement of natural stream bed material, consistent with the upstream and downstream channel restoration.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+32, STA 43+75, STA 46+60, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in the Drainage Report in Attachment C.

Water Quality:

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis.

At the existing outfalls, there is no evidence of erosion. All banks are stable with heavy vegetation and scour holes containing large rocks. A long-term Pollution Prevention Plan/ Operation and Maintenance Plan is included in Attachment D. This plan clearly identifies that the Town Highway maintenance will be responsible for inspections and periodic maintenance, which includes street sweeping and sediment removal.

5.0 THE STORMWATER MANAGEMENT STANDARDS

The Massachusetts Department of Environmental Protection (MassDEP) developed the Stormwater Policy that includes the ten Stormwater Management Standards. These standards address water quality and water quantity. It should be noted that the upstream watershed areas are unchanged. Minor

increases in flows will have negligible effect on the discharges in Vinica Brook. This roadway redevelopment project was designed to comply with the standards up to the maximum extent practicable. See Attachment B for the Stormwater Checklist.

Standard 1: *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The proposed project will create seven new closed drainage systems, but none of these systems will include new untreated discharges. The redevelopment project includes widening Monson Road and adding a shoulder for the safety of pedestrians and bikes. The total increase in impervious area is 0.70 acres, and the total increase in flow for a 10-yr storm event is 3.83%. The new pipe discharges will be treated by standard water quality measures to the maximum extent practicable as indicated in the Standard 4 explanation. Modified rockfill outfall protection is proposed for each new outfall and is summarized with backup calculations in the Drainage Report in Attachment C.

Standard 2: *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

The proposed project will include roadway widening with the addition of 4-ft shoulders to improve safety conditions and meet the requirements of MassDOT. Retention or detention is not practicable within the roadway right of way. The total increase in flows is 1.7 cfs for the 10 Year storm, which is a 3.83% increase over the pre-development peak discharge rate. The total increase in flows for the 2 Year storm is 1.2 cfs. The increase in flow is distributed across multiple outfalls and culvert crossings as shown in Tables 1 and 2 below. The increase in flow was calculated with the Rational Method based on the increase in impervious area per drainage area. This flow will be treated with catch basins with deep sumps as well as natural grass and lined swales. The flow will discharge to areas with outlet protection (level spreaders, modified rockfill aprons, or scour holes), which will reduce the velocity of the flow allowing sediment to deposit and decrease potential erosion.

Table 1. Increase in Flows for 10-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	4.47	4.56	0.09
Sta 15+32 Crossing	8.21	8.42	0.21
Sta 24+92 Crossing	8.15	8.41	0.26
Sta 31+62 Outlet/ Runoff	5.39	5.61	0.22
Sta 43+75 Crossing	1.42	1.52	0.10
Sta. 46+60 Crossing	1.82	1.76	-0.05
Sta 50+72 Crossing	5.34	5.65	0.31
Sta 73+23 Outlet/ Runoff	3.36	3.50	0.13
Sta 82+07 Outlet/ Runoff	4.57	4.85	0.28
Sta 85+72 Outlet/ Crossing	2.20	2.36	0.16
Total	**44.9**	**46.6**	**1.7**

The largest increase in flow is 0.31 cfs at the 50+72 crossing. The flow will be dissipated by an existing scour hole before traveling downstream to an unnamed brook. At all the crossings with proposed improvements, there will be a reduction in velocity due to increased openness ratios in the box culverts and larger proposed pipe diameters.

Table 2. Increase in Flows for 2-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	3.05	3.11	0.06
Sta 15+30 Crossing	5.60	5.75	0.15
Sta 24+92 Crossing	5.55	5.73	0.18
Sta 31+62 Outlet/ Runoff	3.67	3.82	0.15
Sta 43+75 Crossing	0.96	1.03	0.07
Sta. 46+60 Crossing	1.24	1.20	-0.04
Sta 50+72 Crossing	3.64	3.85	0.21
Sta 73+23 Outlet/ Runoff	2.29	2.38	0.09
Sta 82+07 Outlet/ Runoff	3.11	3.30	0.19
Sta 85+72 Outlet/ Crossing	1.50	1.61	0.11
Total	**30.6**	**31.8**	**1.2**

This roadway project requires road widening, which causes an increase in flow. The site does not contain areas to detain or retain stormwater runoff due to lack of available space within the public layout. The stormwater is treated before discharge, and the outlets contain outlet protection to reduce potential erosion. This roadway redevelopment project will comply with this standard up to the maximum extent practicable.

Standard 3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration to the maximum extent possible. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type*

Due to the limitations of right-of-way and existing utilities, there is insufficient space for the installation of recharge BMPs. Efforts were made to reduce the amount of curbing to allow roadway runoff into pervious areas. Roadside swales, including natural grass swales as well as modified rockfill lined swales are proposed along the corridor to help promote infiltration and provide disconnection. Additionally, the creation of approximately 75 linear feet of re-routed and daylighted stream channel increases the land under water area and promotes further recharge. Due to this project being a redevelopment, this standard complies to the maximum extent practicable.

Standard 4: *For new development, stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS)*

This project is a limited project that does not include modifications to the upstream watersheds, but only improvements to the existing roadway and storm drainage systems. All proposed drainage structures will have 4' deep sumps. Natural grass and lined swales are proposed to the maximum extent practicable to keep stormwater off of the roadway, promote infiltration, and contribute to TSS removal.

Standard 5: *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs. The use of infiltration practices without pretreatment is prohibited*

This standard is not applicable because roadways are not among the areas classified as having higher potential pollutant loads.

Standard 6: *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas*

The three perennial brooks crossing Monson Road within the project are designated as Cold-Water Fisheries. These crossings are Vinica Brook at the Reed Hill Road intersection, Schoolhouse Brook (STA 50 +72) and the unnamed brook at STA 24+92. Stormwater discharges have been proposed near existing outfall locations in order to maintain the existing drainage patterns. All new outfalls are proposed outside of wetlands and streams and outfall protection is proposed in advance of the critical areas in order to reduce erosion and excess sediment. Additionally deep sump catch basins are proposed throughout the entire proposed closed drainage system(s) as an approved pretreatment BMP. This proposed BMP together with the proposed roadway improvements represent a significant improvement over the existing conditions given the lack of existing pretreatment of roadway runoff and roadside embankment erosion which is contributing to poor stormwater quality especially near the resource and critical areas immediately adjacent to each culvert crossing.

Regarding other BMPs such as dry water quality swales, wet water quality swales, bioretention cells, and drainage channels, insufficient space within the public layout restricts the installation of additional water quality measures. Linear stormwater infiltration practices, like the ones listed above, were considered for the project, however, due to the relocation of the existing stone walls within the remaining town layout limits to reduce the total length of removal of stone walls below the MEPA threshold, many of the stone walls occupy locations where excavated infiltration swales could be installed without more significant right-of-way impacts. Additionally, in many areas long, linear and parallel wetlands and watercourses run along the roadway and occupy portions of the roadway town layout which also normally be considered for linear practices. Lastly, in order to qualify as a linear stormwater practice, the design would need to provide a certain depth and width in order to provide the minimum quality volume characteristics which significantly increase the easements needed on the abutting private properties which include single family developed and undeveloped residential and large parcels of undeveloped wildlife sanctuary property all of which are densely vegetated with mature shade and other tree species.

Standard 7: *Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.*

This project qualifies as a redevelopment project according to the definition within volume 2, chapter 3 of the *Massachusetts Stormwater Handbook.* The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

Piped stormwater systems and roadside swales are proposed to improve the conveyance and quality of stormwater. Stormwater water quality measures including deep sump catch basins are included to increase the removal of total suspended solids. Provision of structural SCMs beyond deep sump catch

basins such as linear infiltration was investigated for this project however provision of such measures is not feasible due to lack of available space within the project right of way.

Standard 8: *Erosion and Sedimentation Controls must be implemented to prevent impacts during construction or land disturbance activities*

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment E. The location of proposed erosion control measures and installation details are shown on the plans. These measures include inlet protection on all catch basins and sediment barriers down gradient of all disturbances within the wetland buffer zones. Because the project will disturb more than an acre of land the contractor will request coverage under the NPDES Construction General Permit and will provide a Stormwater Pollution Prevention Plan (SWPPP).

Standard 9: *All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed*

An Operation and Maintenance Plan is provided in Attachment D.

Standard 10: *All illicit discharges to the system are prohibited*

Illicit discharges are not permitted in the Town of Wales. The project's stormwater management system, as shown on the plans submitted with this report, have been designed in full compliance with Standard 10. The project area does not have any known illicit connections. Any illicit connections to the stormwater management system found in the project limit of work during construction will be removed and/or resolved through MassDOT's Illicit Discharge Detention and Elimination (IDDE) Program. The Long-Term Pollution Prevention Plan, provided in Appendix E, includes measures to prevent illicit discharges.

6.0 EROSION & SEDIMENTATION CONTROL MEASURES

To protect the adjacent properties from construction related activities, a Soil Erosion and Sediment Control Plan has been developed in accordance with the latest Massachusetts Department of Environmental Protection (MassDEP) Erosion and Sediment Control Guidelines. This plan will be implemented prior to the start of any site disturbance and will involve the combined use of compost filter tubes, silt fencing, silt sacks, and vegetative stabilization. Refer to Design Plans for soil erosion and sediment control notes and details.

Once a construction schedule has been established, a responsible person shall be named who will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials, installation, and maintenance of erosion and sediment structures, and the communication and detailed explanation of the requirements and objectives of the erosion and sediment control measures to all people involved in the site work.

Weston & Sampson shall be notified at 1-860-616-6495 of any proposed alteration to the erosion and sediment control plan prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

7.0 SUMMARY

The proposed project will improve the roadway, traffic and drainage conditions at the project site. The proposed roadway redevelopment will comply with the standards to the maximum extent practicable. The proposed project shall satisfy the stormwater requirements of the Massachusetts Stormwater Handbook.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Management Report, including the soils information, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, and the plans showing the stormwater management system, and have assessed that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also assessed that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

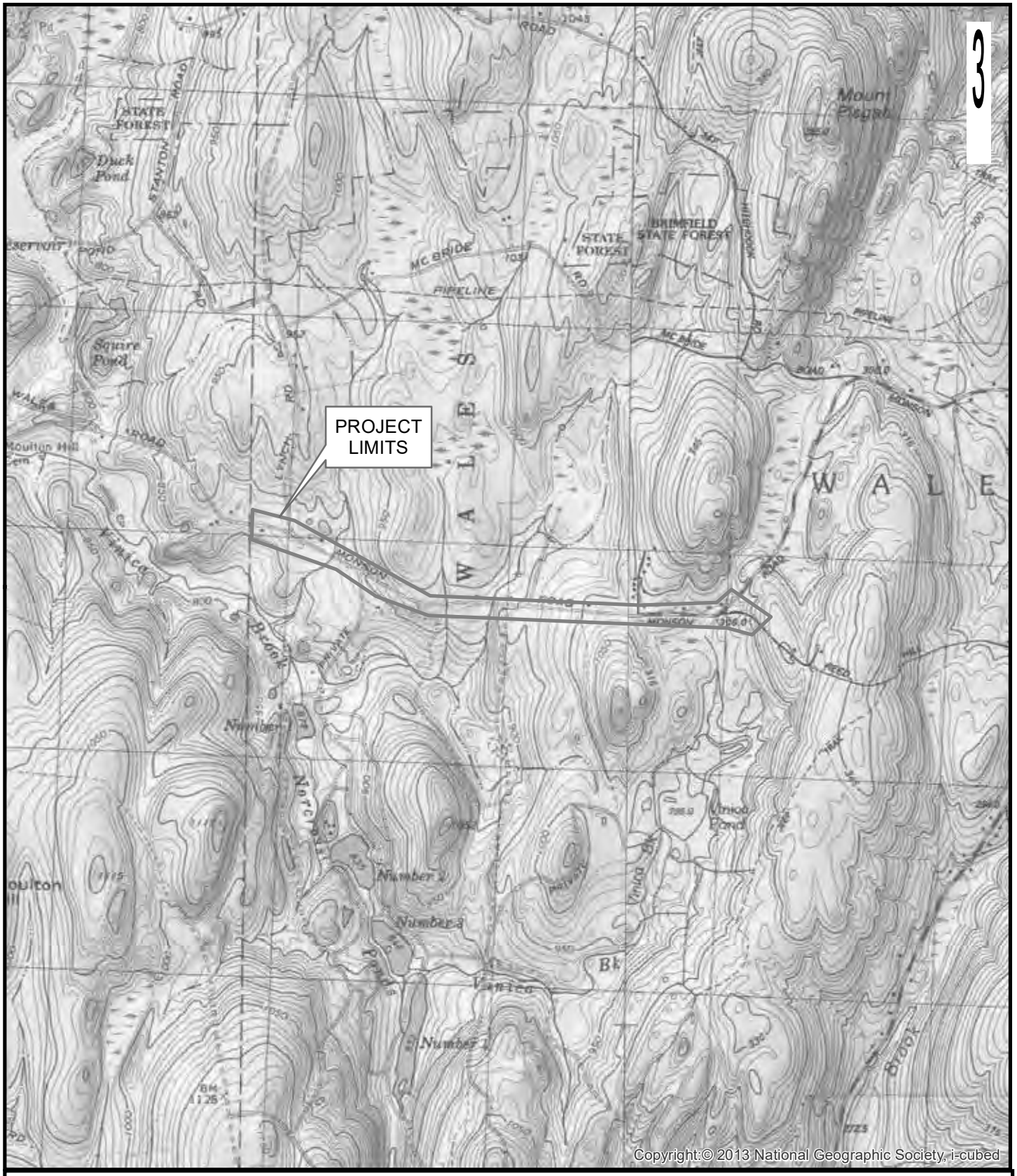
Registered Professional Engineer Block and Signature

Conrad C. Nuthmann 6/4/2024

Signature and Date

ATTACHMENT A

Figures



3

Project Limits

FIGURE 1
MONSON ROAD IMPROVEMENTS
Wales, MA

LOCUS MAP

1 inch = 2,000 feet

1,000 0 1,000

Scale In Feet

Weston & Sampson

Path: P:\MA\Wales, MA\2170841 Monson Rd Reconstruction\CAD\GIS\LocusMap.mxd User: ColesL Saved: 1/31/2018 2:49:29 PM Opened: 1/31/2018 2:49:49 PM

ATTACHMENT B

Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

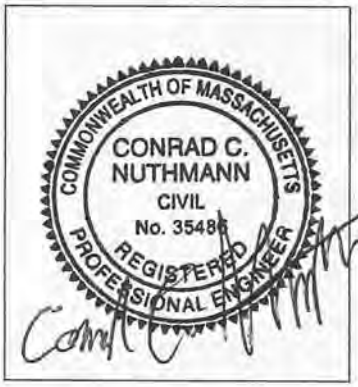
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Conrad C. Nuthmann 6/5/2024
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

☒ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

ATTACHMENT C

Drainage Report

Weston & Sampson

westonandsampson.com

712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

August 2024

TOWN OF
Wales
MASSACHUSETTS

DRAINAGE REPORT
Monson Road Reconstruction
Project File No.608163

DRAINAGE REPORT

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF APPENDICES ii

1.0 INTRODUCTION 1

2.0 METHODOLIGIES 1

3.0 DESIGN SUMMARY 2
3.1 Drainage Regulations 2
3.2 Rational Method Factors 2

4.0 EXISTING CONDITIONS 3

5.0 PROPOSED CONDITIONS 3
5.1 Drainage Swales 3
5.2 Storm Sewer Systems 4
5.3 Cross Culverts 5
5.4 HY-8 6
5.5 HEC-RAS 6
5.6 Temporary Water Handling 7

6.0 WATER QUALITY MEASURES 7

7.0 CONCLUSION 7

LIST OF APPENDICES

Appendix A .....Watershed Maps

Appendix B ..... Rational Method Data

Appendix C ..... Hydraflow Reports

Appendix D .....HY-8 Reports

Appendix E .....HEC-RAS

Appendix F..... Drainage Swales

Appendix G ..... Outlet Protection

1.0 INTRODUCTION

This Drainage Report was developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has stormwater sheet off the road into undefined swales and wetlands. Drainage issues include roadside sediment deposits that cause water to flood the road, which damages the road structure. Pavement unraveling causes erosion at the edge of the pavement. There are also minimal water quality measures. There are nine culvert crossings that convey unnamed streams under Monson Road. The culverts also convey stormwater runoff that travels via roadside swales. These streams eventually discharge into Vinica Brook, which closest point is located approximately 1,000-ft to the south of the Monson Road intersection with Lynch Road. The existing culverts are inadequately sized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 5.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

This report summarizes the existing drainage conditions and issues, the methodology used to perform the drainage analysis, and the proposed improvements to the storm drainage system.

2.0 METHODOLIGIES

Watershed areas were established through the use of project topographic survey, Mass GIS LIDAR Data, and site visits to verify watershed area limits. Site investigation of the entire project area included review of the condition of existing roads, utilities, culverts, and general surroundings. Field observations provided a better understanding of drainage patterns, watershed areas, and structures not included on mapping. Following site investigations, the layout of each drainage system was finalized and mapped. See Appendix A for Drainage Area Maps.

The Rational Method was used to determine the peak surface runoff rate of this watershed. The Rational Method involves three factors: the drainage area, the runoff coefficients based on surface features, and rainfall intensity based on the time of concentration of the drainage area. Individual peak surface runoff rates were determined for each catch basin where storm water is collected. The individual runoff rates were then combined into an overall system to represent the existing conditions. This was done for each of the systems studied, and the findings are discussed in the following sections.

Hydraflow Storm Sewers Extensions for AutoCAD Civil 3D 2023 was used to model the proposed piped drainage systems. The computer program used the Rational Method to determine peak flow rates based

on specific parameters input by the user. The capacity of each pipe was analyzed and compared to the flow in cubic feet per second (cfs) through the system. The software also computed gutter spreads and hydraulic grade lines. The Rational Method input is attached in Appendix B. Hydraflow results are included in Appendix C. The proposed systems were finalized to improve drainage conditions in a cost-effective manner, improve water quality, minimize property impacts, and maintain roadway conditions in the future.

The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. HY-8 is a computerized implementation of Federal Highway Administration (FHWA) culvert hydraulic design. The program calculates the capacity of the culvert with headwater and tail water influences. The program also calculates energy dissipation. The HY-8 Reports are included in Appendix D.

3.0 DESIGN SUMMARY

The closed drainage systems and cross culverts were designed to meet MassDOT Standards.

3.1 Drainage Regulations

- The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design.
- The roadway storm drain system is designed for a 10-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide. A 25-year design storm frequency was checked for systems with low points.
- The cross culverts are designed for a 25-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide.

3.2 Rational Method Factors

- Drainage Area - The properties within the watershed limits of the storm drainage systems consist of woods and residential and commercial lots.
- Runoff coefficients were based on land cover obtained from aerial photography, survey, and field observations. The following runoff coefficients were used:
  - Impervious Areas (Asphalt, Concrete, Roofs, Etc.) = 0.90
  - Grass (open space) = 0.3
  - Woods = 0.2
- Precipitation data is based on the most current information taken from NOAA Atlas 14, Volume 10, Version 2, Precipitation Frequency Data Server for Wales, MA.
- Time of concentrations were based on the TR-55 method. A 5-minute minimum time of concentration was used for paved areas. The time of concentrations range from five minutes to twenty-four minutes.

4.0 EXISTING CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.2 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.9 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Eight culvert crossings convey unnamed brooks under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+33, Sta. 24+92, Sta. 34+50 Sta. 43+76, Sta. 46+65, Sta. 50+72, Sta 82+07, and Sta 86+53. These unnamed brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Appendix D for existing culvert reports.

5.0 PROPOSED CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and also improve the existing drainage conditions. The proposed impervious area within the project limits is 5.1 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.0 acres. 0.88 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. See utility plans under separate cover.

5.1 Drainage Swales

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Four swales will have grass linings, and two swales will have modified rockfill linings. See Appendix E for Swale Calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

The natural grass swale from STA 14+50 to 17+00 has two sections: the first part conveys water from Sta. 17+00 into the culvert crossing at STA 15+25 and the second part continues west of the culvert crossing to outlet into the 15" RCP under the two residential driveways. This 15" RCP outlets into the grass swale which runs from STA 13+50 to STA 11+50. The existing grade from STA 11+00 to 11+50 carries the water from the swale into the existing wetlands. Curbing is provided from STA 13+50 to 15+00 on the south side of the road to protect runoff from getting in the yard of the house at 170 Monson Road. From STA 15+25 to STA 17+25, due to the superelevation of the roadway and the existing drainage patterns, the flow all sheets off to the southwest into the outlet area of the 18" RCP cross culvert at STA 15+25.

A modified rockfill drainage swale is proposed from STA 31+75 to 39+50 (flowing to the west) to catch the large amount of runoff traveling from the north side of Monson Road down into the project site. There will be no curbing on the northern side of the road to allow the runoff from the road to enter the swale. In addition, there will be no curbing on the south side of the road to allow any water on the high side of

the superelevation to naturally sheet off and follow the existing drainage patterns. At the high point of the roadway, STA 40+30, the modified rockfill swale will tie into a proposed grass swale which will flow to the east to outlet into the twin 12" RCP cross culverts.

After the initiation of the design project, the Town of Wales dug a roadside ditch from Sta. 44+00 to Sta. 46+65 to divert flow away from the existing plugged culvert at Sta. 43+76. The Town then installed a 12" CPP crossing at Sta. 46+65 to convey the diverted flow across Monson Road. This diversion created new wetlands along the side of the road as well as on the south side of the road where the 12" CPP outlets. The proposed conditions will replace the culvert at Sta. 43+76 with twin 12" RCPs and maintain the roadside ditch to divert a portion of the flow away from Sta. 43+76 during large storm events, so stormwater can travel east to the existing low point off the roadway at Sta. 46+65 and enter a proposed 12" RCP culvert to cross Monson Road to the south side. These proposed conditions will maintain the newly created wetlands as well as the existing drainage patterns.

A modified rockfill swale is proposed on the south side of the road from STA 70+50 to the outfall location at STA 73+25. This area of the project site, based on the natural topography, has water travelling onto the roadway from the south. This proposed swale will catch a large area of runoff before it can reach the roadway.

5.2 Storm Sewer Systems

Seven closed storm sewer systems are proposed along Monson Road. See Appendix B for drainage area information and see Appendix C for the Hydraflow Storm Sewer Reports. These systems shall outfall into streams or wooded areas. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts. See Appendix F for outlet protection calculations.

System Sta. 22+25

This system contains six catch basins and 12" or 15" reinforced concrete pipes (RCP). The system captures approximately 650 feet of roadway drainage along Monson Road between Lynch Road and the culvert at STA 24+93.This system also captures off-road drainage which is currently settling in the front yard of property 155 Monson Rd. This system discharges into the modified rockfill outlet protection at Sta. 22+25 directly before the flagged B-series wetlands.

System Sta. 25+50

This system contains two catch basins, and pipes are 12" RCP. The system captures approximately 700 feet of roadway drainage along the southern lane of Monson Road between the culvert at STA 24+93 and Sta. 30+00 (Peck Road). This system discharges into the outlet protection area of the two cross culverts near STA 25+00.

System Sta. 50+50

This system contains six catch basins, and pipes are 12" RCP. The system captures approximately 400 feet of roadway drainage along Monson Road between STA 48+00 and STA 52+00. The low point is located at STA 50+38 where this system outfalls into the proposed outlet protection near the existing 36" PVC cross culvert.

System Sta. 51+24

This system contains fourteen catch basins, and pipes are 12" RCP. The system captures approximately 1835 feet of roadway drainage along of Monson Road between STA 52+00 and STA

70+35. This system flows to the west and outlets into the proposed outlet protection for the existing 36" PVC cross culvert at STA 51+24.

System Sta. 73+30

This system contains five catch basins, and pipes are 12" RCP. The system captures approximately 500 feet of roadway drainage along Monson Road between STA 70+35 and STA 75+33. This system outfalls near the low point of the roadway at STA 73+25 with a proposed modified rockfill apron as outlet protection. The proposed swale on the south side of the road also outlets at the same location.

System Sta. 81+97

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 590 feet of roadway drainage along Monson Road between STA 75+35 and STA 81+25. There is no curb on the south side of the roadway from STA 76+50 to STA 79+20 so that water can sheet of naturally and eventually flow into the wetlands. At the low point at STA 82+75, there is no curb on either side of the road to allow water to sheet off into the adjacent wetlands. The water from the closed system discharges onto a modified rockfill apron which is part of the outlet protection for the 18" RCP culvert crossing at STA 82+05.

System Sta. 85+72

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 315 feet of roadway drainage along Monson Road between Sta 83+85 and Sta. 87+00. This system is located at a low point (STA 85+85) and outfalls into the graded rockfill channel which is in the place of the existing Reed Hill Rd. intersection. The adjacent wetland replication area adjoins the existing wetlands to accept the water from this closed system in addition to the box culvert coming from the north side of Monson Road and the proposed 18" culvert which crosses the relocated Reed Hill Road intersection. A proposed grass swale also helps convey water on the south side of Monson Road from STA 84+50 into the wetland replication area.

5.3 Cross Culverts

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Appendix D for proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 3 Design Summary. The 12" CPP culvert at STA 15+33 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9.5 ft and rise 6.5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+76 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+65 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain. The 12" CMP crossing at STA 55+20 was modeled using Hydraflow, which shows that a 12" pipe has enough capacity to convey the small contributing drainage area during a 25-year storm event, therefore the existing pipe will remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, the 24" stone box culvert which crossed diagonally under Monson Road near STA 86+53 will be replaced by a well-defined box culvert of span 8 ft and rise 4.5 ft. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+33, STA 43+76, STA 46+65, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in Appendix F.

5.4 HY-8

The primary software used for hydraulic analysis of culvert is HY-8. The crossings at STA 1+50, 15+33, 43+76, 46+65 and 82+07 were analyzed for existing and proposed conditions. The FHWA Culvert Hydraulic Analysis Program (HY-8) enables to analyze culvert performance for a crossing that has multiple culvert barrels that share the same tailwater and roadway overtopping.
Refer Appendix D for detailed results.

5.5 HEC-RAS

Culvert crossings at St. 24+92, 50+72 and 86+53 were evaluated using HEC-RAS program. Water surface profiles for the brook's 2, 10, 25, 50, and 100-year return frequency flood events were developed in a manner consistent with the standards used to develop water surface profiles under the NFIP. Survey information acquired for the project base plans was input using the HEC-RAS computer application and used as a basis for assembling a flood elevation profile hydraulic model of the project site. In the completed model, the channel and overbanks were assigned roughness coefficients (Manning's "n"). These values were selected based on aerial maps and field visit. All flood simulations performed with the project HEC-RAS model were done in a mixed flow mode and employed the upstream and downstream stream slope as the upstream and downstream boundary condition respectively.

A detailed hydraulic analysis was performed for the culvert crossings (both existing and proposed) in order to evaluate for 2, 5, 10, 25-year storm design. This investigation was conducted in a manner consistent with American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Department of Transport (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

The HEC-RAS model was performed for both existing as well as proposed conditions for the crossing 24+92, the existing crossing at 50+72 and the proposed crossing at 83+56. The geometry data, manning's constant and culvert data were input. Refer Appendix D for output data.

At Station (24+92): A four-sided precast concrete box culvert is proposed at this crossing. The span of culvert is **9.5 ft** and rise of **6.5 ft.** Two feet of the box culvert will be filled with natural stream bottom material. The results show this crossing will handle up to a 100-year event.

At Station (50+72): A 36" PVC pipe culvert exists for this crossing with the invert elevations of 922.04 on the upstream side and 920.04 on the downstream side. Existing structure was modeled using HEC-RAS. The results show this crossing will not overtop during a 25-year design period.

At Station (86+53): A 24" Stone box culvert exists over the entire crossing. A tributary of Vinica Brook crosses Monson Road at this station. The small woodland channel flows under Monson Road into a small depression near the intersection of Reed Hill Road. A precast concrete box culvert of span **8 ft**

and rise **4.5 ft** is proposed for this crossing. 2-feet of natural material will be filled at the bottom. Results indicate the crossing will adequately handle up to a 100-yr storm event.

6.0 TEMPORARY WATER HANDLING

Temporary water handling will be provided using temporary bypass pipes and sandbag systems as shown on the plans. (see design plans for sizes and invert elevations) will be installed. Sandbags in form of cofferdams will. The size of temporary pipes and flow through sandbags was based on HEC-RAS modeling information. A steady flow analysis was performed with approximate inverts and 2-year return period. The 2-year return period is a common design standard for temporary water handling structures and is considered a reasonable balance between the risk of failure and the cost of construction.

7.0 WATER QUALITY MEASURES

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis. Due to limitations in the amount of public right-of-way, there will be no proposed water quality BMP's in an effort to reduce impacts on private property.

8.0 CONCLUSION

The proposed storm drainage systems are designed in accordance with the guidelines set in Chapter 8 (Drainage and Erosion Control) of the Mass Highway manual. The Hydraflow results show that the proposed systems are designed to convey a 10-year storm. The culverts are designed to convey a 25-year storm. The piped systems will assist in capturing roadway runoff to alleviate any potential flooding. The proposed drainage systems adequately address water quality to the maximum extent practicable.

APPENDIX A

Watershed Maps

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:53 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	8
PROJECT FILE NO. 608163			

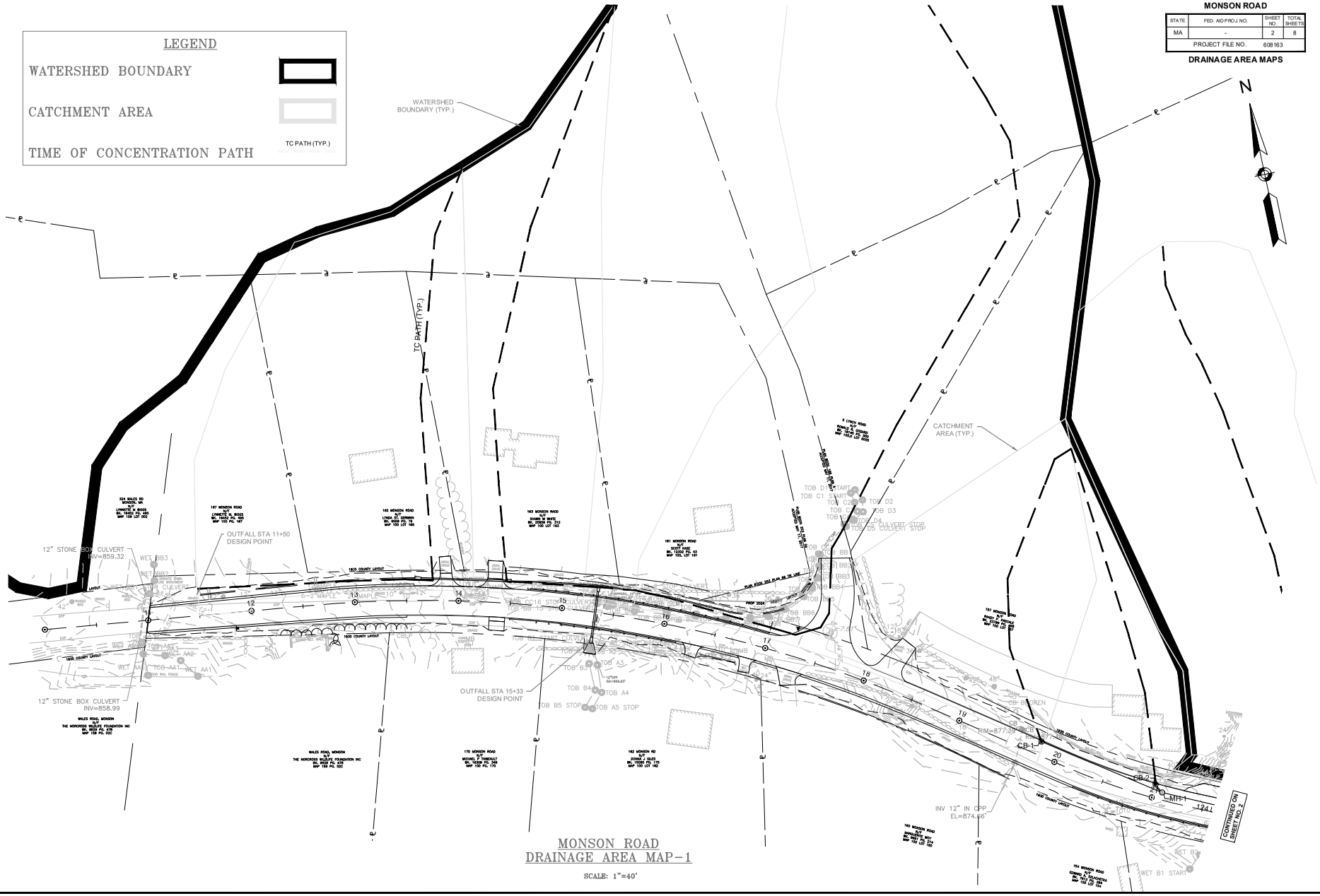
DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)



MONSON ROAD
DRAINAGE AREA MAP-1

SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM

Proposal No. 608163 (SU) 12812

24" x 36"

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	8
PROJECT FILE NO. 608163			

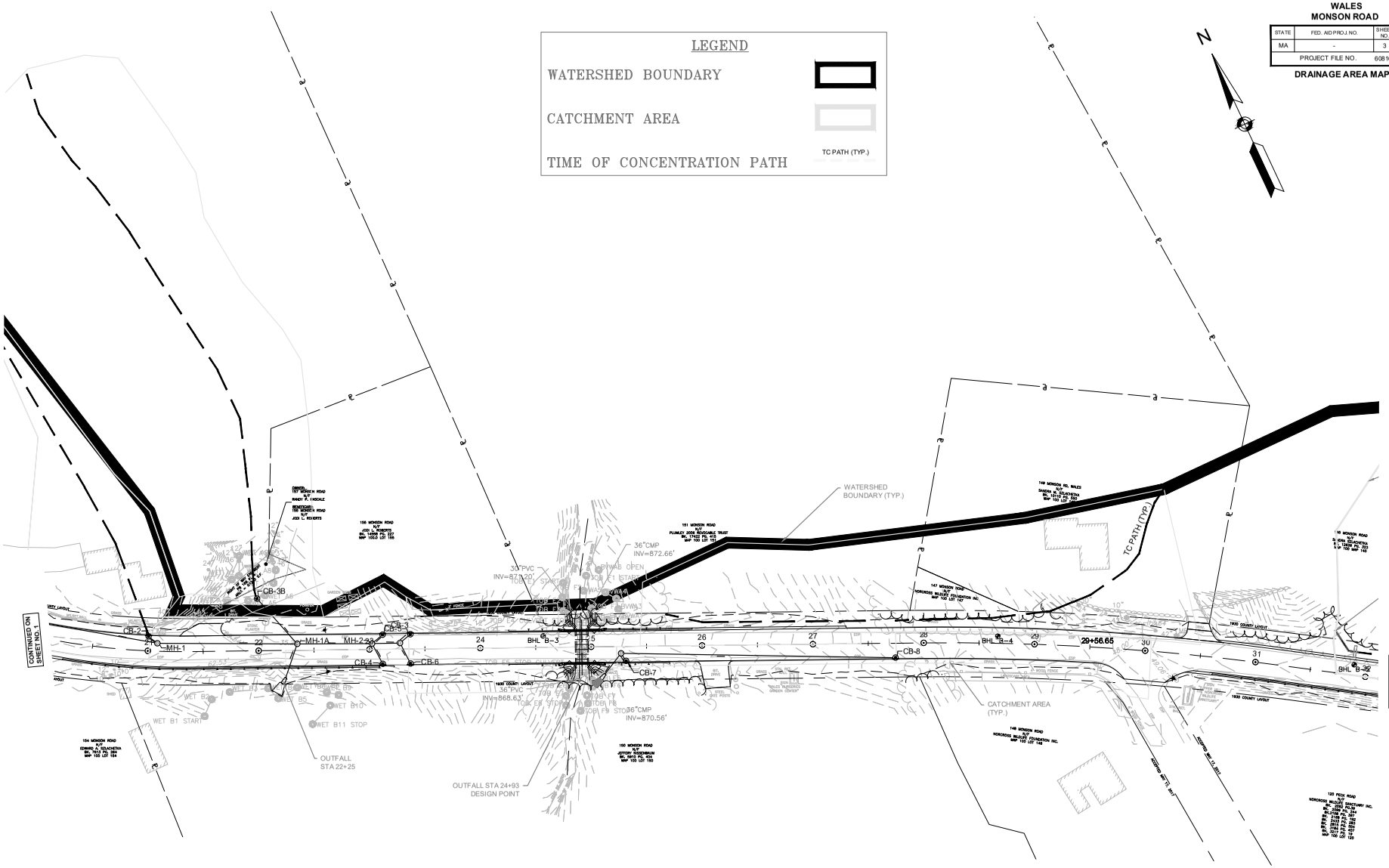
DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)



MONSON ROAD
DRAINAGE AREA MAP-2

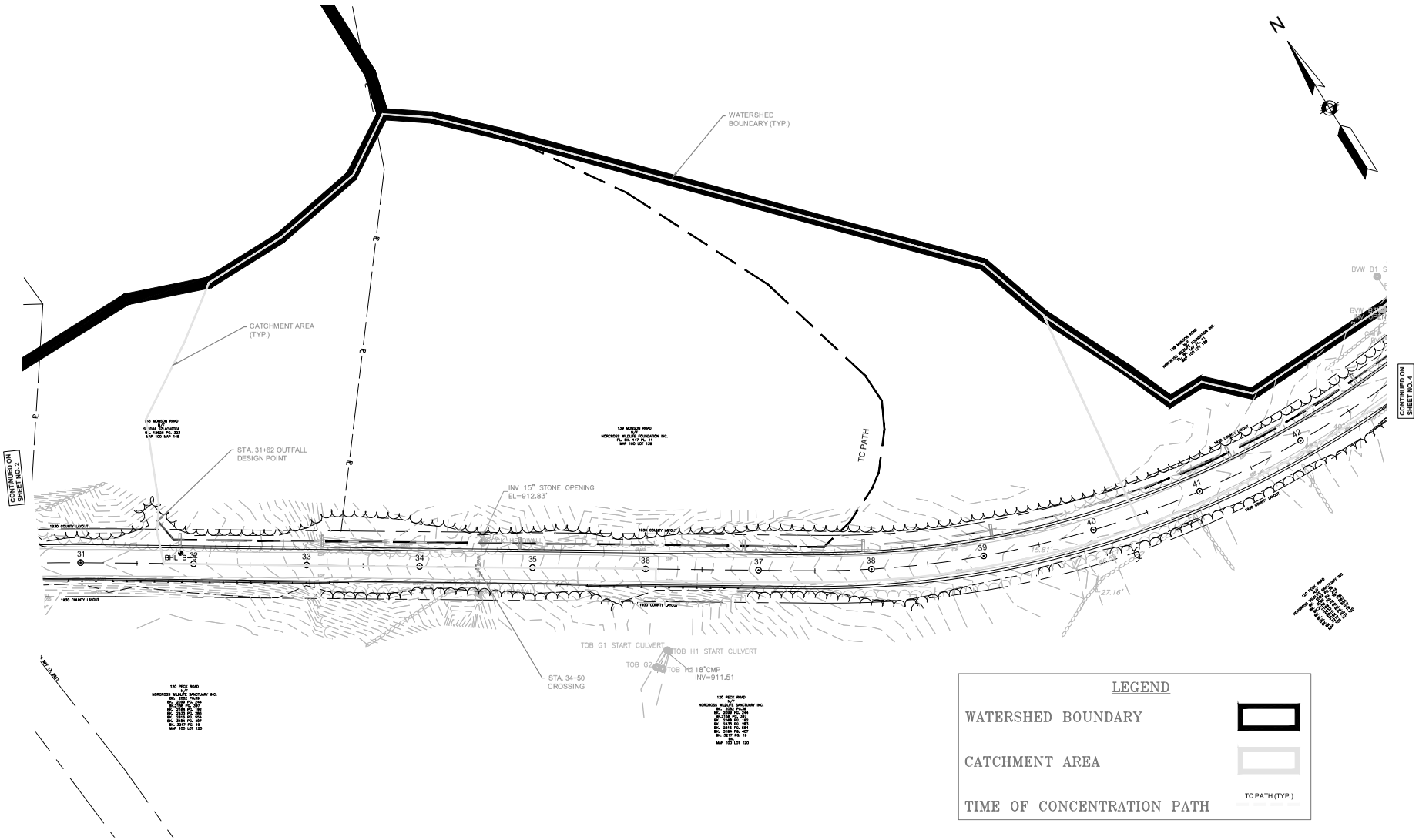
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-132121
608163 - sht

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



MONSON ROAD
DRAINAGE AREA MAP-3

SCALE: 1"=40'

A08840 - 2.dgn
MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-138112

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
PROJECT FILE NO. 608163			

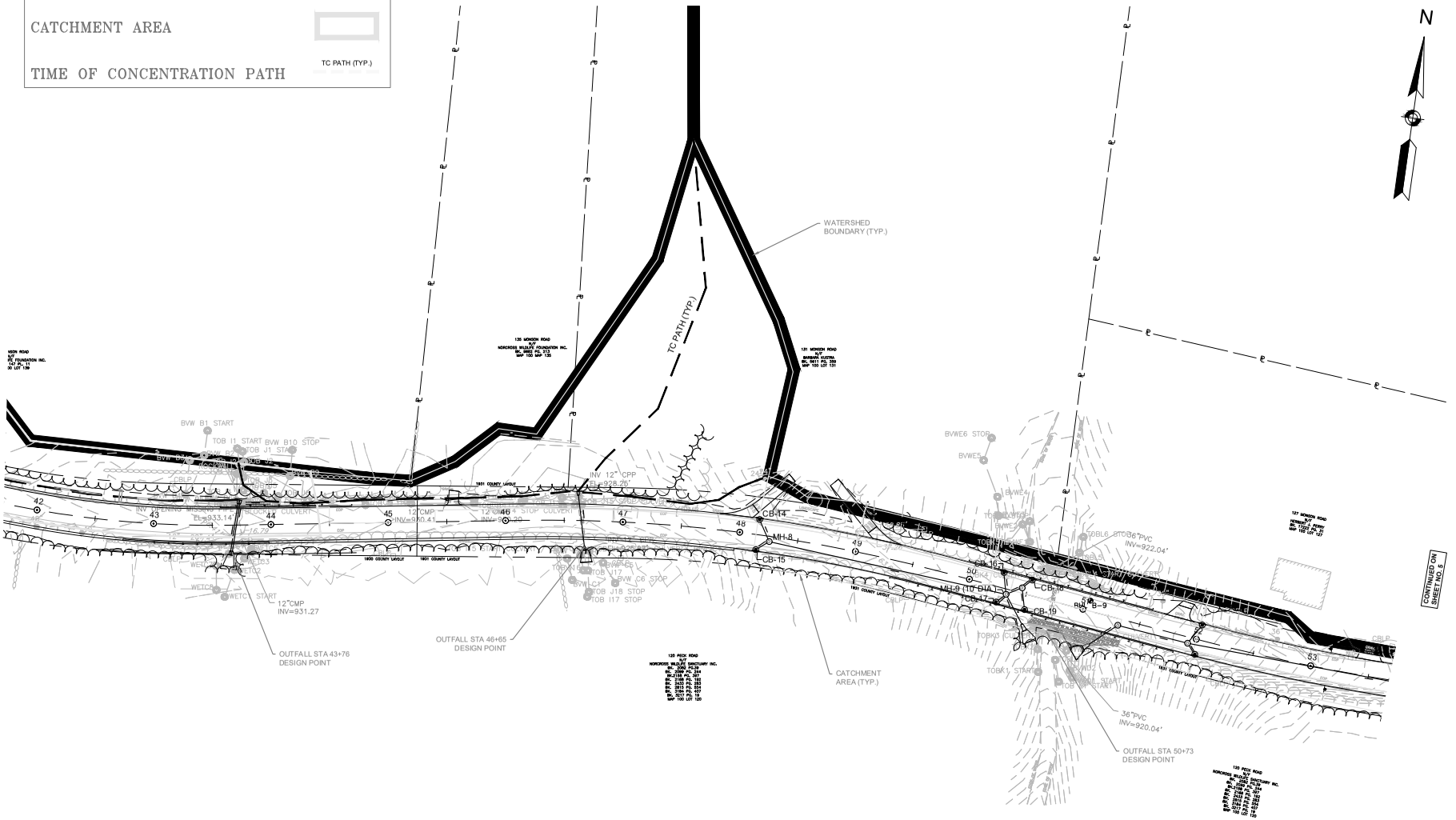
DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)



MONSON ROAD
DRAINAGE AREA MAP-4

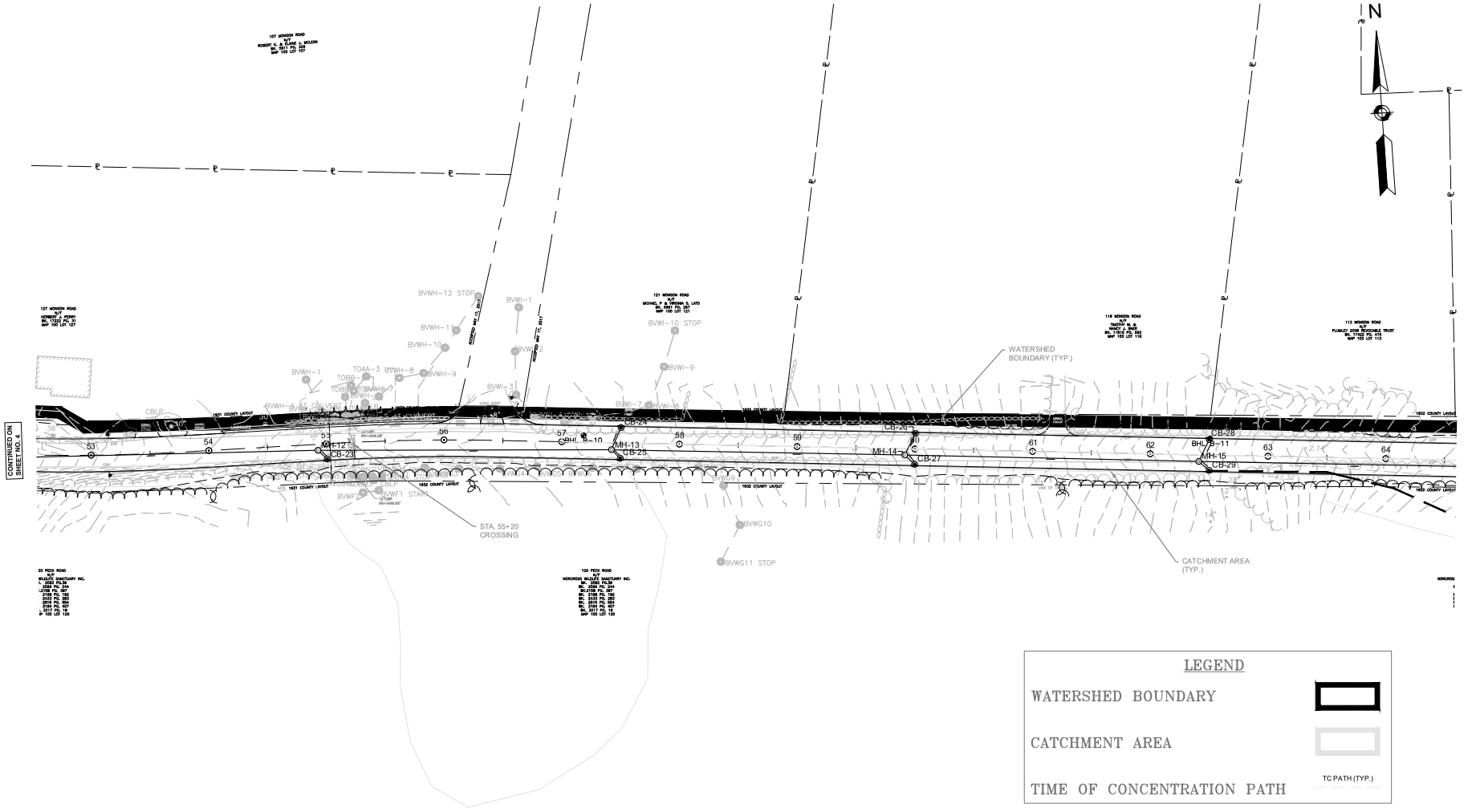
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:59 AM
Proposal No. 608163-132612
A08840 - 250

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



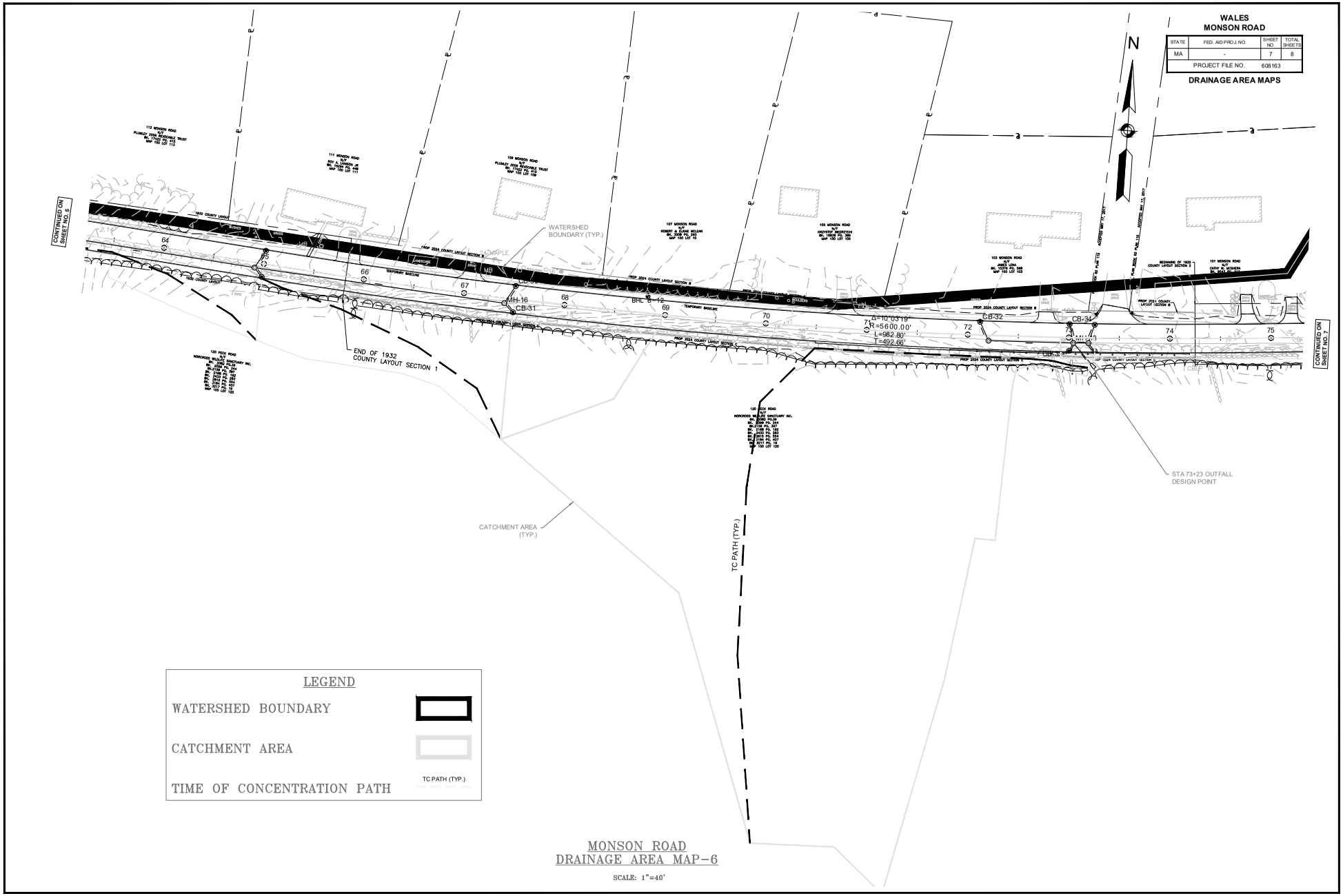
LEGEND

WATERSHED BOUNDARY	
CATCHMENT AREA	
TIME OF CONCENTRATION PATH	TC PATH (TYP.)

MONSON ROAD
DRAINAGE AREA MAP-5

SCALE: 1"=40'

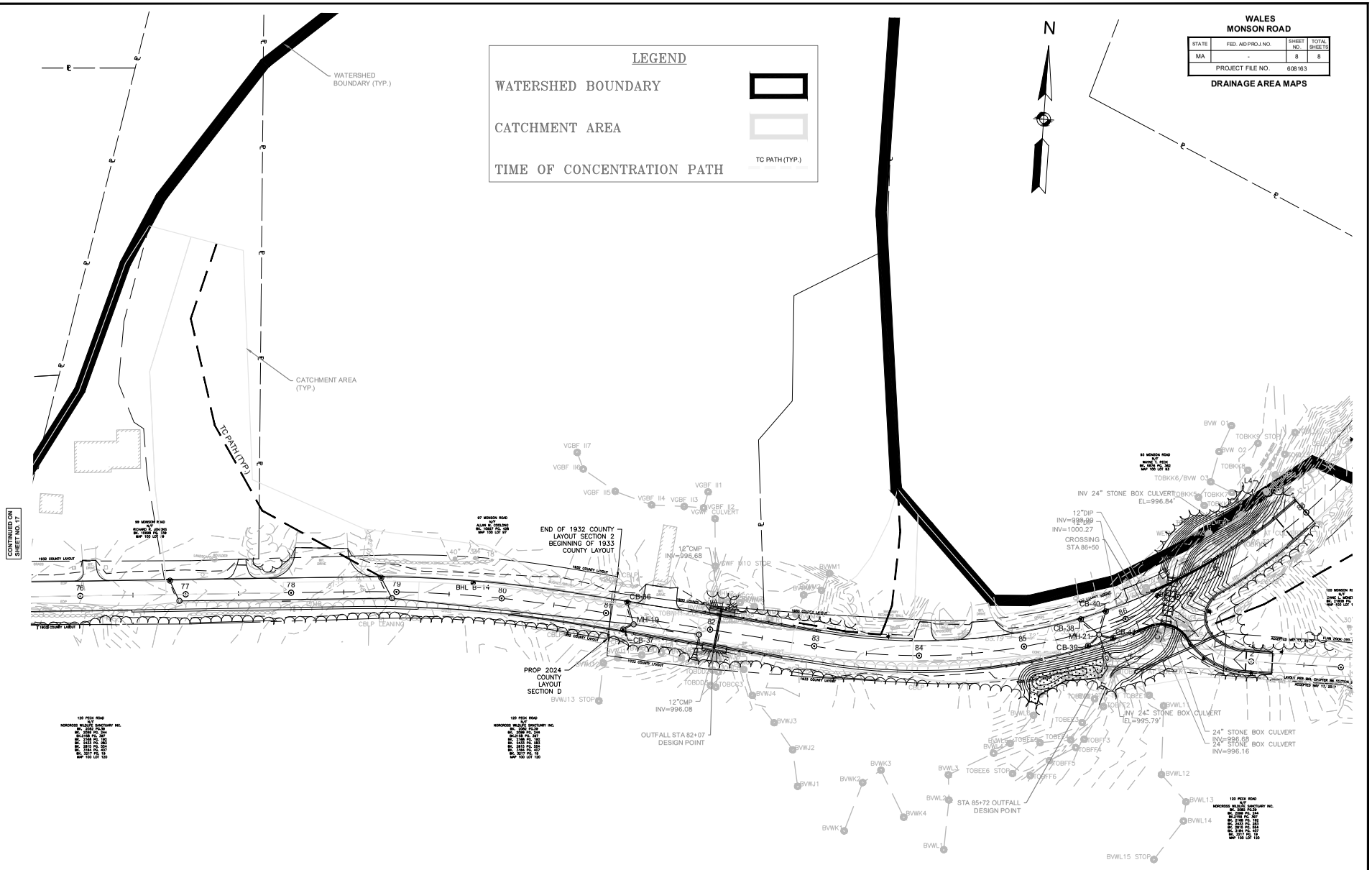
MONSON ROAD-DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:59 AM
Proposal No. 608163-136112
A08840 - 51



MONSON ROAD-DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM

Proposal No. 608163-128121

A08949 - 752



MONSON ROAD
DRAINAGE AREA MAP–7

SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:51 AM
Project No. 608163.128212
A08840 - 253

APPENDIX B

Rational Method Data

Monson Road Reconstruction
Wales, MA

Date: 4/8/2024
By: NSD
Checked By: RSV

Weston & Sampson

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)
Proposed Drainage System								
	STA 24+84							
CB1		48,140	**1.105**	2,722	7,922	37,496	0.26	11
CB2		24,150	**0.554**	5,996	16,154	2,000	0.44	5
CB3		9,479	**0.218**	5,061	4,418		0.62	5
CB3B		92,066	**2.114**	2,150	5,730	84,186	0.22	15
CB4		372	**0.009**	372			0.90	5
CB5		5,665	**0.130**	2,370	3,295		0.55	5
CB6		5,703	**0.131**	2,720	948	2,035	0.55	5
	STA 25+00							
CB7		4,854	**0.111**	4,050	804		0.80	5
CB8		7,359	**0.169**	6,261	1,098		0.81	5
	STA 50+61							
CB14		2,813	**0.065**	769	2,044		0.46	5
CB15		3,181	**0.073**	2,086		1,095	0.66	5
CB16		3,387	**0.078**	762	417	2,208	0.37	5
CB17		4,558	**0.105**	2,885	158	1,515	0.65	5
CB18		7,714	**0.177**	3,404	1,284	3,026	0.53	5
CB19		4,866	**0.112**	2,185	758	1,923	0.53	5
	STA 51+24							
CB20		9,120	**0.209**	6,483	1,406	1,231	0.71	5
CB21		6,026	**0.138**	2,414	1,437	2,175	0.50	5
CB22		2,673	**0.061**	1,854	819		0.72	5
CB23		6,334	**0.145**	5,584		750	0.82	5
CB24		5,414	**0.124**	4,364		1,050	0.76	5
CB25		4,912	**0.113**	4,350		562	0.82	5
CB26		4,444	**0.102**	3,664	780		0.79	5
CB27		3,941	**0.090**	3,578	363		0.84	5
CB28		5,465	**0.125**	3,756	1,709		0.71	5
CB29		10,177	**0.234**	3,549		6,628	0.44	5
CB28B		4,735	**0.109**	3,765	970		0.78	5
CB29B		23,495	**0.539**	3,627		19,868	0.31	7.3
CB30		4,950	**0.114**	3,994	956		0.78	5
CB31		14,123	**0.324**	2,122	12,001		0.39	5
	STA 73+30							
CB32		3,093	**0.071**	2,762	331		0.84	5
CB34		1,830	**0.042**	1,649	181		0.84	5
CB35		700	**0.016**	470	230		0.70	5
CB34B		11,104	**0.255**	4,501	6,603		0.54	5
CB35B		4,454	**0.102**	3,140	1,314		0.72	5
	STA 81+97							
CB36		6,857	**0.157**	1,065	5,792		0.39	5.0
CB36B		36,290	**0.833**	6,103	30,187		0.40	10.0
CB36C		31,245	**0.717**	5,437	25,808		0.40	10.0
CB37		5,183	**0.119**	4,845		338	0.85	5
	STA 85+72							
CB38		11,348	**0.261**	6,499	4,849		0.64	5
CB39		1,038	**0.024**	758		280	0.71	5
CB40		5,335	**0.122**	3,556	1,187	592	0.69	5
CB41		359	**0.008**	273	86		0.76	5

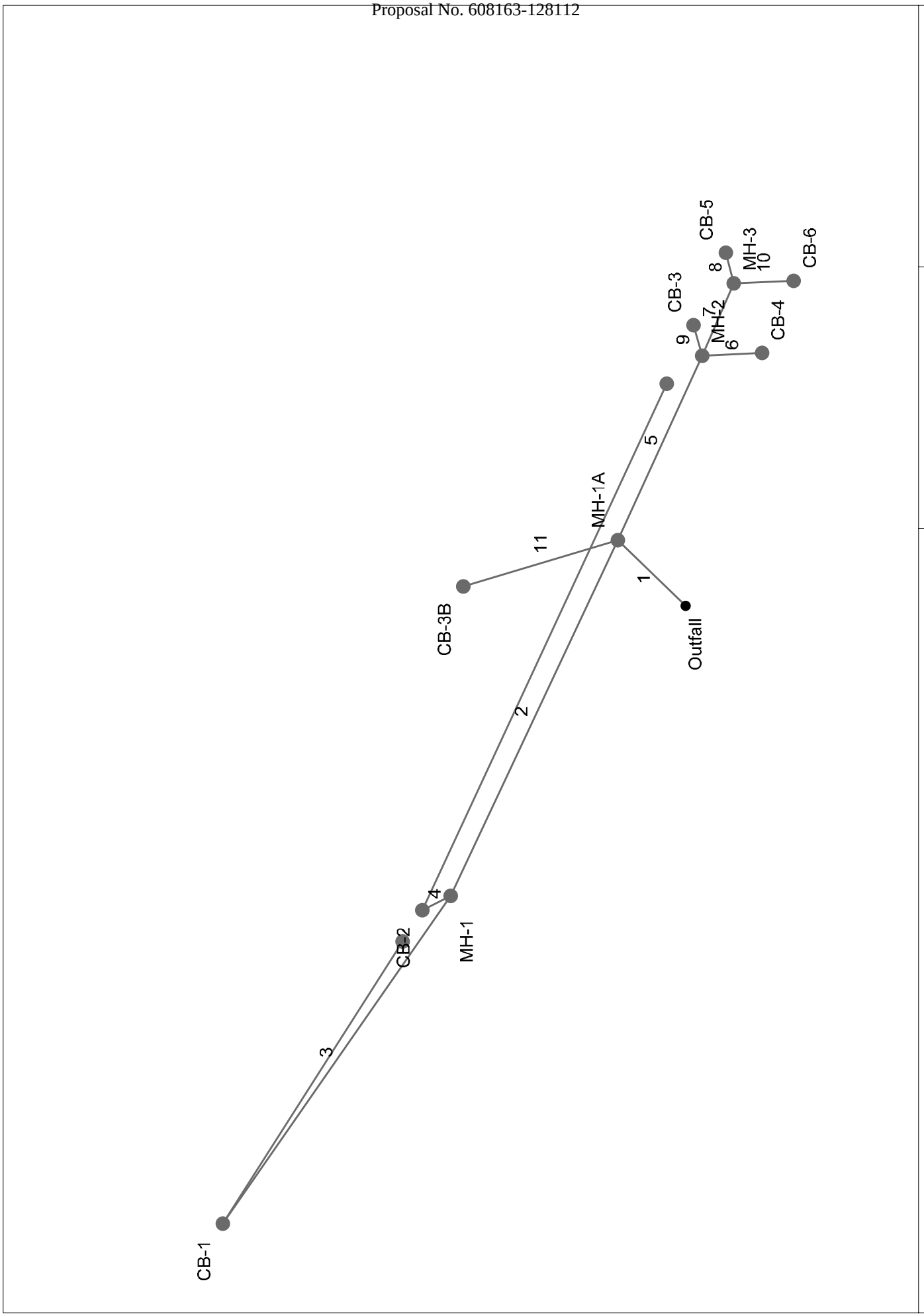
NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover	C
Impervious	0.9
Grass	0.3
Unimproved (Woods)	0.2

APPENDIX C

Hydraflow Reports

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

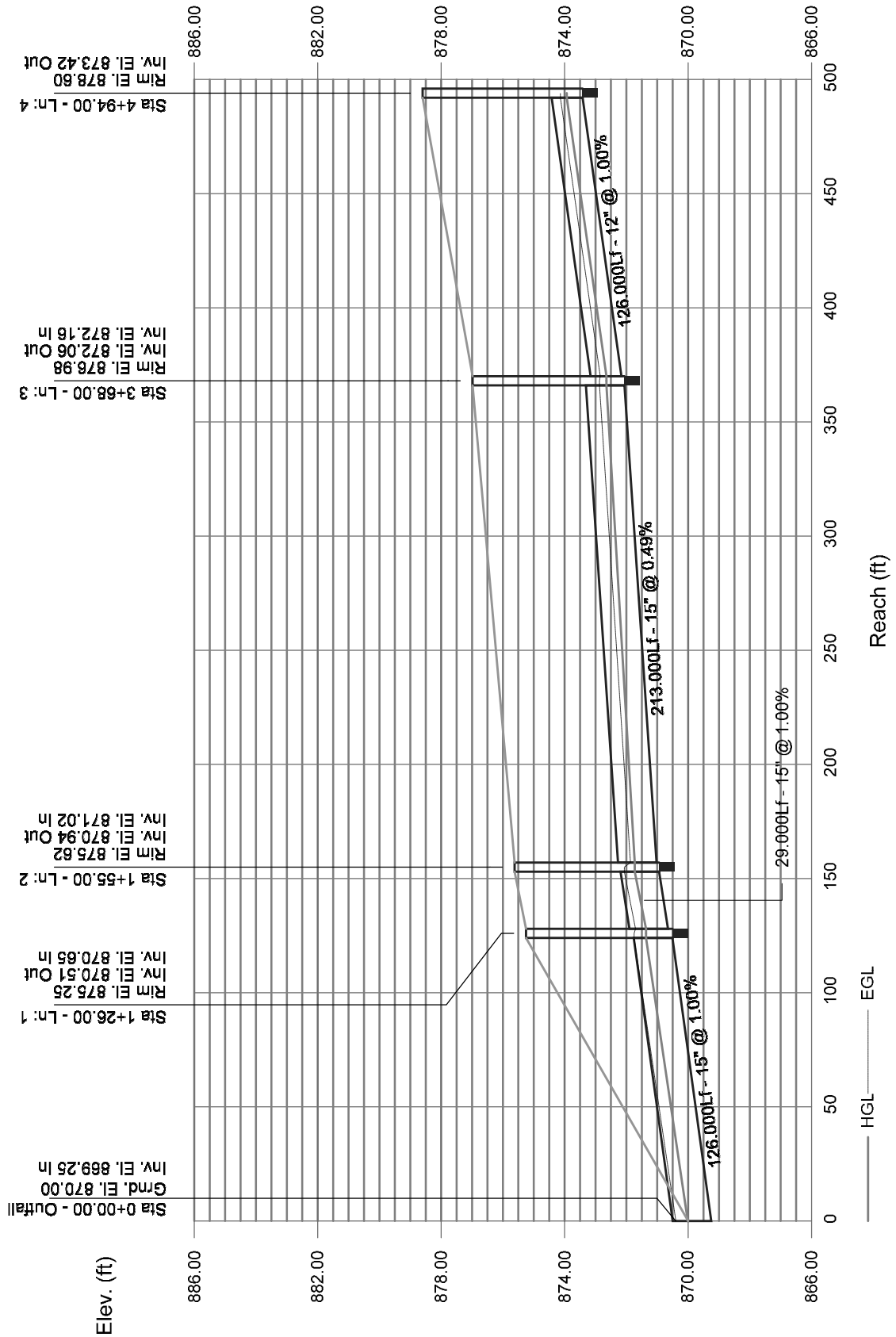


Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Date: 3/15/2024

Storm Sewers v2023.00

Storm Sewer Profile

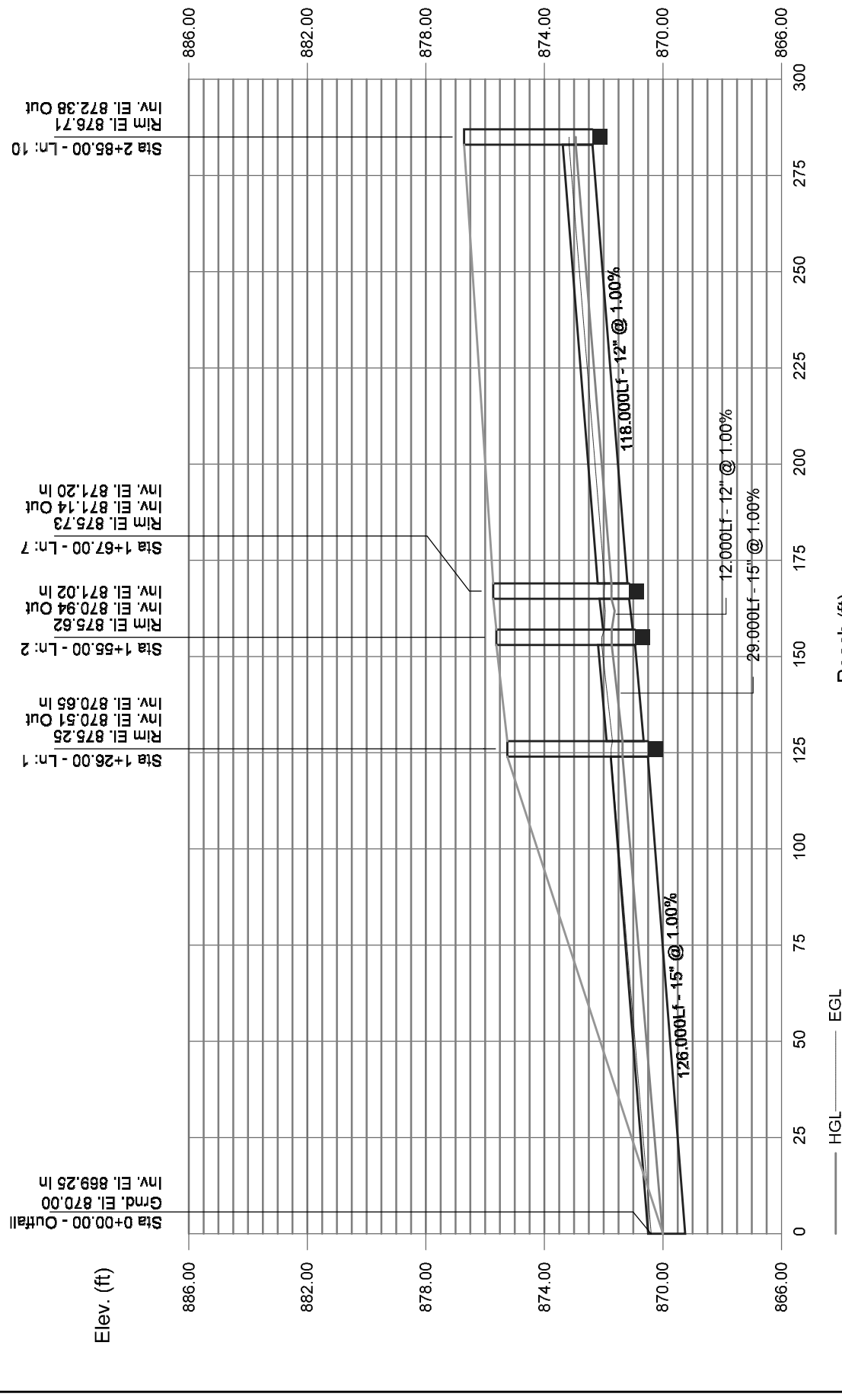
Proj. file: Sta.24+84.stm



Storm Sewers

Storm Sewer Profile

Proj. file: Sta.24+84.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-1A	Manhole	875.51	Cir	4.00	4.00	15	Cir	869.82	12 12 12	Cir Cir Cir	870.00 870.00 870.00
2	MH-1	Manhole	876.90	Cir	4.00	4.00	12	Cir	872.06	12 12	Cir Cir	872.16 872.16
3	CB-1	Combination	878.65	Cir	4.00	4.00	12	Cir	873.42			
4	CB-2	Combination	876.63	Cir	4.00	4.00	12	Cir	872.26			
5	MH-2	Manhole	875.15	Cir	4.00	4.00	12	Cir	870.68	12 12 12	Cir Cir Cir	871.02 870.75 871.02
6	CB-4	Combination	874.99	Cir	4.00	4.00	12	Cir	871.22			
7	MH-3	Manhole	875.16	Cir	4.00	4.00	12	Cir	870.88	12 12	Cir Cir	871.00 871.00
8	CB-5	Combination	875.45	Cir	4.00	4.00	12	Cir	871.12			
9	CB-3	Combination	874.99	Cir	4.00	4.00	12	Cir	871.14			
10	CB-6	Combination	875.54	Cir	4.00	4.00	12	Cir	871.21			
11	CB-3B	Combination	874.88	Cir	4.00	4.00	12	Cir	870.55			

Project File: Sta.24+84-REV2.stm | Number of Structures: 11 | Run Date: 3/15/2024

A00840 -760

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	15.9	3.7	4.51	5.78	5.11	15	1.07	869.50	869.82	870.33	870.68	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	4.3	2.14	3.98	3.96	12	1.66	870.00	872.06	870.68	872.69	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	4.4	1.47	3.56	3.56	12	1.00	872.16	873.42	872.69	873.93	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	5.9	0.97	3.56	2.75	12	1.00	872.16	872.26	872.69	872.67	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.4	5.8	1.46	3.67	3.09	12	1.06	870.00	870.68	870.68	871.19	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	5.9	0.03	3.65	0.78	12	1.05	871.02	871.22	871.19	871.29	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	5.9	1.07	2.57	3.12	12	0.52	870.75	870.88	871.20	871.33	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.90	2.08	12	1.20	871.00	871.12	871.47	871.42	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	5.9	0.39	3.38	2.65	12	1.20	871.02	871.14	871.25	871.40	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.74	2.08	12	1.11	871.00	871.21	871.47	871.51	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	3.7	1.74	3.70	3.44	12	1.08	870.00	870.55	870.68	871.11	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 -761

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.47	0.00	1.07	0.40	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.20	4.86	0.29	2.69	2.0	4
4	CB-2	0.97	0.40	1.13	0.24	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.21	3.69	0.28	1.92	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.03	0.00	0.03	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.12	0.76	0.05	0.76	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
9	CB-3	0.39	0.12	0.51	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.00	0.19	3.00	2.0	Off
10	CB-6	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
11	CB-3B	1.74	0.00	1.74	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.17	8.35	0.33	8.35	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -762

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	16.0	4.6	5.55	5.78	5.36	15	1.07	869.50	869.82	870.48	870.80	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	5.3	2.64	3.98	3.94	12	1.66	870.00	872.06	871.25	872.76	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	5.4	1.80	3.56	3.79	12	1.00	872.16	873.42	872.76	873.99	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	7.2	1.19	3.56	2.91	12	1.00	872.16	872.26	872.76	872.72	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.5	7.0	1.78	3.67	2.64	12	1.06	870.00	870.68	871.25	871.38	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	7.2	0.04	3.65	0.69	12	1.05	871.02	871.22	871.51	871.30	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	7.1	1.30	2.57	2.21	12	0.52	870.75	870.88	871.51	871.53	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.90	2.06	12	1.20	871.00	871.12	871.62	871.46	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	7.2	0.48	3.38	1.91	12	1.20	871.02	871.14	871.51	871.43	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.74	2.06	12	1.11	871.00	871.21	871.62	871.55	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	4.6	2.14	3.70	2.86	12	1.08	870.00	870.55	871.25	871.40	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840-763

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.80	0.00	1.25	0.55	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.21	5.63	0.30	3.04	2.0	4
4	CB-2	1.19	0.55	1.36	0.38	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.23	4.03	0.30	2.27	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.04	0.00	0.04	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.85	0.05	0.85	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
9	CB-3	0.48	0.38	0.85	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.38	0.25	4.38	2.0	Off
10	CB-6	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
11	CB-3B	2.14	0.00	2.14	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.20	9.92	0.37	9.92	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -764

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

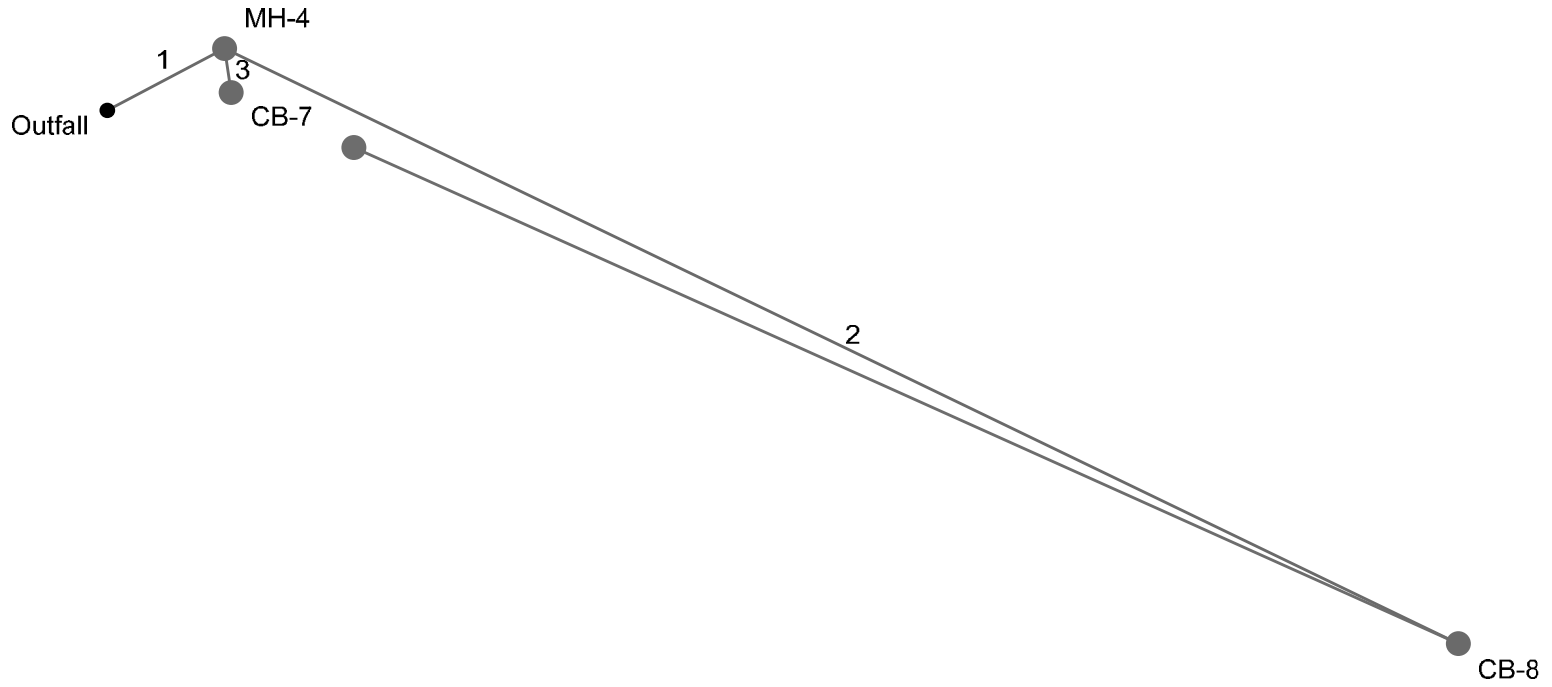
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH1A-OUTLET	User																		0.00
2	MH1-MH1A	User																		0.00
3	CB1-MH1	TR55	0.800	30.00	3.10	5.00	10.05	270.00	7.70	UnPaved	4.48	1.01								11.05
4	CB2-MH1	TR55	0.240	33.00	3.10	5.80	3.90	300.00	8.00	UnPaved	4.56	1.10								5.00
5	MH2-MH1A	User																		0.00
6	CB4-MH2	User																		5.00
7	MH3-MH2	User																		0.00
8	CB5-MH3	User																		5.00
9	CB3-MH2	User																		5.00
10	CB6-MH3	User																		5.00
11	CB3B-MH1A	TR55	0.400	50.00	3.10	1.76	13.19	480.00	4.00	UnPaved	3.23	2.48								15.67

Project File: Sta.24+84-REV2.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 11 | Date: 3/15/2024

A00840 -765

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



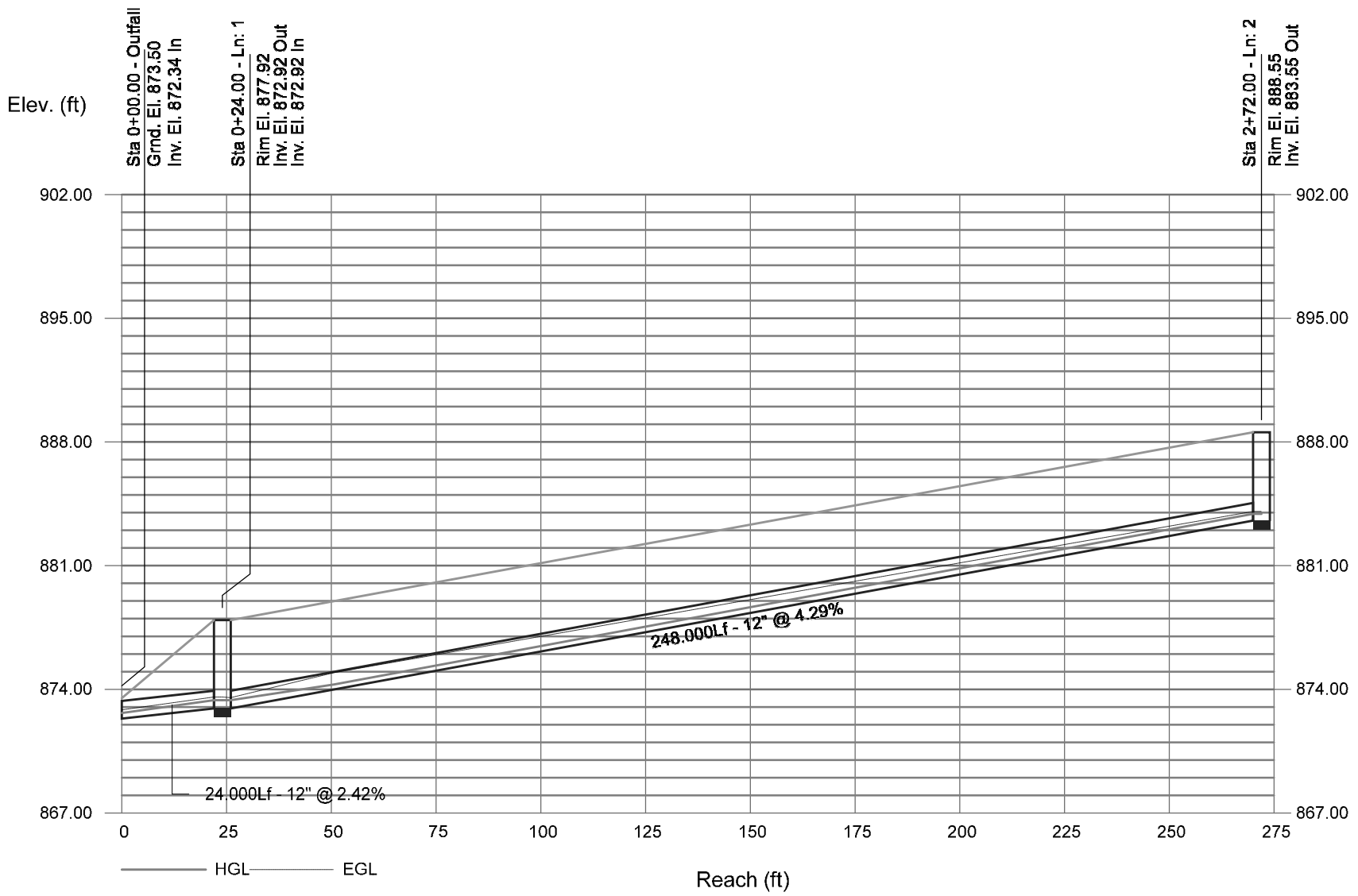
A00840 -766

Proposal No. 608163-128112

Project File: Sta.25+00.stm	Number of lines: 3	Date: 12/5/2023

Storm Sewer Profile

Proj. file: Sta.25+00.stm



A00840 -767

Proposal No: 608163-128112

Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-4	Manhole	877.92	Cir	4.00	4.00	12	Cir	872.92	12 12	Cir Cir	872.92 872.92
2	CB-8	Combination	888.55	Cir	4.00	4.00	12	Cir	883.55			
3	CB-7	Combination	877.89	Cir	4.00	4.00	12	Cir	873.06			

Project File: Sta.25+00.stm | Number of Structures: 3 | Run Date: 12/5/2023

A00840 -768

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	24.000	0.00	0.28	0.00	0.00	0.23	0.0	6.6	5.4	1.22	5.54	4.53	12	2.42	872.34	872.92	872.66	873.39	873.50	877.92	MH4-OUTLET
2	1	248.000	0.17	0.17	0.81	0.14	0.14	5.0	5.0	5.9	0.81	7.37	2.64	12	4.29	872.92	883.55	873.39	883.93	877.92	888.55	CB8-MH4
3	1	8.000	0.11	0.11	0.80	0.09	0.09	5.0	5.0	5.9	0.52	4.71	2.04	12	1.75	872.92	873.06	873.39	873.36	877.92	877.89	CB7-MH4

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 -769

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-8	0.81	0.00	0.59	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.060	4.00	0.020	0.020	0.013	0.09	4.42	0.22	2.74	2.0	3
3	CB-7	0.52	0.23	0.51	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.020	0.020	0.013	0.10	5.04	0.23	3.27	2.0	Off

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES: Inlet N-Values = 0.015; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

A00840 -770

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

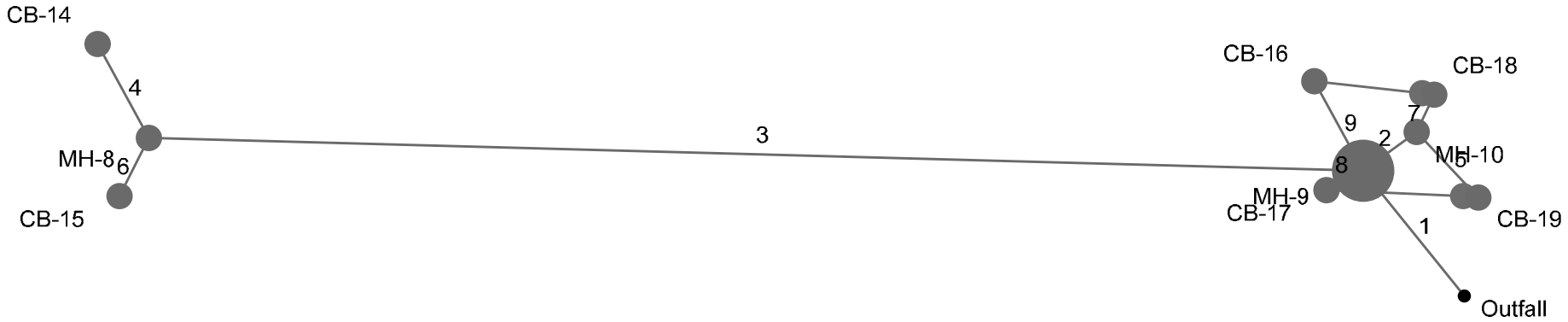
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH4-OUTLET	User																		0.00
2	CB8-MH4	User																		5.00
3	CB7-MH4	User																		5.00

Project File: Sta.25+00.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 3 | Date: 12/5/2023

A00840 -771

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



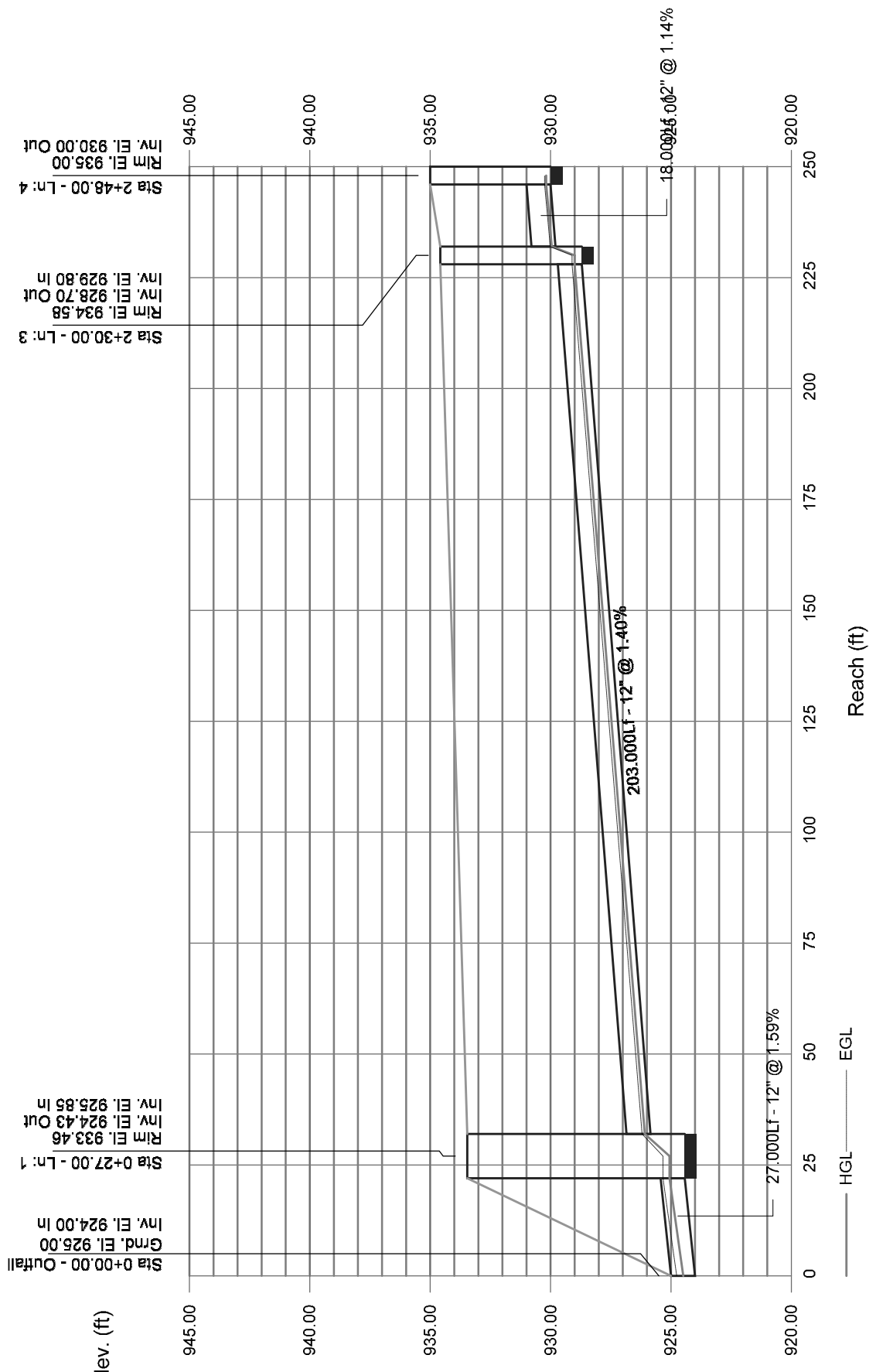
A00840 -772

Proposal No. 608163-128112

Project File: Sta.50+70.stm	Number of lines: 9	Date: 3/15/2024

Proj. file: Sta.50+70.stm

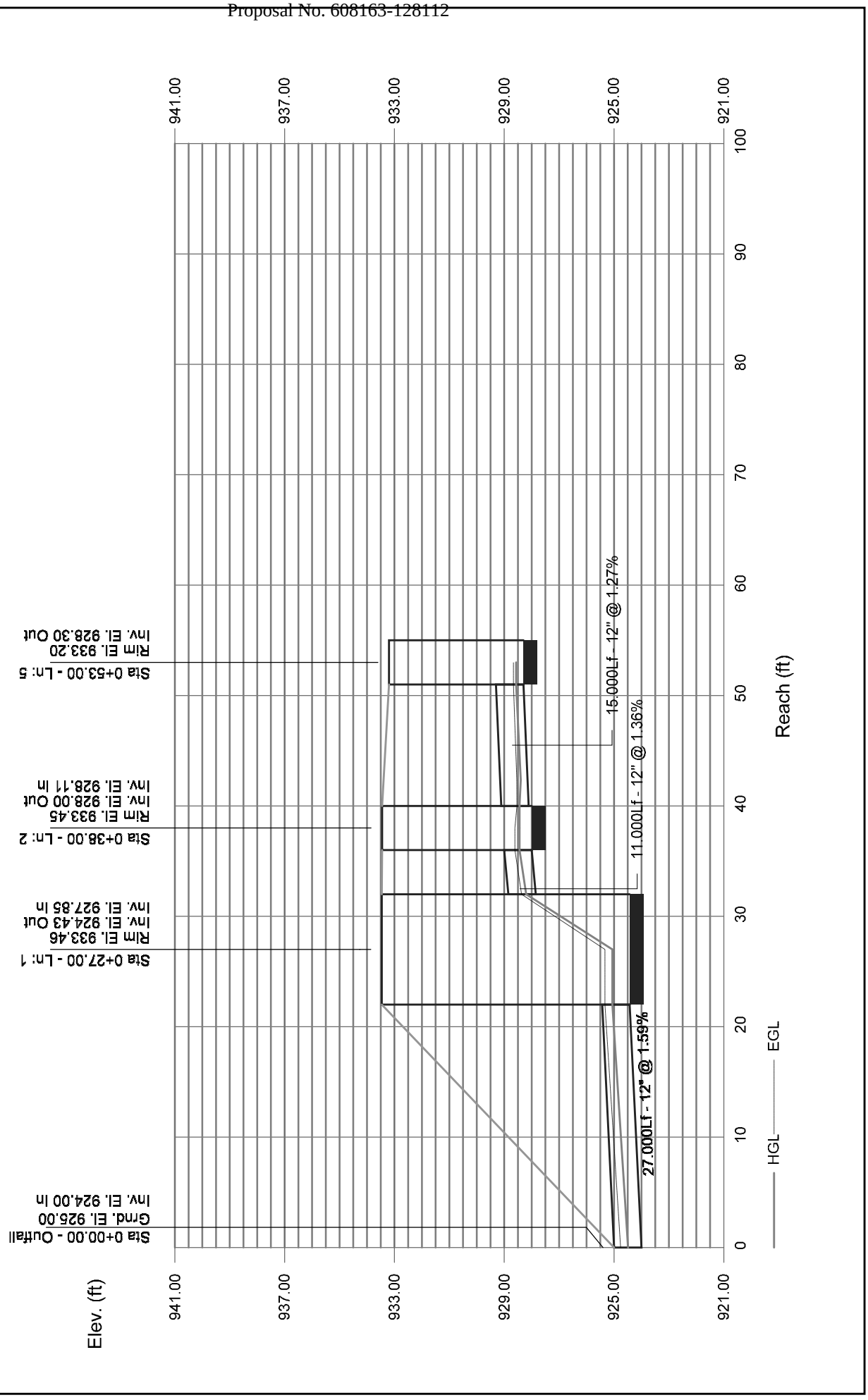
Storm Sewer Profile



Storm Sewers

Storm Sewer Profile

Proj. file: Sta.50+70.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-9	Manhole	933.46	Cir	10.00	10.00	12	Cir	924.43	12 12 12 12	Cir Cir Cir Cir	927.85 925.85 928.26 928.44
2	MH-10	Manhole	933.45	Cir	4.00	4.00	12	Cir	928.00	12 12	Cir Cir	928.11 928.20
3	MH-8	Manhole	934.58	Cir	4.00	4.00	12	Cir	928.70	12 12	Cir Cir	929.80 928.84
4	CB-14	Combination	935.00	Cir	4.00	4.00	12	Cir	930.00			
5	CB-19	Combination	933.20	Cir	4.00	4.00	12	Cir	928.30			
6	CB-15	Combination	934.02	Cir	4.00	4.00	12	Cir	928.97			
7	CB-18	Combination	933.32	Cir	4.00	4.00	12	Cir	928.31			
8	CB-17	Combination	933.36	Cir	4.00	4.00	12	Cir	928.37			
9	CB-16	Combination	933.61	Cir	4.00	4.00	12	Cir	928.63			

Project File: Sta.50+70.stm | Number of Structures: 9 | Run Date: 3/15/2024

A00840 -775

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.3	5.5	1.77	4.49	4.62	12	1.59	924.00	924.43	924.44	925.00	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	5.9	0.90	4.16	3.66	12	1.36	927.85	928.00	928.17	928.40	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	5.9	0.43	4.22	2.98	12	1.40	925.85	928.70	926.07	928.97	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	5.9	0.16	3.80	2.16	12	1.14	929.80	930.00	929.94	930.17	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	5.9	0.34	4.01	2.10	12	1.27	928.11	928.30	928.40	928.54	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	5.9	0.27	3.87	2.52	12	1.18	928.84	928.97	929.02	929.18	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	5.9	0.56	4.46	3.29	12	1.57	928.20	928.31	928.44	928.62	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	5.9	0.38	4.46	2.95	12	1.57	928.26	928.37	928.46	928.63	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	5.9	0.17	3.76	2.20	12	1.12	928.44	928.63	928.59	928.80	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840-776

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.16	0.00	0.15	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.06	3.02	0.19	1.22	2.0	Off
5	CB-19	0.34	0.09	0.44	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.73	0.17	2.73	2.0	Off
6	CB-15	0.27	0.00	0.27	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.10	2.12	0.17	0.13	2.0	Off
7	CB-18	0.56	0.02	0.58	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.04	3.30	0.20	3.30	2.0	Off
8	CB-17	0.38	0.00	0.29	0.09	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.09	4.44	0.22	2.63	2.0	5
9	CB-16	0.17	0.00	0.15	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.31	0.20	1.49	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -777

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.2	6.7	2.17	4.49	4.92	12	1.59	924.00	924.43	924.49	925.06	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	7.2	1.10	4.16	3.88	12	1.36	927.85	928.00	928.20	928.44	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	7.2	0.53	4.22	3.16	12	1.40	925.85	928.70	926.09	929.00	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	7.2	0.20	3.80	2.29	12	1.14	929.80	930.00	929.95	930.18	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	7.2	0.42	4.01	2.17	12	1.27	928.11	928.30	928.44	928.57	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	7.2	0.33	3.87	2.67	12	1.18	928.84	928.97	929.04	929.21	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	7.2	0.69	4.46	3.49	12	1.57	928.20	928.31	928.47	928.66	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	7.2	0.47	4.46	3.12	12	1.57	928.26	928.37	928.48	928.65	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	7.2	0.21	3.76	2.33	12	1.12	928.44	928.63	928.60	928.82	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm

Number of lines: 9

Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840-778

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.20	0.00	0.17	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.07	3.25	0.20	1.48	2.0	Off
5	CB-19	0.42	0.13	0.55	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.17	0.20	3.17	2.0	Off
6	CB-15	0.33	0.00	0.33	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.11	2.28	0.19	0.43	2.0	Off
7	CB-18	0.69	0.03	0.72	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.07	3.79	0.23	3.79	2.0	Off
8	CB-17	0.47	0.00	0.34	0.13	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.10	4.78	0.23	2.95	2.0	5
9	CB-16	0.21	0.00	0.18	0.03	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.56	0.20	1.76	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -779

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

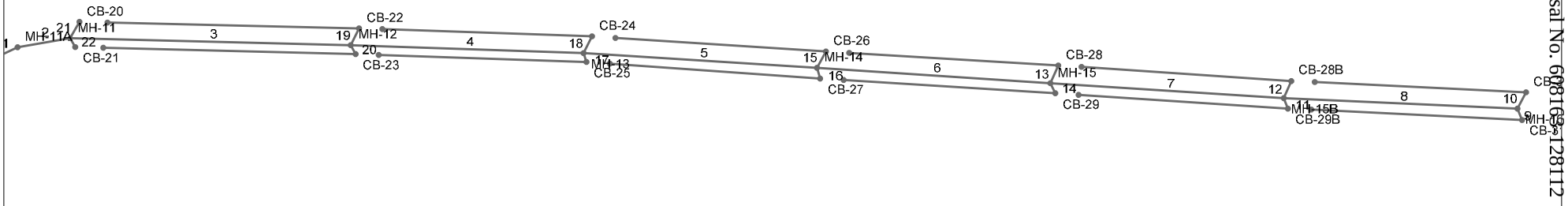
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH9-OUTLET	User																		0.00
2	MH10-MH9	User																		0.00
3	MH8-MH9	User																		0.00
4	CB14-MH8	User																		5.00
5	CB19-MH10	User																		5.00
6	CB15-MH8	User																		5.00
7	CB18-MH10	User																		5.00
8	CB17-MH9	User																		5.00
9	CB16-MH9	User																		5.00

Project File: Sta.50+70.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 9 | Date: 3/15/2024

A00840 -780

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.51+24.stm	Number of lines: 22	Date: 3/15/2024

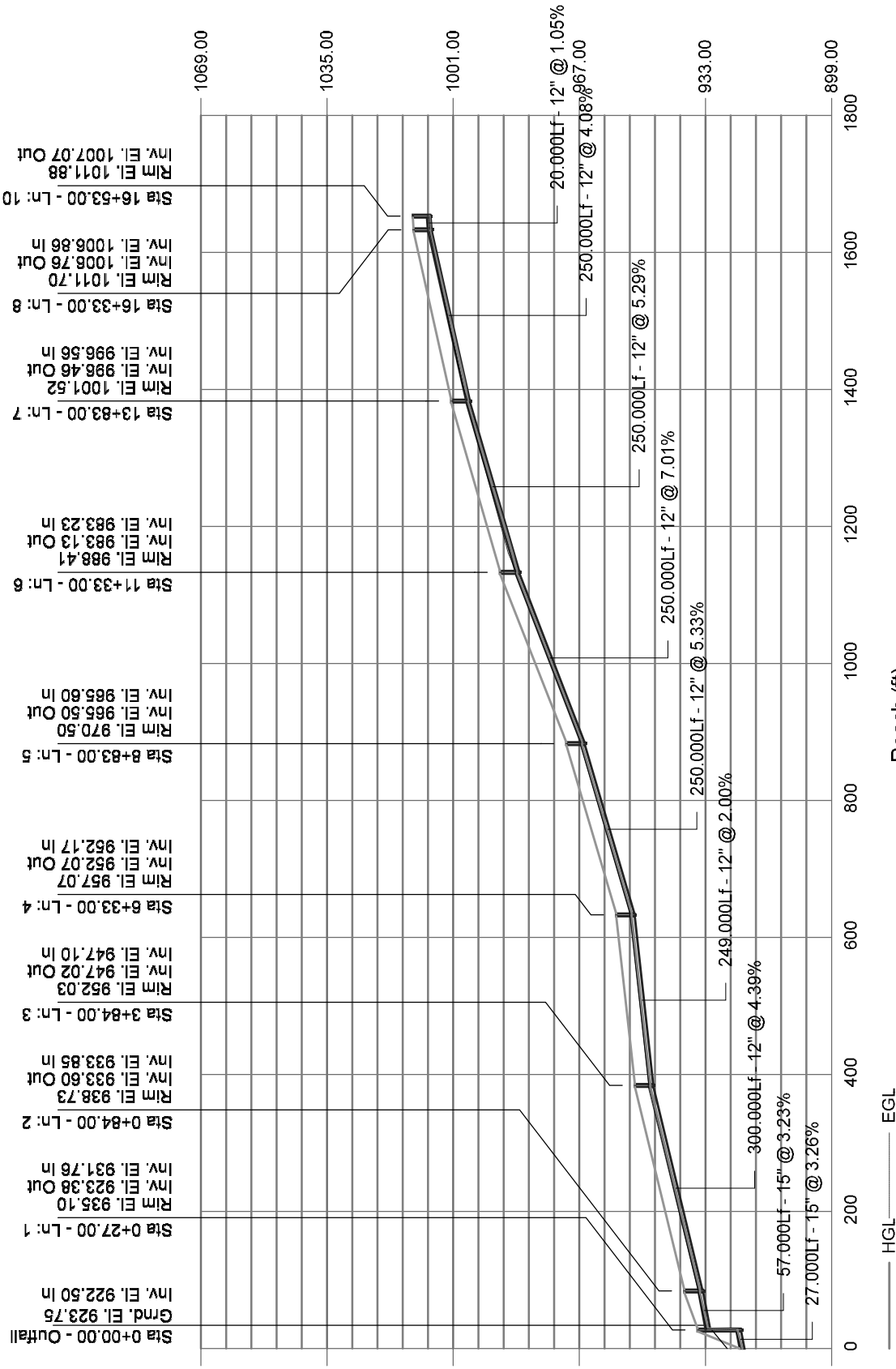
Storm Sewers v2023.00

A00840 -781

Proposal No. 6001691128112

Storm Sewer Profile

Proj. file: Sta.51+24.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-11A	Manhole	935.10	Cir	4.00	4.00	15	Cir	923.38	15	Cir	931.76
2	MH-11	Manhole	938.73	Rect	4.00	4.00	15	Cir	933.60	12	Cir	933.85
										12	Cir	933.64
										12	Cir	934.36
3	MH-12	Manhole	952.03	Cir	4.00	4.00	12	Cir	947.02	12	Cir	947.10
										12	Cir	947.21
										12	Cir	947.12
4	MH-13	Manhole	957.07	Cir	4.00	4.00	12	Cir	952.07	12	Cir	952.17
										12	Cir	952.17
										12	Cir	952.17
5	MH-14	Manhole	970.50	Cir	4.00	4.00	12	Cir	965.50	12	Cir	965.60
										12	Cir	965.75
										12	Cir	965.82
6	MH-15	Manhole	988.41	Cir	4.00	4.00	12	Cir	983.13	12	Cir	983.23
										12	Cir	983.34
										12	Cir	983.45
7	MH-15B	Manhole	1001.52	Cir	4.00	4.00	12	Cir	996.46	12	Cir	996.56
										12	Cir	996.67
										12	Cir	996.56
8	MH-16	Manhole	1011.70	Cir	4.00	4.00	12	Cir	1006.76	12	Cir	1007.06
										12	Cir	1006.86
9	CB-31	Combination	1011.79	Cir	4.00	2.00	12	Cir	1007.19			
10	CB-30	Combination	1011.88	Cir	4.00	4.00	12	Cir	1007.07			
11	CB-29B	Combination	1001.78	Cir	4.00	4.00	12	Cir	996.78			
12	CB-28B	Combination	1001.70	Cir	4.00	4.00	12	Cir	996.76			
13	CB-28	Combination	988.60	Cir	4.00	4.00	12	Cir	983.54			
14	CB-29	Combination	988.57	Cir	4.00	4.00	12	Cir	983.57			
15	CB-26	Combination	970.98	Cir	4.00	4.00	12	Cir	965.95			
16	CB-27	Combination	970.94	Cir	4.00	4.00	12	Cir	965.94			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00840-783

Proposal No. 608163-128112

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
17	CB-25	Combination	957.22	Cir	4.00	4.00	12	Cir	952.27			
18	CB-24	Combination	957.26	Cir	4.00	4.00	12	Cir	952.37			
19	CB-22	Combination	952.45	Cir	4.00	4.00	12	Cir	947.41			
20	CB-23	Combination	951.93	Cir	4.00	4.00	12	Cir	947.23			
21	CB-20	Combination	938.84	Cir	4.00	4.00	12	Cir	933.84			
22	CB-21	Combination	939.47	Cir	4.00	4.00	12	Cir	934.47			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00840 -784

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	2.38	0.00	0.00	1.35	0.0	16.4	3.6	4.91	11.66	7.15	15	3.26	922.50	923.38	923.07	924.28	923.75	935.10	MH11A-OUTLET
2	1	57.000	0.00	2.38	0.00	0.00	1.35	0.0	16.3	3.7	4.94	11.60	7.14	15	3.23	931.76	933.60	932.33	934.50	935.10	938.73	MH11-MH11A
3	2	300.000	0.00	2.03	0.00	0.00	1.13	0.0	15.6	3.7	4.23	7.46	6.84	12	4.39	933.85	947.02	934.50	947.89	938.73	952.03	MH12-MH11
4	3	249.000	0.00	1.82	0.00	0.00	0.96	0.0	14.8	3.8	3.70	5.03	5.48	12	2.00	947.10	952.07	947.89	952.89	952.03	957.07	MH13-MH12
5	4	250.000	0.00	1.63	0.00	0.00	0.81	0.0	14.0	3.9	3.21	8.22	5.14	12	5.33	952.17	965.50	952.89	966.27	957.07	970.50	MH14-MH13
6	5	250.000	0.00	1.44	0.00	0.00	0.66	0.0	13.1	4.1	2.68	9.43	4.69	12	7.01	965.60	983.13	966.27	983.83	970.50	988.41	MH15-MH14
7	6	250.000	0.00	1.08	0.00	0.00	0.46	0.0	12.1	4.2	1.96	8.19	4.00	12	5.29	983.23	996.46	983.83	997.06	988.41	1001.52	MH15B-MH15
8	7	250.000	0.00	0.43	0.00	0.00	0.21	0.0	5.1	5.9	1.23	7.19	3.29	12	4.08	996.56	1006.76	997.06	1007.23	1001.52	1011.70	MH16-MH15B
9	8	13.000	0.32	0.32	0.39	0.12	0.12	5.0	5.0	5.9	0.74	3.56	3.25	12	1.00	1007.06	1007.19	1007.37	1007.55	1011.70	1011.79	CB31-MH16
10	8	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.65	2.27	12	1.05	1006.86	1007.07	1007.23	1007.37	1011.70	1011.88	CB30-MH16
11	7	12.000	0.54	0.54	0.31	0.17	0.17	12.0	12.0	4.2	0.71	3.41	2.71	12	0.92	996.67	996.78	997.06	997.13	1001.52	1001.78	CB29B-MH15B
12	7	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.56	1.96	12	1.00	996.56	996.76	997.06	997.06	1001.52	1001.70	CB28B-MH15B
13	6	21.000	0.13	0.13	0.71	0.09	0.09	5.0	5.0	5.9	0.55	3.48	2.05	12	0.95	983.34	983.54	983.83	983.85	988.41	988.60	CB28-MH15
14	6	12.000	0.23	0.23	0.44	0.10	0.10	5.0	5.0	5.9	0.60	3.56	2.46	12	1.00	983.45	983.57	983.83	983.89	988.41	988.57	CB29-MH15
15	5	20.000	0.10	0.10	0.79	0.08	0.08	5.0	5.0	5.9	0.47	3.56	1.85	12	1.00	965.75	965.95	966.27	966.23	970.50	970.98	CB26-MH14
16	5	12.000	0.09	0.09	0.84	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.92	12	1.00	965.82	965.94	966.27	966.22	970.50	970.94	CB27-MH14
17	4	10.000	0.09	0.09	0.82	0.07	0.07	5.0	5.0	5.9	0.44	3.56	1.62	12	1.00	952.17	952.27	952.89	952.54	957.07	957.22	CB25-MH13
18	4	20.000	0.10	0.10	0.76	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.64	12	1.00	952.17	952.37	952.89	952.65	957.07	957.26	CB24-MH13
19	3	20.000	0.06	0.06	0.72	0.04	0.04	5.0	5.0	5.9	0.26	3.56	1.31	12	1.00	947.21	947.41	947.89	947.62	952.03	952.45	CB22-MH12
20	3	11.000	0.15	0.15	0.82	0.12	0.12	5.0	5.0	5.9	0.73	3.56	2.01	12	1.00	947.12	947.23	947.89	947.59	952.03	951.93	CB23-MH12
21	2	20.000	0.21	0.21	0.71	0.15	0.15	5.0	5.0	5.9	0.88	3.56	2.15	12	1.00	933.64	933.84	934.50	934.23	938.73	938.84	CB20-MH11
22	2	11.000	0.14	0.14	0.50	0.07	0.07	5.0	5.0	5.9	0.41	3.56	2.75	12	1.00	934.36	934.47	934.59	934.74	938.73	939.47	CB21-MH11

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840 -785

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-11A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-11	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	1
3	MH-12	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	MH-13	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	MH-14	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	MH-15	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	MH-15B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	MH-16	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	CB-31	0.74	0.00	0.53	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.57	0.22	2.86	2.0	11
10	CB-30	0.51	0.00	0.39	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.08	3.97	0.21	2.28	2.0	12
11	CB-29B	0.71	0.21	0.63	0.29	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.10	4.97	0.23	3.24	2.0	14
12	CB-28B	0.51	0.11	0.46	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.29	0.22	2.59	2.0	13
13	CB-28	0.55	0.16	0.53	0.18	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.12	0.22	2.45	2.0	15
14	CB-29	0.60	0.29	0.64	0.26	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.82	2.0	16
15	CB-26	0.47	0.18	0.50	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	3.92	0.21	2.25	2.0	18
16	CB-27	0.45	0.26	0.53	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	4.05	0.21	2.38	2.0	17
17	CB-25	0.44	0.17	0.45	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.31	0.22	2.61	2.0	20
18	CB-24	0.45	0.15	0.44	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.28	0.22	2.58	2.0	19
19	CB-22	0.26	0.15	0.31	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.68	2.0	21
20	CB-23	0.73	0.16	0.60	0.28	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.024	0.024	0.013	0.13	5.34	0.25	3.49	2.0	22
21	CB-20	0.88	0.10	0.78	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.028	0.028	0.013	0.11	3.77	0.23	2.10	2.0	Off
22	CB-21	0.41	0.28	0.52	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.09	0.22	2.43	2.0	Off

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -786

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

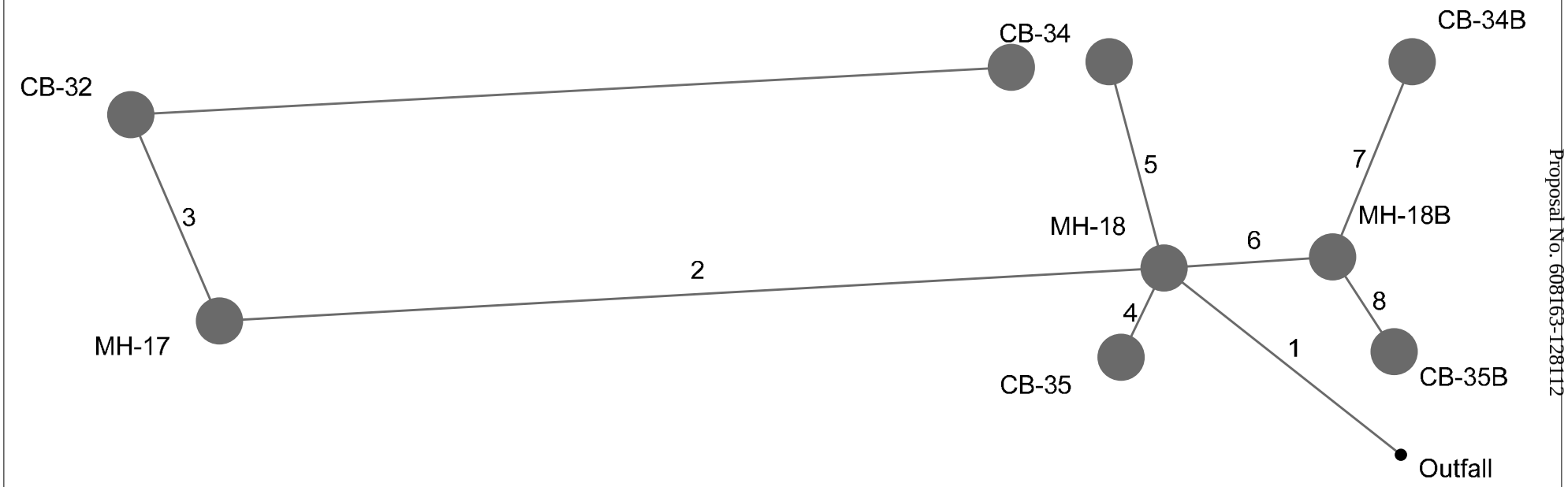
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH11A-OUTLET	User																		0.00
2	MH11-MH11A	User																		0.00
3	MH12-MH11	User																		0.00
4	MH13-MH12	User																		0.00
5	MH14-MH13	User																		0.00
6	MH15-MH14	User																		0.00
7	MH15B-MH15	User																		0.00
8	MH16-MH15B	User																		0.00
9	CB31-MH16	User																		5.00
10	CB30-MH16	User																		5.00
11	CB29B-MH15B	TR55	0.800	30.00	3.10	4.00	10.99	170.00 100.00	13.00 4.00	UnPaved UnPaved	5.82 3.23	0.49 0.52								12.00
12	CB28B-MH15B	User																		5.00
13	CB28-MH15	User																		5.00
14	CB29-MH15	User																		5.00
15	CB26-MH14	User																		5.00
16	CB27-MH14	User																		5.00
17	CB25-MH13	User																		5.00
18	CB24-MH13	User																		5.00
19	CB22-MH12	User																		5.00
20	CB23-MH12	User																		5.00
21	CB20-MH11	User																		5.00
22	CB21-MH11	User																		5.00

Project File: Sta.51+24.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 22 | Date: 3/15/2024

A00840-787

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



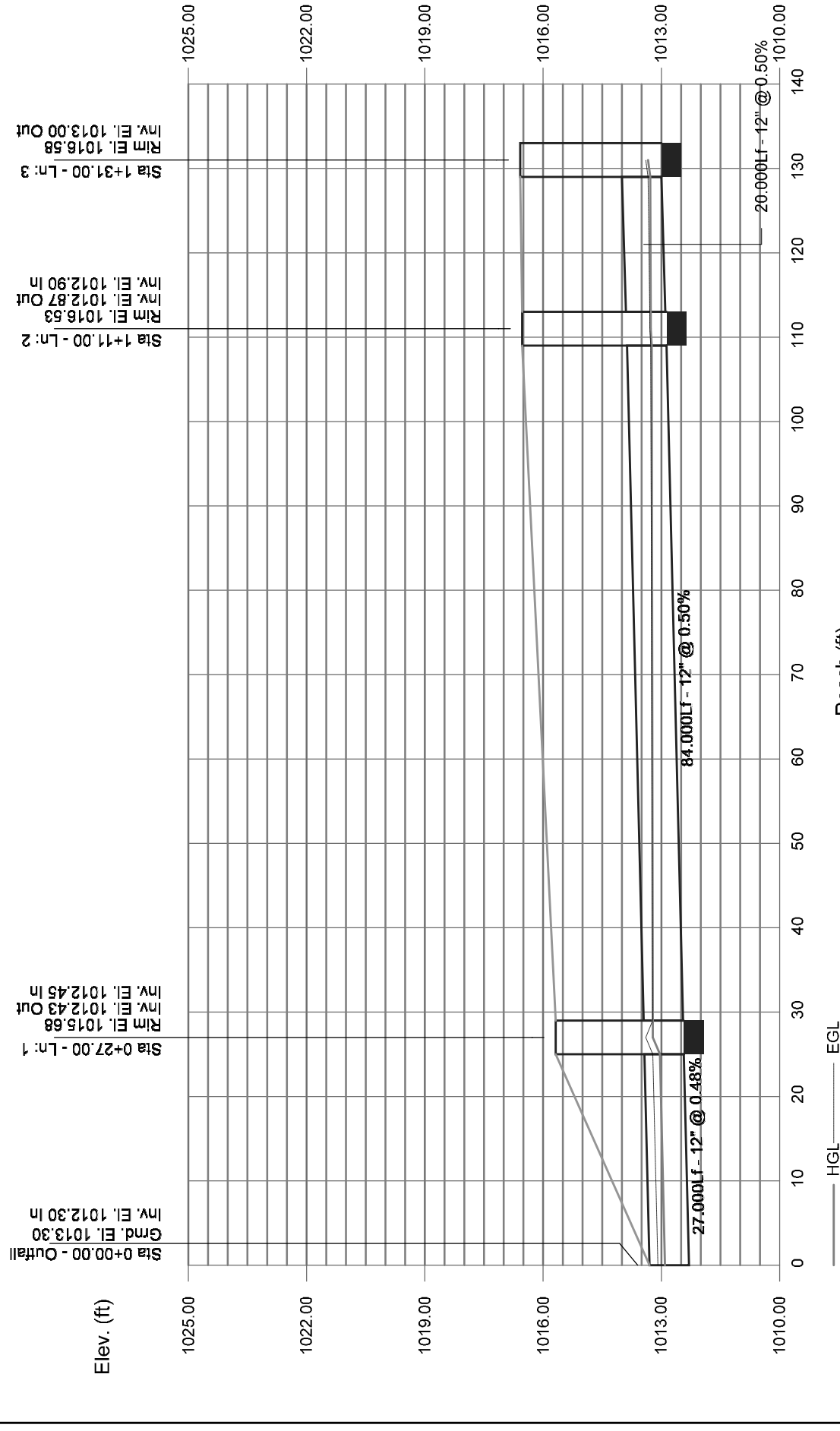
A00840 -788

Proposal No. 608163-128112

Project File: Sta.73+25.stm	Number of lines: 8	Date: 3/15/2024

Storm Sewer Profile

Proj. file: Sta.73+25.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-18	Manhole	1015.68	Cir	4.00	4.00	12	Cir	1012.43	12 12 12 12	Cir Cir Cir Cir	1012.45 1012.45 1012.44 1012.45
2	MH-17	Manhole	1016.53	Cir	4.00	4.00	12	Cir	1012.87	12	Cir	1012.90
3	CB-32	Combination	1016.58	Cir	4.00	2.00	12	Cir	1013.00			
4	CB-35	Combination	1015.93	Cir	4.00	4.00	12	Cir	1012.49			
5	CB-34	Combination	1015.52	Cir	4.00	2.00	12	Cir	1012.53			
6	MH-18B	Manhole	1015.73	Cir	4.00	4.00	12	Cir	1012.52	12 12	Cir Cir	1012.53 1012.55
7	CB-34B	Combination	1015.61	Cir	4.00	4.00	12	Cir	1012.63			
8	CB-35B	Combination	1016.00	Cir	4.00	4.00	12	Cir	1012.60			

Project File: Sta.73+25.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00840-790

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.7	5.4	1.69	2.47	3.39	12	0.48	1012.30	1012.43	1012.91	1013.04	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	5.8	0.34	2.52	0.90	12	0.50	1012.45	1012.87	1013.22	1013.25	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	5.9	0.35	2.52	1.61	12	0.50	1012.90	1013.00	1013.27	1013.28	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	5.9	0.07	2.37	0.11	12	0.44	1012.45	1012.49	1013.22	1013.22	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	5.9	0.20	2.45	0.32	12	0.47	1012.44	1012.53	1013.22	1013.22	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	5.8	1.24	2.43	2.00	12	0.47	1012.45	1012.52	1013.22	1013.23	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	5.9	0.83	2.58	1.39	12	0.53	1012.53	1012.63	1013.29	1013.30	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	5.9	0.43	2.52	0.71	12	0.50	1012.55	1012.60	1013.29	1013.29	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840-791

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.35	0.00	0.28	0.07	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	3.81	0.21	2.07	2.0	5
4	CB-35	0.07	0.00	0.07	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.18	0.07	1.18	2.0	Off
5	CB-34	0.20	0.07	0.27	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.04	2.00	0.12	2.00	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	0.83	0.00	0.83	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.26	0.25	4.26	2.0	Off
8	CB-35B	0.43	0.00	0.43	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.67	0.16	2.67	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -792

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.9	6.5	2.06	2.47	3.76	12	0.48	1012.30	1012.43	1012.91	1013.14	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	7.1	0.42	2.52	0.85	12	0.50	1012.45	1012.87	1013.33	1013.35	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	7.2	0.42	2.52	1.40	12	0.50	1012.90	1013.00	1013.36	1013.37	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	7.2	0.08	2.37	0.11	12	0.44	1012.45	1012.49	1013.33	1013.33	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	7.2	0.24	2.45	0.34	12	0.47	1012.44	1012.53	1013.33	1013.33	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	7.1	1.51	2.43	2.13	12	0.47	1012.45	1012.52	1013.33	1013.35	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	7.2	1.01	2.58	1.45	12	0.53	1012.53	1012.63	1013.41	1013.42	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	7.2	0.52	2.52	0.74	12	0.50	1012.55	1012.60	1013.41	1013.42	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840-793

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.42	0.00	0.33	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	4.11	0.21	2.38	2.0	5
4	CB-35	0.08	0.00	0.08	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.31	0.08	1.31	2.0	Off
5	CB-34	0.24	0.10	0.34	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.02	2.30	0.14	2.30	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	1.01	0.00	1.01	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.10	5.17	0.27	5.17	2.0	Off
8	CB-35B	0.52	0.00	0.52	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.05	0.19	3.05	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840 -794

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

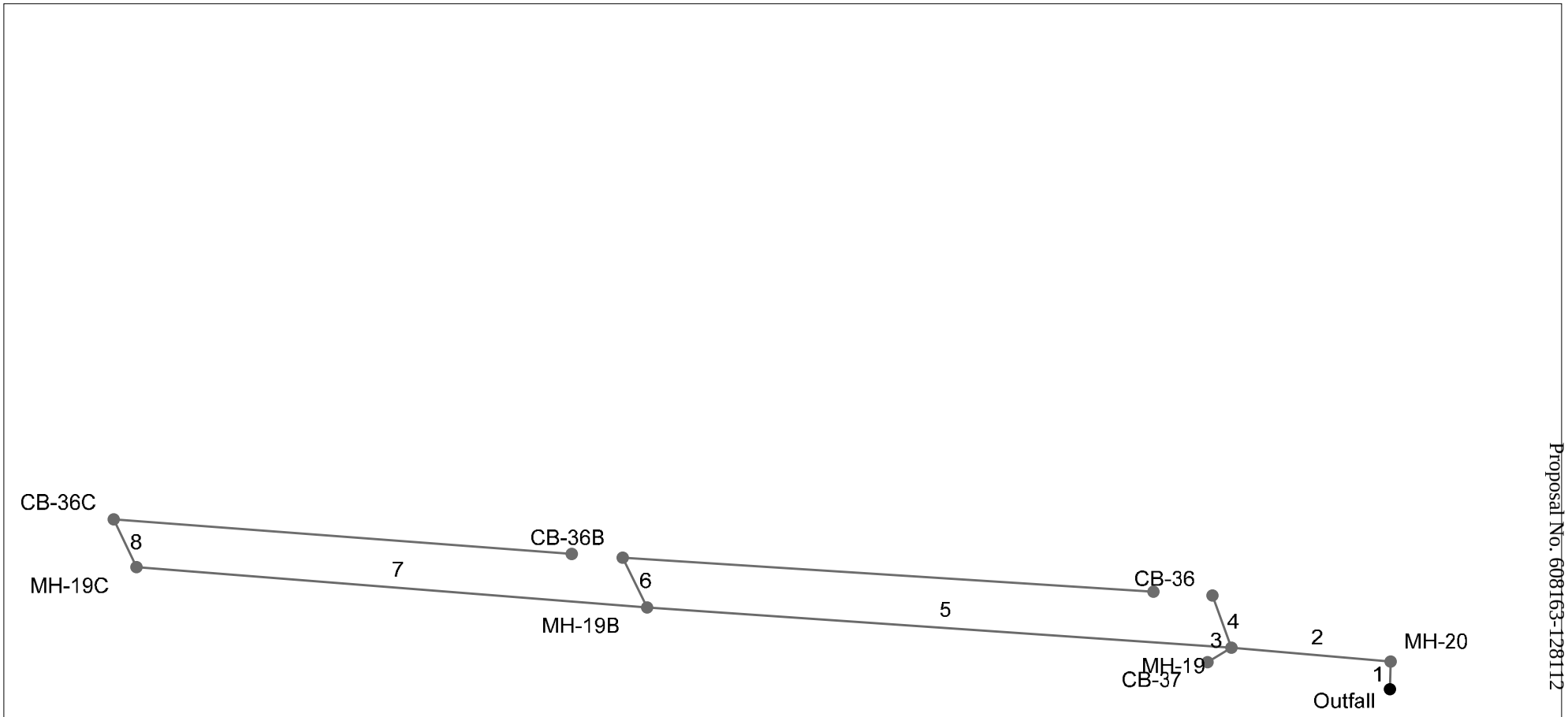
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH18-OUTLET	User																		0.00
2	MH17-MH18	User																		0.00
3	CB32-MH17	User																		5.00
4	CB35-MH18	User																		5.00
5	CB34-MH18	User																		5.00
6	MH18B-MH18	User																		0.00
7	CB34B-MH18B	User																		5.00
8	CB35B-MH18B	User																		5.00

Project File: Sta.73+25.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00840 -795

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



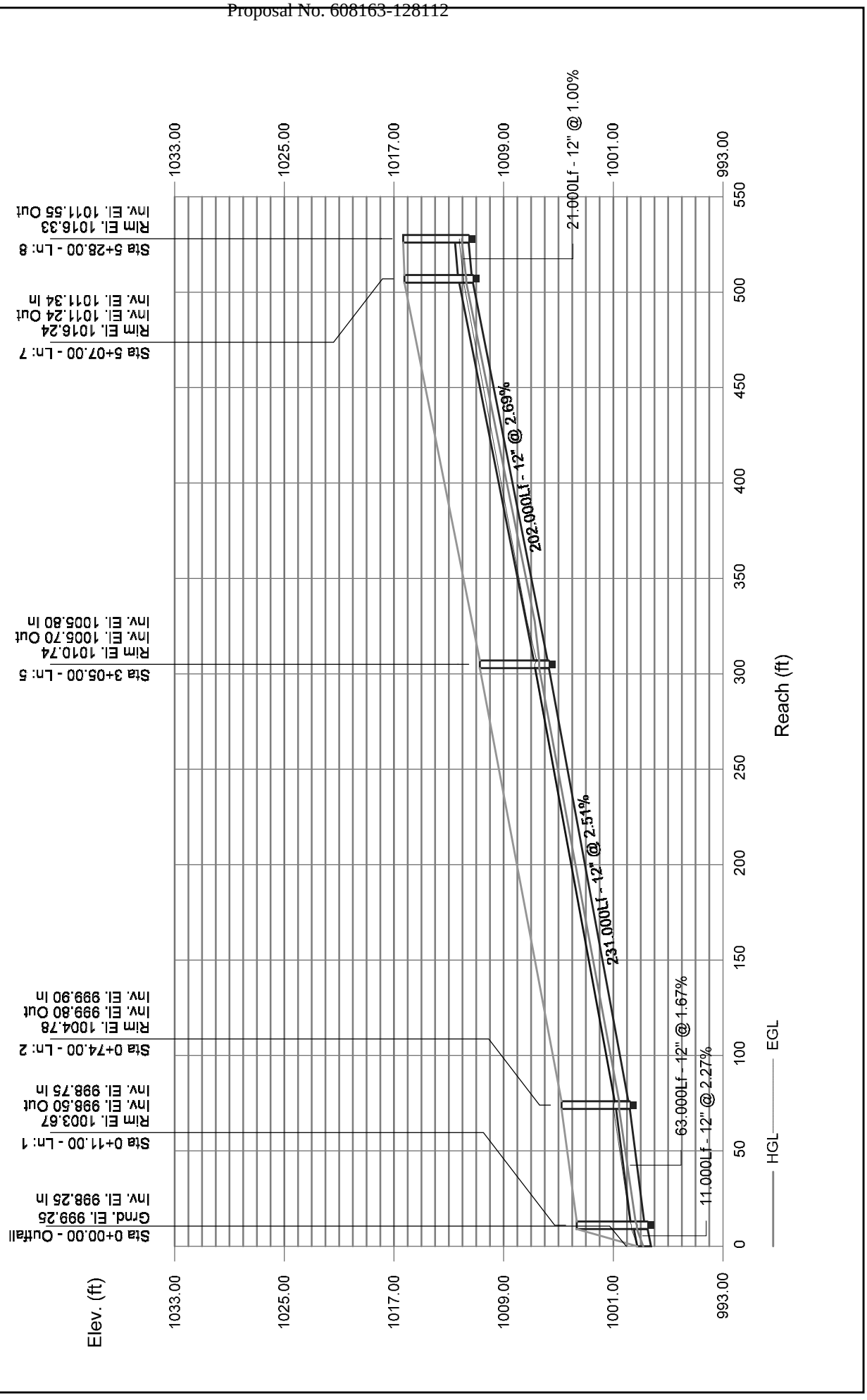
A00840-796

Proposal No. 608163-128112

Project File: Sta.81+97.stm	Number of lines: 8	Date: 3/15/2024

Storm Sewer Profile

Proj. file: Sta.81+97.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-20	Manhole	1003.67	Cir	4.00	4.00	12	Cir	998.50	12	Cir	998.75
2	MH-19	Manhole	1004.78	Cir	4.00	4.00	12	Cir	999.80	12 12 12	Cir Cir Cir	999.90 1000.00 999.90
3	CB-37	Combination	1004.87	Cir	4.00	2.00	12	Cir	1000.01			
4	CB-36	Combination	1005.13	Cir	4.00	2.00	12	Cir	1000.22			
5	MH-19B	Manhole	1010.74	Cir	4.00	4.00	12	Cir	1005.70	12 12	Cir Cir	1006.45 1005.80
6	CB-36B	Combination	1011.71	Cir	4.00	4.00	12	Cir	1006.67			
7	MH-19C	Manhole	1016.24	Cir	4.00	4.00	12	Cir	1011.24	12	Cir	1011.34
8	CB-36C	Combination	1016.33	Cir	4.00	2.00	12	Cir	1011.55			

Project File: Sta.81+97.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00840 -798

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	11.000	0.00	1.83	0.00	0.00	0.78	0.0	12.2	4.2	3.31	5.37	6.12	12	2.27	998.25	998.50	998.82	999.28	999.25	1003.67	MH20-OUTLET
2	1	63.000	0.00	1.83	0.00	0.00	0.78	0.0	12.0	4.2	3.33	4.60	5.72	12	1.67	998.75	999.80	999.38	1000.58	1003.67	1004.78	MH19-MH20
3	2	11.000	0.12	0.12	0.85	0.10	0.10	5.0	5.0	5.9	0.60	3.56	1.90	12	1.00	999.90	1000.01	1000.58	1000.33	1004.78	1004.87	CB37-MH19
4	2	22.000	0.16	0.16	0.39	0.06	0.06	5.0	5.0	5.9	0.37	3.56	1.59	12	1.00	1000.00	1000.22	1000.58	1000.47	1004.78	1005.13	CB36-MH19
5	2	231.000	0.00	1.55	0.00	0.00	0.62	0.0	11.2	4.4	2.72	5.64	4.68	12	2.51	999.90	1005.70	1000.58	1006.41	1004.78	1010.74	MH19B-MH19
6	5	22.000	0.83	0.83	0.40	0.33	0.33	10.0	10.0	4.6	1.53	3.56	4.01	12	1.00	1006.45	1006.67	1006.91	1007.19	1010.74	1011.71	CB36B-MH19B
7	5	202.000	0.00	0.72	0.00	0.00	0.29	0.0	10.1	4.6	1.32	5.84	3.07	12	2.69	1005.80	1011.24	1006.41	1011.73	1010.74	1016.24	MH19C-MH19B
8	7	21.000	0.72	0.72	0.40	0.29	0.29	10.0	10.0	4.6	1.33	3.56	3.85	12	1.00	1011.34	1011.55	1011.76	1012.04	1016.24	1016.33	CB36C-MH19C

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840-799

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-20	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-19	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-37	0.60	0.00	0.55	0.06	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.042	0.020	0.013	0.12	2.92	0.22	1.20	2.0	Off
4	CB-36	0.37	0.92	0.90	0.39	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.031	0.020	0.013	0.15	5.07	0.26	3.00	2.0	Off
5	MH-19B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	2
6	CB-36B	1.53	0.52	1.13	0.92	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.15	7.27	0.27	5.39	2.0	4
7	MH-19C	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	5
8	CB-36C	1.33	0.00	0.81	0.52	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.12	6.18	0.25	4.34	2.0	6

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840-800

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

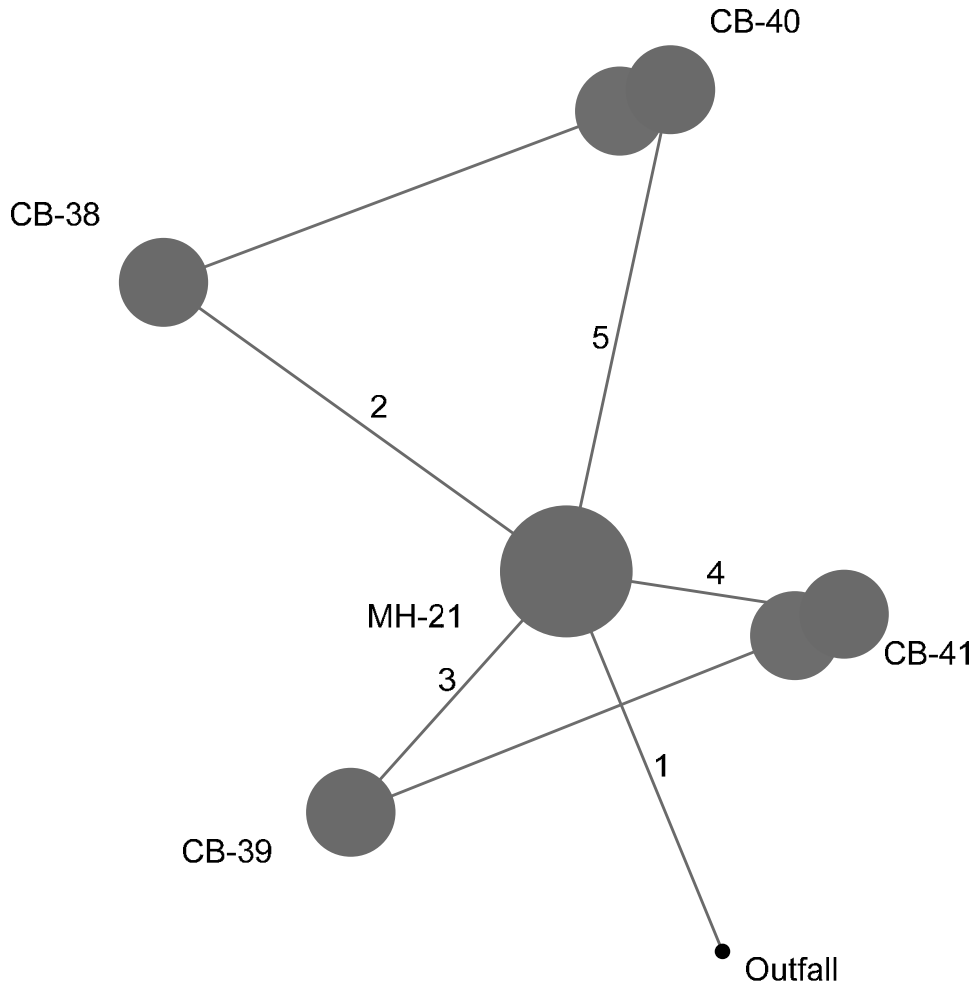
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH20-OUTLET	User																		0.00
2	MH19-MH20	User																		0.00
3	CB37-MH19	User																		5.00
4	CB36-MH19	User																		5.00
5	MH19B-MH19	User																		0.00
6	CB36B-MH19B	User																		10.00
7	MH19C-MH19B	User																		0.00
8	CB36C-MH19C	User																		10.00

Project File: Sta.81+97.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00840-801

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



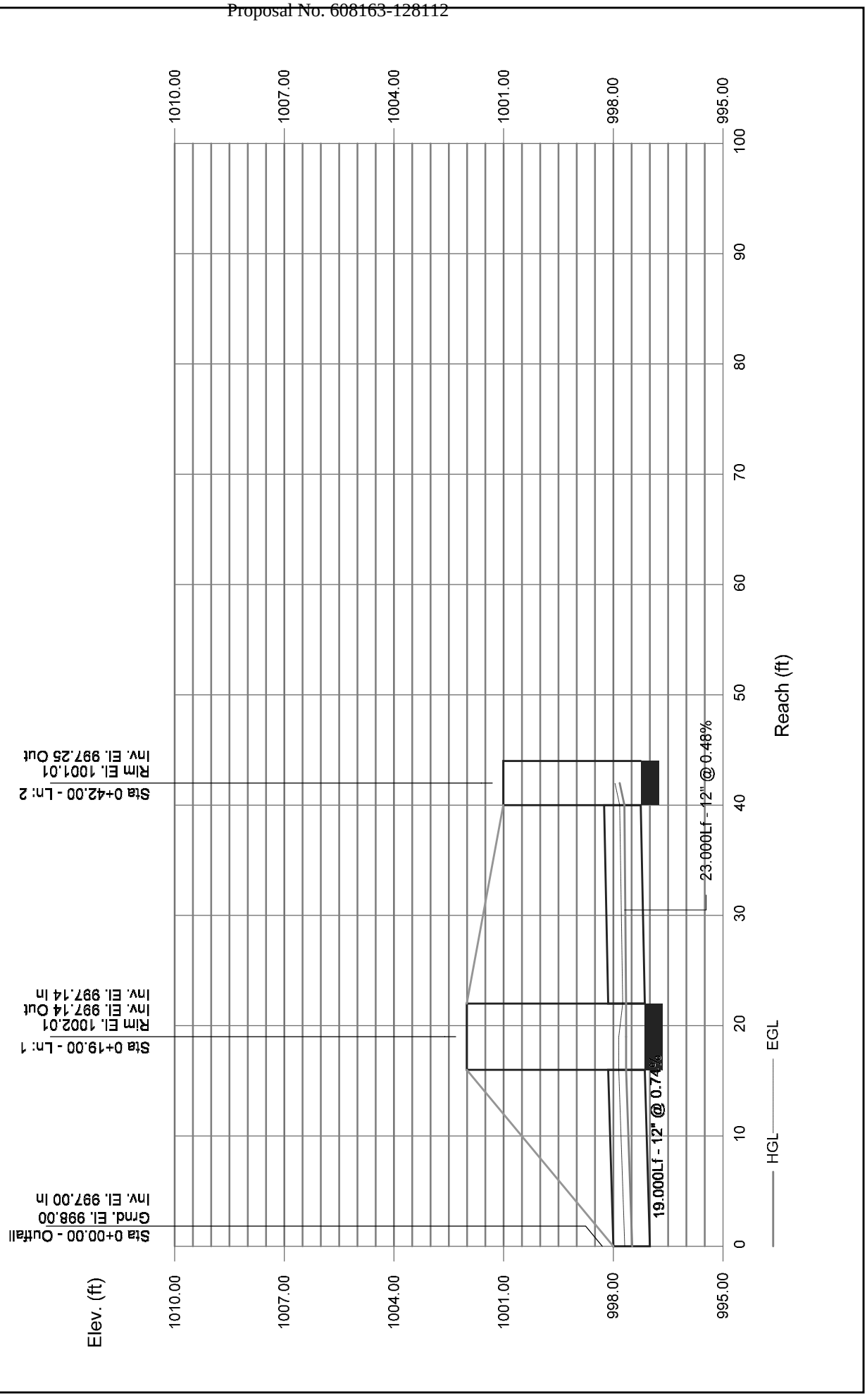
A00840-802

Proposal No. 608163-128112

Project File: Sta.85+72.stm	Number of lines: 5	Date: 4/8/2024

Storm Sewer Profile

Proj. file: Sta.85+72.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-21	Manhole	1002.01	Cir	6.00	6.00	12	Cir	997.14	12 12 12 12	Cir Cir Cir Cir	997.14 997.14 997.14 997.14
2	CB-38	Combination	1001.01	Cir	4.00	4.00	12	Cir	997.25			
3	CB-39	Combination	1002.33	Cir	4.00	4.00	12	Cir	997.21			
4	CB-41	Combination	1002.17	Cir	4.00	4.00	12	Cir	997.21			
5	CB-40	Combination	1000.85	Cir	4.00	4.00	12	Cir	997.25			

Project File: Sta.85+72.stm | Number of Structures: 5 | Run Date: 4/8/2024

A00840-804

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	5.4	1.45	3.06	3.72	12	0.74	997.00	997.14	997.49	997.65	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	5.9	0.98	2.46	2.66	12	0.48	997.14	997.25	997.65	997.70	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	5.9	0.08	2.43	0.23	12	0.47	997.14	997.21	997.65	997.65	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	5.9	0.04	2.61	0.12	12	0.54	997.14	997.21	997.65	997.65	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	5.9	0.49	2.46	1.42	12	0.48	997.14	997.25	997.65	997.66	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00840-805

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	0.98	0.00	0.87	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.19	3.22	0.25	1.43	2.0	5
3	CB-39	0.08	0.00	0.08	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.55	0.18	0.70	2.0	4
4	CB-41	0.04	0.00	0.05	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.99	0.06	0.99	2.0	Off
5	CB-40	0.49	0.11	0.60	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.04	2.04	0.21	2.04	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840-806

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	6.6	1.78	3.06	3.96	12	0.74	997.00	997.14	997.55	997.71	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	7.2	1.20	2.46	2.80	12	0.48	997.14	997.25	997.71	997.76	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	7.2	0.10	2.43	0.24	12	0.47	997.14	997.21	997.71	997.71	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	7.2	0.05	2.61	0.13	12	0.54	997.14	997.21	997.71	997.71	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	7.2	0.60	2.46	1.48	12	0.48	997.14	997.25	997.71	997.72	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm

Number of lines: 5

Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00840-807

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	1.20	0.00	1.02	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.21	3.47	0.27	1.69	2.0	5
3	CB-39	0.10	0.00	0.10	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.75	0.18	0.90	2.0	4
4	CB-41	0.05	0.01	0.06	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.10	1.12	0.07	1.12	2.0	Off
5	CB-40	0.60	0.17	0.77	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.08	2.41	0.25	2.41	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00840-808

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH21-OUTLET	User																		0.00
2	CB38-MH21	User																		5.00
3	CB39-MH21	User																		5.00
4	CB41-MH21	User																		5.00
5	CB40-MH21	User																		5.00

Project File: Sta.85+72.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 5 | Date: 4/8/2024

A00840-809

Proposal No. 608163-128112

APPENDIX D

HY-8 Reports

DRAINAGE REPORT

Existing

HY-8 Reports

STA 15+33 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

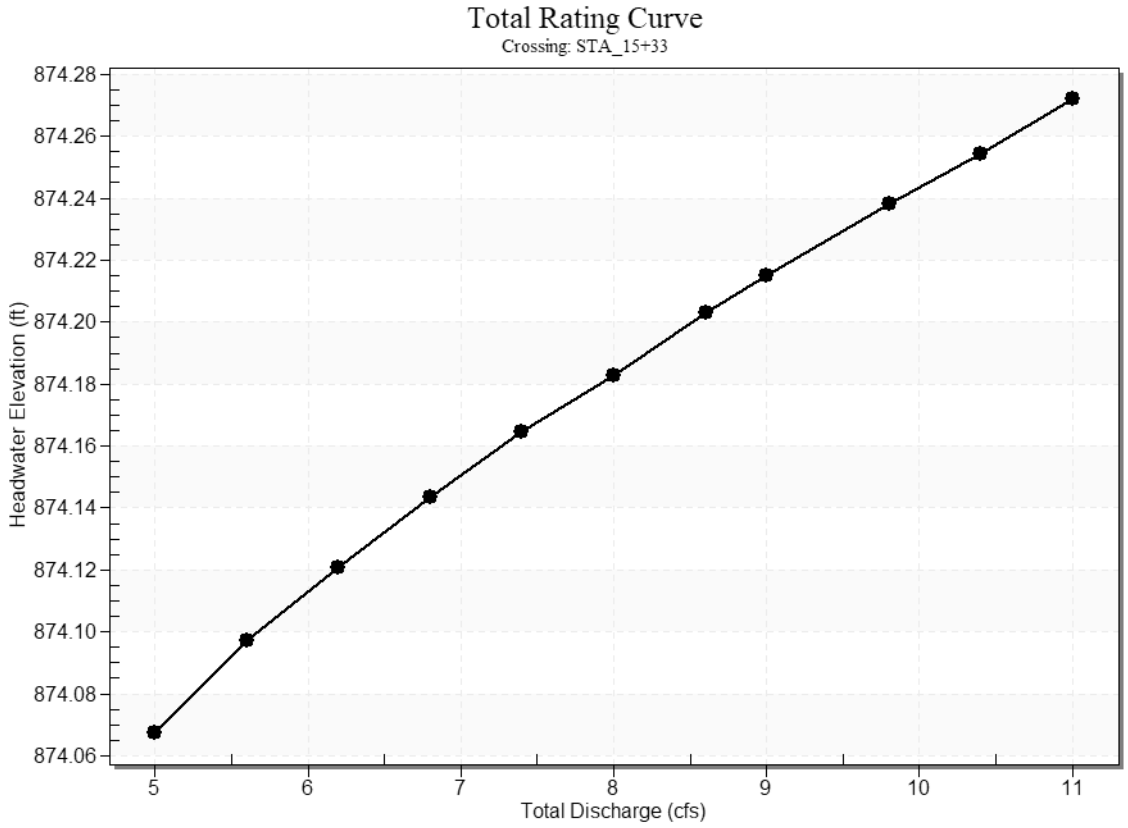
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA_15+33

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
874.07	5.00	4.15	0.84	16
874.10	5.60	4.17	1.40	4
874.12	6.20	4.18	2.00	4
874.14	6.80	4.19	2.59	4
874.16	7.40	4.21	3.16	3
874.18	8.00	4.22	3.75	3
874.20	8.60	4.23	4.35	3
874.21	9.00	4.23	4.75	3
874.24	9.80	4.25	5.54	3
874.25	10.40	4.26	6.14	3
874.27	11.00	4.26	6.73	3
874.00	4.11	4.11	0.00	Overtopping

Rating Curve Plot for Crossing: STA_15+33



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	4.15 cfs	874.07	1.75	3.818	7-M2c	1.00	0.86	0.86	0.13	5.78	2.08
5.60 cfs	4.17 cfs	874.10	1.75	3.847	7-M2c	1.00	0.86	0.86	0.14	5.79	2.18
6.20 cfs	4.18 cfs	874.12	1.76	3.871	7-M2c	1.00	0.86	0.86	0.15	5.80	2.27
6.80 cfs	4.19 cfs	874.14	1.77	3.894	7-M2c	1.00	0.86	0.86	0.16	5.82	2.35

7.40 cfs	4.21 cfs	874.16	1.77	3.915	7-M2c	1.00	0.86	0.86	0.16	5.83	2.42
8.00 cfs	4.22 cfs	874.18	1.78	3.933	7-M2c	1.00	0.87	0.87	0.17	5.84	2.50
8.60 cfs	4.23 cfs	874.20	1.79	3.953	7-M2c	1.00	0.87	0.87	0.18	5.85	2.57
9.00 cfs	4.23 cfs	874.21	1.79	3.965	7-M2c	1.00	0.87	0.87	0.18	5.85	2.61
9.80 cfs	4.25 cfs	874.24	1.80	3.988	7-M2c	1.00	0.87	0.87	0.19	5.87	2.70
10.40 cfs	4.26 cfs	874.25	1.80	4.004	7-M2c	1.00	0.87	0.87	0.20	5.88	2.76
11.00 cfs	4.26 cfs	874.27	1.81	4.022	7-M2c	1.00	0.87	0.87	0.21	5.88	2.82

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

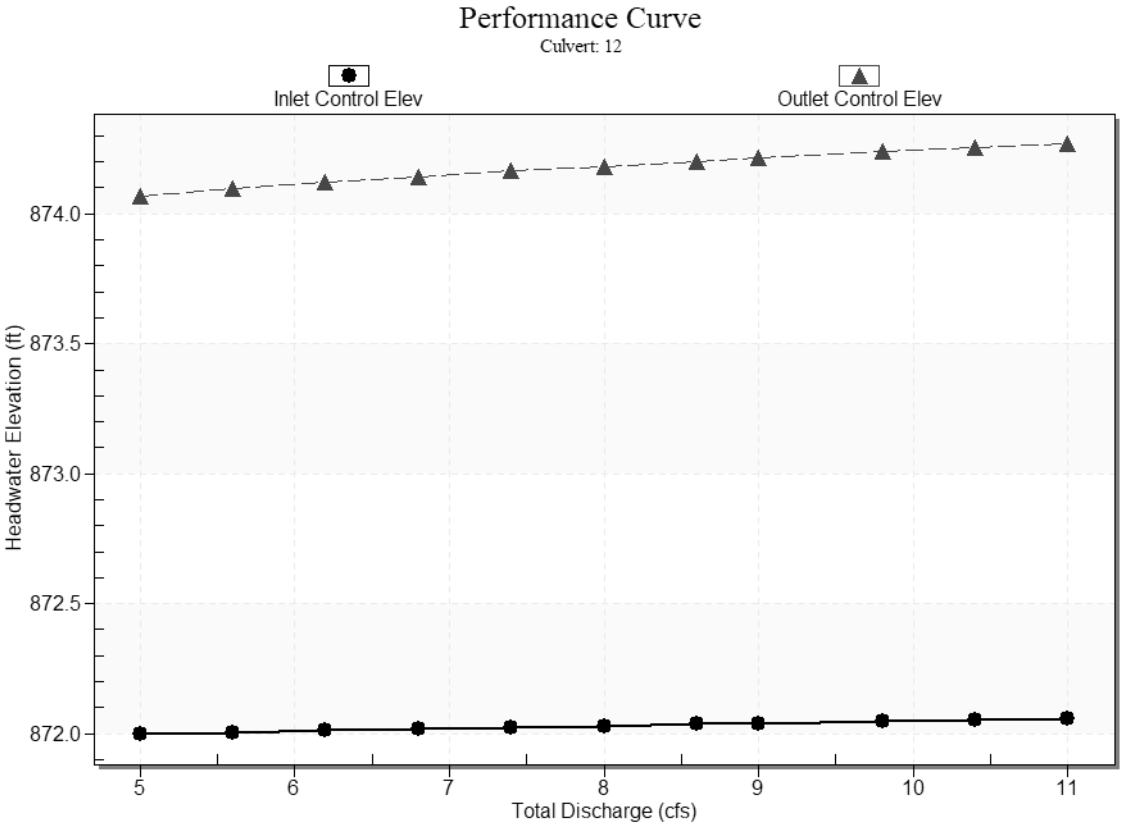
Inlet Elevation (invert): 870.25 ft,

Outlet Elevation (invert): 869.63 ft

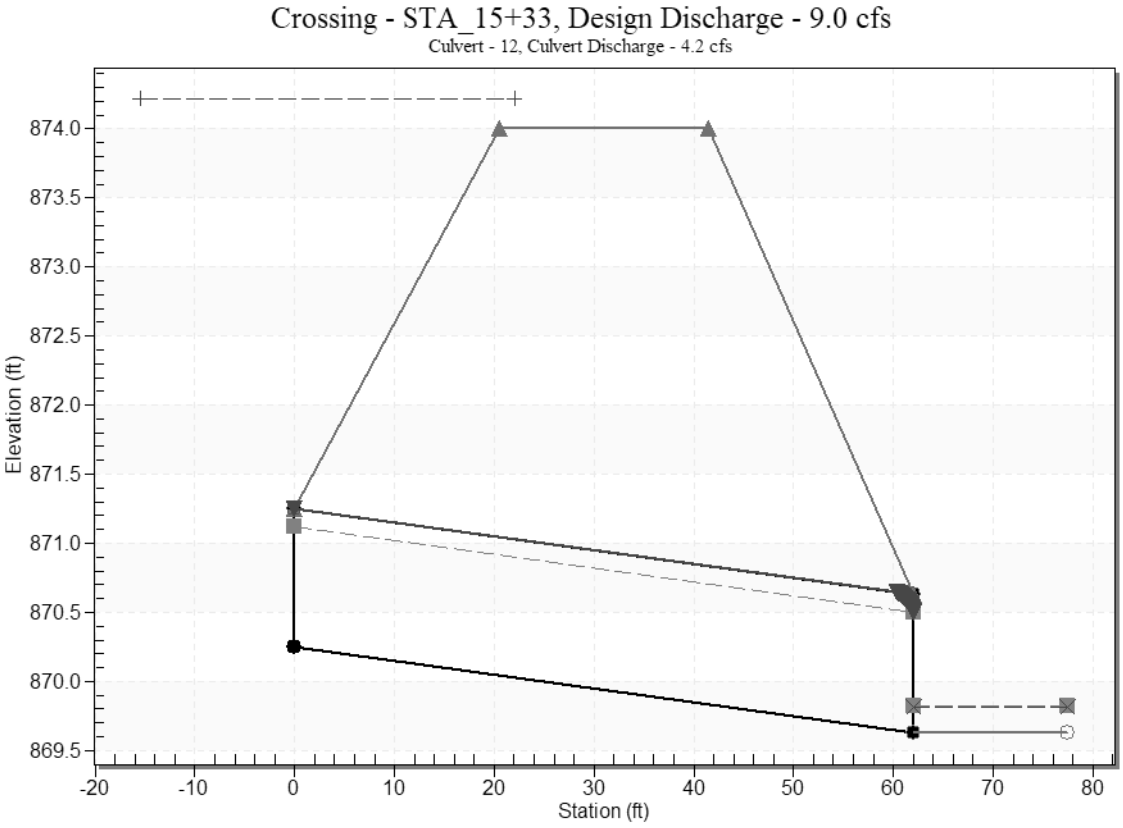
Culvert Length: 62.00 ft,

Culvert Slope: 0.0100

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.25 ft

Outlet Station: 62.00 ft

Outlet Elevation: 869.63 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA_15+33

Table 3 - Downstream Channel Rating Curve (Crossing: STA_15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.76	0.13	2.08	0.40	1.03
5.60	869.77	0.14	2.18	0.43	1.05
6.20	869.78	0.15	2.27	0.46	1.06
6.80	869.79	0.16	2.35	0.49	1.07
7.40	869.79	0.16	2.42	0.51	1.07
8.00	869.80	0.17	2.50	0.53	1.08
8.60	869.81	0.18	2.57	0.56	1.09
9.00	869.81	0.18	2.61	0.57	1.09
9.80	869.82	0.19	2.70	0.60	1.10
10.40	869.83	0.20	2.76	0.63	1.11
11.00	869.84	0.21	2.82	0.65	1.12

Tailwater Channel Data - STA_15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 18.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.63 ft

Roadway Data for Crossing: STA_15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 874.00 ft

Roadway Surface: Paved

Roadway Top Width: 21.00 ft

STA 25+92 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 22.00 cfs

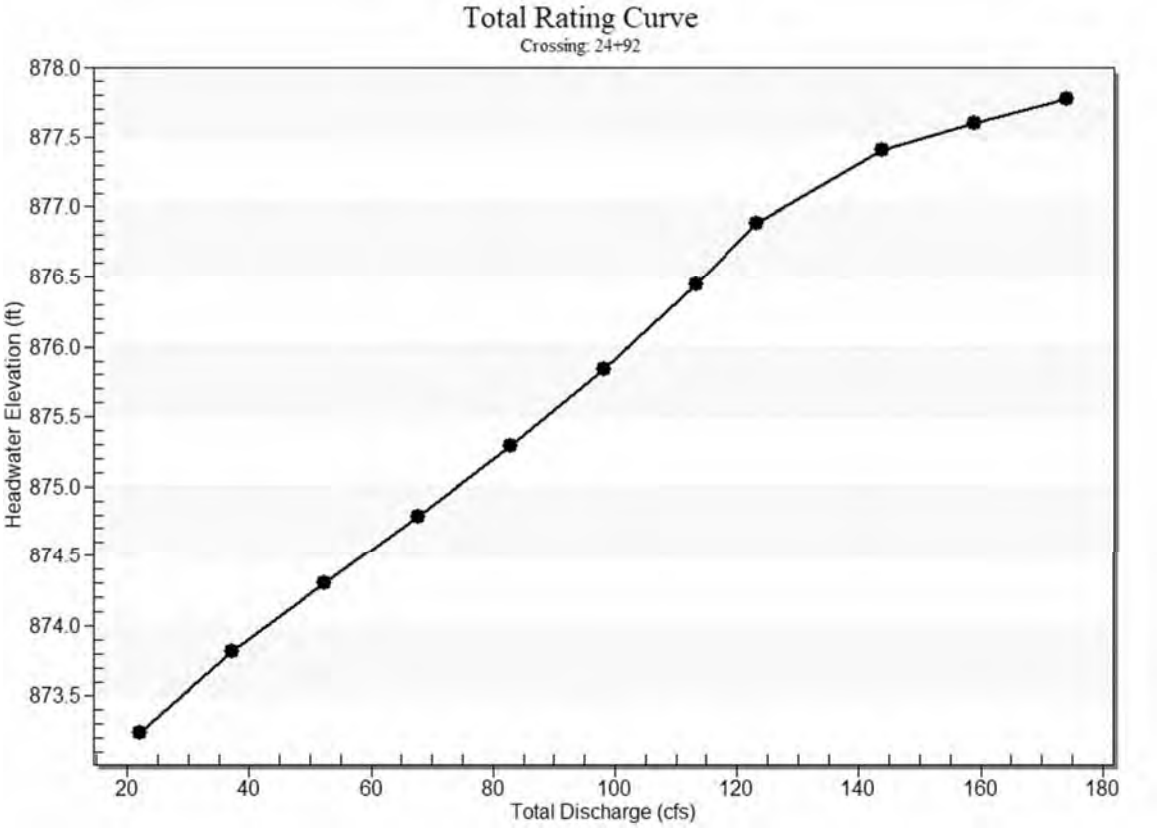
Design Flow: 123.00 cfs

Maximum Flow: 174.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 24+92

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
873.24	22.00	19.92	2.07	0.00	6
873.81	37.20	29.45	7.75	0.00	4
874.30	52.40	37.68	14.74	0.00	2
874.79	67.60	45.15	22.45	0.00	3
875.29	82.80	51.89	30.92	0.00	3
875.84	98.00	58.27	39.73	0.00	4
876.45	113.20	64.64	48.57	0.00	4
876.89	123.00	68.78	54.18	0.00	8
877.40	143.60	73.35	60.17	10.07	6
877.60	158.80	75.00	62.29	21.48	5
877.77	174.00	76.41	64.07	33.43	4
877.10	127.41	70.70	56.72	0.00	Overtopping

Rating Curve Plot for Crossing: 24+92



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	19.92 cfs	873.24	2.04	0.0*	1-S2n	0.73	1.43	0.84	0.24	12.27	4.39
37.20 cfs	29.45 cfs	873.81	2.61	0.321	1-S2n	0.89	1.76	1.06	0.33	13.16	5.34
52.40 cfs	37.68 cfs	874.30	3.10	0.863	5-S2n	1.01	2.00	1.23	0.40	13.74	6.06
67.60 cfs	45.15 cfs	874.79	3.59	1.392	5-S2n	1.11	2.19	1.38	0.46	14.23	6.66

82.80 cfs	51.89 cfs	875.29	4.09	2.232	5-S2n	1.20	2.34	1.50	0.52	14.65	7.16
98.00 cfs	58.27 cfs	875.84	4.64	2.680	5-S2n	1.28	2.47	1.61	0.58	15.03	7.60
113.20 cfs	64.64 cfs	876.45	5.25	3.162	5-S2n	1.35	2.58	1.72	0.63	15.41	8.00
123.00 cfs	68.78 cfs	876.89	5.69	3.495	5-S2n	1.40	2.64	1.79	0.66	15.66	8.24
143.60 cfs	73.35 cfs	877.40	6.20	3.878	5-S2n	1.46	2.70	1.86	0.72	15.94	8.69
158.80 cfs	75.00 cfs	877.60	6.40	4.022	5-S2n	1.47	2.72	1.88	0.77	16.04	9.00
174.00 cfs	76.41 cfs	877.77	6.57	4.146	5-S2n	1.49	2.73	1.91	0.81	16.13	9.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

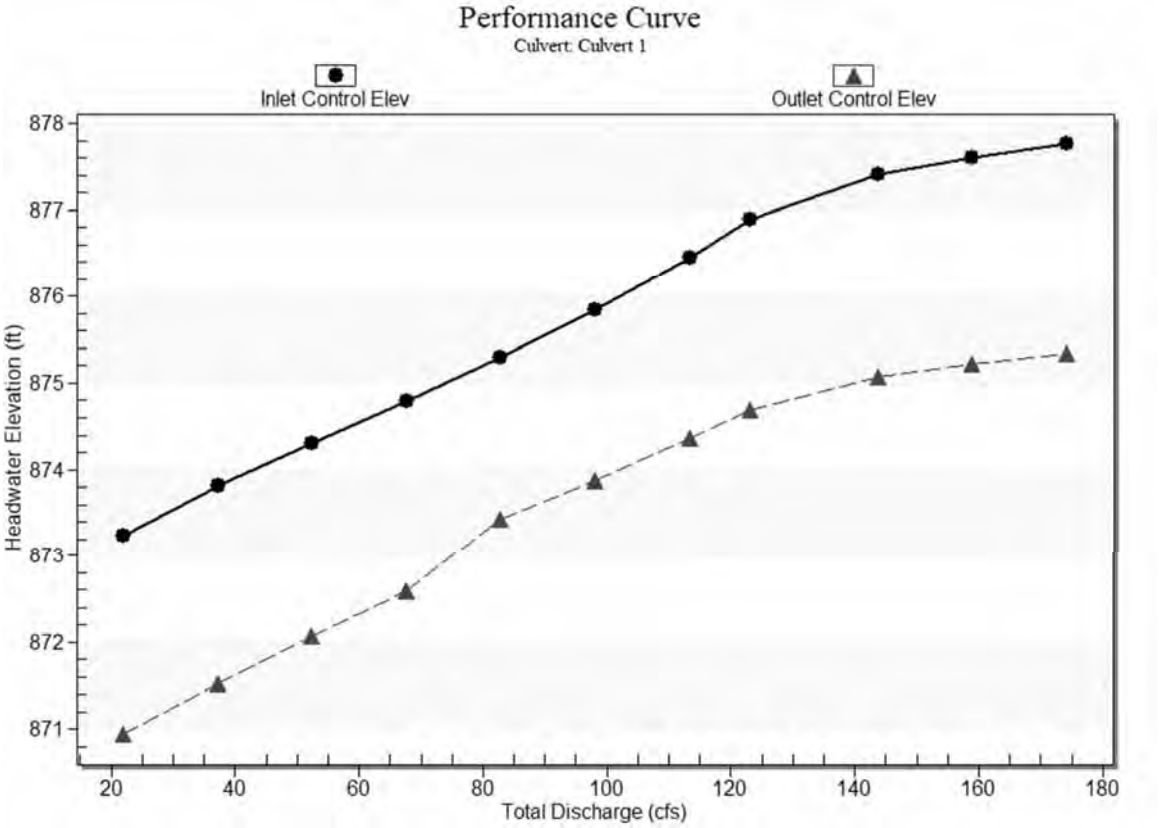
Inlet Elevation (invert): 871.20 ft,

Outlet Elevation (invert): 869.29 ft

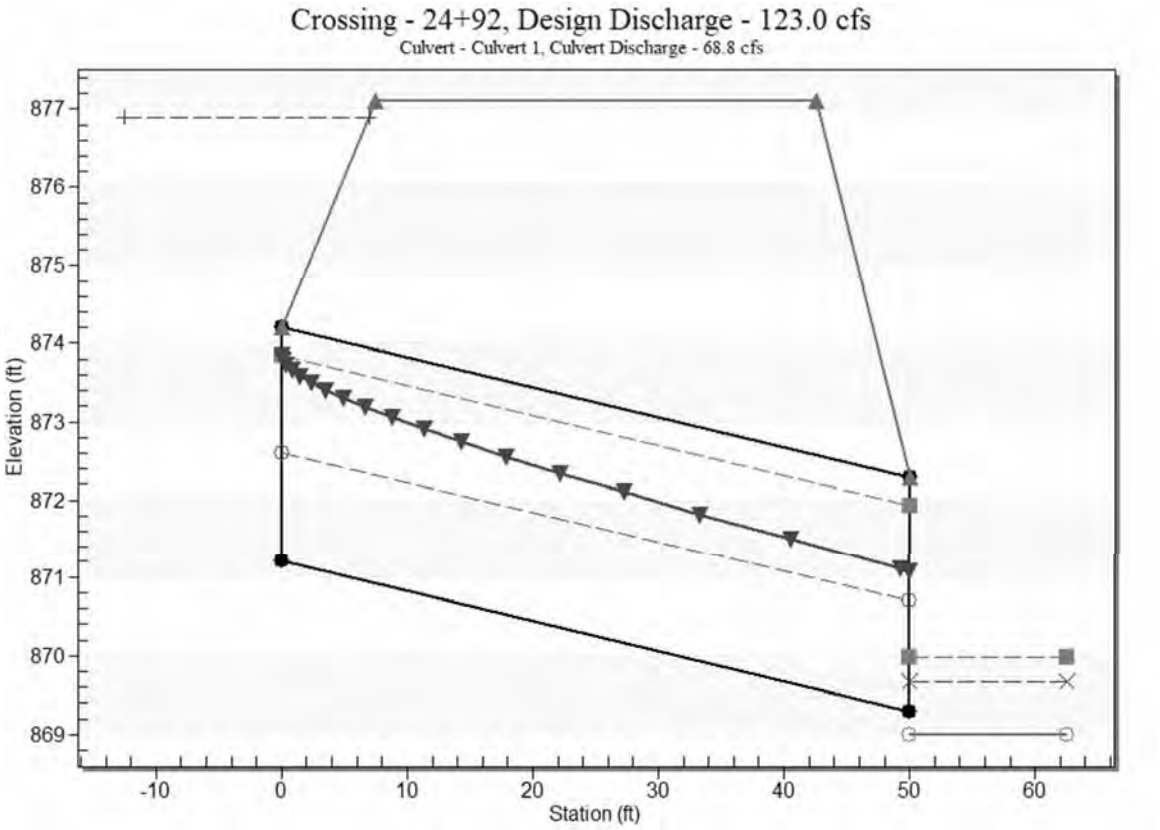
Culvert Length: 50.04 ft,

Culvert Slope: 0.0382

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.20 ft

Outlet Station: 50.00 ft

Outlet Elevation: 869.29 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0110

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Culvert Data: Culvert 2

Table 3 - Culvert Summary Table: Culvert 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	2.07 cfs	873.24	0.58	0.0*	1-S2n	0.32	0.45	0.32	0.24	5.01	4.39
37.20 cfs	7.75 cfs	873.81	1.15	0.0*	1-S2n	0.62	0.88	0.62	0.33	7.39	5.34
52.40 cfs	14.74 cfs	874.30	1.64	0.0*	1-S2n	0.85	1.22	0.85	0.40	8.90	6.06
67.60 cfs	22.45 cfs	874.79	2.13	0.0*	1-S2n	1.06	1.52	1.06	0.46	10.02	6.66
82.80 cfs	30.92 cfs	875.29	2.63	0.0*	1-S2n	1.26	1.80	1.29	0.52	10.62	7.16
98.00 cfs	39.73 cfs	875.84	3.18	0.730	5-S2n	1.46	2.05	1.49	0.58	11.34	7.60
113.20 cfs	48.57 cfs	876.45	3.79	1.974	5-S2n	1.64	2.27	1.67	0.63	12.00	8.00
123.00 cfs	54.18 cfs	876.89	4.23	2.523	5-S2n	1.76	2.39	1.79	0.66	12.29	8.24
143.60 cfs	60.17 cfs	877.40	4.74	3.161	5-S2n	1.89	2.50	1.93	0.72	12.53	8.69
158.80 cfs	62.29 cfs	877.60	4.94	3.399	5-S2n	1.93	2.54	1.98	0.77	12.61	9.00
174.00 cfs	64.07 cfs	877.77	5.11	3.604	5-S2	1.97	2.57	2.01	0.81	12.70	9.29

n

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

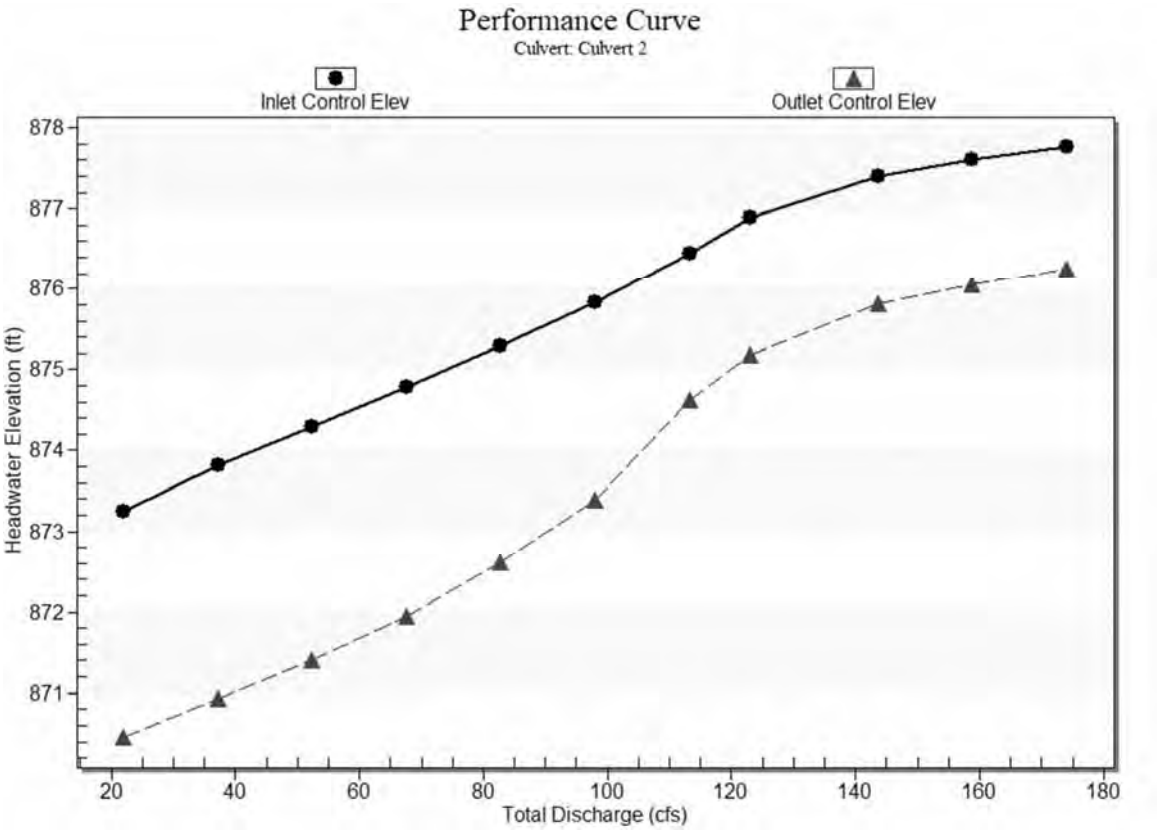
Inlet Elevation (invert): 872.66 ft,

Outlet Elevation (invert): 870.00 ft

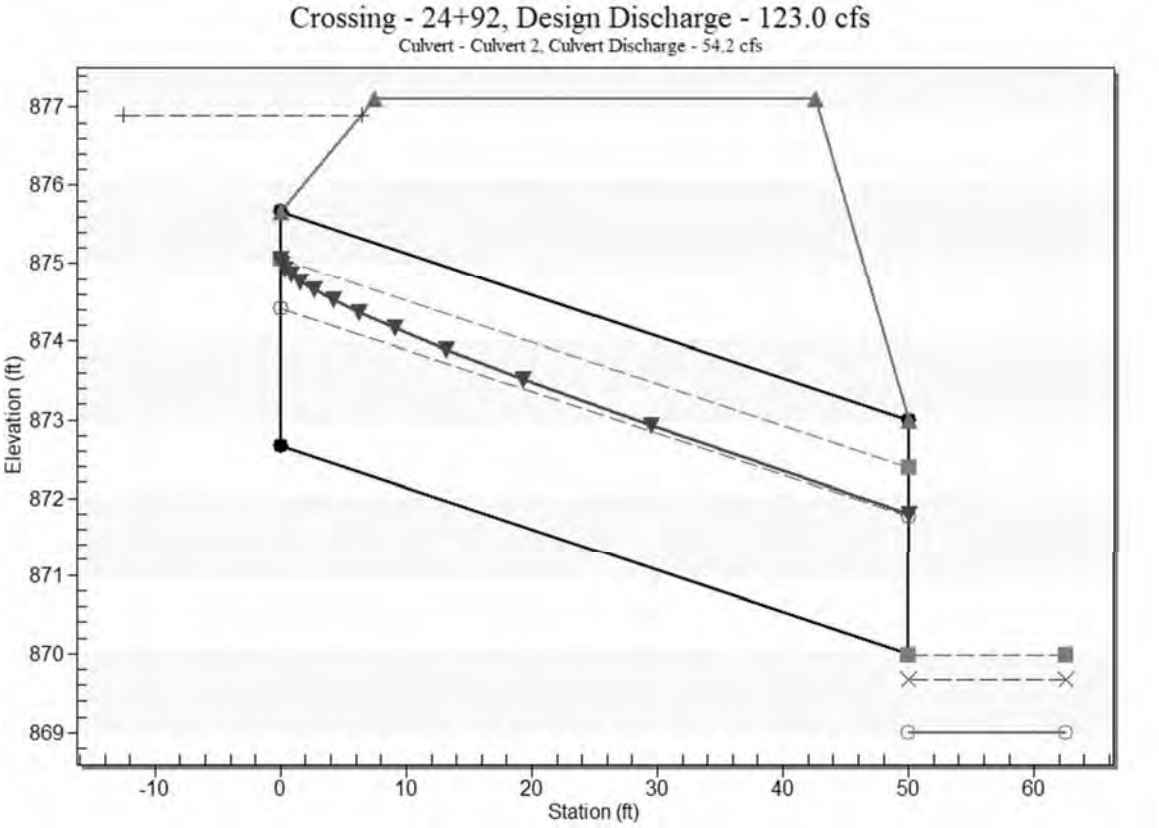
Culvert Length: 50.07 ft,

Culvert Slope: 0.0532

Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 872.66 ft

Outlet Station: 50.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 24+92

Table 4 - Downstream Channel Rating Curve (Crossing: 24+92)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
22.00	869.24	0.24	4.39	1.49	1.62
37.20	869.33	0.33	5.34	2.04	1.70
52.40	869.40	0.40	6.06	2.50	1.75
67.60	869.46	0.46	6.66	2.90	1.79
82.80	869.52	0.52	7.16	3.27	1.82
98.00	869.58	0.58	7.60	3.61	1.85
113.20	869.63	0.63	8.00	3.92	1.87
123.00	869.66	0.66	8.24	4.12	1.89
143.60	869.72	0.72	8.69	4.50	1.91
158.80	869.77	0.77	9.00	4.77	1.93
174.00	869.81	0.81	9.29	5.03	1.94

Tailwater Channel Data - 24+92

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.00 ft

Roadway Data for Crossing: 24+92

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 877.10 ft

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

STA 43+76 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

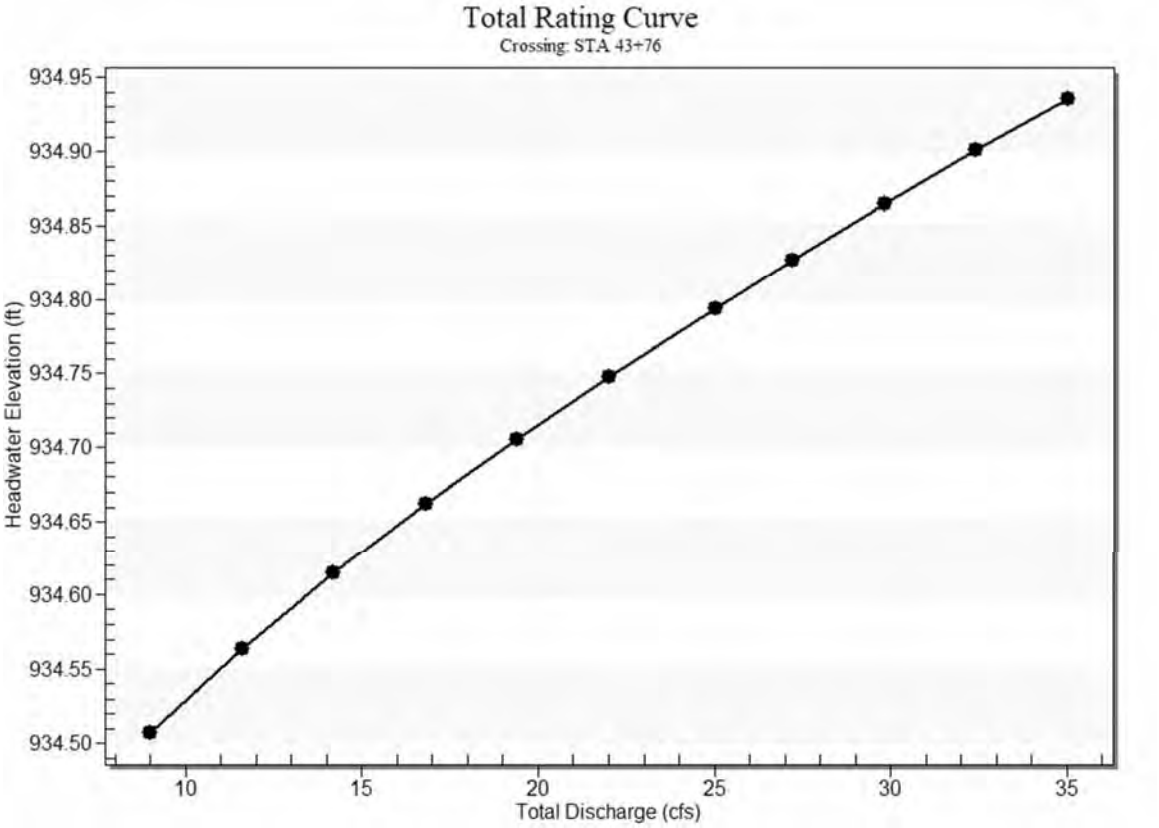
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.51	9.00	3.33	5.63	8
934.56	11.60	3.46	8.09	4
934.61	14.20	3.58	10.60	4
934.66	16.80	3.68	13.11	4
934.71	19.40	3.77	15.58	3
934.75	22.00	3.86	18.11	3
934.79	25.00	3.95	21.02	3
934.83	27.20	4.02	23.17	3
934.86	29.80	4.09	25.70	3
934.90	32.40	4.16	28.24	3
934.94	35.00	4.22	30.72	2
934.30	2.78	2.78	0.00	Overtopping

Rating Curve Plot for Crossing: STA 43+76



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	3.33 cfs	934.51	1.37	0.0*	5-S2n	0.50	0.78	0.50	0.27	8.41	1.44
11.60 cfs	3.46 cfs	934.56	1.42	0.0*	5-S2n	0.51	0.79	0.52	0.31	8.45	1.58
14.20 cfs	3.58 cfs	934.61	1.47	0.040	5-S2n	0.52	0.81	0.53	0.35	8.51	1.69
16.80 cfs	3.68 cfs	934.66	1.52	0.105	5-S2n	0.53	0.82	0.54	0.38	8.56	1.79

19.40 cfs	3.77 cfs	934.71	1.57	0.164	5-S2n	0.53	0.83	0.55	0.42	8.62	1.88
22.00 cfs	3.86 cfs	934.75	1.61	0.220	5-S2n	0.54	0.83	0.55	0.45	8.66	1.96
25.00 cfs	3.95 cfs	934.79	1.65	0.282	5-S2n	0.55	0.84	0.56	0.48	8.71	2.05
27.20 cfs	4.02 cfs	934.83	1.69	0.325	5-S2n	0.56	0.85	0.57	0.50	8.74	2.11
29.80 cfs	4.09 cfs	934.86	1.72	0.375	5-S2n	0.56	0.86	0.57	0.53	8.78	2.17
32.40 cfs	4.16 cfs	934.90	1.76	0.423	5-S2n	0.57	0.86	0.58	0.56	8.81	2.23
35.00 cfs	4.22 cfs	934.94	1.80	0.468	5-S2n	0.57	0.87	0.59	0.58	8.84	2.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

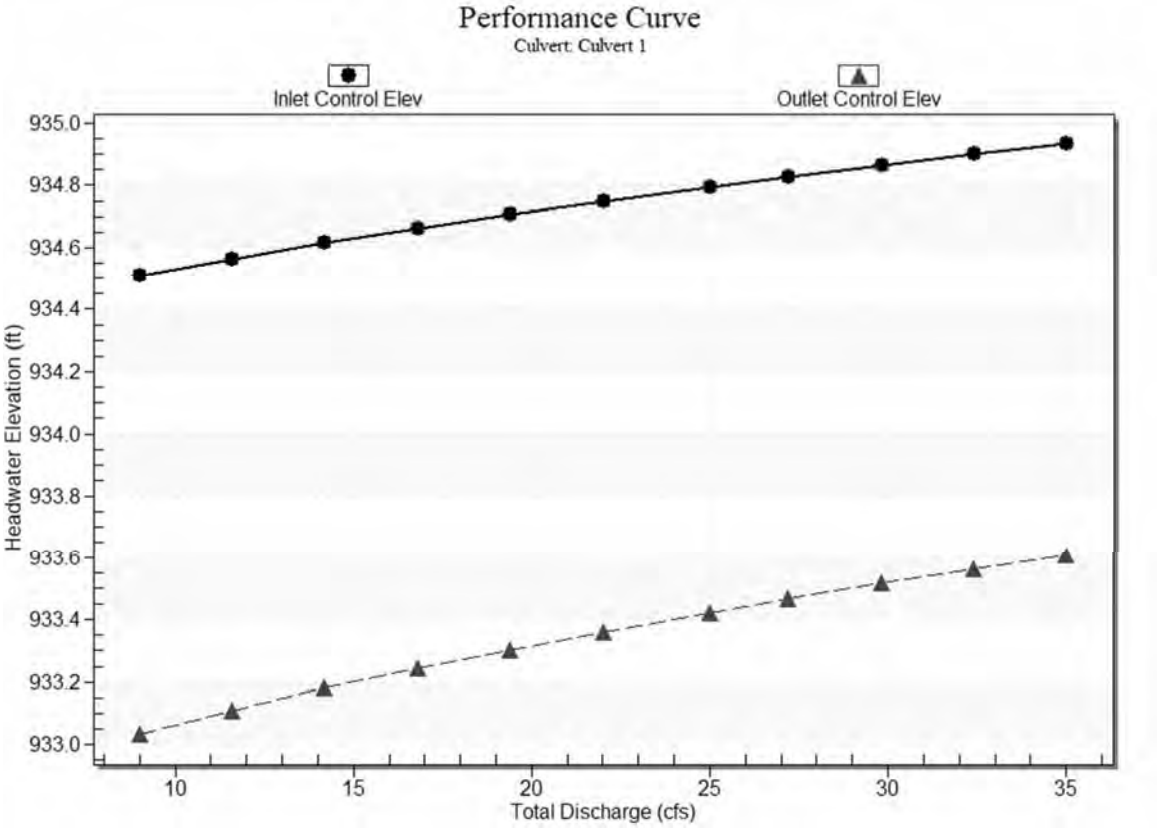
Inlet Elevation (invert): 933.14 ft,

Outlet Elevation (invert): 931.27 ft

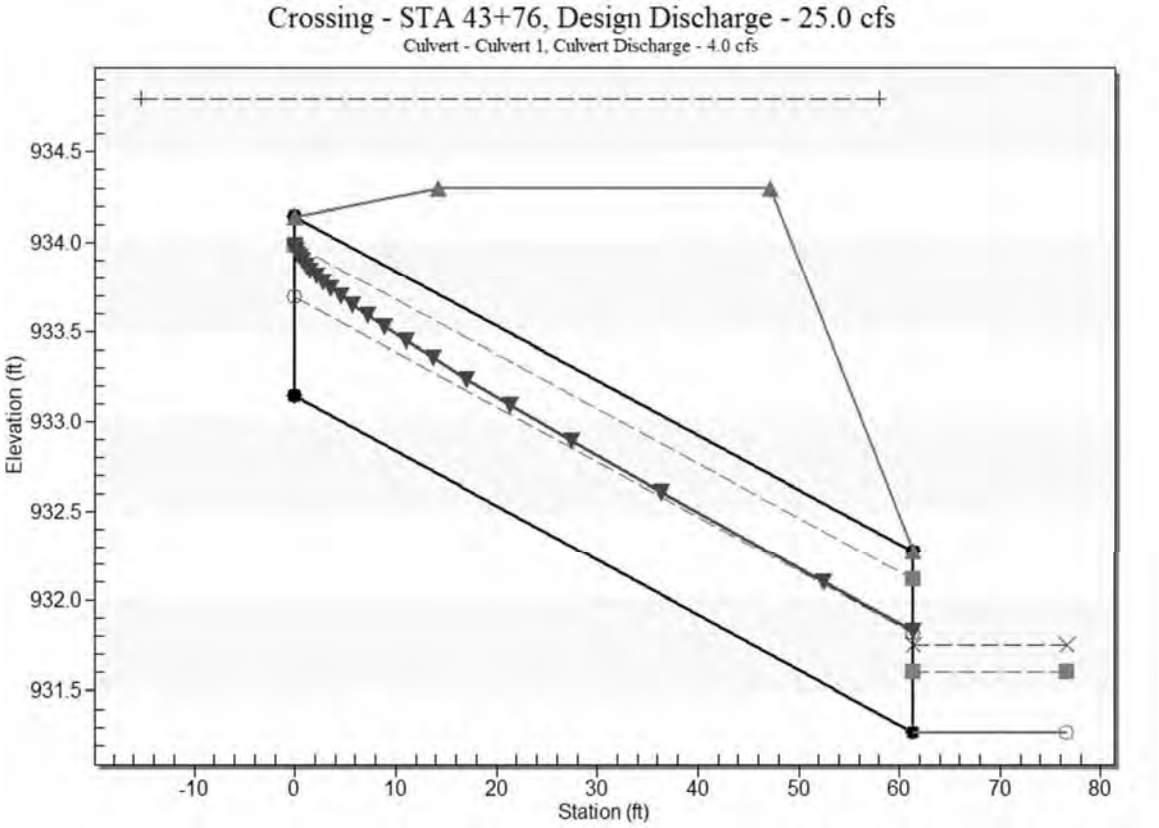
Culvert Length: 61.37 ft,

Culvert Slope: 0.0305

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 933.14 ft

Outlet Station: 61.34 ft

Outlet Elevation: 931.27 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: STA 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.54	0.27	1.44	0.17	0.52
11.60	931.58	0.31	1.58	0.19	0.53
14.20	931.62	0.35	1.69	0.22	0.54
16.80	931.65	0.38	1.79	0.24	0.55
19.40	931.69	0.42	1.88	0.26	0.55
22.00	931.72	0.45	1.96	0.28	0.56
25.00	931.75	0.48	2.05	0.30	0.56
27.20	931.77	0.50	2.11	0.32	0.57
29.80	931.80	0.53	2.17	0.33	0.57
32.40	931.83	0.56	2.23	0.35	0.58
35.00	931.85	0.58	2.29	0.36	0.58

Tailwater Channel Data - STA 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 931.27 ft

Roadway Data for Crossing: STA 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 934.30 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 50+72 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 40.00 cfs

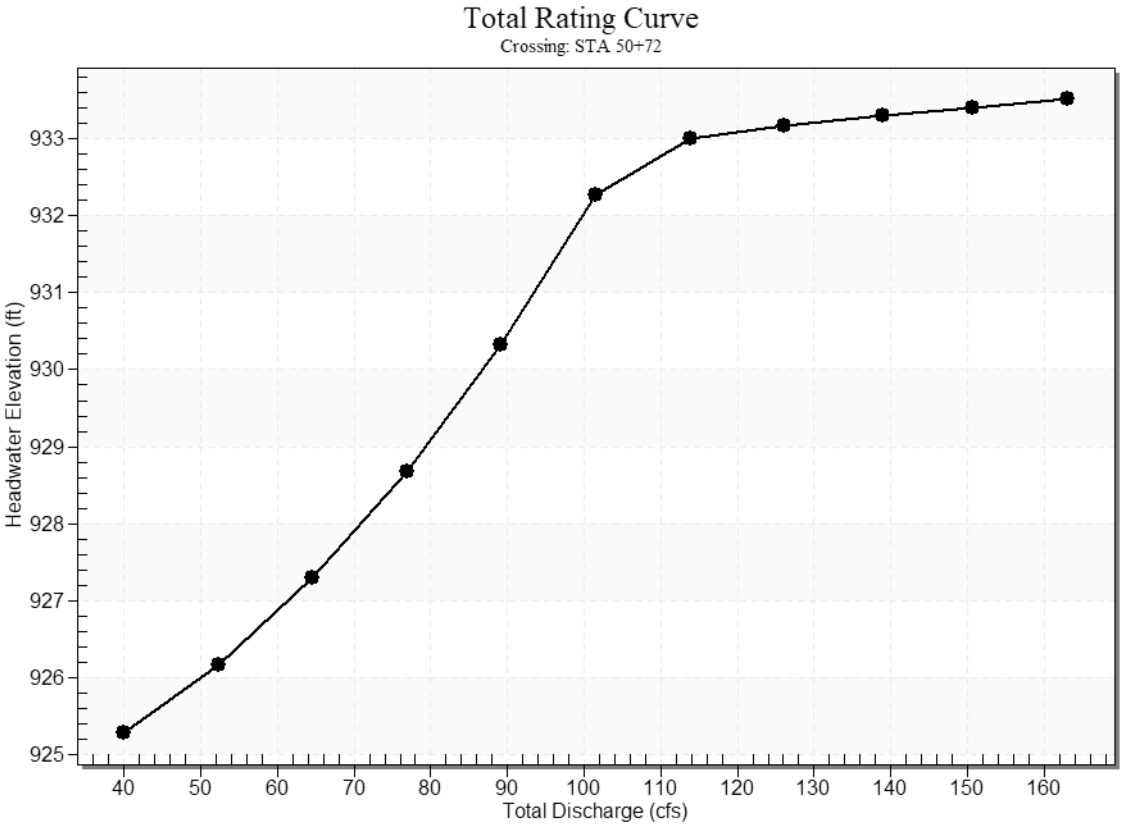
Design Flow: 139.00 cfs

Maximum Flow: 163.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 50+72

Headwater Elevation (ft)	Total Discharge (cfs)	36 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
925.29	40.00	40.00	0.00	1
926.17	52.30	52.30	0.00	1
927.29	64.60	64.60	0.00	1
928.68	76.90	76.90	0.00	1
930.32	89.20	89.20	0.00	1
932.27	101.50	101.50	0.00	1
933.00	113.80	105.69	8.07	7
933.16	126.10	106.57	19.49	6
933.29	139.00	107.32	31.62	5
933.40	150.70	107.91	42.65	4
933.51	163.00	108.49	54.42	4
932.80	104.55	104.55	0.00	Overtopping

Rating Curve Plot for Crossing: STA 50+72



Culvert Data: 36

Table 2 - Culvert Summary Table: 36

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00 cfs	40.00 cfs	925.29	3.25	0.908	5-S2n	0.97	2.06	1.25	0.66	14.38	4.32
52.30 cfs	52.30 cfs	926.17	4.13	2.126	5-S2n	1.12	2.35	1.47	0.77	15.13	4.68
64.60 cfs	64.60 cfs	927.29	5.25	3.003	5-S2n	1.26	2.58	1.68	0.86	15.88	4.98
76.90 cfs	76.90 cfs	928.68	6.64	4.007	5-S2n	1.39	2.74	1.87	0.94	16.64	5.24

89.20 cfs	89.20 cfs	930.32	8.28	5.141	5-S2n	1.51	2.84	2.03	1.01	17.49	5.47
101.50 cfs	101.50 cfs	932.27	10.23	6.363	5-S2n	1.63	2.80	2.18	1.08	18.46	5.68
113.80 cfs	105.69 cfs	933.00	10.96	6.926	5-S2n	1.67	3.00	2.26	1.15	18.48	5.86
126.10 cfs	106.57 cfs	933.16	11.12	7.025	5-S2n	1.68	3.00	2.27	1.21	18.56	6.03
139.00 cfs	107.32 cfs	933.29	11.25	7.109	5-S2n	1.69	3.00	2.28	1.27	18.62	6.20
150.70 cfs	107.91 cfs	933.40	11.36	7.177	5-S2n	1.70	3.00	2.29	1.32	18.68	6.34
163.00 cfs	108.49 cfs	933.51	11.47	7.244	5-S2n	1.70	3.00	2.29	1.38	18.73	6.48

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

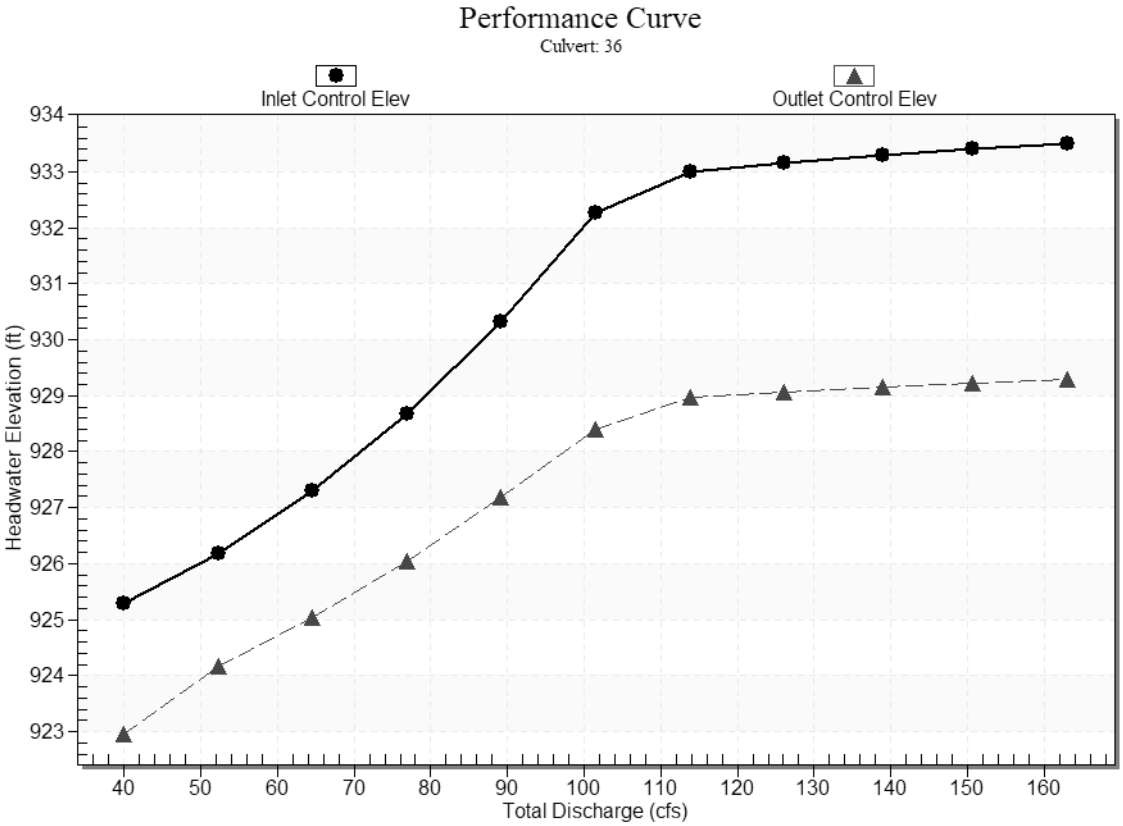
Inlet Elevation (invert): 922.04 ft,

Outlet Elevation (invert): 920.04 ft

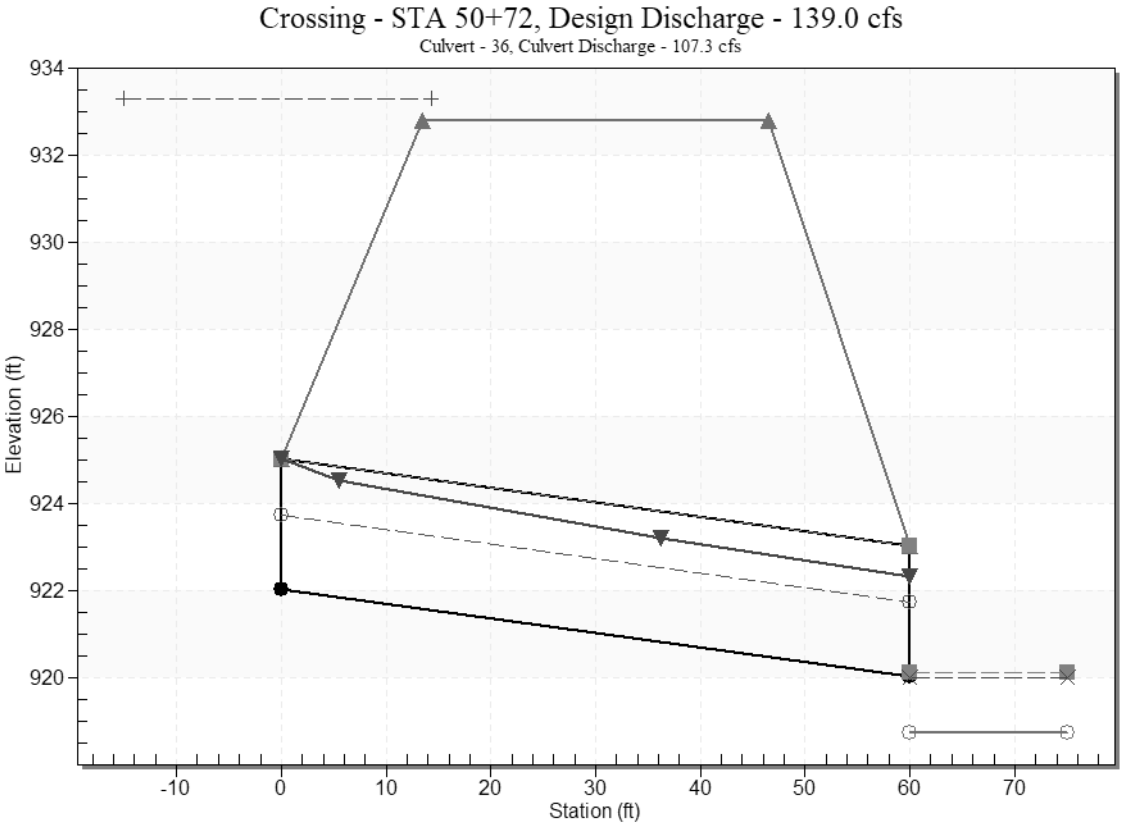
Culvert Length: 60.03 ft,

Culvert Slope: 0.0333

Culvert Performance Curve Plot: 36



Water Surface Profile Plot for Culvert: 36



Site Data - 36

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 922.04 ft

Outlet Station: 60.00 ft

Outlet Elevation: 920.04 ft

Number of Barrels: 1

Culvert Data Summary - 36

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0090

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 50+72

Table 3 - Downstream Channel Rating Curve (Crossing: STA 50+72)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
40.00	919.41	0.66	4.32	1.36	1.06
52.30	919.52	0.77	4.68	1.58	1.08
64.60	919.61	0.86	4.98	1.76	1.10
76.90	919.69	0.94	5.24	1.93	1.11
89.20	919.76	1.01	5.47	2.09	1.12
101.50	919.83	1.08	5.68	2.23	1.13
113.80	919.90	1.15	5.86	2.37	1.14
126.10	919.96	1.21	6.03	2.49	1.15
139.00	920.02	1.27	6.20	2.62	1.16
150.70	920.07	1.32	6.34	2.73	1.17
163.00	920.13	1.38	6.48	2.84	1.17

Tailwater Channel Data - STA 50+72

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0330

Channel Manning's n: 0.0400

Channel Invert Elevation: 918.75 ft

Roadway Data for Crossing: STA 50+72

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 932.80 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 82+07 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

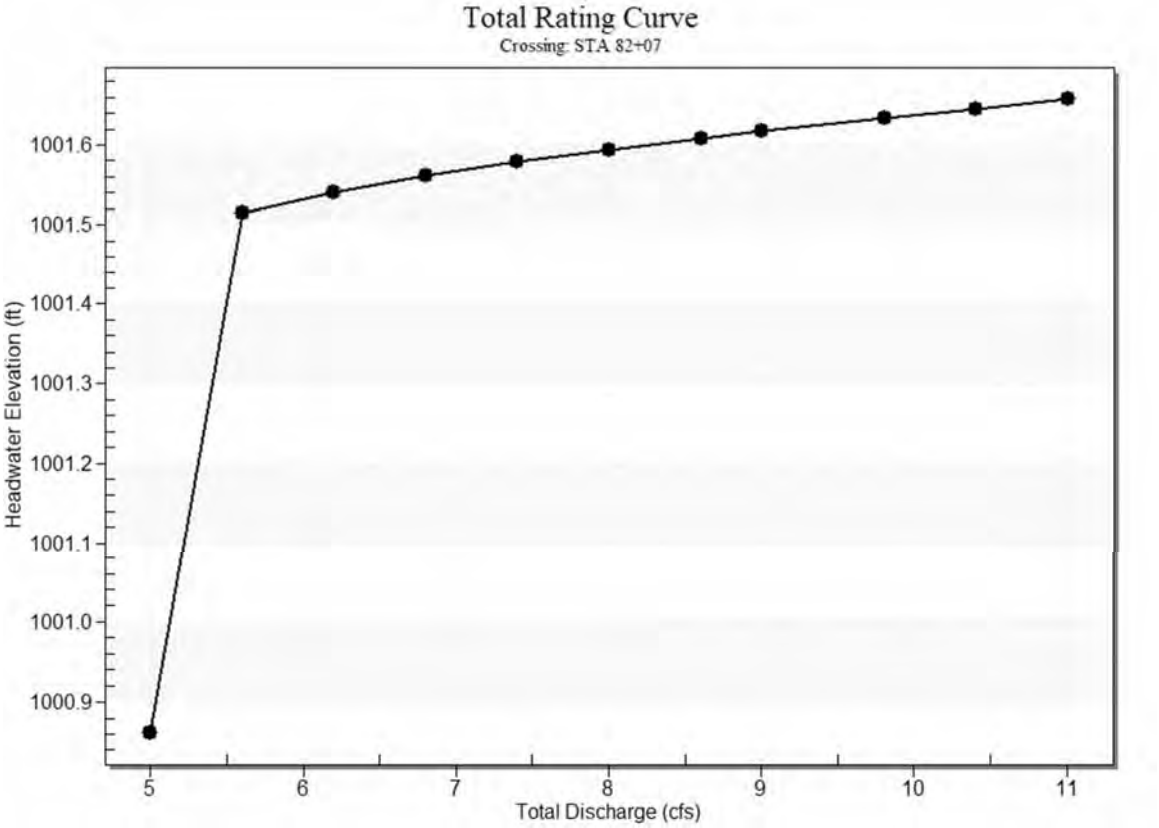
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1000.86	5.00	5.00	0.00	1
1001.51	5.60	5.41	0.15	49
1001.54	6.20	5.42	0.73	5
1001.56	6.80	5.43	1.32	4
1001.58	7.40	5.44	1.93	4
1001.59	8.00	5.45	2.50	3
1001.61	8.60	5.46	3.10	3
1001.62	9.00	5.47	3.51	3
1001.63	9.80	5.48	4.30	3
1001.65	10.40	5.48	4.90	3
1001.66	11.00	5.49	5.50	3
1001.50	5.40	5.40	0.00	Overtopping

Rating Curve Plot for Crossing: STA 82+07



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	1000.86	2.23	4.182	7-M2c	1.00	0.92	0.92	0.10	6.63	2.00
5.60 cfs	5.41 cfs	1001.51	2.49	4.834	7-M2c	1.00	0.94	0.94	0.11	7.08	2.09
6.20 cfs	5.42 cfs	1001.54	2.50	4.861	7-M2c	1.00	0.94	0.94	0.11	7.09	2.18
6.80 cfs	5.43 cfs	1001.56	2.51	4.881	7-M2c	1.00	0.94	0.94	0.12	7.11	2.26

7.40 cfs	5.44 cfs	1001.58	2.52	4.898	7-M2c	1.00	0.94	0.94	0.13	7.12	2.34
8.00 cfs	5.45 cfs	1001.59	2.52	4.913	7-M2c	1.00	0.94	0.94	0.13	7.13	2.41
8.60 cfs	5.46 cfs	1001.61	2.53	4.928	7-M2c	1.00	0.94	0.94	0.14	7.14	2.48
9.00 cfs	5.47 cfs	1001.62	2.53	4.937	7-M2c	1.00	0.94	0.94	0.14	7.15	2.52
9.80 cfs	5.48 cfs	1001.63	2.54	4.953	7-M2c	1.00	0.94	0.94	0.15	7.16	2.61
10.40 cfs	5.48 cfs	1001.65	2.54	4.965	7-M2c	1.00	0.94	0.94	0.15	7.16	2.67
11.00 cfs	5.49 cfs	1001.66	2.55	4.977	7-M2c	1.00	0.94	0.94	0.16	7.17	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

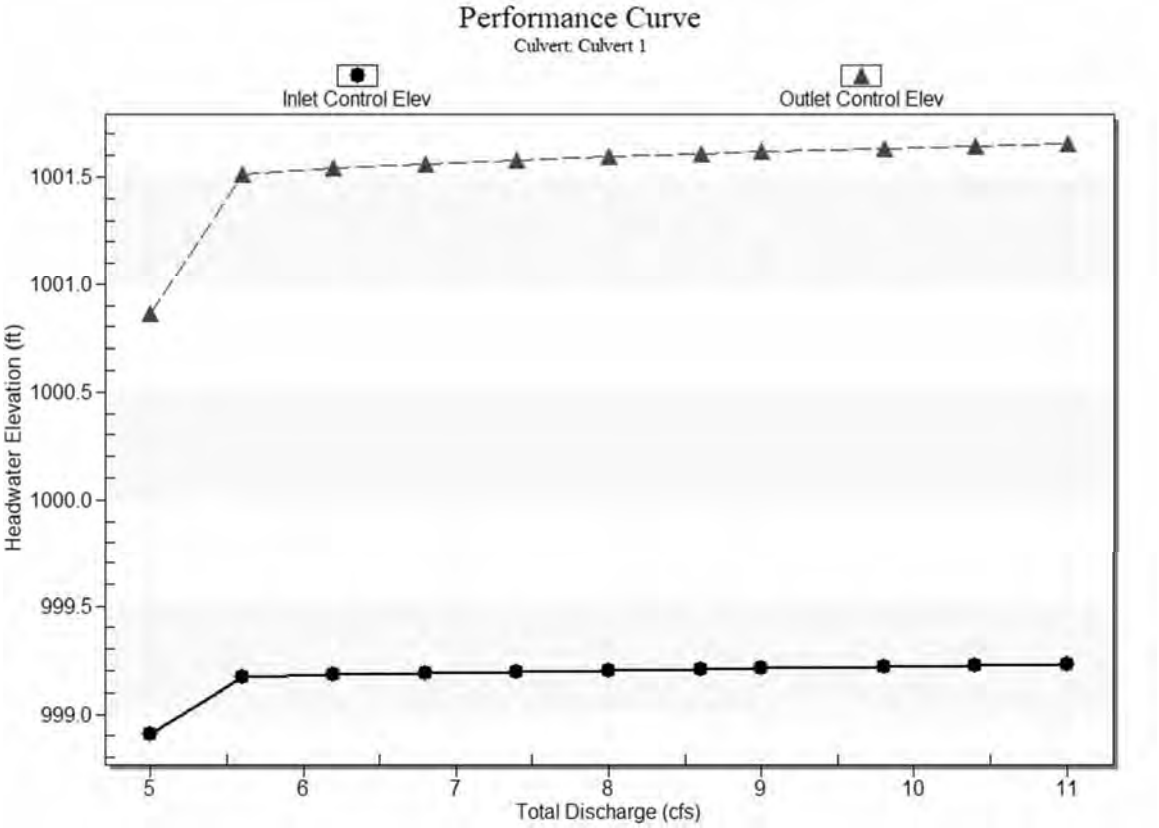
Inlet Elevation (invert): 996.68 ft,

Outlet Elevation (invert): 996.08 ft

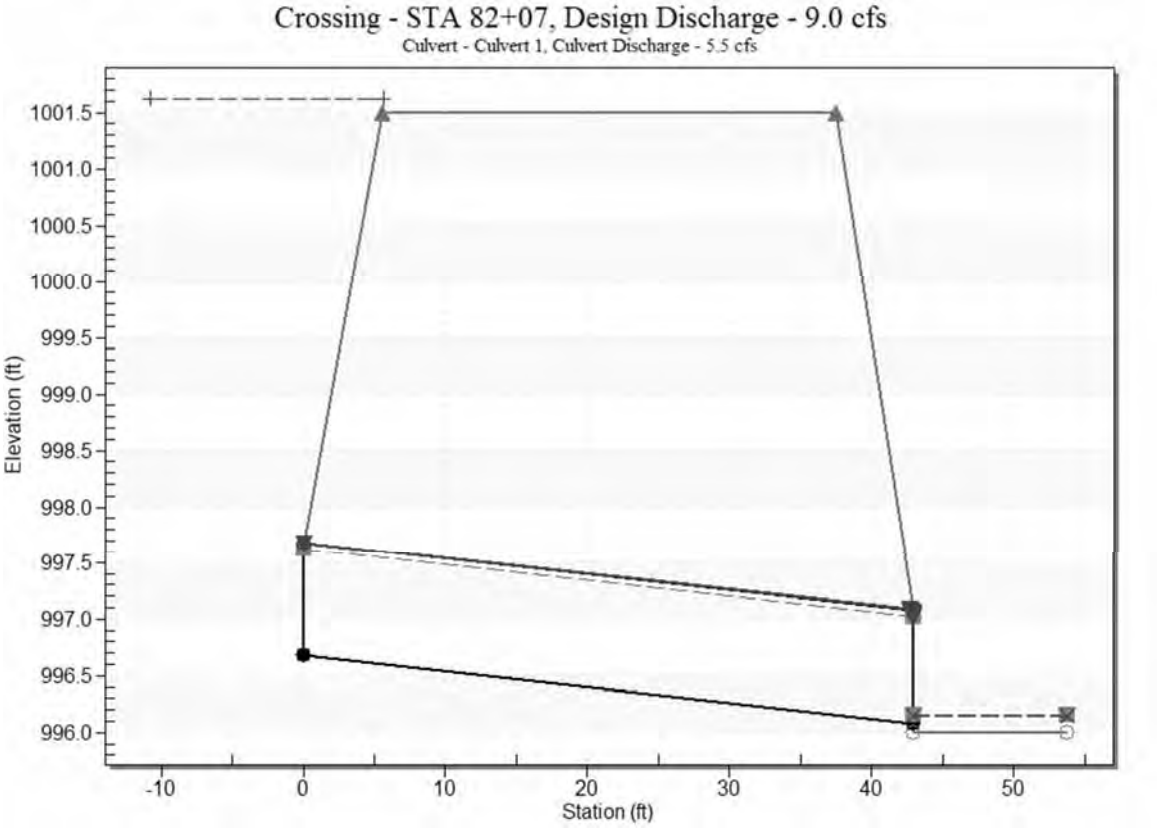
Culvert Length: 43.00 ft,

Culvert Slope: 0.0140

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.68 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.08 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: STA 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - STA 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: STA 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 1001.50 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

STA 85+60 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 26.00 cfs

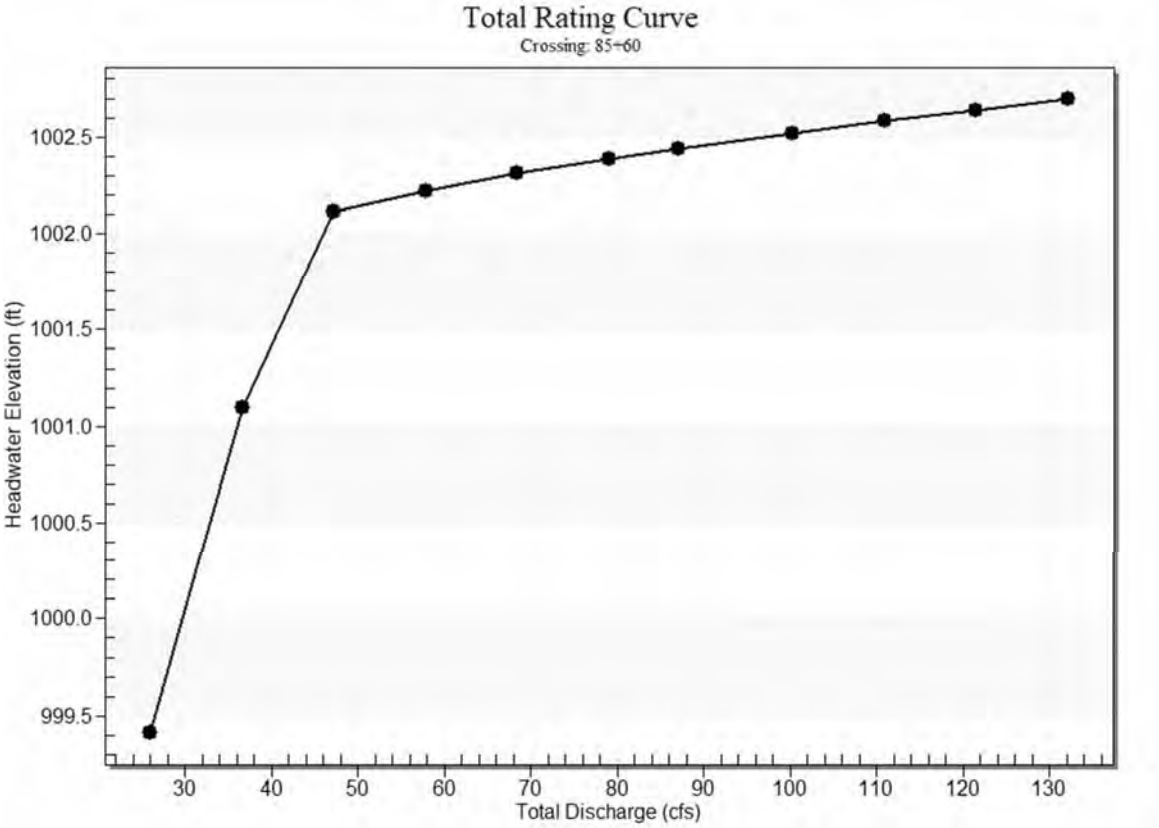
Design Flow: 87.00 cfs

Maximum Flow: 132.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 85+60

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.41	26.00	26.00	0.00	1
1001.10	36.60	36.60	0.00	1
1002.11	47.20	41.63	5.48	6
1002.22	57.80	42.11	15.60	6
1002.31	68.40	42.47	25.85	5
1002.39	79.00	42.79	36.09	4
1002.44	87.00	43.00	43.95	4
1002.52	100.20	43.33	56.83	4
1002.58	110.80	43.58	67.08	3
1002.64	121.40	43.81	77.50	3
1002.70	132.00	44.03	87.91	3
1002.00	41.10	41.10	0.00	Overtopping

Rating Curve Plot for Crossing: 85+60



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
26.00 cfs	26.00 cfs	999.41	3.25	2.849	5-S2n	1.71	1.74	1.71	0.57	7.62	4.30
36.60 cfs	36.60 cfs	1001.10	4.94	4.305	6-FFc	2.00	2.00	2.00	0.70	9.15	4.87
47.20 cfs	41.63 cfs	1002.11	5.95	5.090	6-FFc	2.00	2.00	2.00	0.82	10.41	5.33
57.80 cfs	42.11 cfs	1002.22	6.06	5.171	6-FFc	2.00	2.00	2.00	0.92	10.53	5.73

68.40 cfs	42.47 cfs	1002.31	6.15	5.233	6-FFc	2.00	2.00	2.00	1.02	10.62	6.07
79.00 cfs	42.79 cfs	1002.39	6.23	5.286	6-FFc	2.00	2.00	2.00	1.11	10.70	6.38
87.00 cfs	43.00 cfs	1002.44	6.28	5.323	6-FFc	2.00	2.00	2.00	1.18	10.75	6.60
100.20 cfs	43.33 cfs	1002.52	6.36	5.380	6-FFc	2.00	2.00	2.00	1.28	10.83	6.92
110.80 cfs	43.58 cfs	1002.58	6.42	5.422	6-FFc	2.00	2.00	2.00	1.36	10.89	7.16
121.40 cfs	43.81 cfs	1002.64	6.48	5.463	6-FFc	2.00	2.00	2.00	1.44	10.95	7.38
132.00 cfs	44.03 cfs	1002.70	6.54	5.502	6-FFc	2.00	2.00	2.00	1.51	11.01	7.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

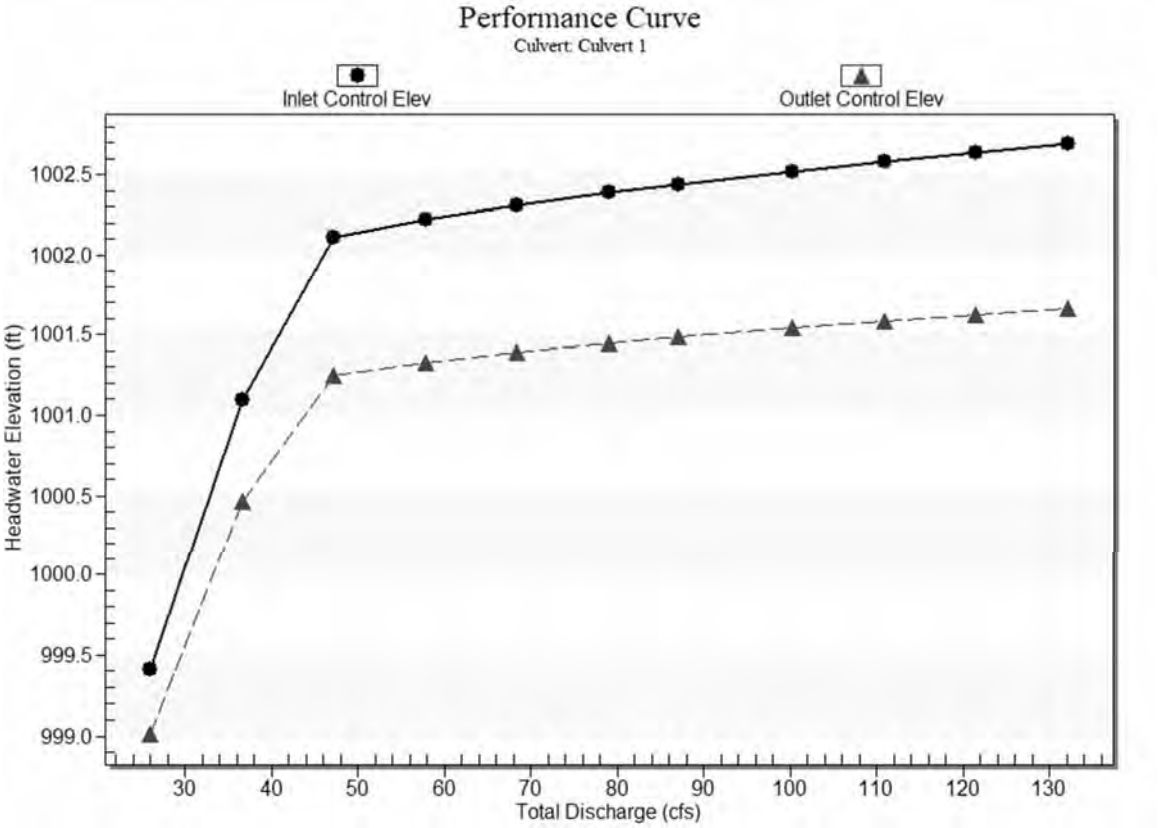
Inlet Elevation (invert): 996.16 ft,

Outlet Elevation (invert): 995.79 ft

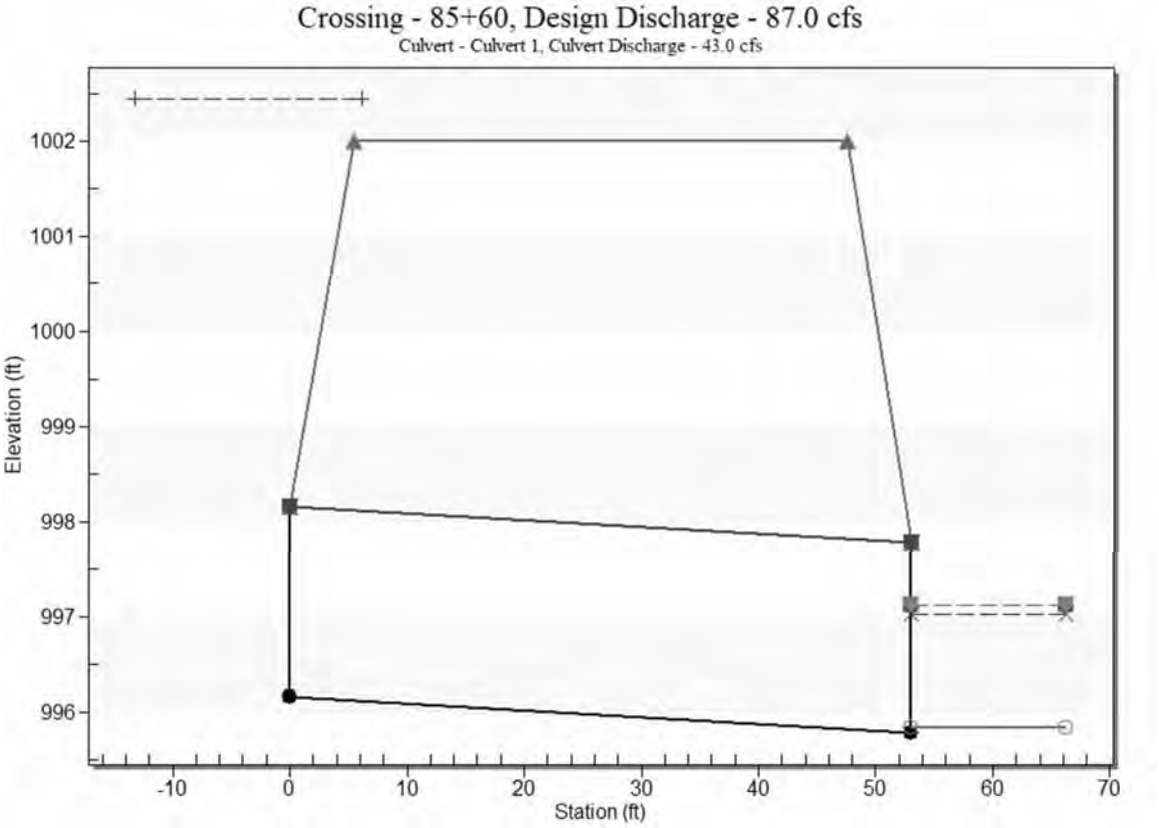
Culvert Length: 53.00 ft,

Culvert Slope: 0.0070

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.16 ft

Outlet Station: 53.00 ft

Outlet Elevation: 995.79 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 2.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: 85+60

Table 3 - Downstream Channel Rating Curve (Crossing: 85+60)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
26.00	996.41	0.57	4.30	1.78	1.03
36.60	996.54	0.70	4.87	2.19	1.06
47.20	996.66	0.82	5.33	2.55	1.08
57.80	996.76	0.92	5.73	2.88	1.09
68.40	996.86	1.02	6.07	3.19	1.11
79.00	996.95	1.11	6.38	3.47	1.12
87.00	997.02	1.18	6.60	3.68	1.13
100.20	997.12	1.28	6.92	4.00	1.14
110.80	997.20	1.36	7.16	4.25	1.14
121.40	997.28	1.44	7.38	4.49	1.15
132.00	997.35	1.51	7.58	4.72	1.16

Tailwater Channel Data - 85+60

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0500

Channel Invert Elevation: 995.84 ft

Roadway Data for Crossing: 85+60

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1002.00 ft

Roadway Surface: Paved

Roadway Top Width: 42.00 ft

WALES. MA

DRAINAGE REPORT

Proposed

HY-8 Reports

Proposed STA 1+50
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.50 cfs

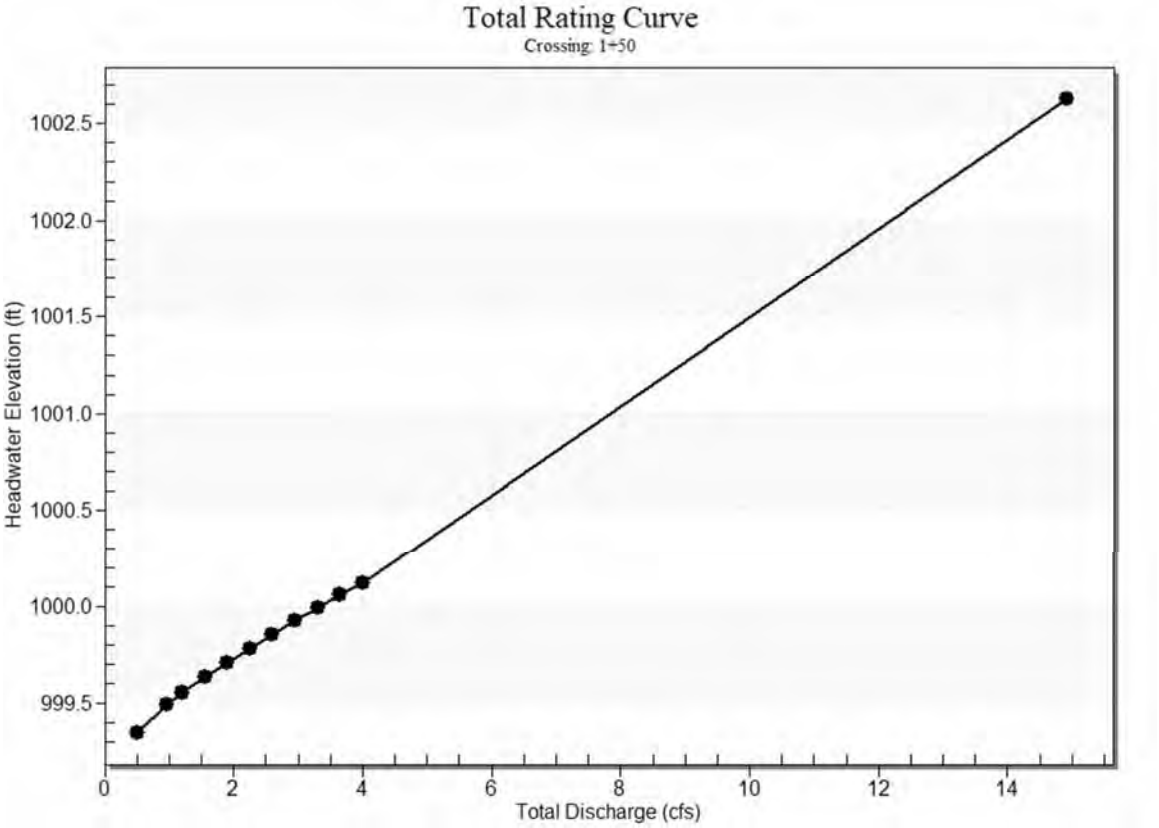
Design Flow: 0.97 cfs

Maximum Flow: 4.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 1+50

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.35	0.50	0.50	0.00	1
999.50	0.97	0.97	0.00	1
999.55	1.20	1.20	0.00	1
999.63	1.55	1.55	0.00	1
999.71	1.90	1.90	0.00	1
999.78	2.25	2.25	0.00	1
999.86	2.60	2.60	0.00	1
999.93	2.95	2.95	0.00	1
999.99	3.30	3.30	0.00	1
1000.06	3.65	3.65	0.00	1
1000.12	4.00	4.00	0.00	1
1002.60	14.34	14.34	0.00	Overtopping

Rating Curve Plot for Crossing: 1+50



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.50 cfs	0.50 cfs	999.35	0.35	0.0*	1-S2n	0.18	0.26	0.18	0.10	4.08	0.79
0.97 cfs	0.97 cfs	999.50	0.50	0.0*	1-S2n	0.25	0.37	0.25	0.15	4.96	1.02
1.20 cfs	1.20 cfs	999.55	0.55	0.0*	1-S2n	0.28	0.41	0.28	0.17	5.28	1.10
1.55 cfs	1.55 cfs	999.63	0.63	0.0*	1-S2n	0.32	0.47	0.32	0.20	5.69	1.21

1.90 cfs	1.90 cfs	999.71	0.71	0.0*	1-S2n	0.35	0.52	0.35	0.23	6.03	1.30
2.25 cfs	2.25 cfs	999.78	0.78	0.0*	1-S2n	0.38	0.57	0.38	0.25	6.32	1.39
2.60 cfs	2.60 cfs	999.86	0.86	0.0*	1-S2n	0.41	0.61	0.41	0.27	6.60	1.46
2.95 cfs	2.95 cfs	999.93	0.93	0.0*	1-S2n	0.44	0.65	0.44	0.29	6.85	1.53
3.30 cfs	3.30 cfs	999.99	0.99	0.0*	1-S2n	0.47	0.69	0.47	0.31	7.06	1.59
3.65 cfs	3.65 cfs	1000.06	1.06	0.0*	1-S2n	0.49	0.73	0.49	0.33	7.20	1.65
4.00 cfs	4.00 cfs	1000.12	1.12	0.0*	1-S2n	0.51	0.77	0.51	0.35	7.46	1.70

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

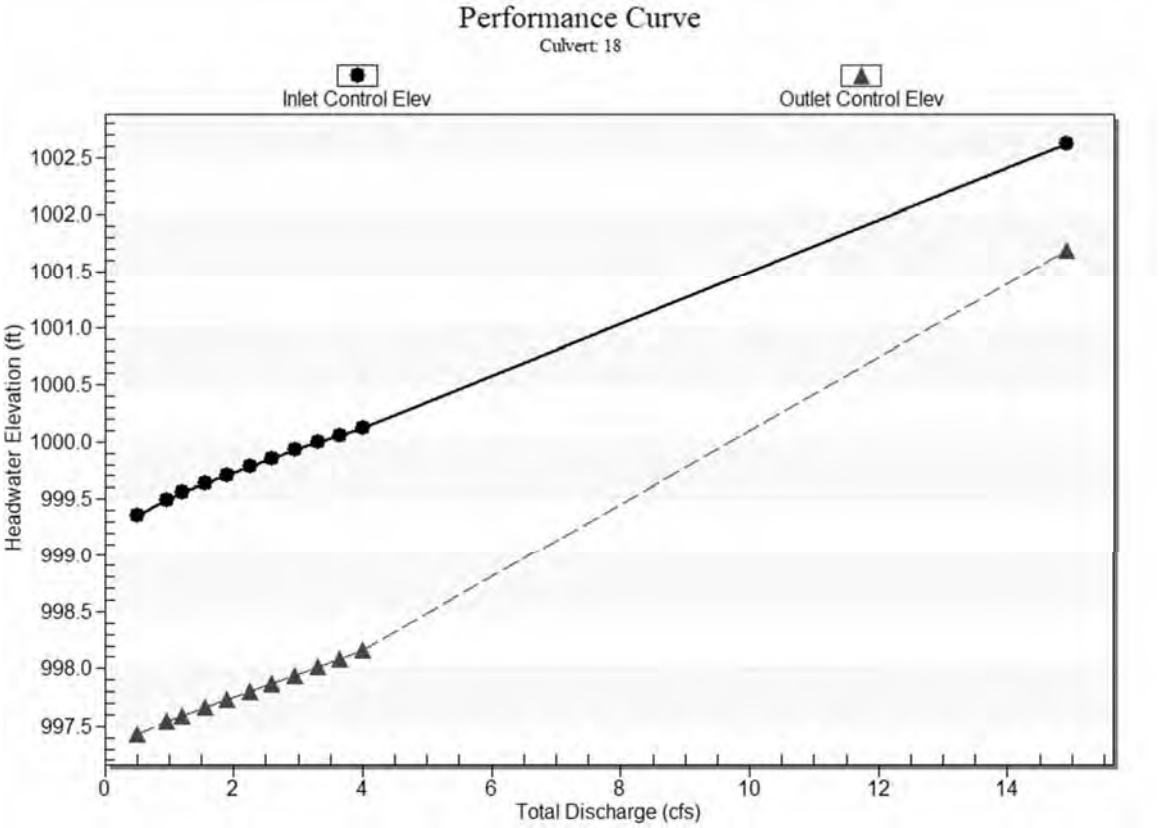
Inlet Elevation (invert): 999.00 ft,

Outlet Elevation (invert): 997.16 ft

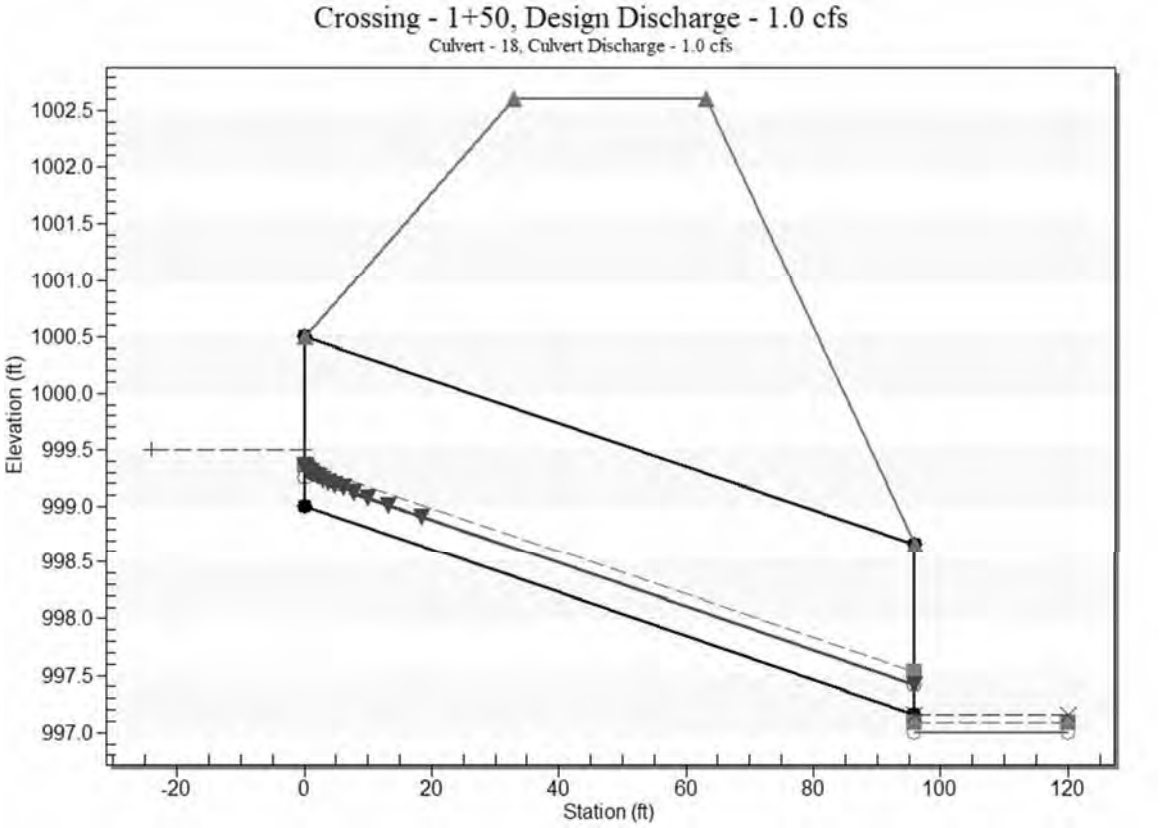
Culvert Length: 96.02 ft,

Culvert Slope: 0.0192

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 999.00 ft

Outlet Station: 96.00 ft

Outlet Elevation: 997.16 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 1+50

Table 3 - Downstream Channel Rating Curve (Crossing: 1+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.50	997.10	0.10	0.79	0.06	0.44
0.97	997.15	0.15	1.02	0.09	0.47
1.20	997.17	0.17	1.10	0.11	0.48
1.55	997.20	0.20	1.21	0.12	0.49
1.90	997.23	0.23	1.30	0.14	0.50
2.25	997.25	0.25	1.39	0.16	0.51
2.60	997.27	0.27	1.46	0.17	0.51
2.95	997.29	0.29	1.53	0.18	0.52
3.30	997.31	0.31	1.59	0.20	0.52
3.65	997.33	0.33	1.65	0.21	0.53
4.00	997.35	0.35	1.70	0.22	0.53

Tailwater Channel Data - 1+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 997.00 ft

Roadway Data for Crossing: 1+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 ft

Crest Elevation: 1002.60 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

STA 15+33
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

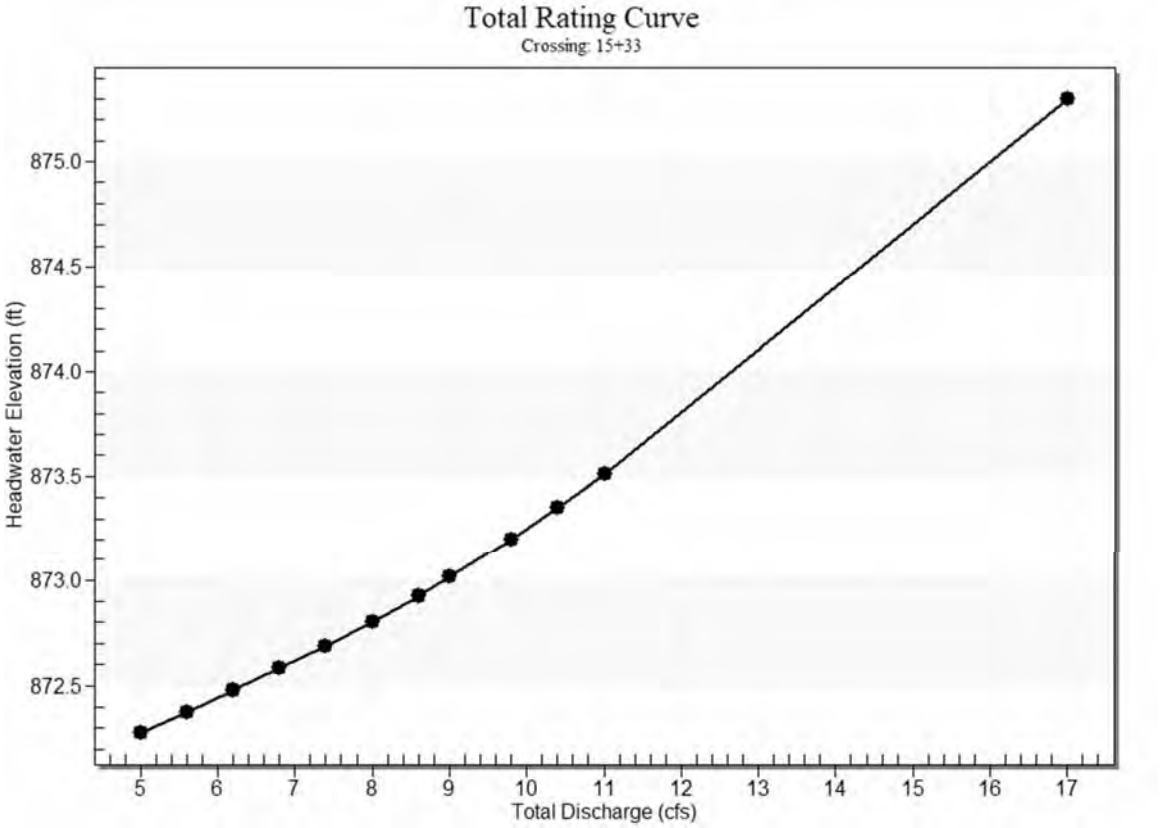
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 15+33

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
872.28	5.00	5.00	0.00	1
872.38	5.60	5.60	0.00	1
872.48	6.20	6.20	0.00	1
872.58	6.80	6.80	0.00	1
872.69	7.40	7.40	0.00	1
872.80	8.00	8.00	0.00	1
872.93	8.60	8.60	0.00	1
873.01	9.00	9.00	0.00	1
873.20	9.80	9.80	0.00	1
873.35	10.40	10.40	0.00	1
873.51	11.00	11.00	0.00	1
875.23	15.98	15.98	0.00	Overtopping

Rating Curve Plot for Crossing: 15+33



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	872.28	1.28	0.0*	1-S2n	0.52	0.86	0.54	0.21	8.68	2.73
5.60 cfs	5.60 cfs	872.38	1.38	0.0*	1-S2n	0.55	0.91	0.58	0.22	8.90	2.84
6.20 cfs	6.20 cfs	872.48	1.48	0.079	1-S2n	0.58	0.96	0.62	0.24	9.09	2.95
6.80 cfs	6.80 cfs	872.58	1.58	0.210	5-S2n	0.61	1.01	0.65	0.25	9.28	3.05

7.40 cfs	7.40 cfs	872.69	1.69	0.347	5-S2n	0.64	1.05	0.68	0.26	9.45	3.14
8.00 cfs	8.00 cfs	872.80	1.80	0.489	5-S2n	0.67	1.10	0.72	0.27	9.61	3.22
8.60 cfs	8.60 cfs	872.93	1.93	0.819	5-S2n	0.70	1.14	0.75	0.28	9.76	3.31
9.00 cfs	9.00 cfs	873.01	2.01	0.908	5-S2n	0.71	1.16	0.77	0.29	9.86	3.36
9.80 cfs	9.80 cfs	873.20	2.20	1.095	5-S2n	0.75	1.21	0.81	0.31	10.04	3.46
10.40 cfs	10.40 cfs	873.35	2.35	1.242	5-S2n	0.78	1.24	0.84	0.32	10.18	3.53
11.00 cfs	11.00 cfs	873.51	2.51	1.396	5-S2n	0.80	1.27	0.87	0.33	10.31	3.60

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

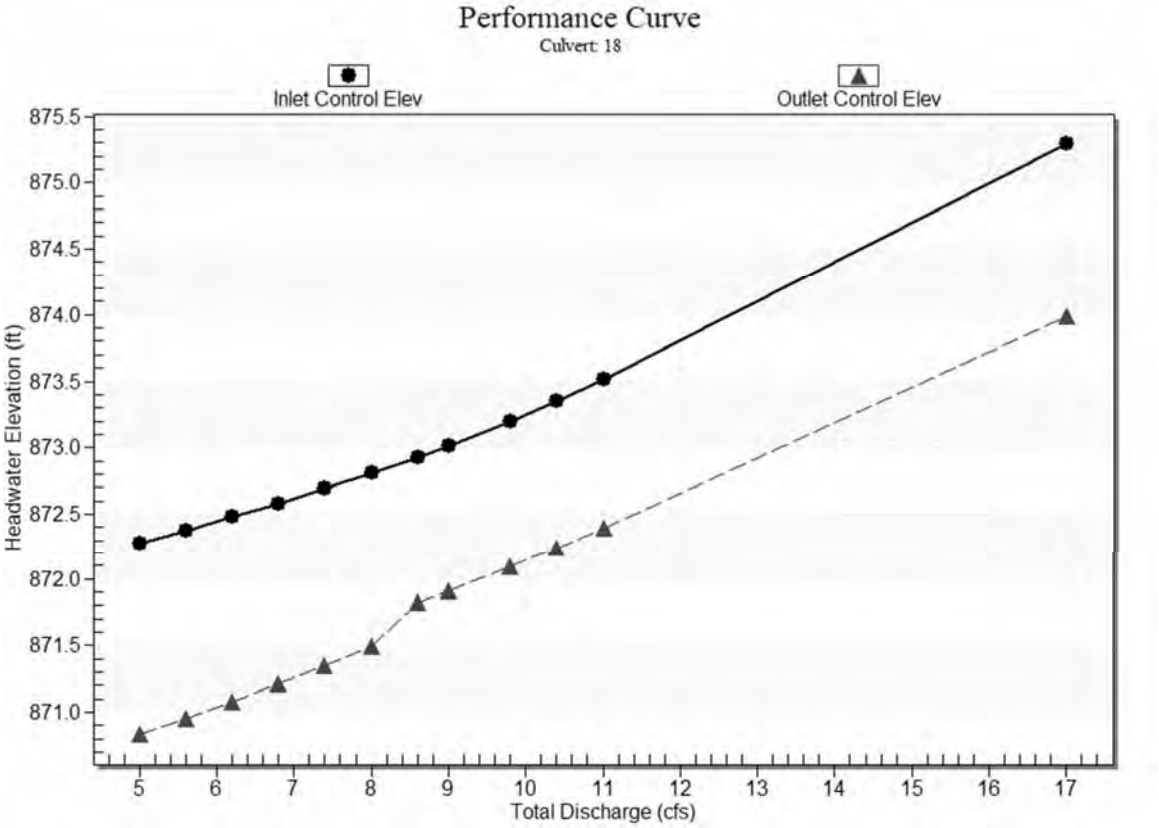
Inlet Elevation (invert): 871.00 ft,

Outlet Elevation (invert): 869.70 ft

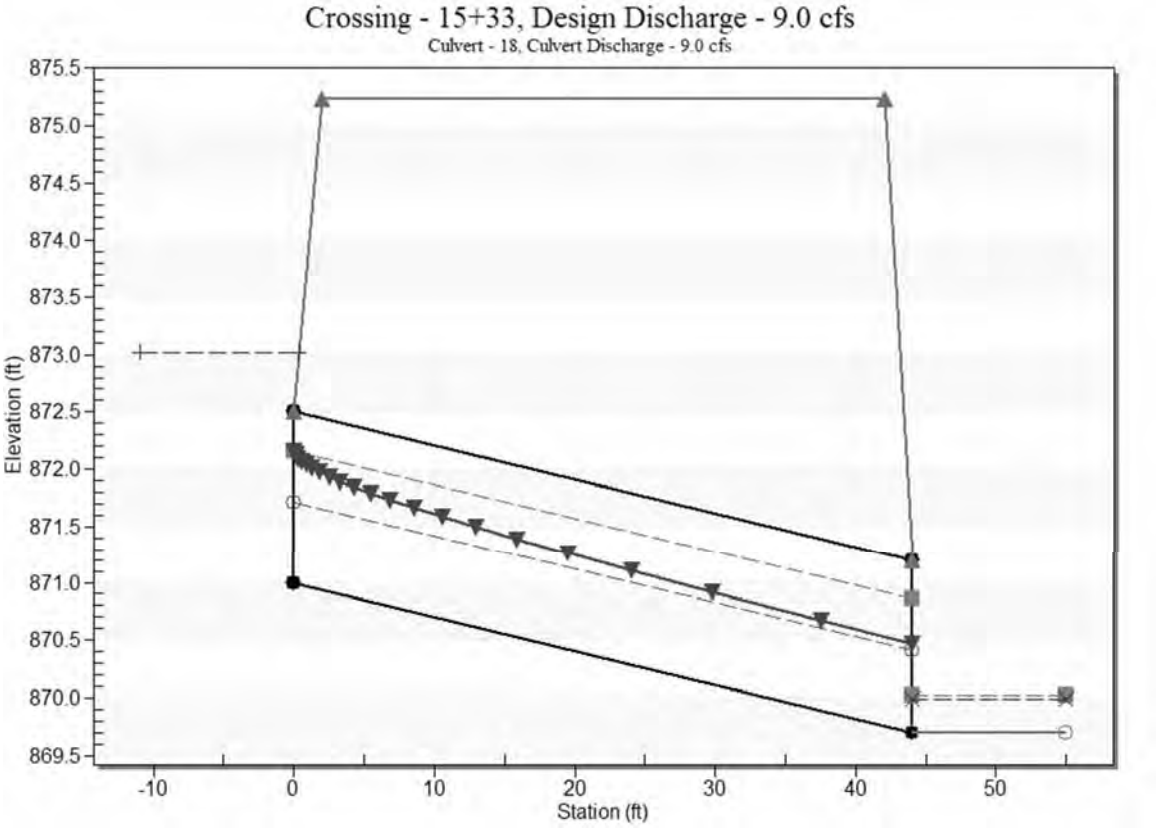
Culvert Length: 44.02 ft,

Culvert Slope: 0.0295

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.00 ft

Outlet Station: 44.00 ft

Outlet Elevation: 869.70 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 15+33

Table 3 - Downstream Channel Rating Curve (Crossing: 15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.91	0.21	2.73	0.65	1.11
5.60	869.92	0.22	2.84	0.69	1.12
6.20	869.94	0.24	2.95	0.73	1.13
6.80	869.95	0.25	3.05	0.77	1.14
7.40	869.96	0.26	3.14	0.81	1.14
8.00	869.97	0.27	3.22	0.85	1.15
8.60	869.98	0.28	3.31	0.89	1.16
9.00	869.99	0.29	3.36	0.91	1.16
9.80	870.01	0.31	3.46	0.96	1.17
10.40	870.02	0.32	3.53	0.99	1.18
11.00	870.03	0.33	3.60	1.02	1.18

Tailwater Channel Data - 15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.70 ft

Roadway Data for Crossing: 15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 875.23 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Sta. 43+76 (Split Flow w/ 46+65) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

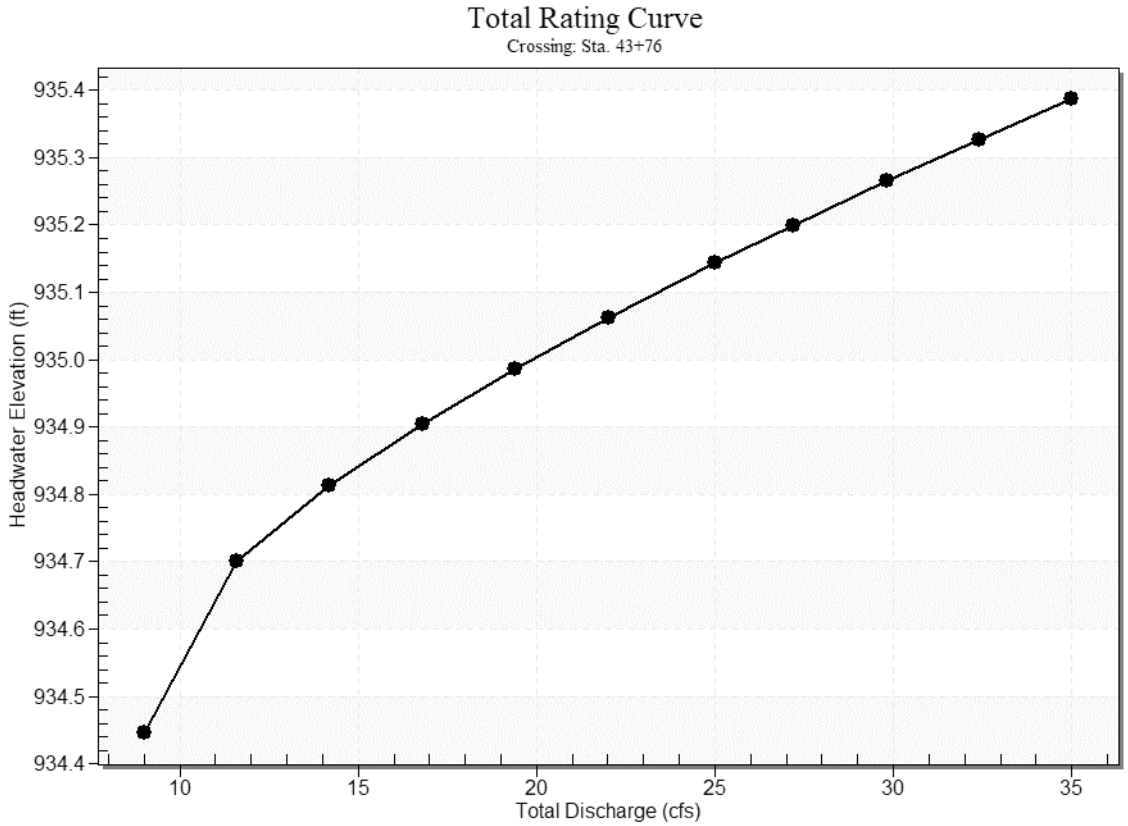
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.45	9.00	9.00	0.00	1
934.70	11.60	9.83	1.74	8
934.81	14.20	10.18	4.01	6
934.90	16.80	10.45	6.33	5
934.99	19.40	10.69	8.69	4
935.06	22.00	10.90	11.08	4
935.14	25.00	11.13	13.86	4
935.20	27.20	11.28	15.88	3
935.26	29.80	11.46	18.31	3
935.33	32.40	11.63	20.76	3
935.39	35.00	11.78	23.21	3
934.55	9.35	9.35	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 43+76



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	9.00 cfs	934.45	1.95	0.819	5-S2n	0.59	0.89	0.61	0.27	9.00	1.44
11.60 cfs	9.83 cfs	934.70	2.20	1.106	5-S2n	0.62	0.91	0.65	0.31	9.17	1.58
14.20 cfs	10.18 cfs	934.81	2.31	1.230	5-S2n	0.64	0.92	0.66	0.35	9.25	1.69
16.80 cfs	10.45 cfs	934.90	2.40	1.332	5-S2n	0.65	0.93	0.67	0.38	9.31	1.79

19.40 cfs	10.69 cfs	934.99	2.49	1.422	5-S2n	0.66	0.93	0.68	0.42	9.34	1.88
22.00 cfs	10.90 cfs	935.06	2.56	1.505	5-S2n	0.67	0.94	0.69	0.45	9.38	1.96
25.00 cfs	11.13 cfs	935.14	2.64	1.596	5-S2n	0.68	0.94	0.70	0.48	9.43	2.05
27.20 cfs	11.28 cfs	935.20	2.70	1.657	5-S2n	0.69	0.94	0.71	0.50	9.45	2.11
29.80 cfs	11.46 cfs	935.26	2.76	1.728	5-S2n	0.69	0.95	0.72	0.53	9.48	2.17
32.40 cfs	11.63 cfs	935.33	2.83	1.797	5-S2n	0.70	0.95	0.73	0.56	9.51	2.23
35.00 cfs	11.78 cfs	935.39	2.89	1.862	5-S2n	0.71	0.95	0.73	0.58	9.53	2.29

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

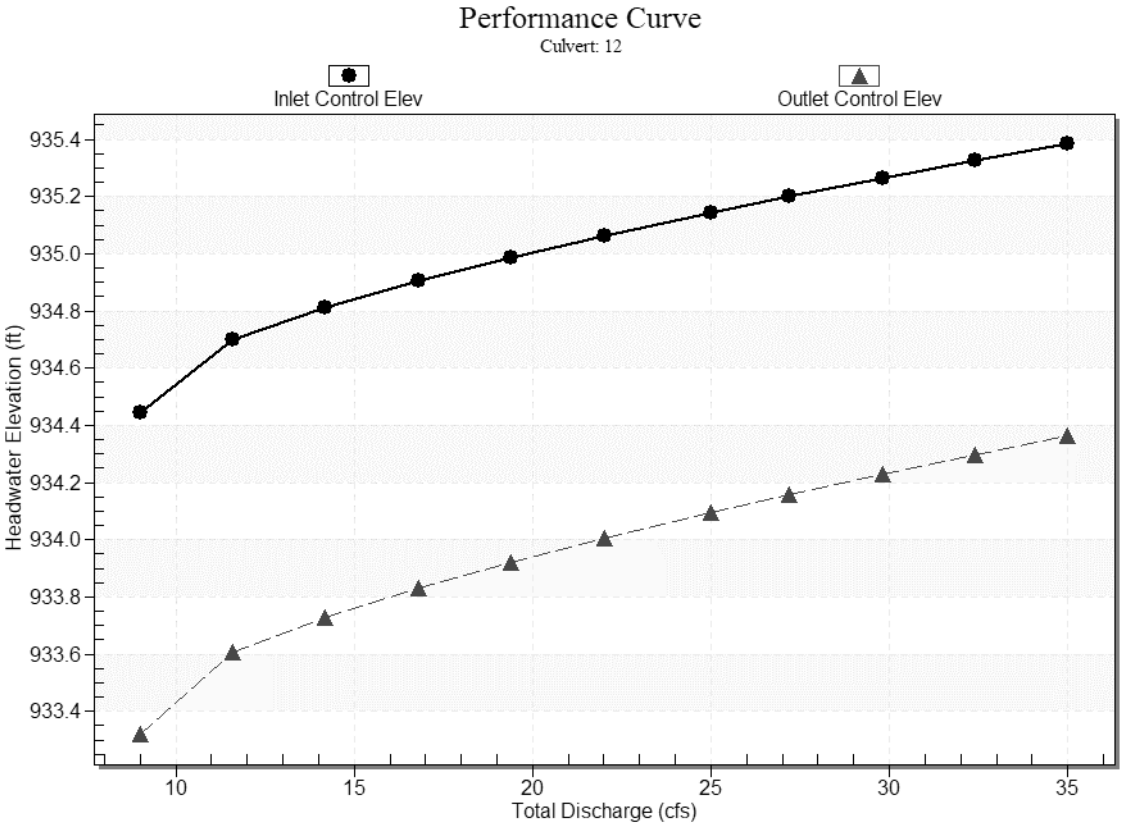
Inlet Elevation (invert): 932.50 ft,

Outlet Elevation (invert): 930.96 ft

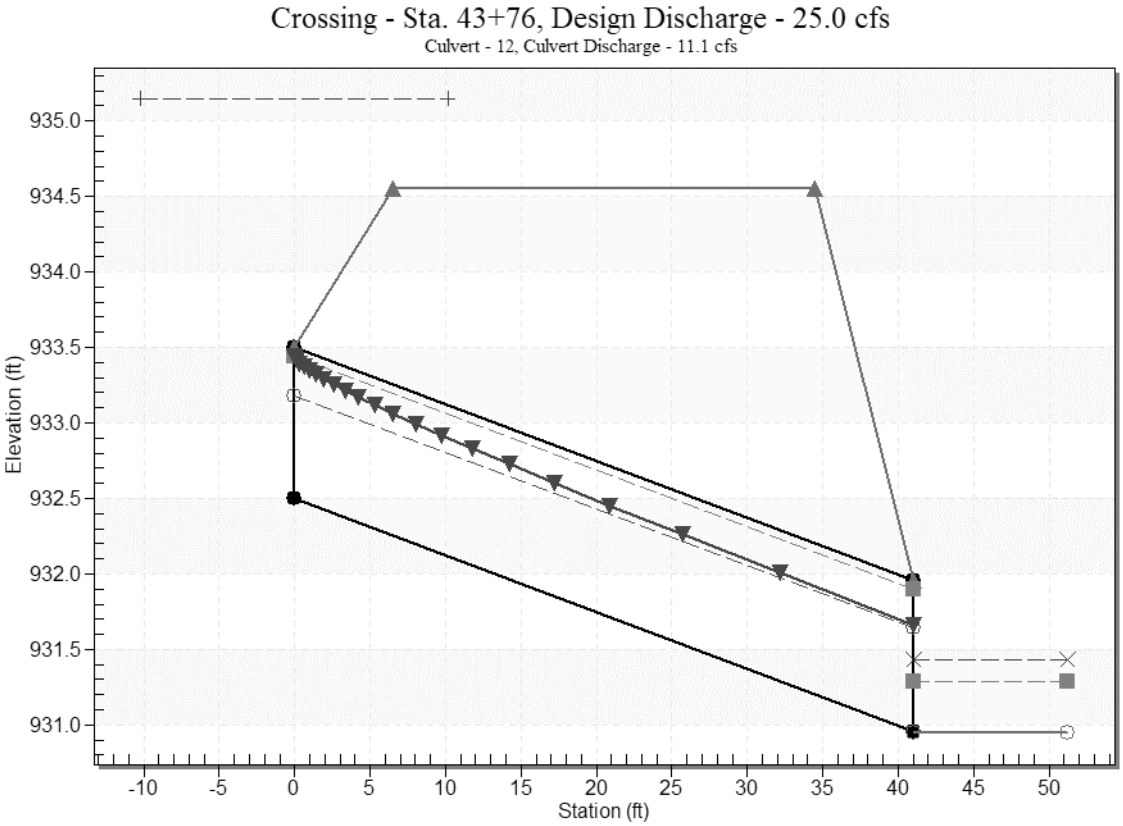
Culvert Length: 41.03 ft,

Culvert Slope: 0.0376

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 932.50 ft

Outlet Station: 41.00 ft

Outlet Elevation: 930.96 ft

Number of Barrels: 2

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.22	0.27	1.44	0.17	0.52
11.60	931.26	0.31	1.58	0.19	0.53
14.20	931.30	0.35	1.69	0.22	0.54
16.80	931.33	0.38	1.79	0.24	0.55
19.40	931.37	0.42	1.88	0.26	0.55
22.00	931.40	0.45	1.96	0.28	0.56
25.00	931.43	0.48	2.05	0.30	0.56
27.20	931.45	0.50	2.11	0.32	0.57
29.80	931.48	0.53	2.17	0.33	0.57
32.40	931.51	0.56	2.23	0.35	0.58
35.00	931.53	0.58	2.29	0.36	0.58

Tailwater Channel Data - Sta. 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 930.95 ft

Roadway Data for Crossing: Sta. 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 934.55 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Sta 46+65 (Split Flow w/ Sta 43+76) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

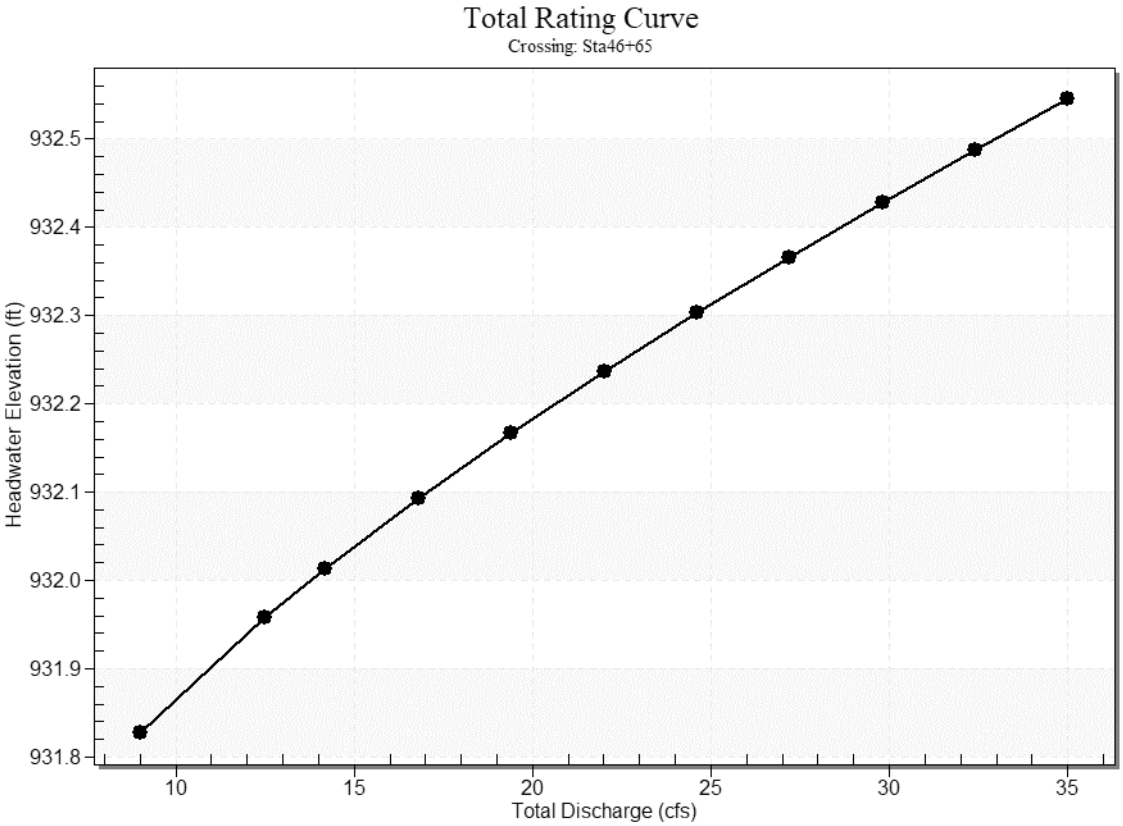
Design Flow: 12.50 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta46+65

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
931.83	9.00	5.29	3.68	9
931.96	12.50	5.48	7.00	5
932.01	14.20	5.55	8.62	4
932.09	16.80	5.66	11.12	4
932.17	19.40	5.76	13.63	4
932.24	22.00	5.86	16.14	4
932.30	24.60	5.94	18.63	3
932.37	27.20	6.02	21.16	3
932.43	29.80	6.10	23.69	3
932.49	32.40	6.17	26.22	3
932.55	35.00	6.24	28.76	3
931.58	4.92	4.92	0.00	Overtopping

Rating Curve Plot for Crossing: Sta46+65



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	5.29 cfs	931.83	2.43	0.0*	5-S2n	0.51	0.93	0.53	0.79	12.39	1.78
12.50 cfs	5.48 cfs	931.96	2.56	0.0*	5-S2n	0.52	0.94	0.55	0.94	12.49	1.96
14.20 cfs	5.55 cfs	932.01	2.61	0.0*	5-S2n	0.52	0.94	0.55	1.00	12.53	2.03
16.80 cfs	5.66 cfs	932.09	2.69	0.0*	5-S2n	0.53	0.95	0.56	1.09	12.59	2.12

19.40 cfs	5.76 cfs	932.17	2.77	0.083	5-S2n	0.54	0.95	0.56	1.17	12.65	2.21
22.00 cfs	5.86 cfs	932.24	2.84	0.233	5-S2n	0.54	0.95	0.57	1.24	12.70	2.28
24.60 cfs	5.94 cfs	932.30	2.90	0.374	5-S2n	0.55	0.95	0.57	1.32	12.75	2.35
27.20 cfs	6.02 cfs	932.37	2.97	0.509	5-S2n	0.55	0.95	0.58	1.38	12.79	2.42
29.80 cfs	6.10 cfs	932.43	3.03	0.638	5-S2n	0.55	0.94	0.58	1.44	12.79	2.48
32.40 cfs	6.17 cfs	932.49	3.09	0.759	5-S2n	0.56	0.92	0.59	1.50	12.85	2.53
35.00 cfs	6.24 cfs	932.55	3.15	0.875	5-S2n	0.56	0.92	0.59	1.56	12.88	2.59

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

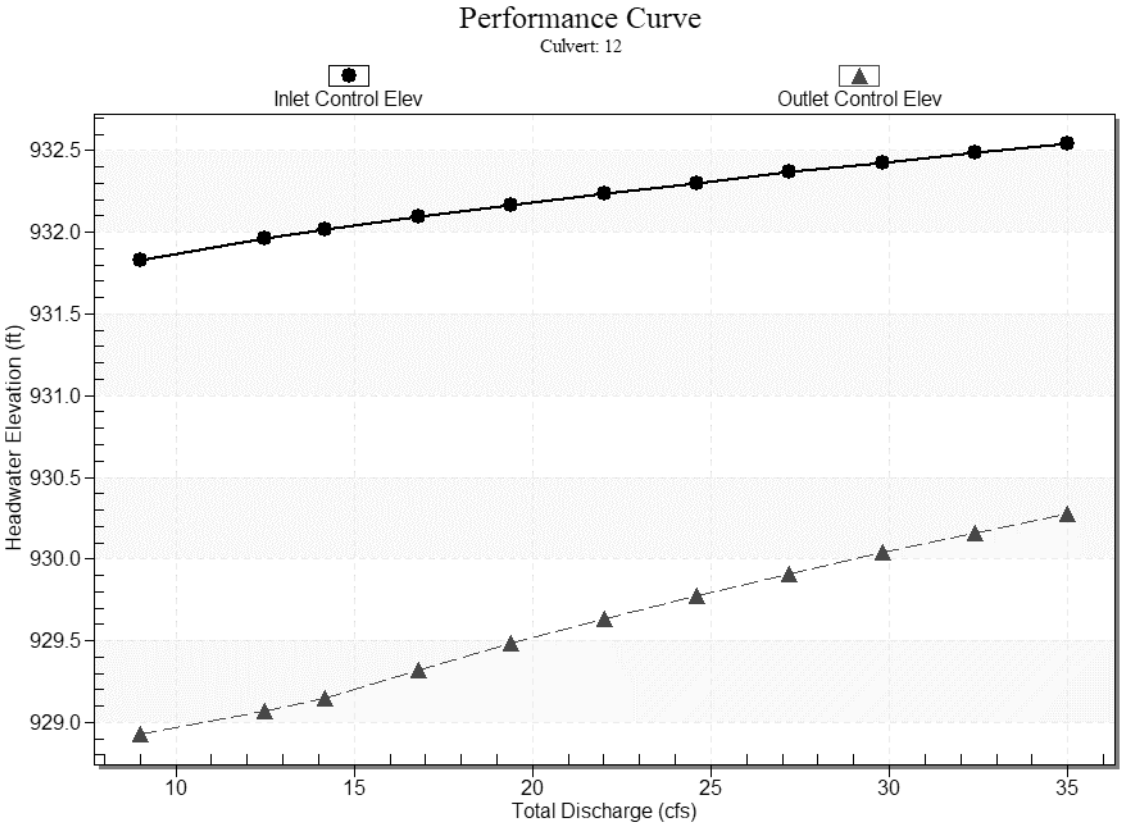
Inlet Elevation (invert): 929.40 ft,

Outlet Elevation (invert): 926.00 ft

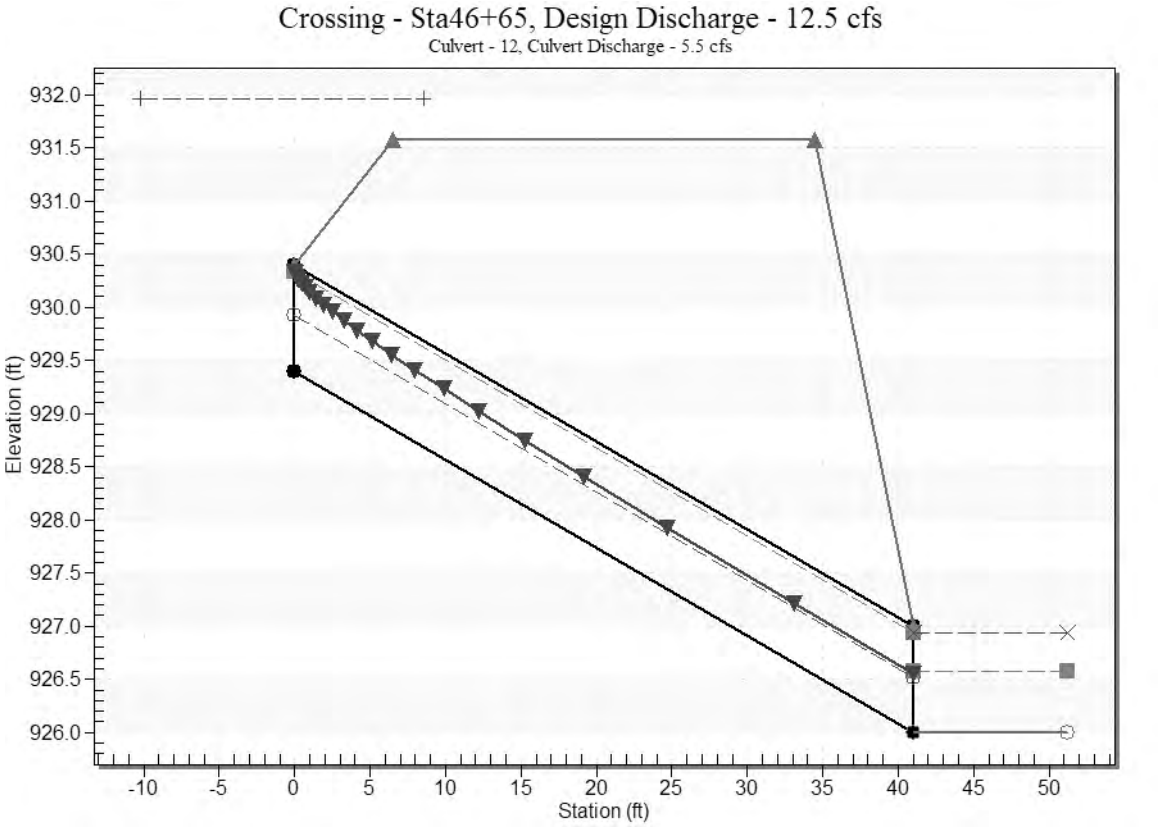
Culvert Length: 41.14 ft,

Culvert Slope: 0.0829

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 929.40 ft

Outlet Station: 41.00 ft

Outlet Elevation: 926.00 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta46+65

Table 3 - Downstream Channel Rating Curve (Crossing: Sta46+65)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	926.79	0.79	1.78	0.25	0.41
12.50	926.94	0.94	1.96	0.29	0.42
14.20	927.00	1.00	2.03	0.31	0.43
16.80	927.09	1.09	2.12	0.34	0.43
19.40	927.17	1.17	2.21	0.36	0.44
22.00	927.24	1.24	2.28	0.39	0.44
24.60	927.32	1.32	2.35	0.41	0.44
27.20	927.38	1.38	2.42	0.43	0.45
29.80	927.44	1.44	2.48	0.45	0.45
32.40	927.50	1.50	2.53	0.47	0.45
35.00	927.56	1.56	2.59	0.49	0.45

Tailwater Channel Data - Sta46+65

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0400

Channel Invert Elevation: 926.00 ft

Roadway Data for Crossing: Sta46+65

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 931.58 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Proposed STA 82+07
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

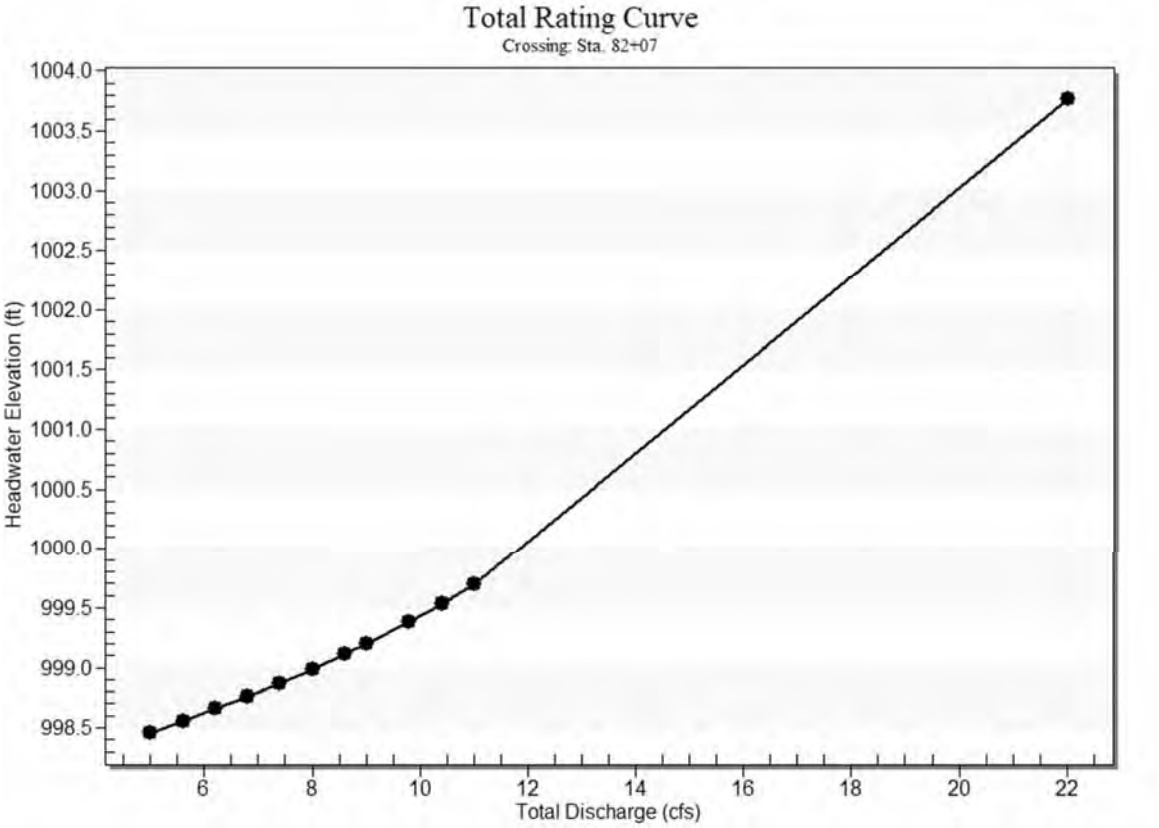
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
998.46	5.00	5.00	0.00	1
998.56	5.60	5.60	0.00	1
998.66	6.20	6.20	0.00	1
998.76	6.80	6.80	0.00	1
998.87	7.40	7.40	0.00	1
998.99	8.00	8.00	0.00	1
999.11	8.60	8.60	0.00	1
999.20	9.00	9.00	0.00	1
999.38	9.80	9.80	0.00	1
999.53	10.40	10.40	0.00	1
999.69	11.00	11.00	0.00	1
1003.70	20.61	20.61	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 82+07



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	998.46	1.29	0.549	1-S2n	0.64	0.86	0.66	0.10	6.70	2.00
5.60 cfs	5.60 cfs	998.56	1.39	0.670	1-S2n	0.68	0.91	0.70	0.11	6.89	2.09
6.20 cfs	6.20 cfs	998.66	1.49	0.796	1-S2n	0.72	0.96	0.75	0.11	7.06	2.18
6.80 cfs	6.80 cfs	998.76	1.59	0.927	5-S2n	0.76	1.01	0.79	0.12	7.22	2.26

7.40 cfs	7.40 cfs	998.87	1.70	1.063	5-S2n	0.80	1.05	0.83	0.13	7.37	2.34
8.00 cfs	8.00 cfs	998.99	1.82	1.204	5-S2n	0.84	1.10	0.87	0.13	7.51	2.41
8.60 cfs	8.60 cfs	999.11	1.94	1.534	5-S2n	0.88	1.14	0.91	0.14	7.64	2.48
9.00 cfs	9.00 cfs	999.20	2.03	1.622	5-S2n	0.91	1.16	0.94	0.14	7.72	2.52
9.80 cfs	9.80 cfs	999.38	2.21	1.807	5-S2n	0.96	1.21	0.99	0.15	7.88	2.61
10.40 cfs	10.40 cfs	999.53	2.36	1.954	5-S2n	1.00	1.24	1.03	0.15	8.00	2.67
11.00 cfs	11.00 cfs	999.69	2.52	2.107	5-S2n	1.04	1.27	1.08	0.16	8.10	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

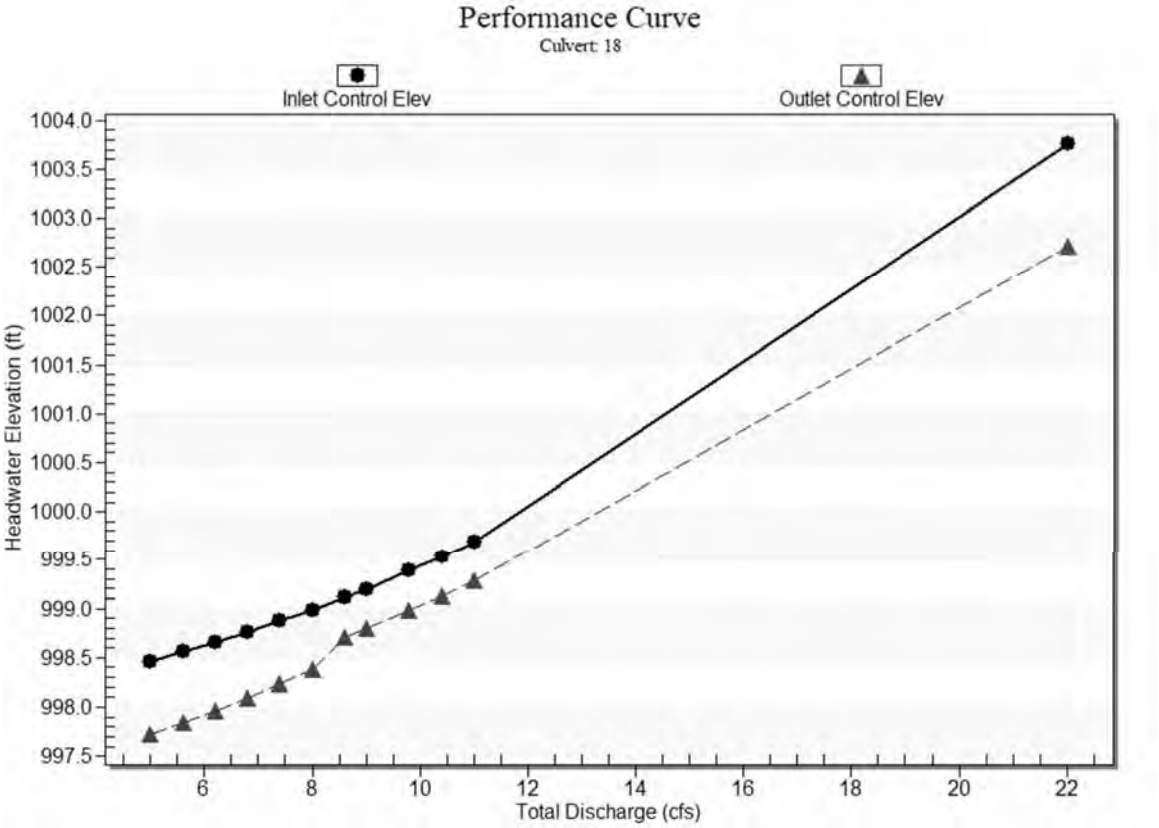
Inlet Elevation (invert): 997.17 ft,

Outlet Elevation (invert): 996.59 ft

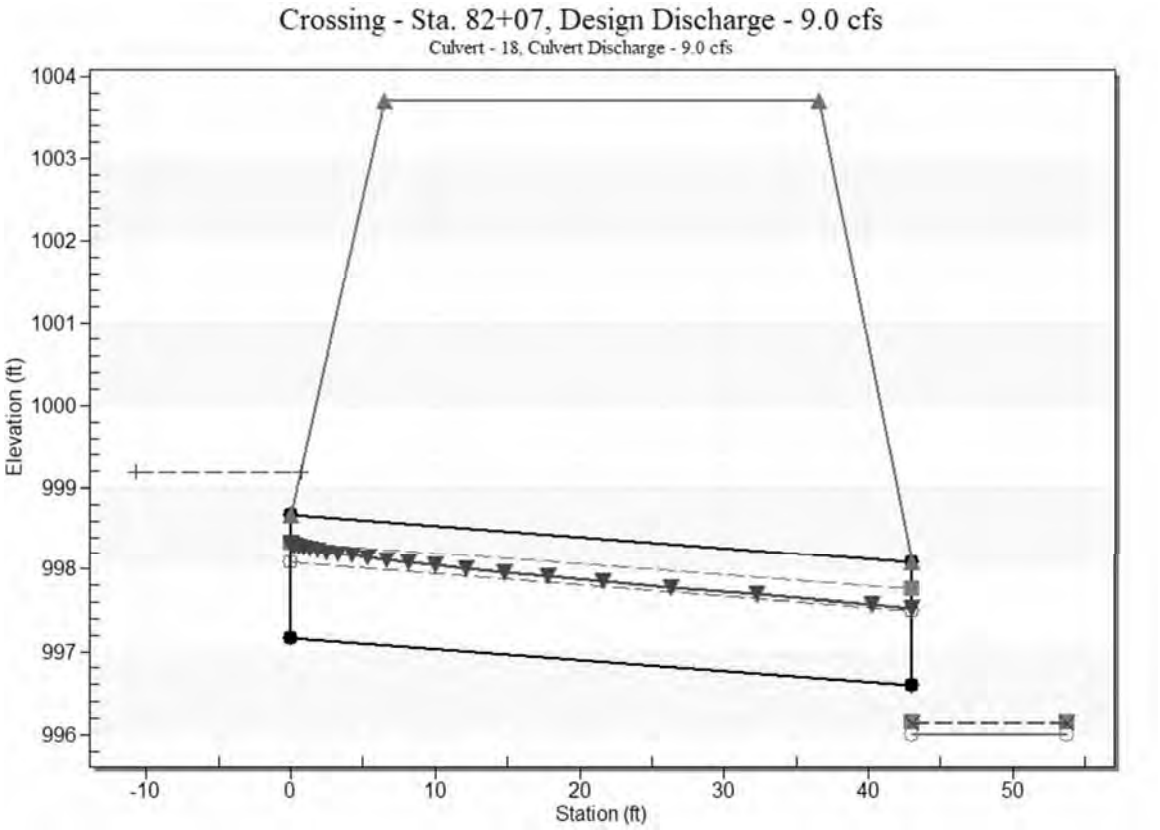
Culvert Length: 43.00 ft,

Culvert Slope: 0.0135

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 997.17 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.59 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - Sta. 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: Sta. 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 25.00 ft

Crest Elevation: 1003.70 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

APPENDIX E

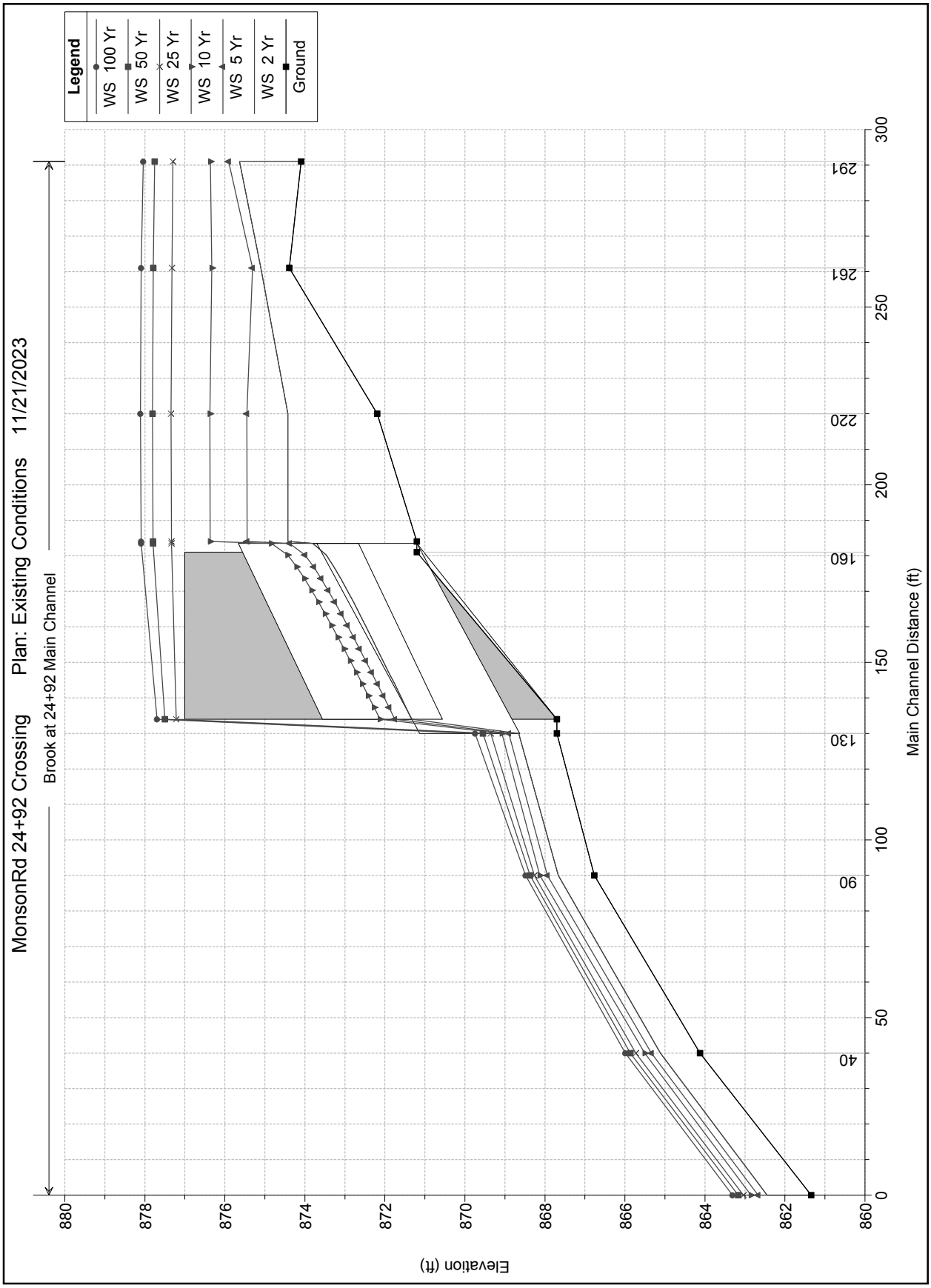
HEC-RAS

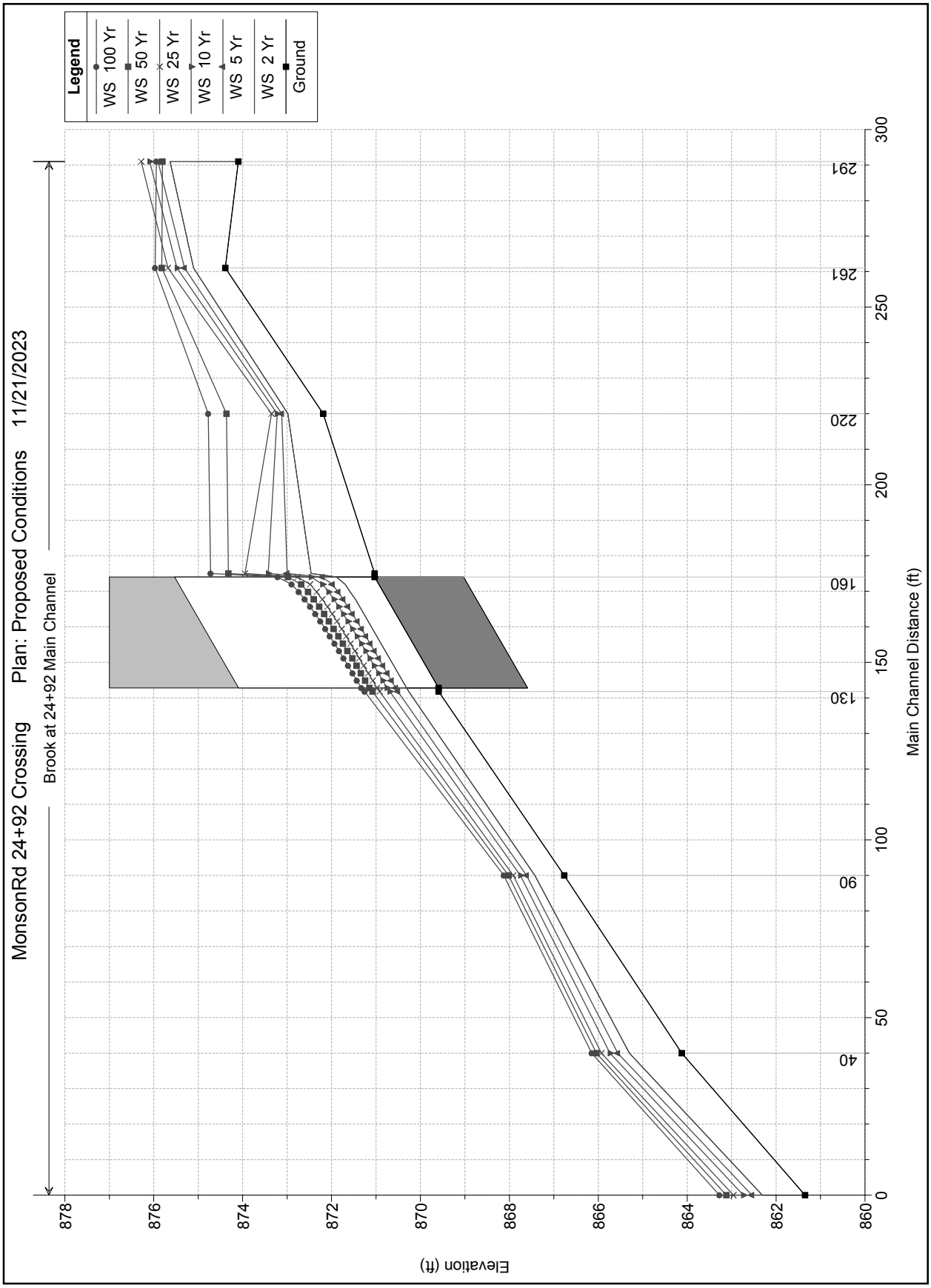
HEC-RAS Computed Results for crossing 24+92 proposed

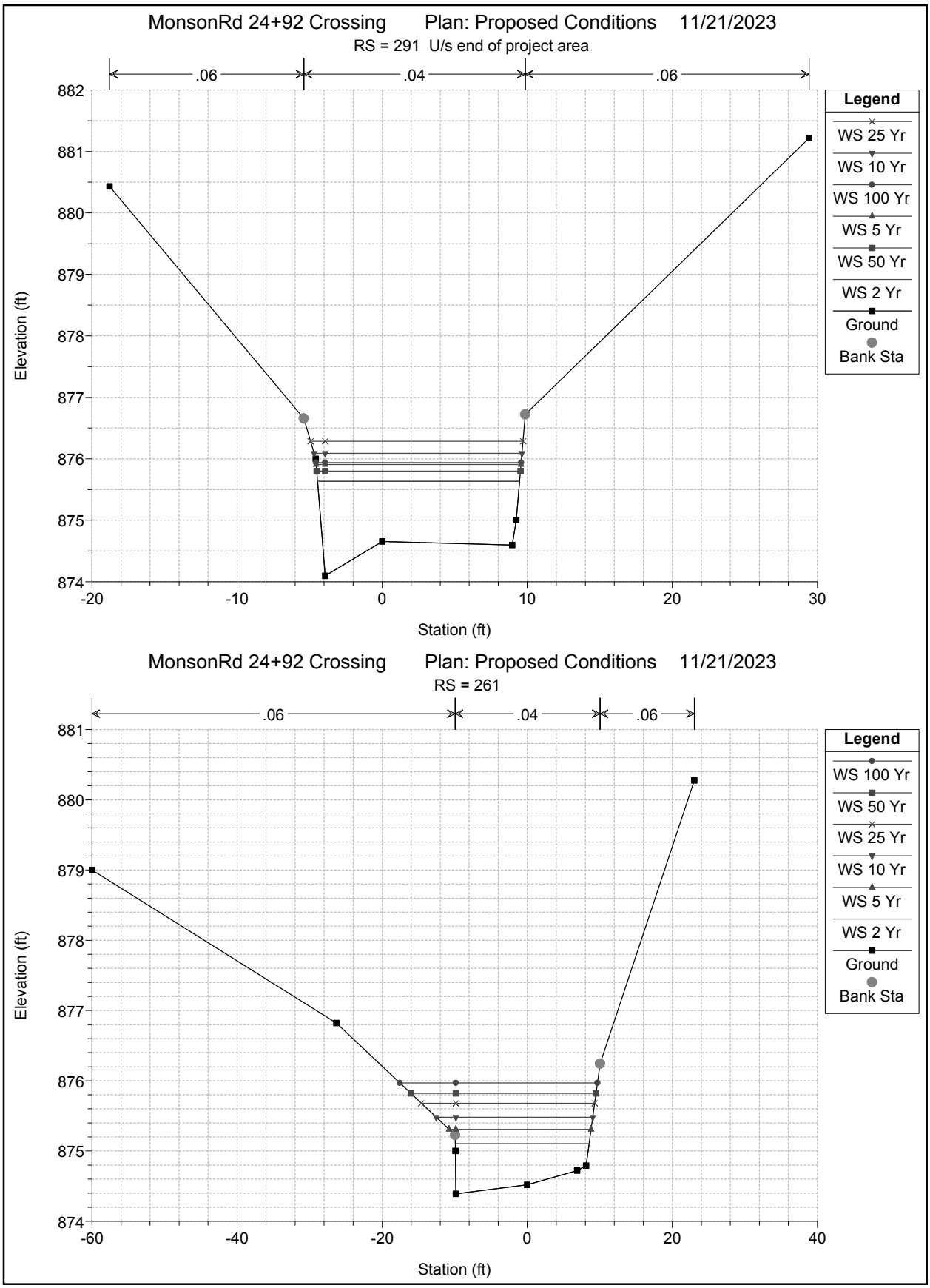
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

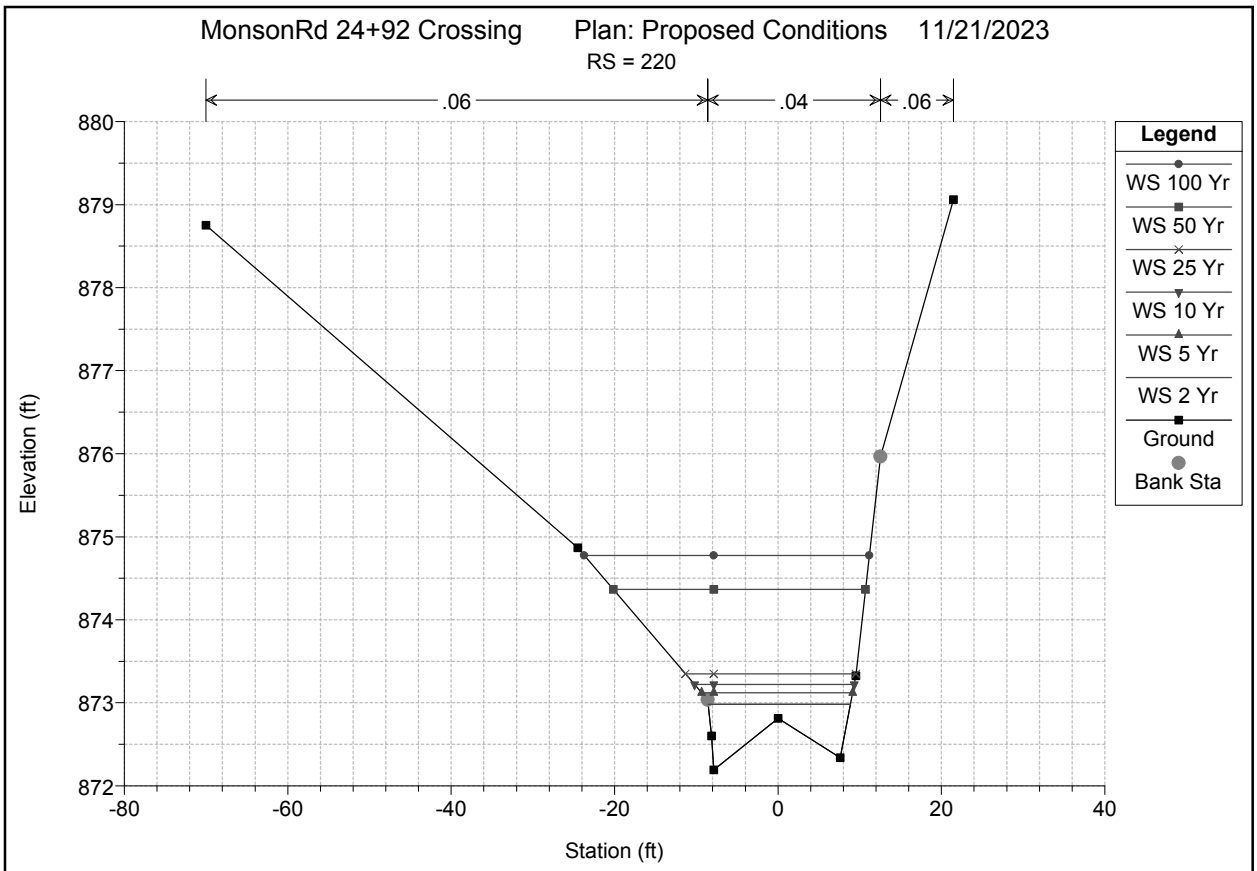
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	5.23
DESIGN FLOOD ELEVATION (FEET,NAVD)	876.1

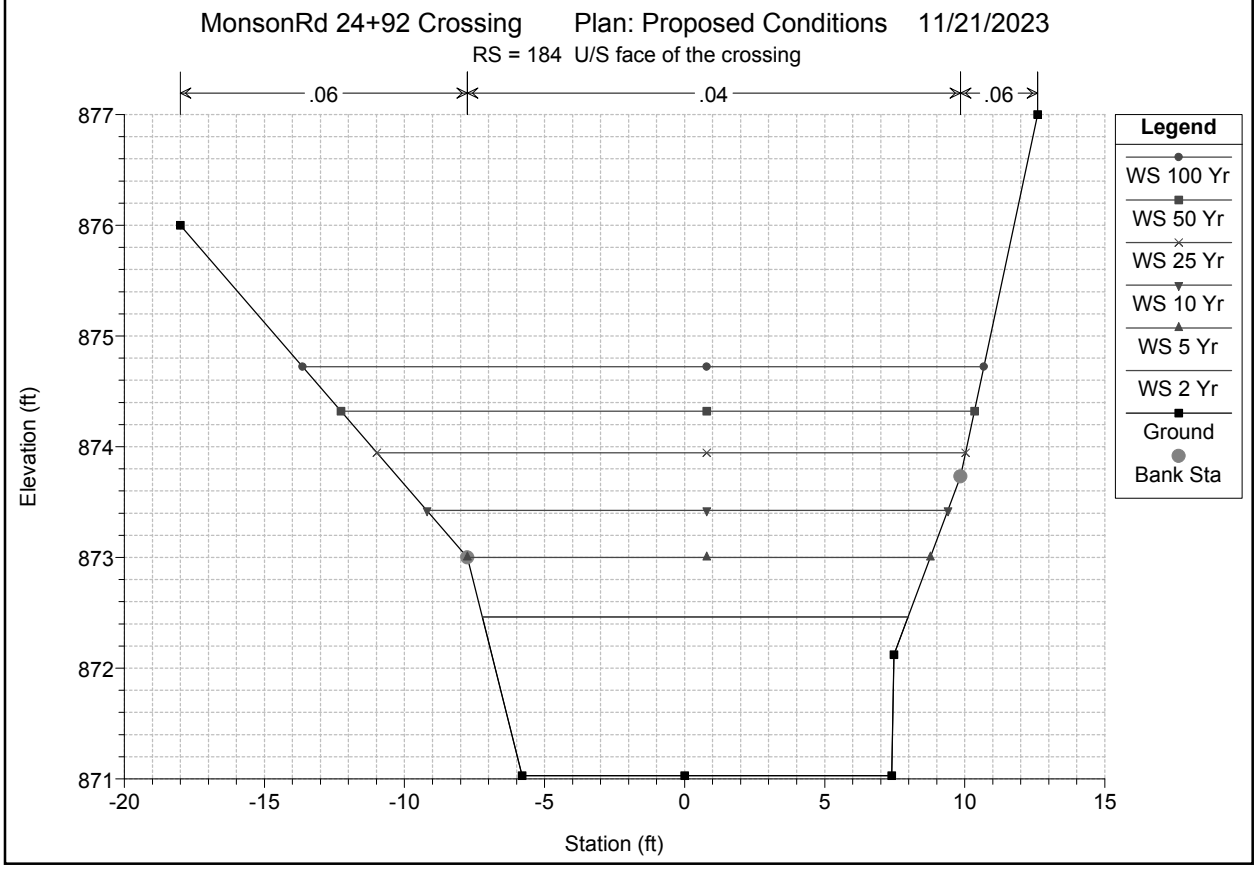
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	31.21	9.5	6.5	871.03	869.59

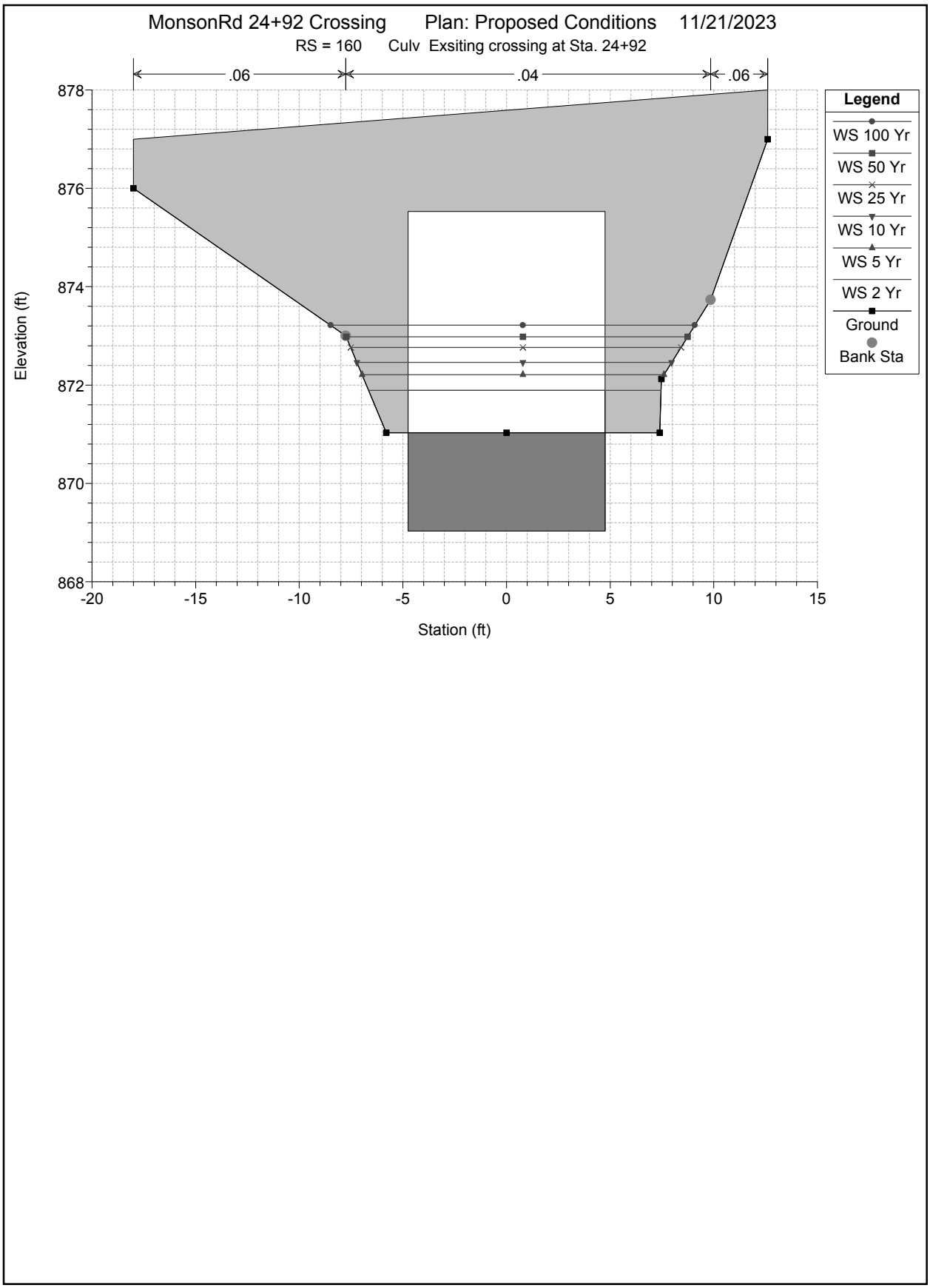

MonsonRd 24+92 Crossing
Plan: Existing Conditions 11/21/2023
Brook at 24+92 Main Channel
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
880
878
876
874
872
870
868
866
864
862
860
0
40
50
90
100
130
150
160
200
220
250
261
291
300

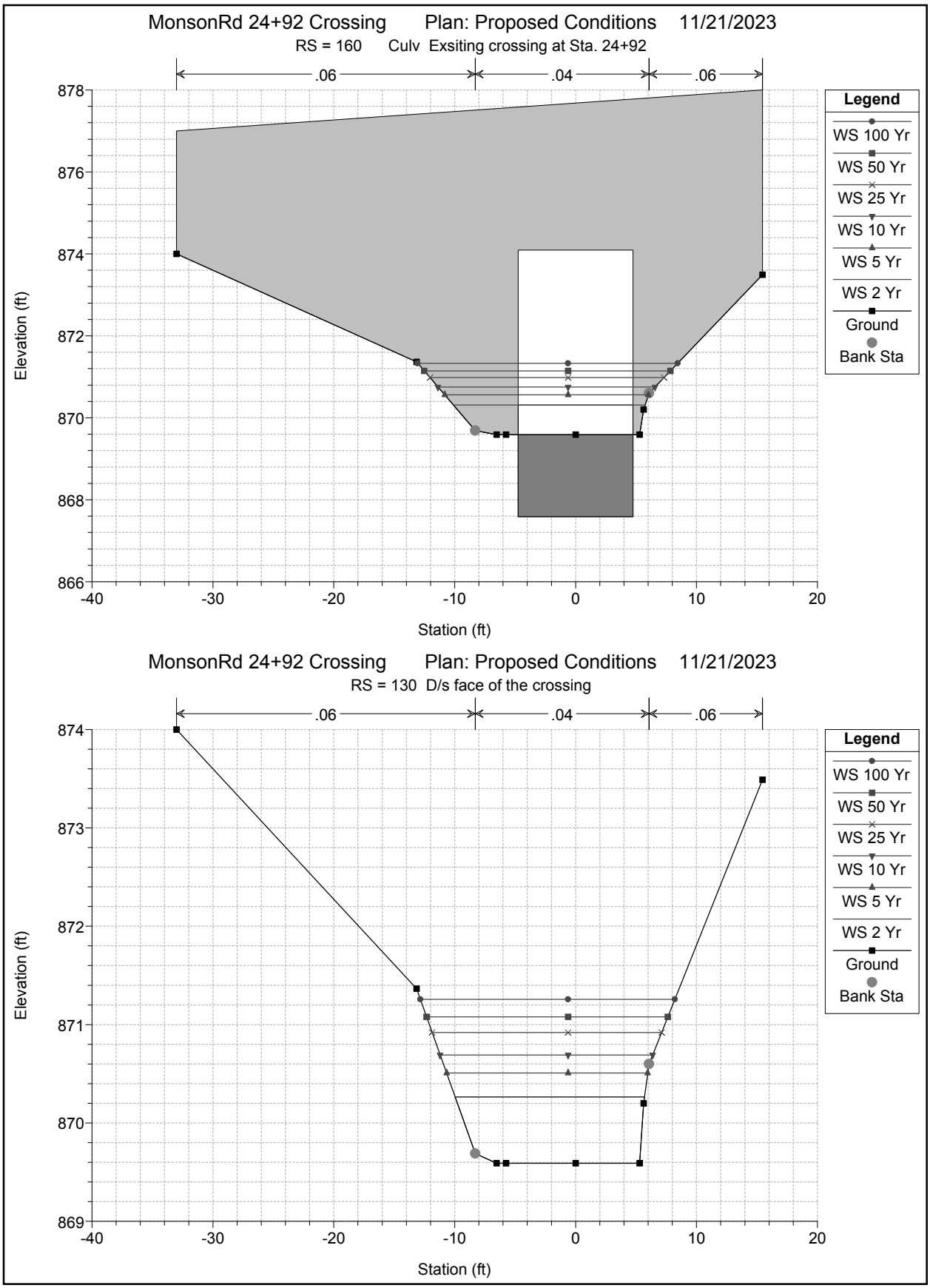

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
Brook at 24+92 Main Channel
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
878
876
874
872
870
868
866
864
862
860
0
40
50
90
100
130
150
160
200
220
250
261
291
300

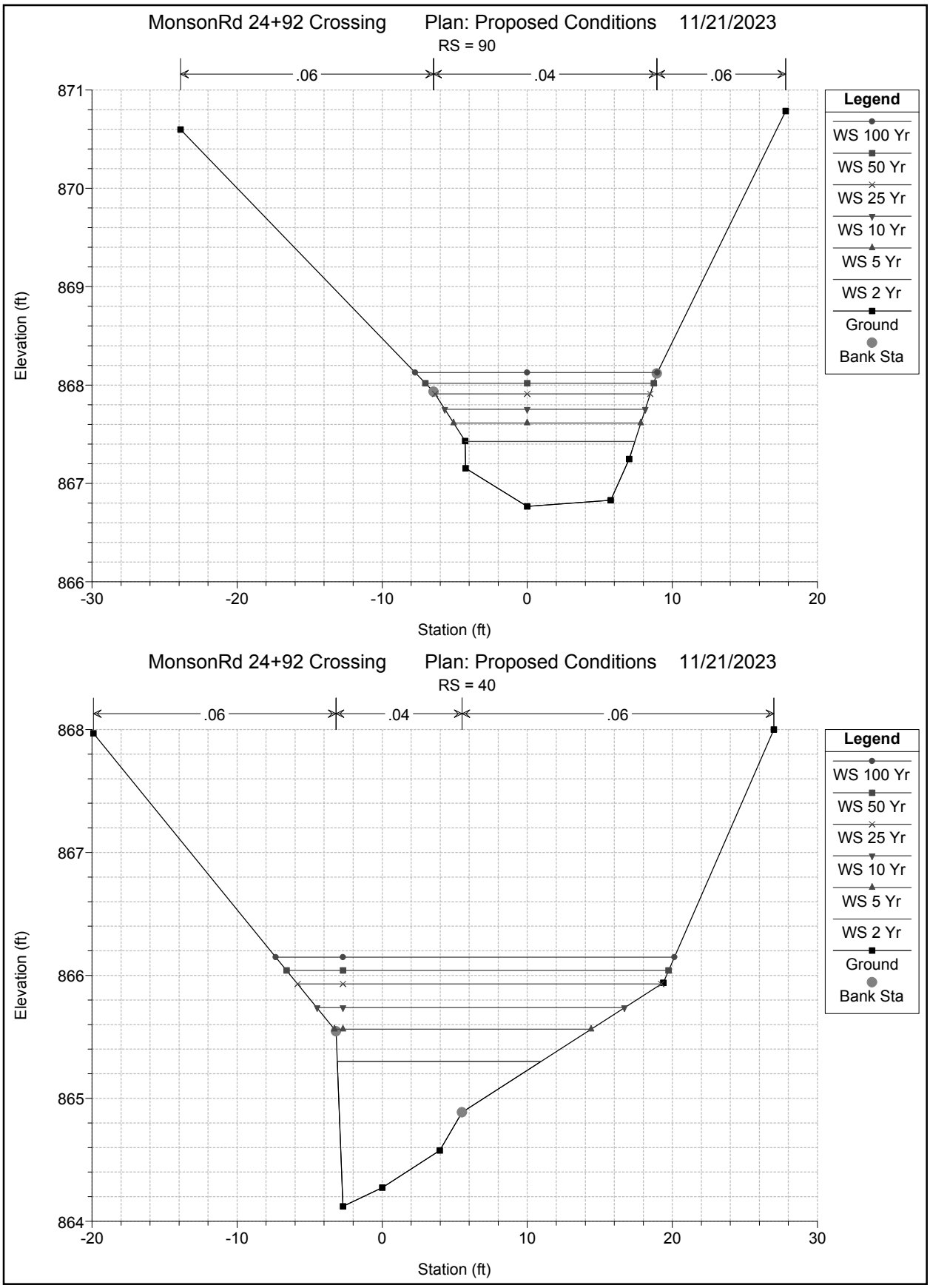

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 291 U/s end of project area
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 25 Yr
WS 10 Yr
WS 100 Yr
WS 5 Yr
WS 50 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 261
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta

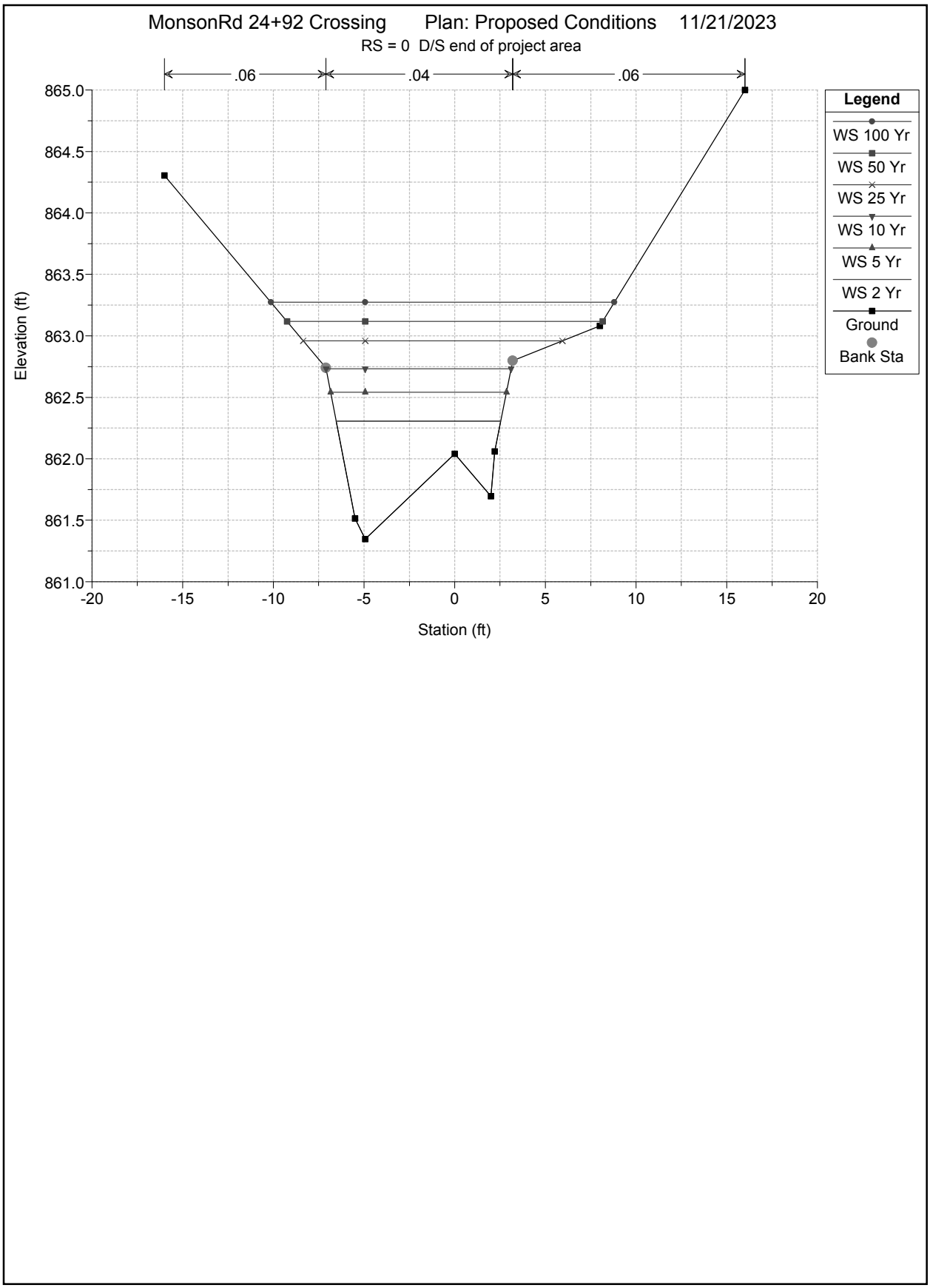

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 220
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 184 U/S face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 160 Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
878
876
874
872
870
868
Elevation (ft)
-20
-15
-10
-5
0
5
10
15
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 160 Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 130 D/s face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 90
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 40
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Elevation (ft)
Station (ft)
865.0
864.5
864.0
863.5
863.0
862.5
862.0
861.5
861.0
-20
-15
-10
-5
0
5
10
15
20
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006791	2.93	14.70	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008508	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.36	875.68	876.57	0.006020	3.67	25.08	14.77	0.50
Main Channel	291	25 Yr	123.00	874.10	877.30	875.92	877.45	0.002536	3.11	40.73	20.05	0.34
Main Channel	291	50 Yr	147.00	874.10	877.75	876.10	877.90	0.002041	3.11	50.68	23.65	0.32
Main Channel	291	100 Yr	174.00	874.10	878.04	876.28	878.21	0.002053	3.32	57.84	25.93	0.32
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	876.33		876.43	0.002553	2.56	40.10	31.59	0.35
Main Channel	261	25 Yr	123.00	874.39	877.32		877.38	0.000818	1.97	78.88	47.62	0.21
Main Channel	261	50 Yr	147.00	874.39	877.79		877.84	0.000619	1.91	103.13	56.34	0.19
Main Channel	261	100 Yr	174.00	874.39	878.09		878.14	0.000598	2.00	120.89	61.94	0.19
Main Channel	220	2 Yr	43.00	872.19	874.43	873.12	874.45	0.000483	1.15	42.65	31.46	0.15
Main Channel	220	5 Yr	69.00	872.19	875.45	873.35	875.46	0.000244	1.06	80.46	43.27	0.12
Main Channel	220	10 Yr	92.00	872.19	876.37		876.38	0.000141	0.97	126.10	55.86	0.09
Main Channel	220	25 Yr	123.00	872.19	877.35		877.36	0.000094	0.93	187.38	70.07	0.08
Main Channel	220	50 Yr	147.00	872.19	877.81		877.82	0.000090	0.97	221.42	76.84	0.08
Main Channel	220	100 Yr	174.00	872.19	878.11		878.12	0.000098	1.05	245.16	81.22	0.08
Main Channel	184	2 Yr	43.00	871.20	874.42	871.96	874.43	0.000149	0.85	53.33	23.04	0.09
Main Channel	184	5 Yr	69.00	871.20	875.44	872.21	875.46	0.000129	0.97	79.06	27.39	0.09
Main Channel	184	10 Yr	92.00	871.20	876.37	872.41	876.38	0.000104	1.01	105.91	30.07	0.08
Main Channel	184	25 Yr	123.00	871.20	877.34	872.65	877.35	0.000094	1.08	135.44	30.60	0.08
Main Channel	184	50 Yr	147.00	871.20	877.80	872.81	877.82	0.000101	1.18	149.53	30.60	0.08
Main Channel	184	100 Yr	174.00	871.20	878.09	872.99	878.12	0.000119	1.32	158.61	30.60	0.09
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	867.70	868.66	868.57	868.96	0.020428	4.43	9.71	11.70	0.86
Main Channel	130	5 Yr	69.00	867.70	868.90	868.85	869.37	0.023223	5.47	12.63	11.91	0.94
Main Channel	130	10 Yr	92.00	867.70	869.08	869.08	869.68	0.026087	6.26	14.71	12.20	1.00
Main Channel	130	25 Yr	123.00	867.70	869.35	869.35	870.06	0.025316	6.77	18.18	12.94	1.01
Main Channel	130	50 Yr	147.00	867.70	869.55	869.55	870.33	0.024776	7.08	20.76	13.47	1.01
Main Channel	130	100 Yr	174.00	867.70	869.75	869.75	870.60	0.024193	7.41	23.49	14.02	1.00
Main Channel	90	2 Yr	43.00	866.77	867.67	867.67	868.01	0.027657	4.71	9.13	13.26	1.00
Main Channel	90	5 Yr	69.00	866.77	867.94	867.94	868.38	0.025952	5.31	12.99	15.06	1.01
Main Channel	90	10 Yr	92.00	866.77	868.13	868.13	868.65	0.024492	5.79	16.00	16.73	1.01

A00840 -892

Proposal No. 608163-128112

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	868.26	868.37	868.99	0.028912	6.83	18.34	18.05	1.12
Main Channel	90	50 Yr	147.00	866.77	868.37	868.54	869.23	0.030415	7.43	20.37	19.13	1.16
Main Channel	90	100 Yr	174.00	866.77	868.48	868.71	869.48	0.032139	8.07	22.50	20.20	1.21
Main Channel	40	2 Yr	43.00	864.12	865.11	865.36	865.90	0.067632	7.16	6.26	11.48	1.51
Main Channel	40	5 Yr	69.00	864.12	865.34	865.68	866.38	0.064742	8.34	9.25	14.57	1.53
Main Channel	40	10 Yr	92.00	864.12	865.50	865.93	866.71	0.063759	9.12	11.81	16.78	1.55
Main Channel	40	25 Yr	123.00	864.12	865.73	866.15	866.99	0.054635	9.56	16.05	21.03	1.48
Main Channel	40	50 Yr	147.00	864.12	865.86	866.29	867.21	0.052564	10.01	19.05	23.72	1.47
Main Channel	40	100 Yr	174.00	864.12	865.99	866.44	867.43	0.051739	10.50	22.16	25.77	1.48
Main Channel	0	2 Yr	43.00	861.35	862.45	862.65	863.19	0.066836	6.91	6.22	9.44	1.50
Main Channel	0	5 Yr	69.00	861.35	862.67	863.00	863.71	0.068697	8.18	8.44	10.04	1.57
Main Channel	0	10 Yr	92.00	861.35	862.85	863.27	864.10	0.066222	8.97	10.31	11.83	1.59
Main Channel	0	25 Yr	123.00	861.35	863.04	863.54	864.58	0.065444	10.00	12.92	16.08	1.62
Main Channel	0	50 Yr	147.00	861.35	863.17	863.72	864.87	0.063441	10.58	15.21	17.93	1.63
Main Channel	0	100 Yr	174.00	861.35	863.31	863.90	865.14	0.061000	11.09	17.79	19.30	1.62

A00840 -893

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006822	2.93	14.67	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008494	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.09	875.68	876.38	0.010123	4.36	21.10	14.33	0.63
Main Channel	291	25 Yr	123.00	874.10	876.28	875.92	876.69	0.012395	5.14	23.92	14.65	0.71
Main Channel	291	50 Yr	147.00	874.10	875.80	876.09	876.96	0.050095	8.64	17.02	14.05	1.38
Main Channel	291	100 Yr	174.00	874.10	875.94	876.28	877.25	0.050078	9.17	18.97	14.14	1.40
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	875.48	875.48	875.92	0.024916	5.32	17.56	21.56	0.98
Main Channel	261	25 Yr	123.00	874.39	875.68	875.68	876.19	0.022903	5.77	22.12	23.89	0.97
Main Channel	261	50 Yr	147.00	874.39	875.82	875.82	876.38	0.021751	6.05	25.62	25.53	0.96
Main Channel	261	100 Yr	174.00	874.39	875.97	875.97	876.57	0.020640	6.32	29.57	27.26	0.95
Main Channel	220	2 Yr	43.00	872.19	872.98	873.12	873.49	0.076775	5.74	7.49	17.42	1.54
Main Channel	220	5 Yr	69.00	872.19	873.12	873.35	873.87	0.078410	6.92	10.00	18.48	1.63
Main Channel	220	10 Yr	92.00	872.19	873.22	873.51	874.17	0.082184	7.83	11.86	19.52	1.71
Main Channel	220	25 Yr	123.00	872.19	873.35	873.71	874.52	0.080896	8.69	14.48	20.87	1.74
Main Channel	220	50 Yr	147.00	872.19	874.37	873.85	874.61	0.006361	4.09	40.77	30.86	0.55
Main Channel	220	100 Yr	174.00	872.19	874.77	873.99	874.97	0.004204	3.77	54.21	34.89	0.46
Main Channel	184	2 Yr	43.00	871.03	872.46	871.71	872.53	0.002652	2.14	20.06	15.19	0.33
Main Channel	184	5 Yr	69.00	871.03	873.00	871.96	873.09	0.002383	2.41	28.59	16.52	0.32
Main Channel	184	10 Yr	92.00	871.03	873.42	872.16	873.53	0.002121	2.57	36.03	18.60	0.31
Main Channel	184	25 Yr	123.00	871.03	873.95	872.40	874.06	0.001820	2.72	46.40	21.01	0.30
Main Channel	184	50 Yr	147.00	871.03	874.32	872.57	874.44	0.001618	2.81	54.60	22.61	0.29
Main Channel	184	100 Yr	174.00	871.03	874.72	872.75	874.85	0.001449	2.90	63.98	24.32	0.28
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	869.59	870.26	870.26	870.59	0.027595	4.58	9.68	15.66	1.00
Main Channel	130	5 Yr	69.00	869.59	870.51	870.51	870.93	0.025058	5.30	13.60	16.64	0.99
Main Channel	130	10 Yr	92.00	869.59	870.69	870.69	871.20	0.023566	5.80	16.75	17.58	0.99
Main Channel	130	25 Yr	123.00	869.59	870.92	870.92	871.52	0.021537	6.32	20.93	18.98	0.98
Main Channel	130	50 Yr	147.00	869.59	871.08	871.08	871.74	0.020548	6.66	24.03	19.96	0.98
Main Channel	130	100 Yr	174.00	869.59	871.26	871.26	871.97	0.019231	6.96	27.66	21.05	0.96
Main Channel	90	2 Yr	43.00	866.77	867.43	867.66	868.19	0.087757	7.01	6.13	11.71	1.71
Main Channel	90	5 Yr	69.00	866.77	867.61	867.94	868.65	0.088978	8.17	8.45	12.92	1.78
Main Channel	90	10 Yr	92.00	866.77	867.75	868.13	868.99	0.089077	8.92	10.32	13.83	1.82

A00840 -894

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	867.91	868.37	869.40	0.091293	9.80	12.54	14.84	1.88
Main Channel	90	50 Yr	147.00	866.77	868.02	868.54	869.69	0.089500	10.37	14.20	15.74	1.89
Main Channel	90	100 Yr	174.00	866.77	868.13	868.71	870.00	0.088274	10.98	15.96	16.70	1.91
Main Channel	40	2 Yr	43.00	864.12	865.30	865.36	865.75	0.029337	5.47	8.69	14.04	1.03
Main Channel	40	5 Yr	69.00	864.12	865.56	865.68	866.15	0.029358	6.40	12.83	17.69	1.06
Main Channel	40	10 Yr	92.00	864.12	865.74	865.93	866.43	0.029868	7.10	16.21	21.18	1.09
Main Channel	40	25 Yr	123.00	864.12	865.93	866.15	866.75	0.030526	7.86	20.67	25.06	1.13
Main Channel	40	50 Yr	147.00	864.12	866.04	866.29	866.96	0.031932	8.44	23.53	26.33	1.17
Main Channel	40	100 Yr	174.00	864.12	866.15	866.44	867.17	0.033594	9.04	26.45	27.48	1.22
Main Channel	0	2 Yr	43.00	861.35	862.31	862.65	863.49	0.135916	8.71	4.94	9.07	2.08
Main Channel	0	5 Yr	69.00	861.35	862.54	863.00	863.99	0.113529	9.67	7.14	9.69	1.99
Main Channel	0	10 Yr	92.00	861.35	862.73	863.27	864.34	0.099306	10.18	9.04	10.20	1.91
Main Channel	0	25 Yr	123.00	861.35	862.96	863.54	864.76	0.083177	10.77	11.73	14.30	1.81
Main Channel	0	50 Yr	147.00	861.35	863.12	863.72	865.00	0.073977	11.11	14.26	17.40	1.74
Main Channel	0	100 Yr	174.00	861.35	863.27	863.90	865.23	0.067208	11.44	17.09	18.94	1.69

A00840 -895

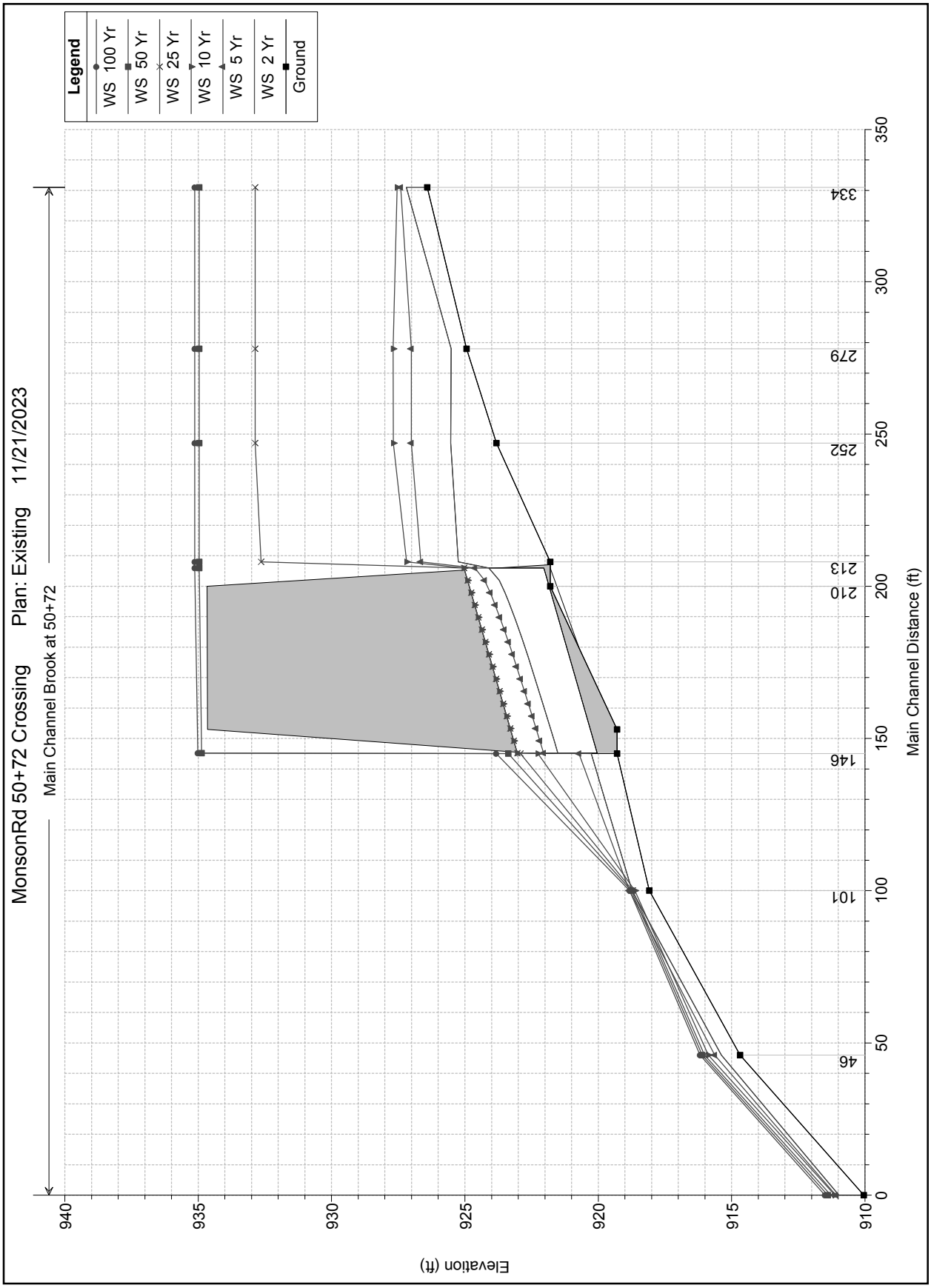
Proposal No. 608163-128112

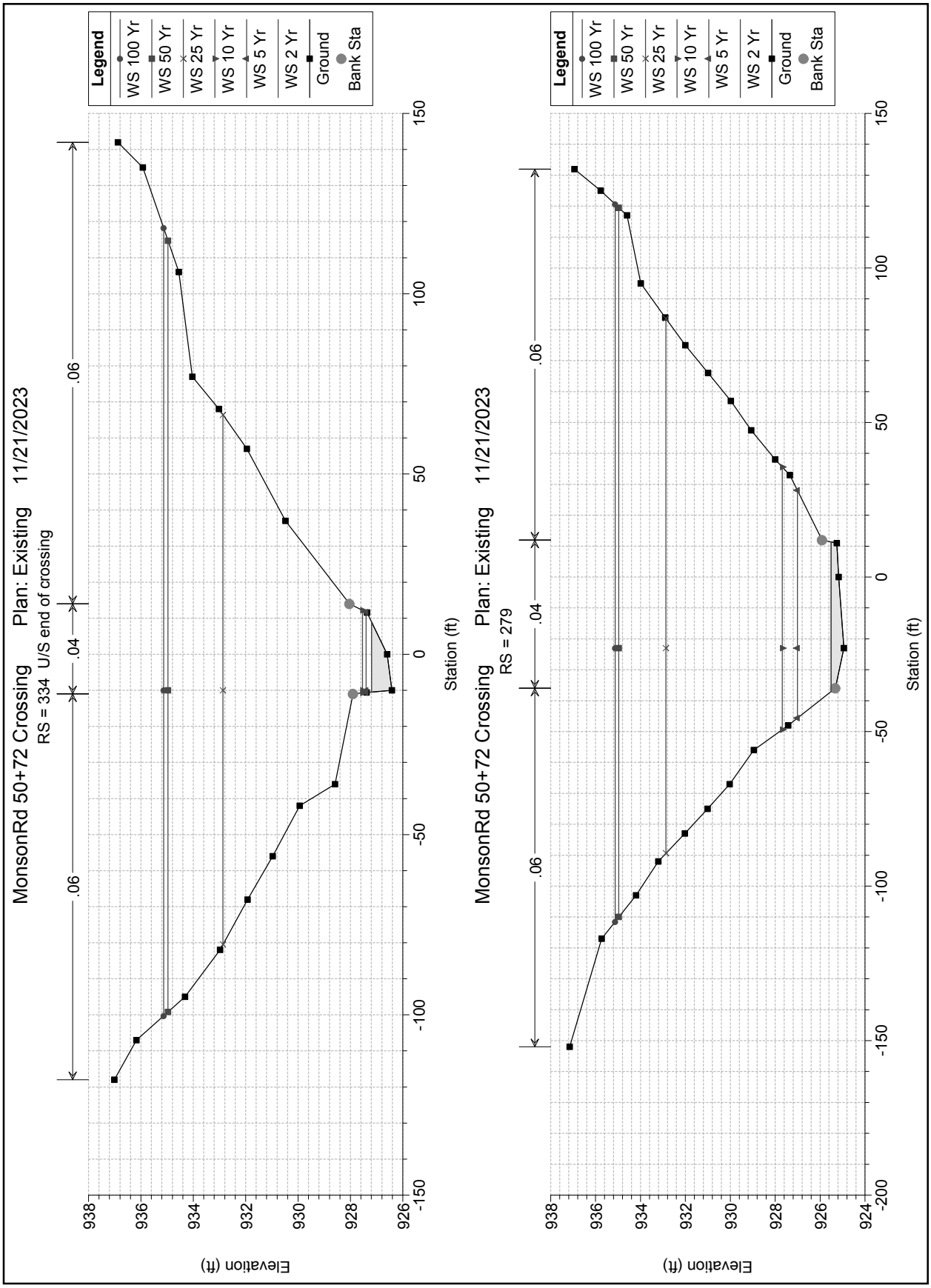
HEC-RAS Computed Results for crossing 50+72 proposed

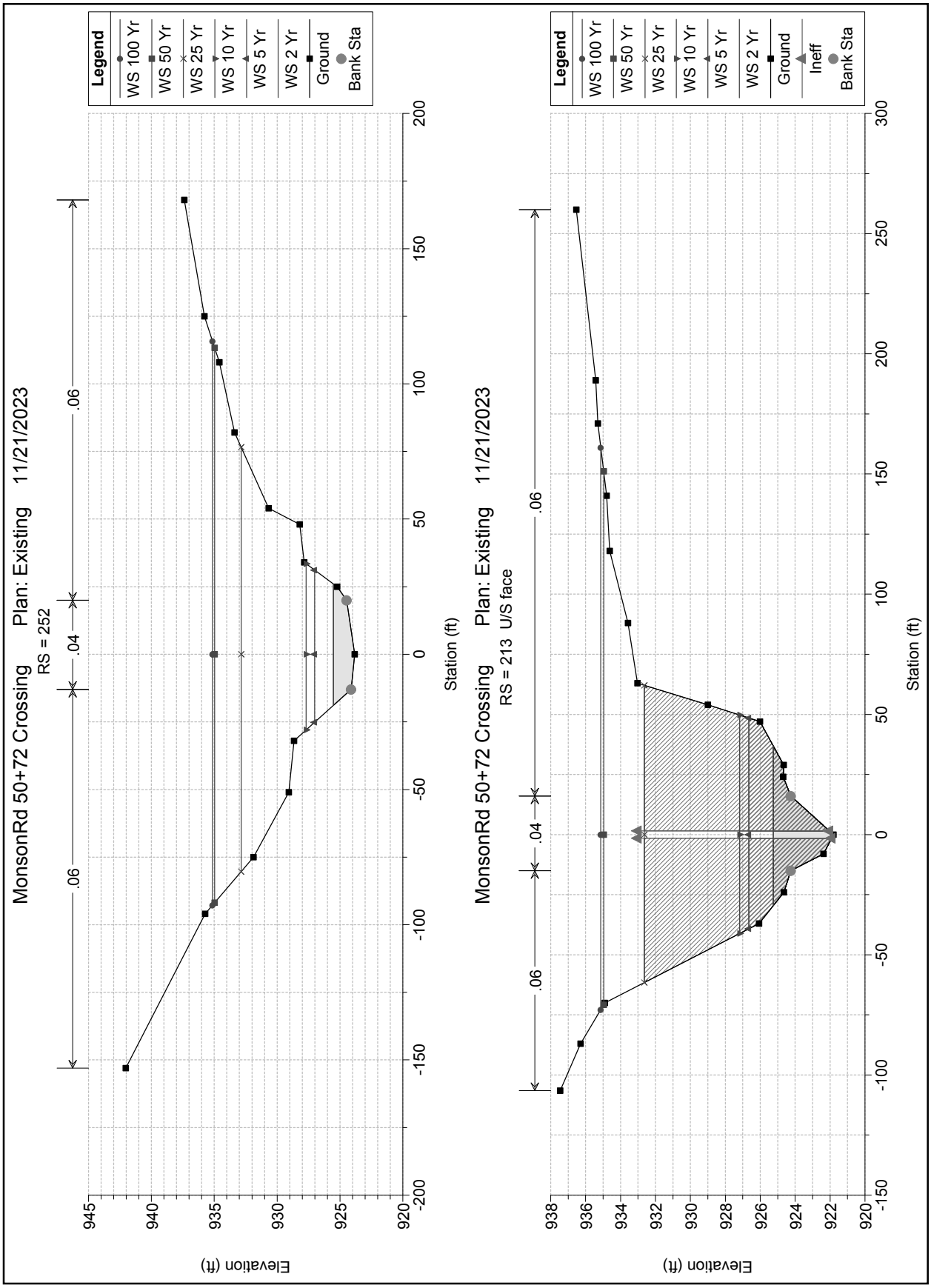
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	
DESIGN FLOOD DISCHARGE (C.F.S)	116
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	10.75
DESIGN FLOOD ELEVATION (FEET, NAVD)	932.64
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	163
BASE FLOOD ELEVATION (FEET, NAVD)	933.34
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

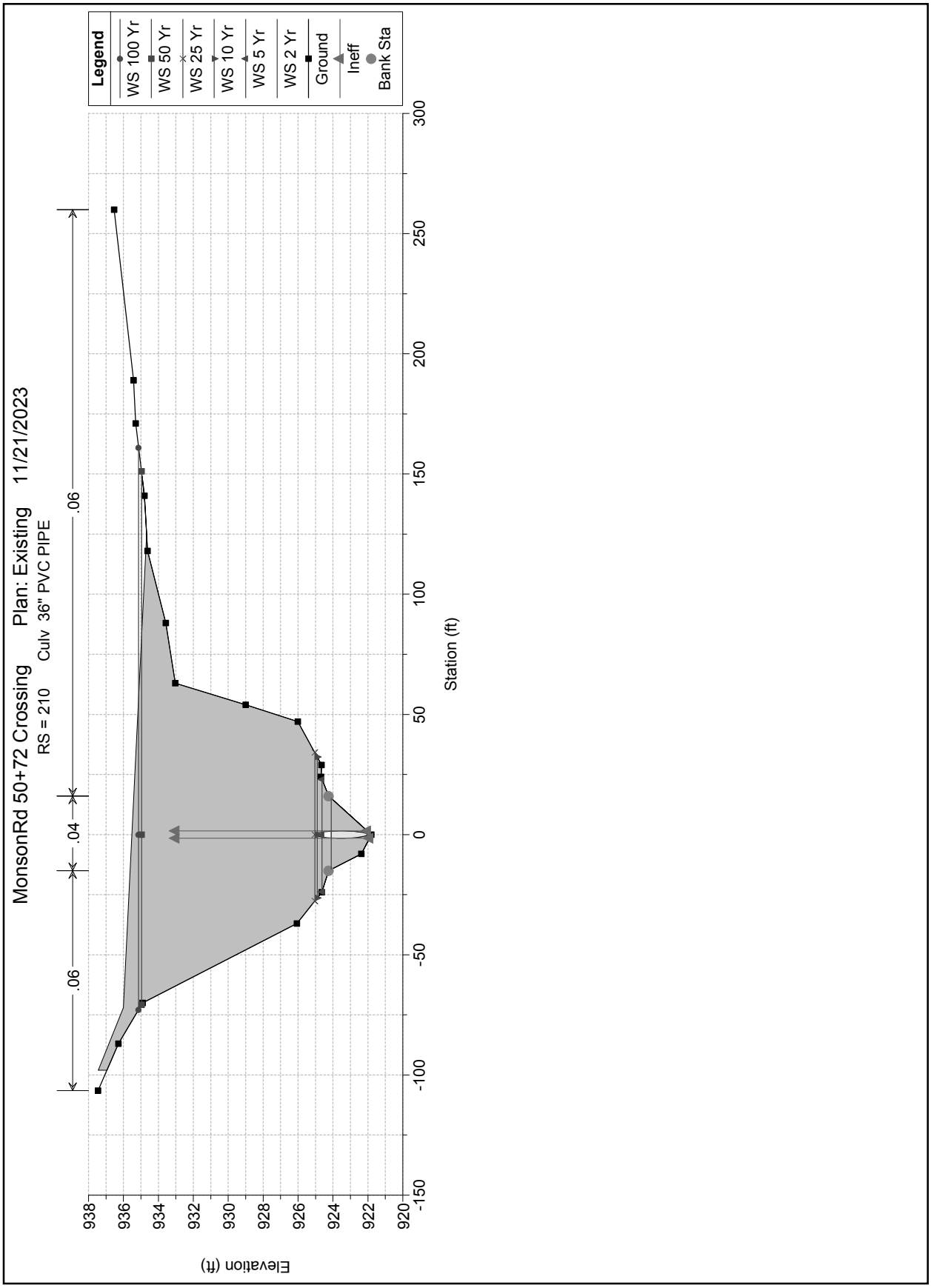
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	40
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	
DESIGN FLOOD ELEVATION (FEET,NAVD)	

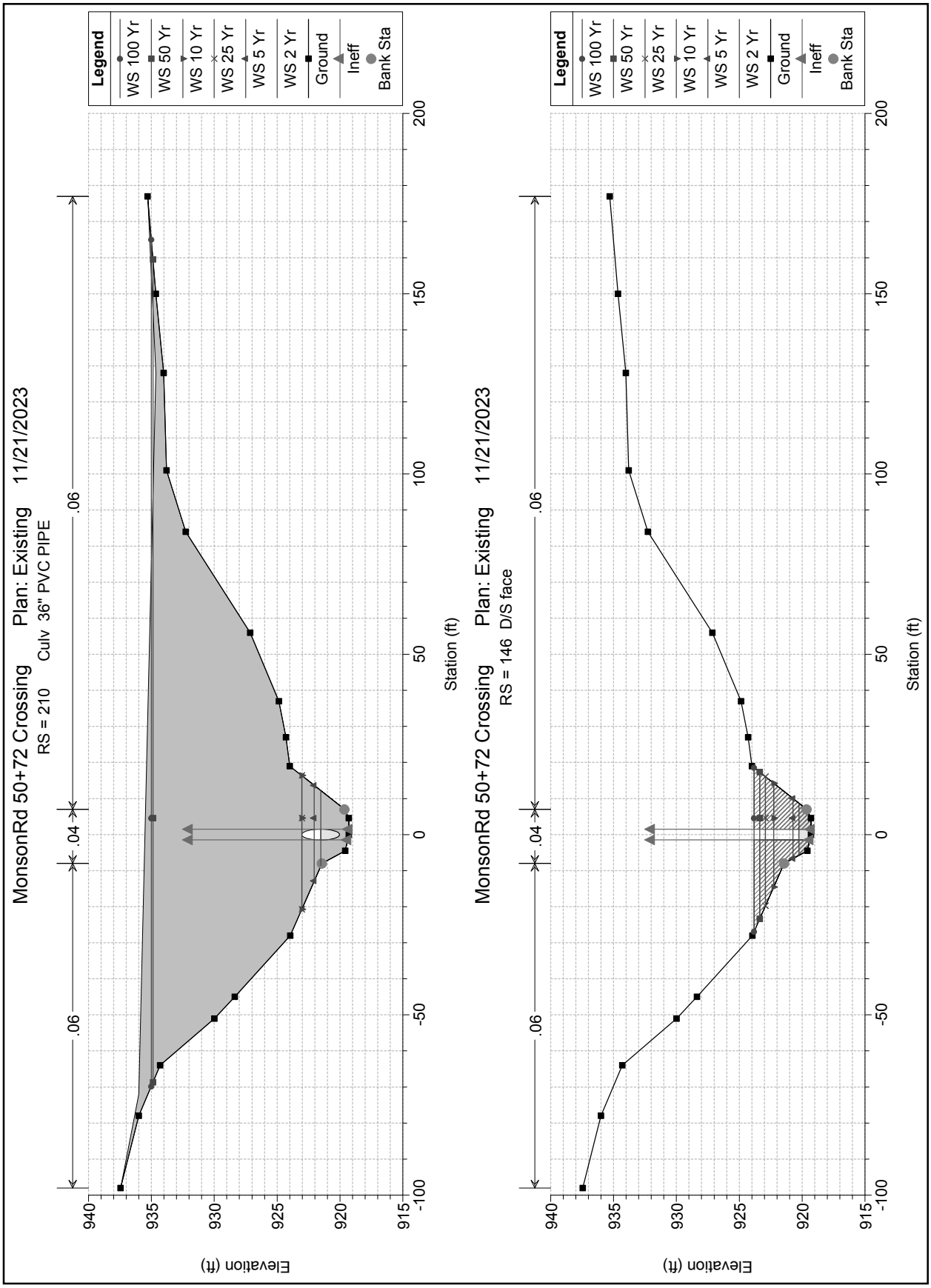
Section	Length (ft)	Span (ft)	Diameter (ft)	Invert (u/s)	Invert (d/s)
Circular Culvert	60.8	3	3	922.04	920.04

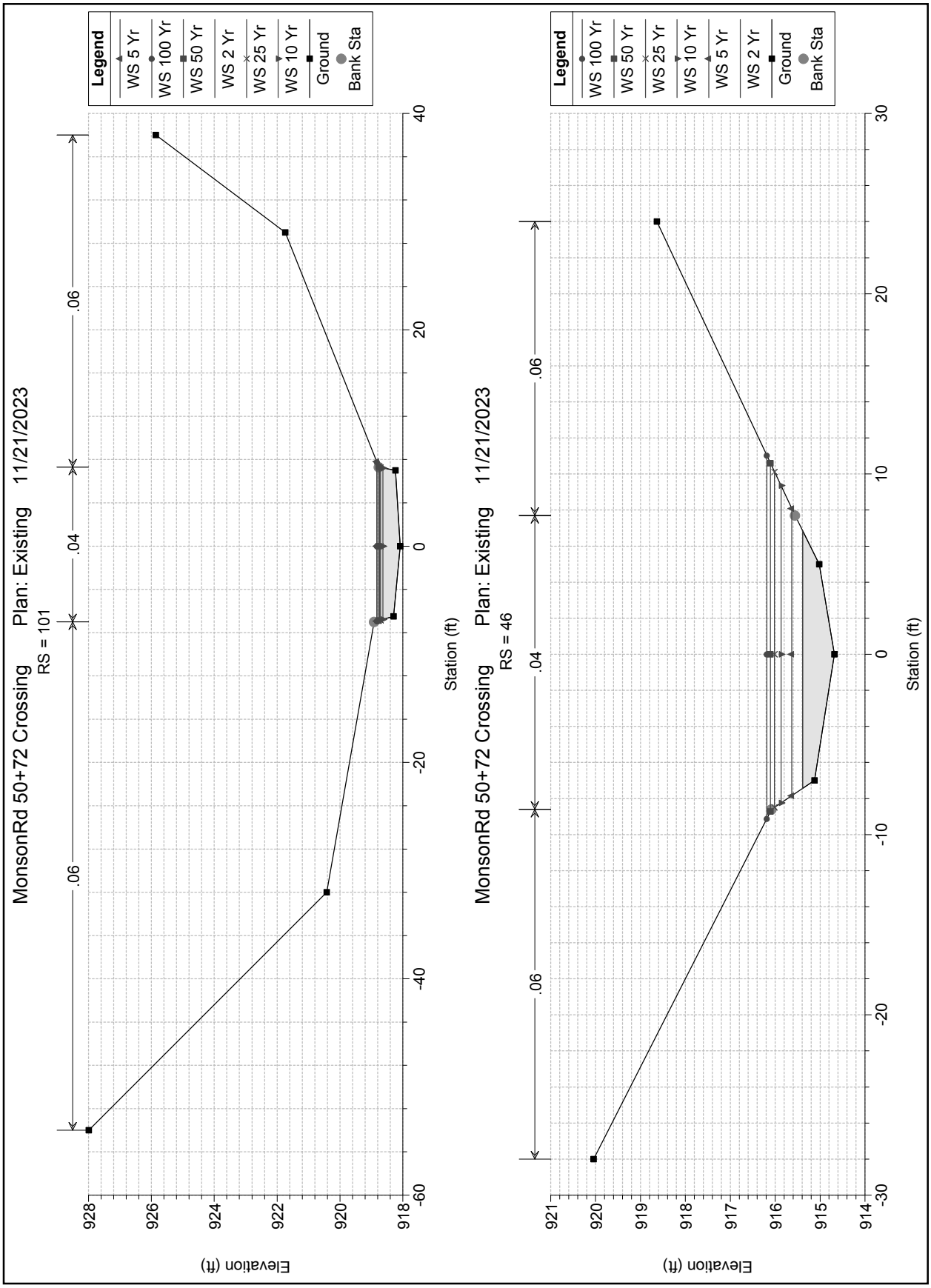

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
Main Channel Brook at 50+72
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
940
935
930
925
920
915
910
0
50
100
150
200
250
300
350
46
101
146
210
213
252
279
334

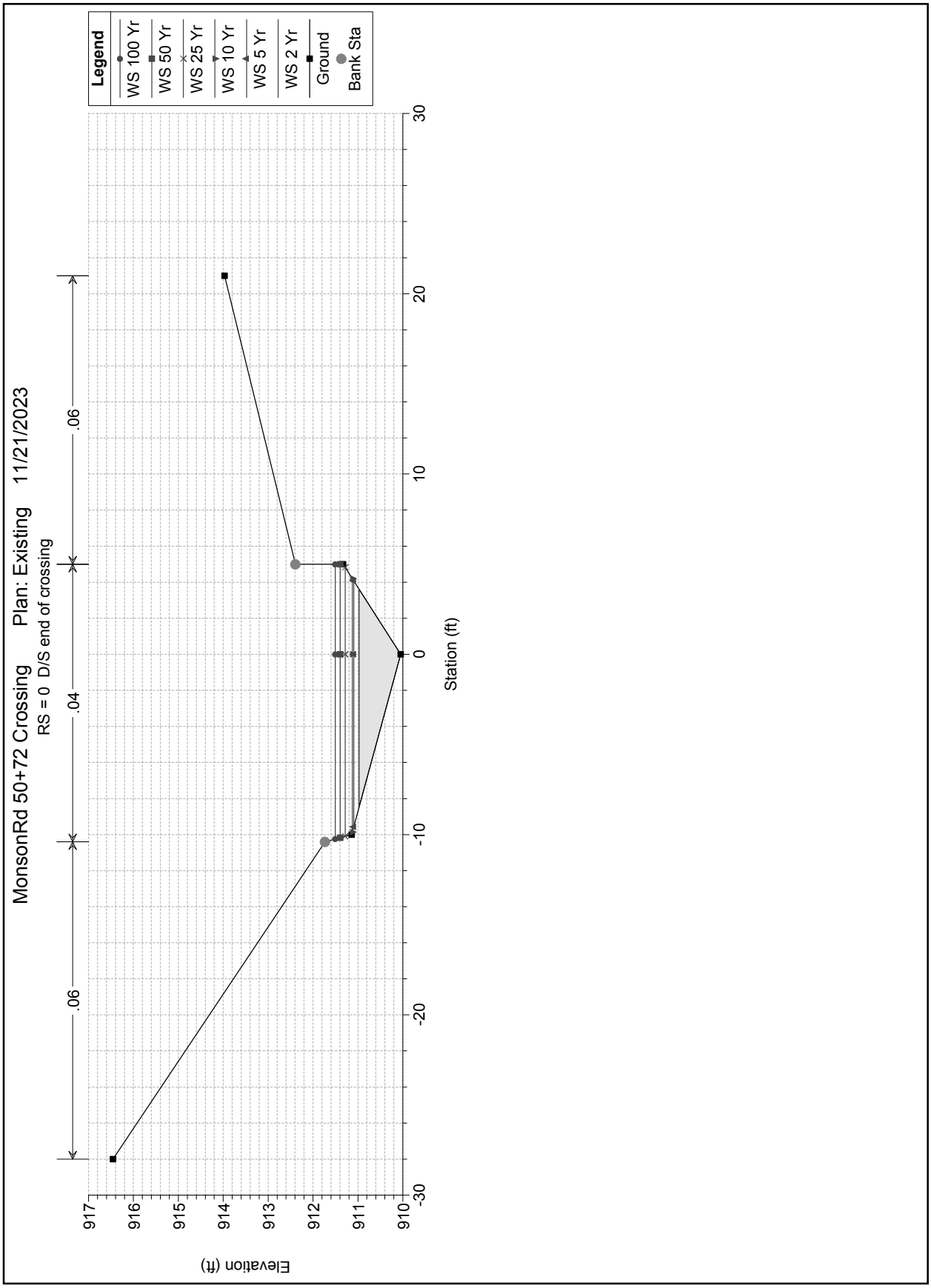

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 334 U/S end of crossing
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
150
100
50
0
-50
-100
-150
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 279
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
924
150
100
50
0
-50
-100
-150
-200


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 252
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
945
940
935
930
925
920
200
150
100
50
0
-50
-100
-150
-200
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 213 U/S face
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
924
922
920
300
250
200
150
100
50
0
-50
-100
-150


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
938
936
934
932
930
928
926
924
922
920
Station (ft)
-150
-100
-50
0
50
100
150
200
250
300


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
Legend
WS 100 Yr
WS 50 Yr
WS 10 Yr
WS 25 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
940
935
930
925
920
915
-100
-50
0
50
100
150
200
Station (ft)
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 146 D/S face
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
940
935
930
925
920
915
-100
-50
0
50
100
150
200
Station (ft)


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 101
Legend
WS 5 Yr
WS 100 Yr
WS 50 Yr
WS 2 Yr
WS 25 Yr
WS 10 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
928
926
924
922
920
918
40
20
0
-20
-40
-60
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 46
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
921
920
919
918
917
916
915
914
30
20
10
0
-10
-20
-30


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 0 D/S end of crossing
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
917
916
915
914
913
912
911
910
Station (ft)
30
20
10
0
-10
-20
-30

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	334	2 Yr	40.00	926.41	927.20	927.20	927.46	0.030832	4.07	9.83	19.51	1.01
Brook at 50+72	334	5 Yr	65.00	926.41	927.41	927.41	927.73	0.028816	4.58	14.19	22.34	1.01
Brook at 50+72	334	10 Yr	86.00	926.41	927.54	927.54	927.93	0.027344	4.98	17.25	22.94	1.01
Brook at 50+72	334	25 Yr	116.00	926.41	932.86	927.72	932.87	0.000013	0.43	463.57	146.85	0.03
Brook at 50+72	334	50 Yr	139.00	926.41	934.96	927.84	934.97	0.000005	0.31	831.05	213.91	0.02
Brook at 50+72	334	100 Yr	163.00	926.41	935.13	927.96	935.13	0.000006	0.35	867.47	218.55	0.02
Brook at 50+72	279	2 Yr	40.00	924.94	925.51	925.40	925.58	0.011315	2.13	18.87	48.50	0.60
Brook at 50+72	279	5 Yr	65.00	924.94	927.01	925.50	927.01	0.000144	0.68	107.26	73.71	0.09
Brook at 50+72	279	10 Yr	86.00	924.94	927.69	925.58	927.69	0.000081	0.63	161.79	85.03	0.07
Brook at 50+72	279	25 Yr	116.00	924.94	932.86		932.87	0.000002	0.21	823.56	173.02	0.01
Brook at 50+72	279	50 Yr	139.00	924.94	934.96		934.97	0.000001	0.18	1241.22	229.51	0.01
Brook at 50+72	279	100 Yr	163.00	924.94	935.13		935.13	0.000001	0.21	1280.14	232.20	0.01
Brook at 50+72	252	2 Yr	40.00	923.82	925.53		925.54	0.000268	0.78	55.96	44.97	0.11
Brook at 50+72	252	5 Yr	65.00	923.82	927.01		927.01	0.000060	0.59	130.59	56.23	0.06
Brook at 50+72	252	10 Yr	86.00	923.82	927.69		927.69	0.000049	0.61	170.66	61.43	0.06
Brook at 50+72	252	25 Yr	116.00	923.82	932.86		932.87	0.000002	0.25	759.54	157.00	0.01
Brook at 50+72	252	50 Yr	139.00	923.82	934.96		934.97	0.000001	0.21	1137.50	205.18	0.01
Brook at 50+72	252	100 Yr	163.00	923.82	935.13		935.13	0.000002	0.24	1172.36	208.53	0.01
Brook at 50+72	213	2 Yr	40.00	921.80	925.25	923.65	925.49	0.002277	3.96	10.10	66.47	0.38
Brook at 50+72	213	5 Yr	65.00	921.80	926.65	924.33	926.97	0.001884	4.55	14.30	87.66	0.37
Brook at 50+72	213	10 Yr	86.00	921.80	927.19	924.83	927.64	0.002312	5.41	15.91	90.93	0.41
Brook at 50+72	213	25 Yr	116.00	921.80	932.64	925.49	932.85	0.000398	3.59	32.28	123.70	0.19
Brook at 50+72	213	50 Yr	139.00	921.80	934.96	925.94	934.97	0.000001	0.21	1214.13	221.92	0.01
Brook at 50+72	213	100 Yr	163.00	921.80	935.13	926.41	935.13	0.000001	0.24	1252.53	233.86	0.01
Brook at 50+72	210		Culvert									
Brook at 50+72	146	2 Yr	40.00	919.29	920.26	921.08	923.38	0.157973	14.17	2.82	14.54	2.58
Brook at 50+72	146	5 Yr	65.00	919.29	920.73	921.77	924.42	0.109571	15.42	4.22	16.69	2.29
Brook at 50+72	146	10 Yr	86.00	919.29	922.26	922.26	923.74	0.016438	9.76	8.81	28.77	1.00
Brook at 50+72	146	25 Yr	116.00	919.29	922.92	922.92	924.72	0.015232	10.75	10.79	35.79	1.00
Brook at 50+72	146	50 Yr	139.00	919.29	923.38	923.38	925.41	0.014659	11.43	12.16	40.68	1.00
Brook at 50+72	146	100 Yr	163.00	919.29	923.83	923.83	926.09	0.014206	12.07	13.51	45.47	1.00
Brook at 50+72	101	2 Yr	40.00	918.08	918.74	918.82	919.15	0.044569	5.14	7.78	14.15	1.22
Brook at 50+72	101	5 Yr	65.00	918.08	918.83	919.07	919.62	0.071050	7.15	9.10	14.75	1.58

A00840 -904

Proposal No. 608163-128112

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72 (Continued)

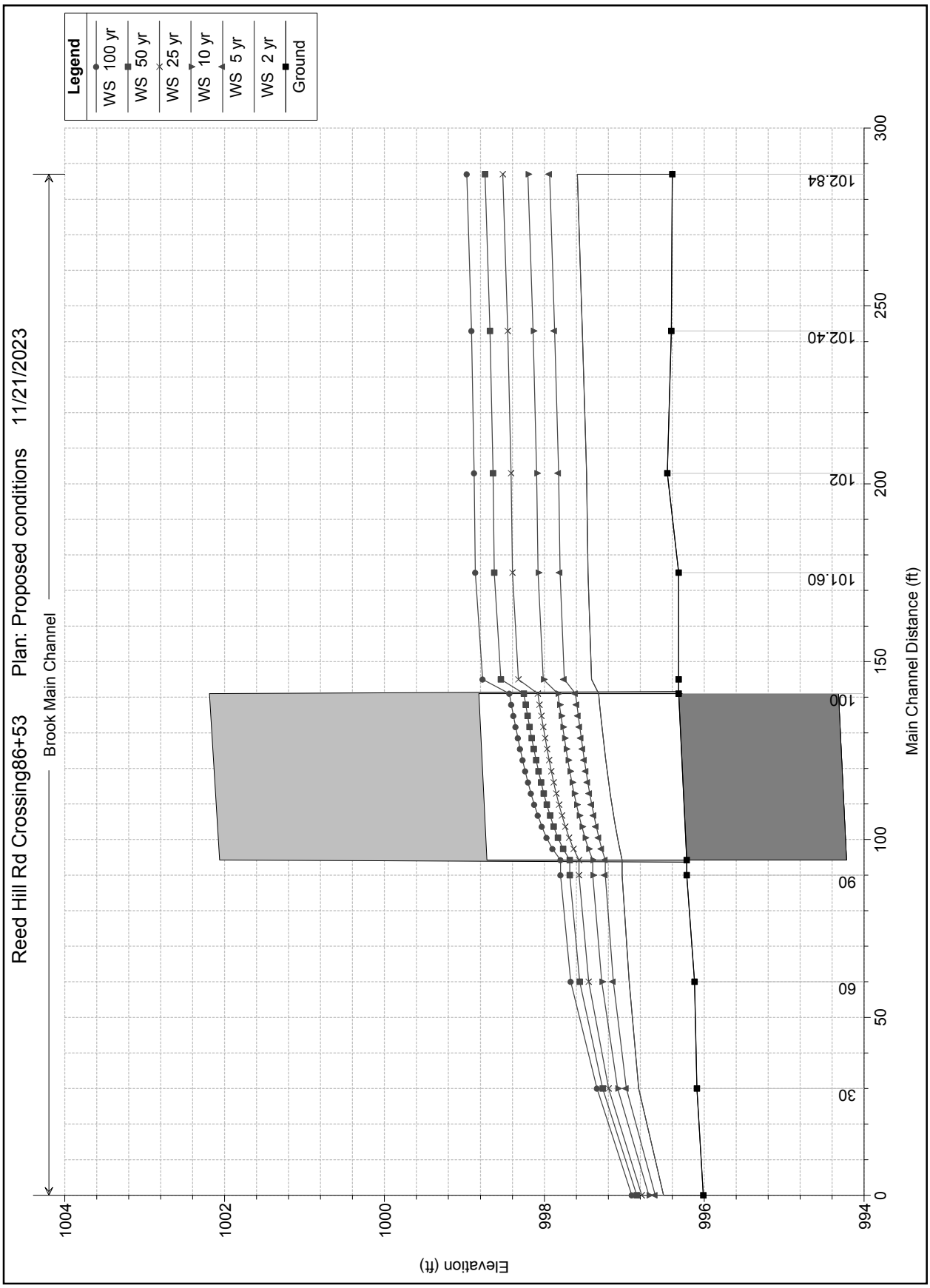
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	101	10 Yr	86.00	918.08	918.63	919.27	921.55	0.410756	13.69	6.28	14.00	3.60
Brook at 50+72	101	25 Yr	116.00	918.08	918.71	919.50	922.56	0.445820	15.74	7.37	14.11	3.84
Brook at 50+72	101	50 Yr	139.00	918.08	918.77	919.65	923.26	0.459074	17.01	8.17	14.23	3.95
Brook at 50+72	101	100 Yr	163.00	918.08	918.82	919.79	923.95	0.465437	18.16	8.99	14.69	4.03
Brook at 50+72	46	2 Yr	40.00	914.68	915.39	915.56	915.98	0.079859	6.16	6.49	14.29	1.61
Brook at 50+72	46	5 Yr	65.00	914.68	915.63	915.80	916.27	0.053473	6.40	10.16	15.93	1.40
Brook at 50+72	46	10 Yr	86.00	914.68	915.87	915.97	916.46	0.033671	6.15	14.18	17.60	1.16
Brook at 50+72	46	25 Yr	116.00	914.68	916.01	916.19	916.79	0.037296	7.09	16.77	18.60	1.25
Brook at 50+72	46	50 Yr	139.00	914.68	916.11	916.34	917.03	0.040066	7.75	18.51	19.32	1.31
Brook at 50+72	46	100 Yr	163.00	914.68	916.19	916.49	917.28	0.042985	8.43	20.12	20.15	1.37
Brook at 50+72	0	2 Yr	40.00	910.05	910.97	911.22	911.77	0.105045	7.14	5.60	12.10	1.85
Brook at 50+72	0	5 Yr	65.00	910.05	911.09	911.45	912.39	0.145922	9.12	7.13	13.65	2.22
Brook at 50+72	0	10 Yr	86.00	910.05	911.12	911.62	913.13	0.217622	11.36	7.57	14.06	2.73
Brook at 50+72	0	25 Yr	116.00	910.05	911.28	911.85	913.43	0.177670	11.74	9.88	14.92	2.54
Brook at 50+72	0	50 Yr	139.00	910.05	911.39	912.01	913.64	0.156288	12.03	11.56	15.17	2.43
Brook at 50+72	0	100 Yr	163.00	910.05	911.50	912.16	913.87	0.140339	12.34	13.21	15.25	2.34

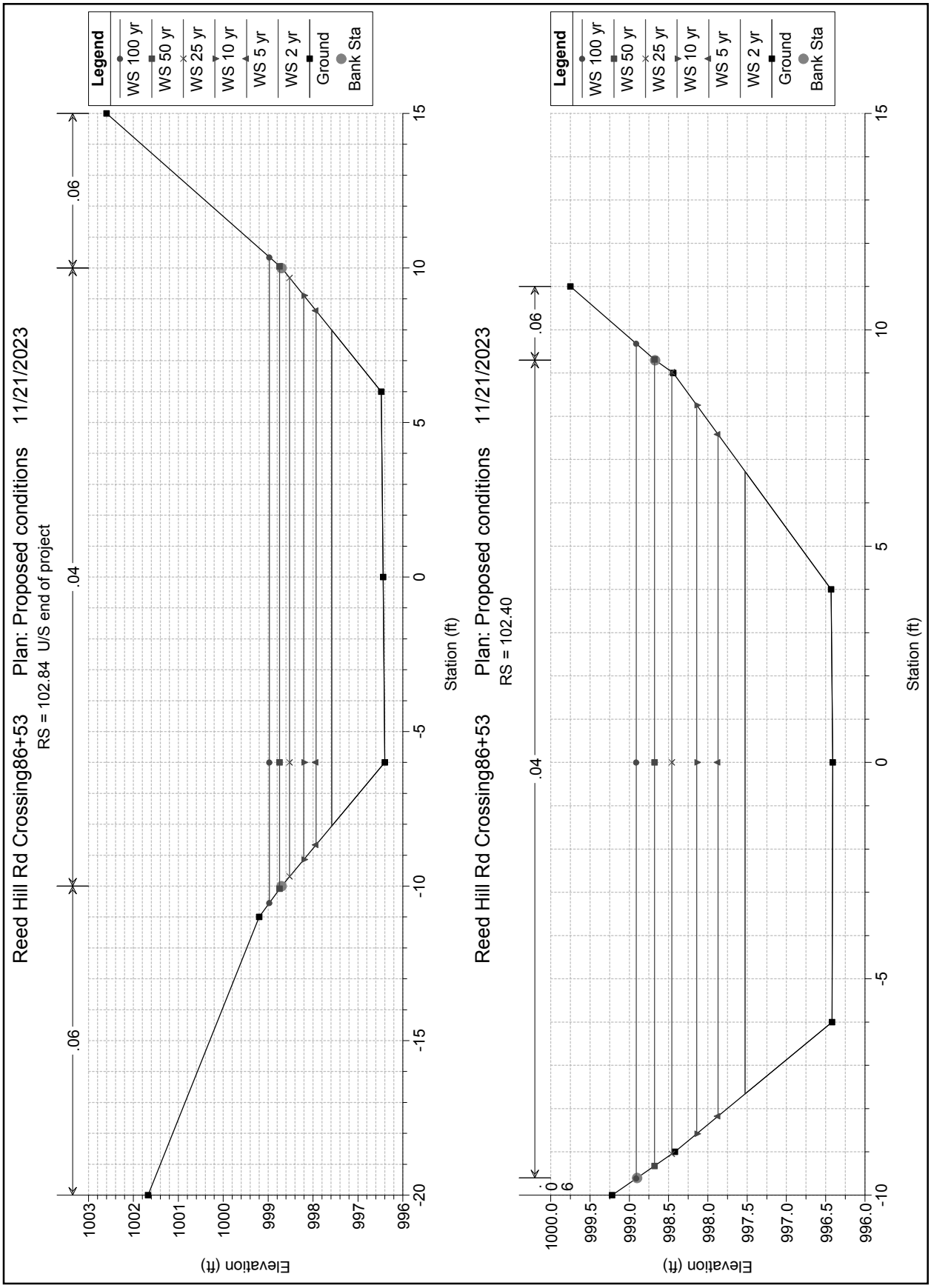
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	50	8	4.5	994.32	994.22

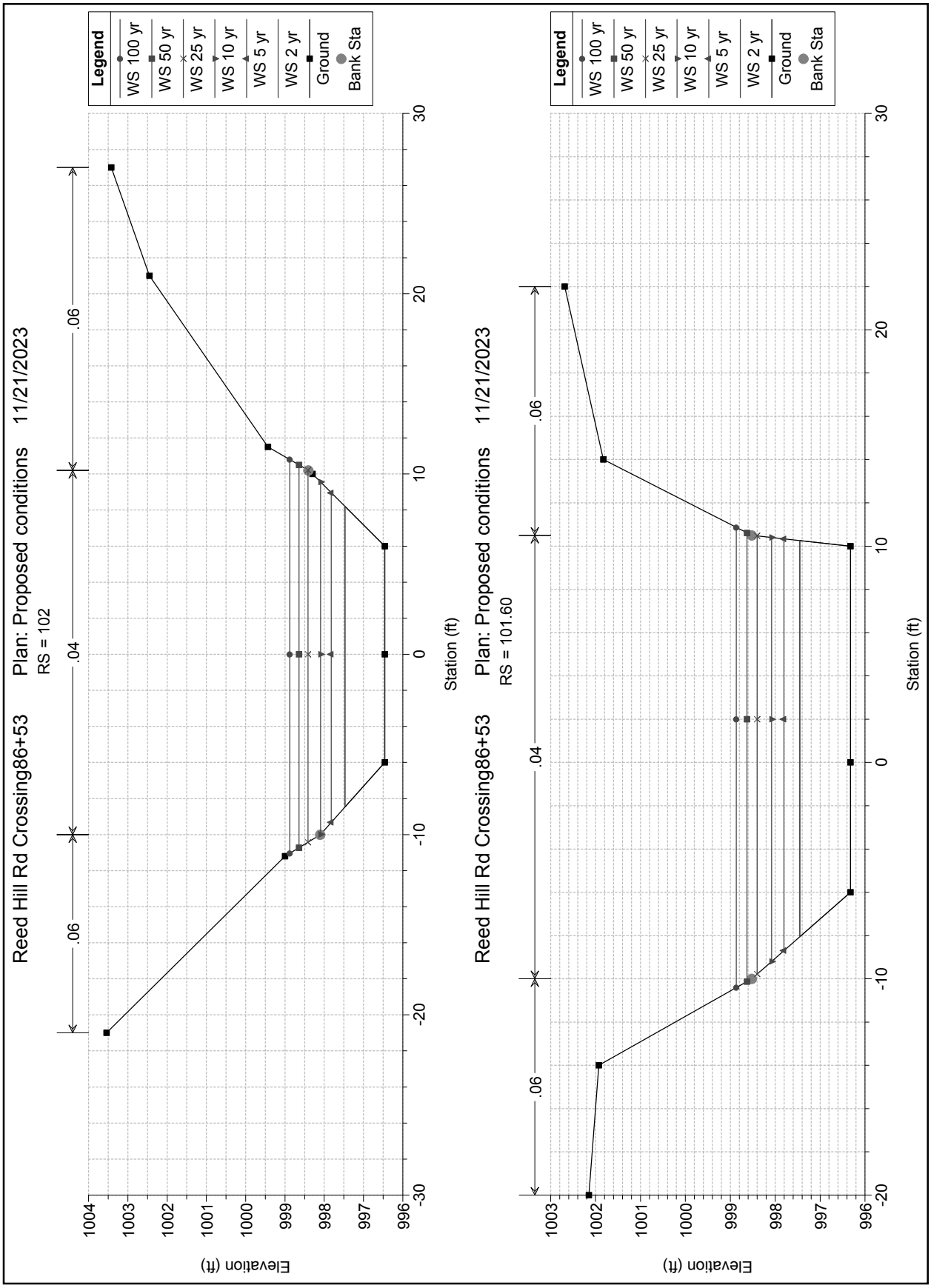
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	8.91
DESIGN FLOOD ELEVATION (FEET,NAVD)	1001.42

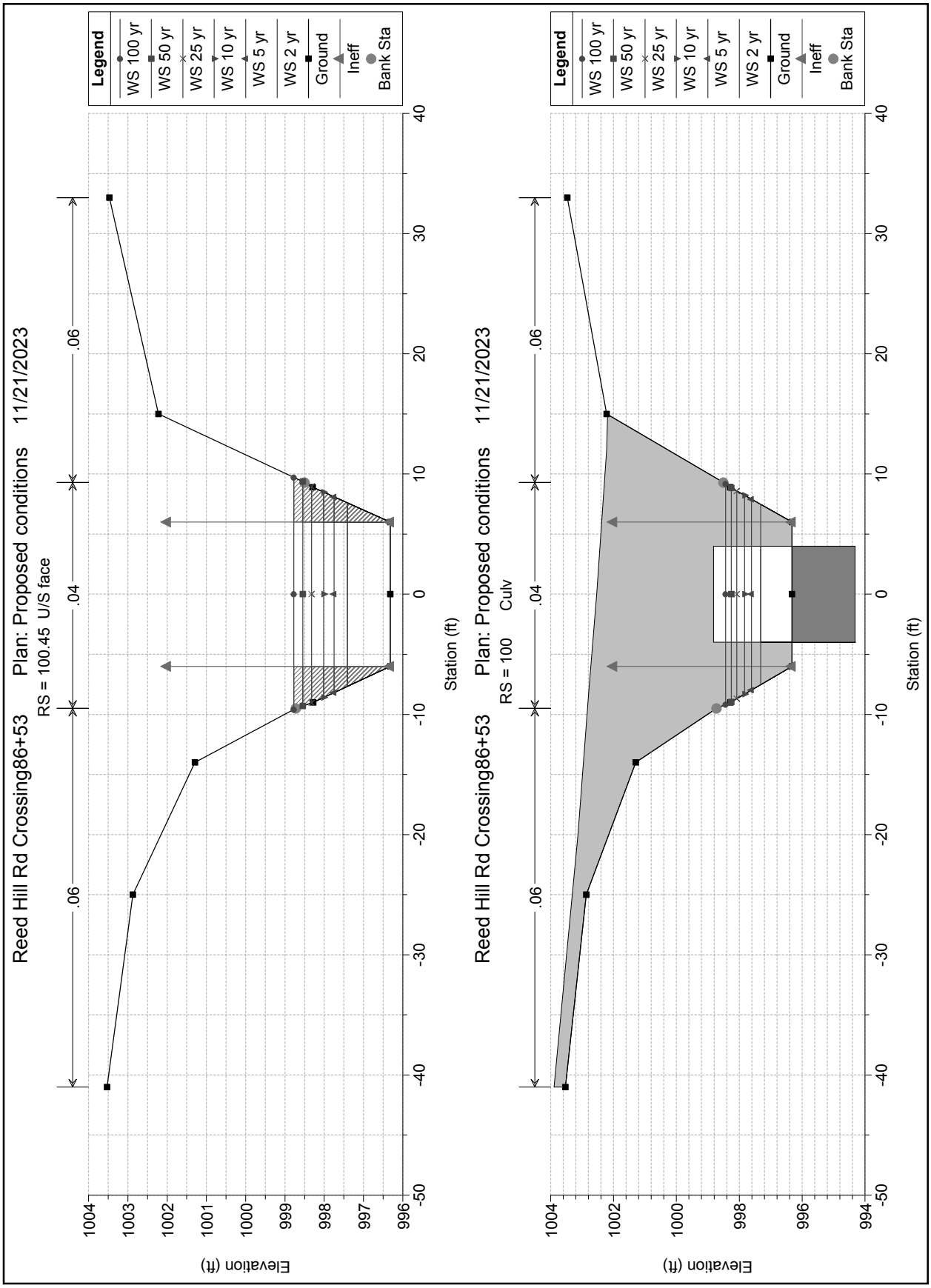
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.32
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

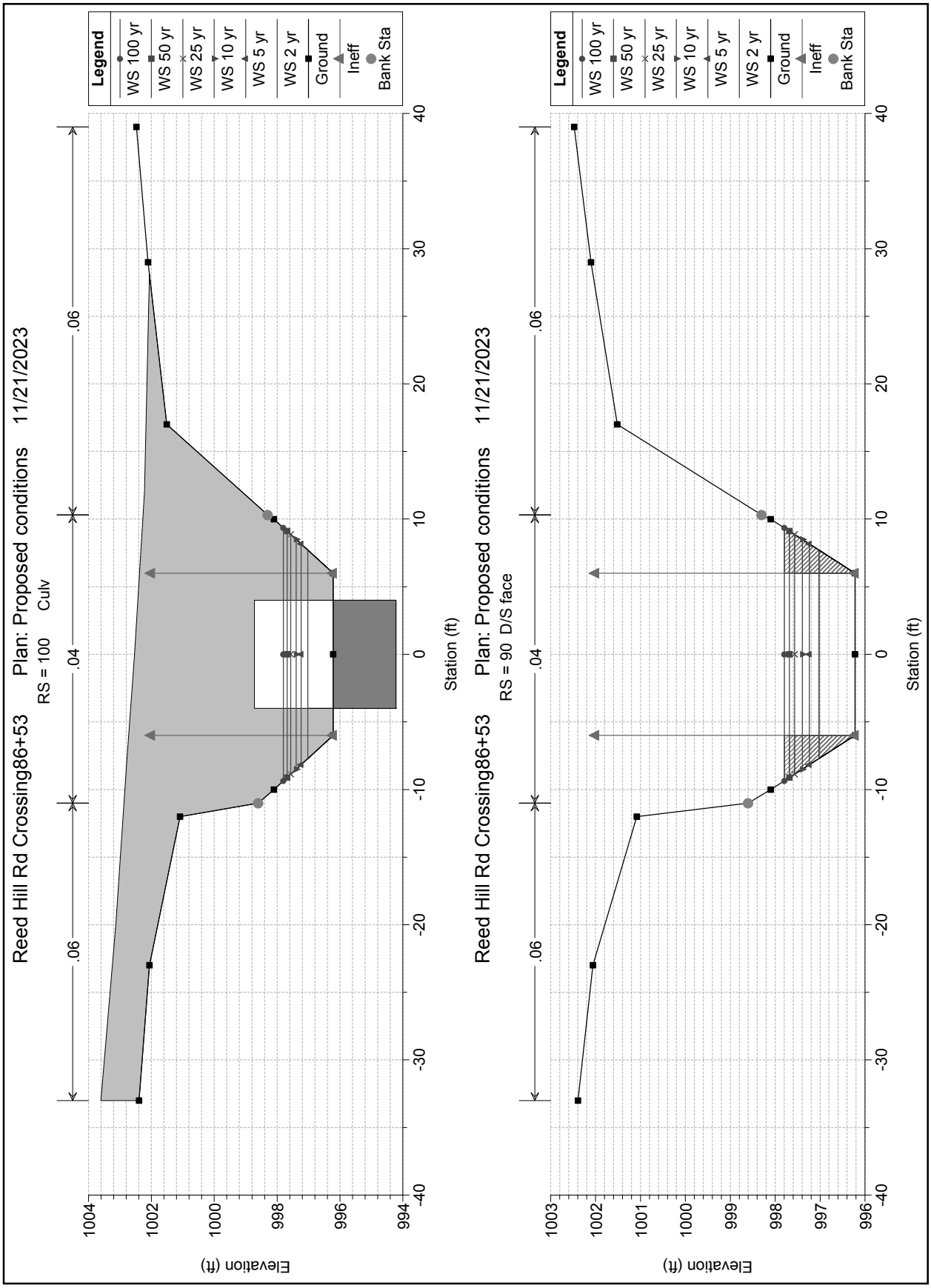
HEC-RAS Computed Results for crossing 86+53 proposed

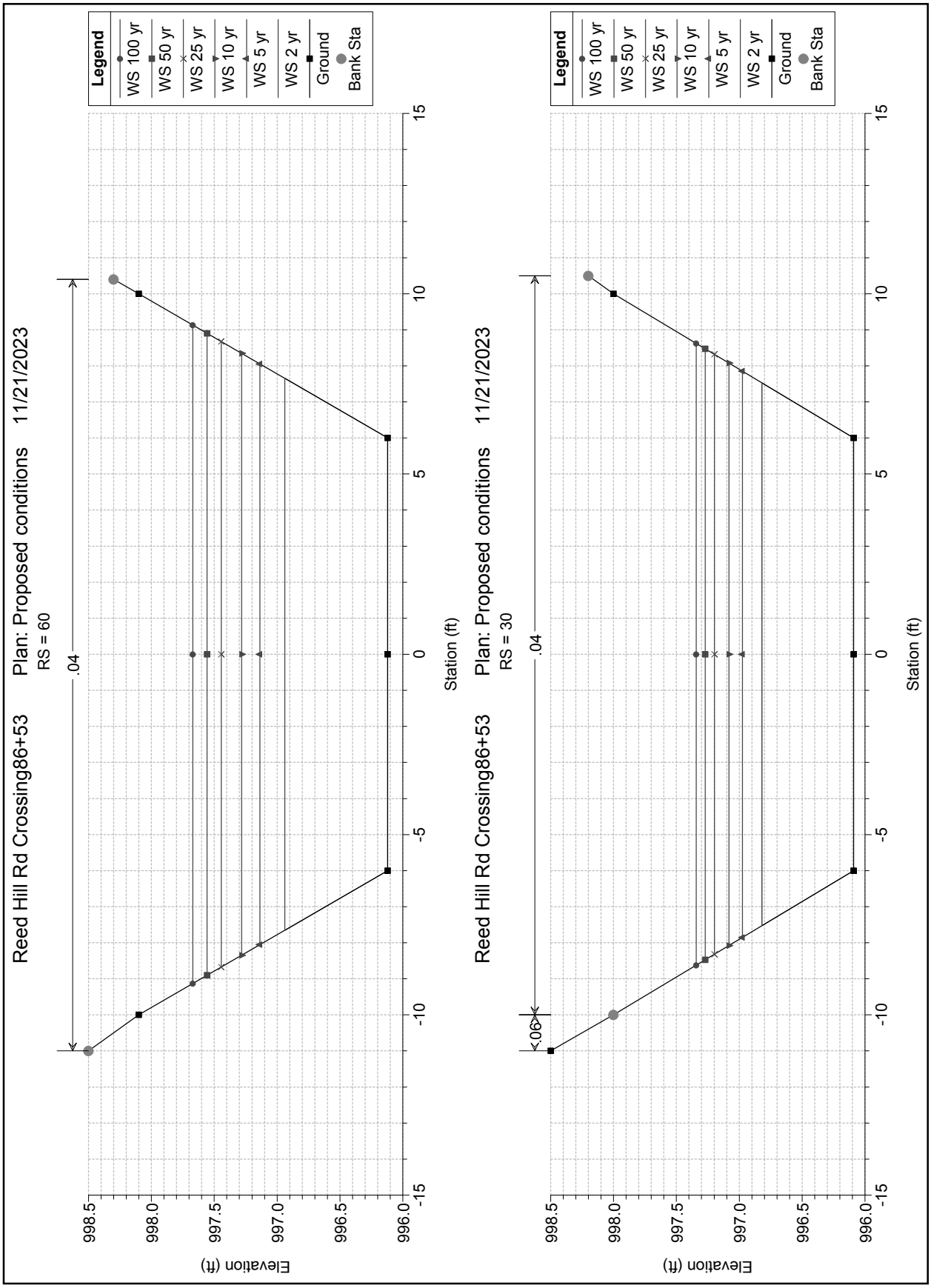

Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
Brook Main Channel
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1004
1002
1000
998
996
994
0
30
50
60
90
100
150
200
250
300
101.60
102
102.40
102.84

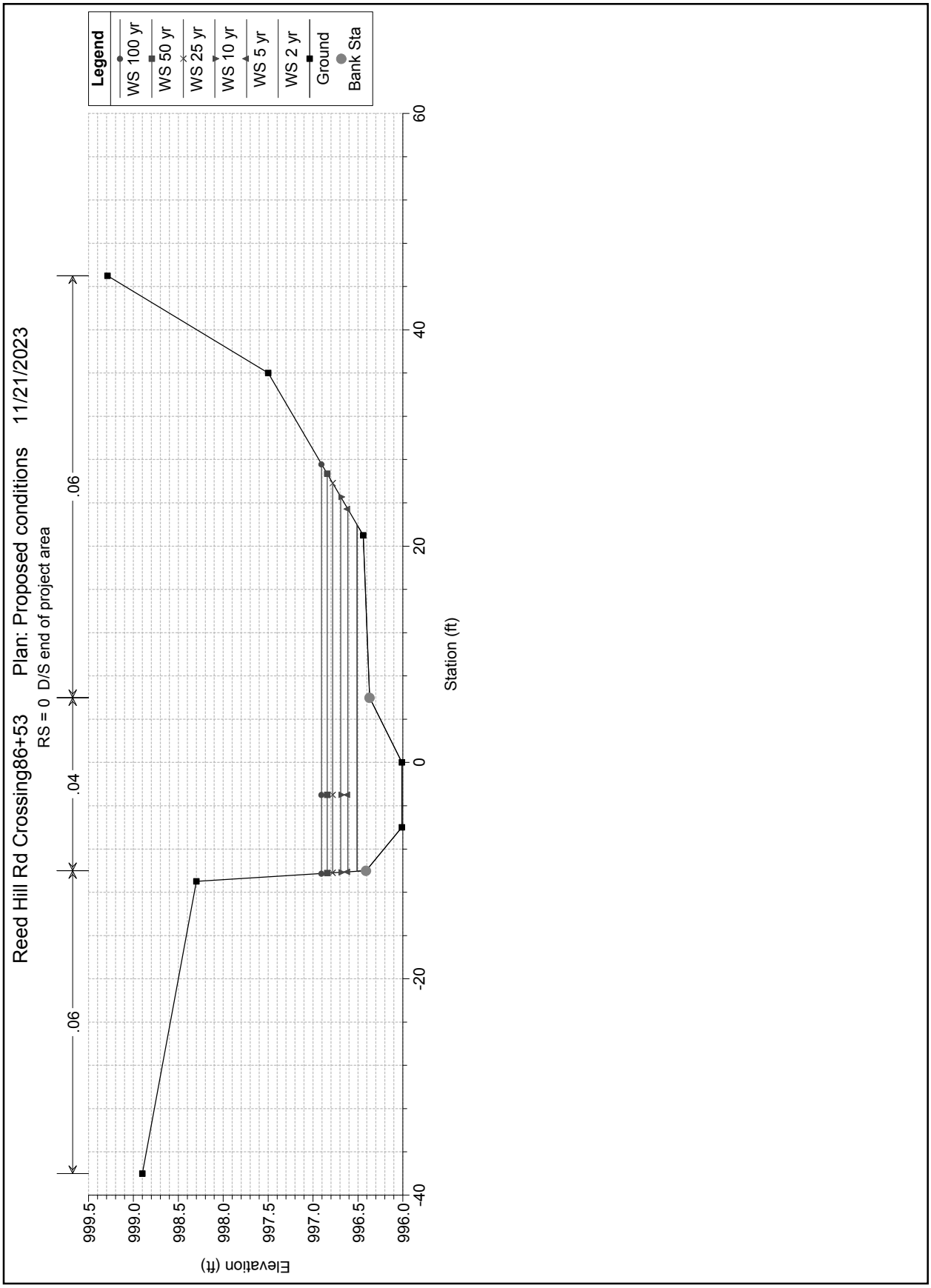

Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.84 U/S end of project
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.40
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 101.60
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100.45 U/S face
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1004
1003
1002
1001
1000
999
998
997
996
40
30
20
10
0
-10
-20
-30
-40
-50
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100 Culv
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1004
1002
1000
998
996
994
40
30
20
10
0
-10
-20
-30
-40
-50


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100
Culv
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 90
D/S face
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 60
.04
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
998.5
998.0
997.5
997.0
996.5
996.0
15
10
5
0
-5
-10
-15
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 30
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
999.5
999.0
998.5
998.0
997.5
997.0
996.5
996.0
-40
-20
0
20
40
60
Station (ft)

HEC-RAS Plan: prop River: Brook Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	102.84	2 yr	18.00	996.40	997.59	996.84	997.61	0.000952	1.12	16.08	16.06	0.20
Main Channel	102.84	5 yr	29.00	996.40	997.93	996.99	997.96	0.000986	1.33	21.88	17.29	0.21
Main Channel	102.84	10 yr	39.00	996.40	998.21	997.10	998.24	0.000992	1.46	26.72	18.25	0.21
Main Channel	102.84	25 yr	52.00	996.40	998.52	997.24	998.56	0.000986	1.59	32.64	19.37	0.22
Main Channel	102.84	50 yr	62.00	996.40	998.74	997.33	998.79	0.000966	1.67	37.02	20.14	0.22
Main Channel	102.84	100 yr	73.00	996.40	998.97	997.43	999.02	0.000908	1.75	41.71	20.89	0.21
Main Channel	102.40	2 yr	18.00	996.41	997.53		997.55	0.001475	1.33	13.50	14.38	0.24
Main Channel	102.40	5 yr	29.00	996.41	997.87		997.91	0.001473	1.55	18.70	15.76	0.25
Main Channel	102.40	10 yr	39.00	996.41	998.14		998.19	0.001444	1.69	23.12	16.84	0.25
Main Channel	102.40	25 yr	52.00	996.41	998.46		998.51	0.001393	1.82	28.63	18.07	0.25
Main Channel	102.40	50 yr	62.00	996.41	998.68		998.74	0.001332	1.90	32.71	18.64	0.25
Main Channel	102.40	100 yr	73.00	996.41	998.91		998.97	0.001248	1.97	37.10	19.29	0.25
Main Channel	102	2 yr	18.00	996.46	997.47		997.49	0.001395	1.24	14.48	16.66	0.24
Main Channel	102	5 yr	29.00	996.46	997.82		997.85	0.001276	1.41	20.59	18.28	0.23
Main Channel	102	10 yr	39.00	996.46	998.10		998.13	0.001197	1.51	25.80	19.54	0.23
Main Channel	102	25 yr	52.00	996.46	998.42		998.46	0.001068	1.62	32.24	20.64	0.23
Main Channel	102	50 yr	62.00	996.46	998.64		998.69	0.000972	1.69	36.99	21.23	0.22
Main Channel	102	100 yr	73.00	996.46	998.88		998.93	0.000897	1.75	42.05	21.84	0.22
Main Channel	101.60	2 yr	18.00	996.32	997.45		997.47	0.000625	0.93	19.44	18.32	0.16
Main Channel	101.60	5 yr	29.00	996.32	997.80		997.82	0.000662	1.12	25.98	19.03	0.17
Main Channel	101.60	10 yr	39.00	996.32	998.08		998.10	0.000680	1.25	31.30	19.60	0.17
Main Channel	101.60	25 yr	52.00	996.32	998.40		998.43	0.000690	1.38	37.71	20.25	0.18
Main Channel	101.60	50 yr	62.00	996.32	998.63		998.66	0.000680	1.46	42.37	20.74	0.18
Main Channel	101.60	100 yr	73.00	996.32	998.86		998.90	0.000657	1.55	47.33	21.27	0.18
Main Channel	100.45	2 yr	18.00	996.32	997.41	996.73	997.44	0.001225	1.38	13.08	15.27	0.23
Main Channel	100.45	5 yr	29.00	996.32	997.75	996.88	997.79	0.001288	1.69	17.15	16.29	0.25
Main Channel	100.45	10 yr	39.00	996.32	998.01	997.01	998.07	0.001319	1.92	20.34	17.09	0.26
Main Channel	100.45	25 yr	52.00	996.32	998.32	997.16	998.40	0.001340	2.16	24.06	18.02	0.27
Main Channel	100.45	50 yr	62.00	996.32	998.54	997.26	998.63	0.001347	2.32	26.69	18.67	0.27
Main Channel	100.45	100 yr	73.00	996.32	998.77	997.37	998.87	0.001349	2.48	29.43	19.31	0.28
Main Channel	100		Culvert									
Main Channel	90	2 yr	18.00	996.22	997.03	996.63	997.08	0.003347	1.86	9.67	15.43	0.37
Main Channel	90	5 yr	29.00	996.22	997.24	996.79	997.33	0.003986	2.37	12.22	16.33	0.41
Main Channel	90	10 yr	39.00	996.22	997.39	996.91	997.51	0.004479	2.77	14.09	17.00	0.45

A00840 -914

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 yr	52.00	996.22	997.57	997.06	997.73	0.005057	3.22	16.15	17.73	0.49
Main Channel	90	50 yr	62.00	996.22	997.68	997.17	997.88	0.005461	3.54	17.54	18.22	0.52
Main Channel	90	100 yr	73.00	996.22	997.80	997.28	998.03	0.005871	3.86	18.93	18.71	0.54
Main Channel	60	2 yr	18.00	996.12	996.94		996.98	0.002948	1.61	11.18	15.31	0.33
Main Channel	60	5 yr	29.00	996.12	997.14		997.20	0.003645	2.03	14.28	16.11	0.38
Main Channel	60	10 yr	39.00	996.12	997.28		997.37	0.004144	2.34	16.67	16.70	0.41
Main Channel	60	25 yr	52.00	996.12	997.45		997.56	0.004663	2.67	19.45	17.35	0.45
Main Channel	60	50 yr	62.00	996.12	997.56		997.69	0.004990	2.90	21.41	17.81	0.47
Main Channel	60	100 yr	73.00	996.12	997.67		997.82	0.005291	3.11	23.46	18.26	0.48
Main Channel	30	2 yr	18.00	996.09	996.82		996.87	0.004345	1.82	9.88	15.06	0.40
Main Channel	30	5 yr	29.00	996.09	996.97		997.06	0.005849	2.37	12.25	15.70	0.47
Main Channel	30	10 yr	39.00	996.09	997.08	996.75	997.20	0.007099	2.79	13.98	16.16	0.53
Main Channel	30	25 yr	52.00	996.09	997.20	996.88	997.36	0.008642	3.28	15.86	16.64	0.59
Main Channel	30	50 yr	62.00	996.09	997.27	996.98	997.48	0.009811	3.63	17.10	16.95	0.64
Main Channel	30	100 yr	73.00	996.09	997.34	997.07	997.59	0.011118	3.99	18.30	17.24	0.68
Main Channel	0	2 yr	18.00	996.01	996.51	996.49	996.62	0.020035	2.76	7.67	32.01	0.79
Main Channel	0	5 yr	29.00	996.01	996.61	996.59	996.76	0.020008	3.24	11.09	33.54	0.82
Main Channel	0	10 yr	39.00	996.01	996.69	996.66	996.86	0.020010	3.58	13.78	34.70	0.84
Main Channel	0	25 yr	52.00	996.01	996.78	996.75	996.98	0.020022	3.95	16.93	36.01	0.86
Main Channel	0	50 yr	62.00	996.01	996.84	996.81	997.07	0.020016	4.20	19.19	36.92	0.88
Main Channel	0	100 yr	73.00	996.01	996.91	996.87	997.15	0.020015	4.44	21.54	37.84	0.89

A00840 -915

Proposal No. 608163-128112

APPENDIX F

Drainage Swales

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 11+50 Lt to STA 13+50 Lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.41	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.031	ft/ft	
	τ		0.79	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA14+50 to 17+00 LT

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon d S$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow	0.63	ft	(10 year)
	From Express Calcs			
S	avg. bed slope	0.025	ft/ft	

τ	0.98	lb/ft^2

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA31+65 Lt to STA40+40

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon d S$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow	0.57	ft	(10 year)
	From Express Calcs			
S	avg. bed slope	0.047	ft/ft	

τ	1.67	lb/ft^2

Rock Riprap (6" diameter) (Permissible Unit Shear Stress 2.00 lb/ft^2)

D50 bottom	5	in

$D50_{sides} = K_1/K_2 * (D50)_{bottom}$

K1 Ratio of shear streese on sides and bottom
Side slope of 2:1
B/d 1.75

K1	0.87

K2 Ratio of tractive force on the sides and bootm using Fig. 7-10
Angle of repose is 42°

K2	0.77

$D50_{sides}$	5.65	in

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA40+40 Lt to STA 46+50 lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.35	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.016	ft/ft	
	τ		0.35	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Weston & Sampson

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 70+50 TO 72+75

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.46	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.03	ft/ft	
	τ		0.86	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Proposing modified rockfill to comply with MassDOT PDDG standards for a swale with 3% slope

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 11+50 to 13+50

Trapezoidal

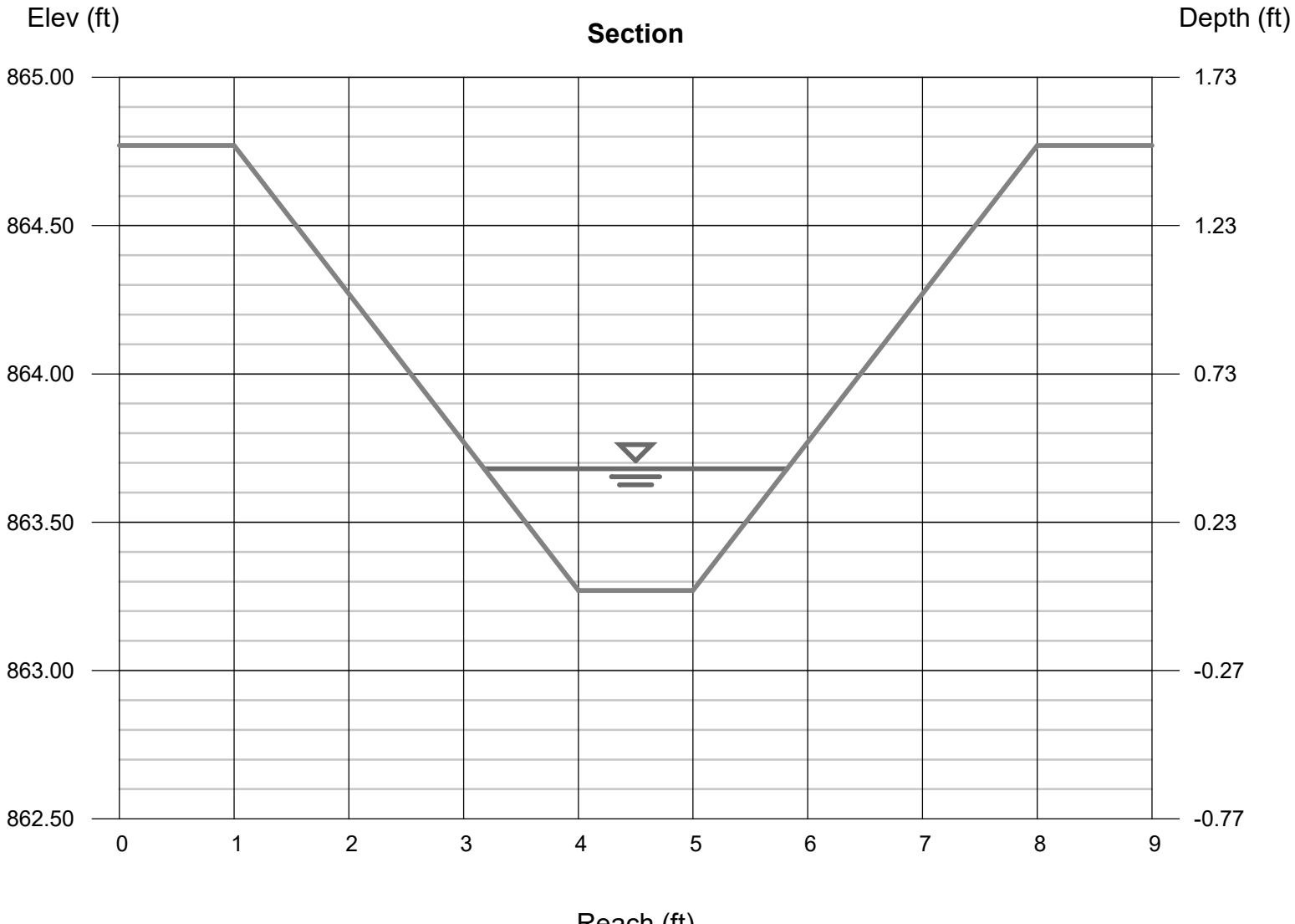
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 863.27
Slope (%)	= 3.10
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.38

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 2.380
Area (sqft)	= 0.75
Velocity (ft/s)	= 3.19
Wetted Perim (ft)	= 2.83
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 2.64
EGL (ft)	= 0.57



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 14+50 to 17+00

Trapezoidal

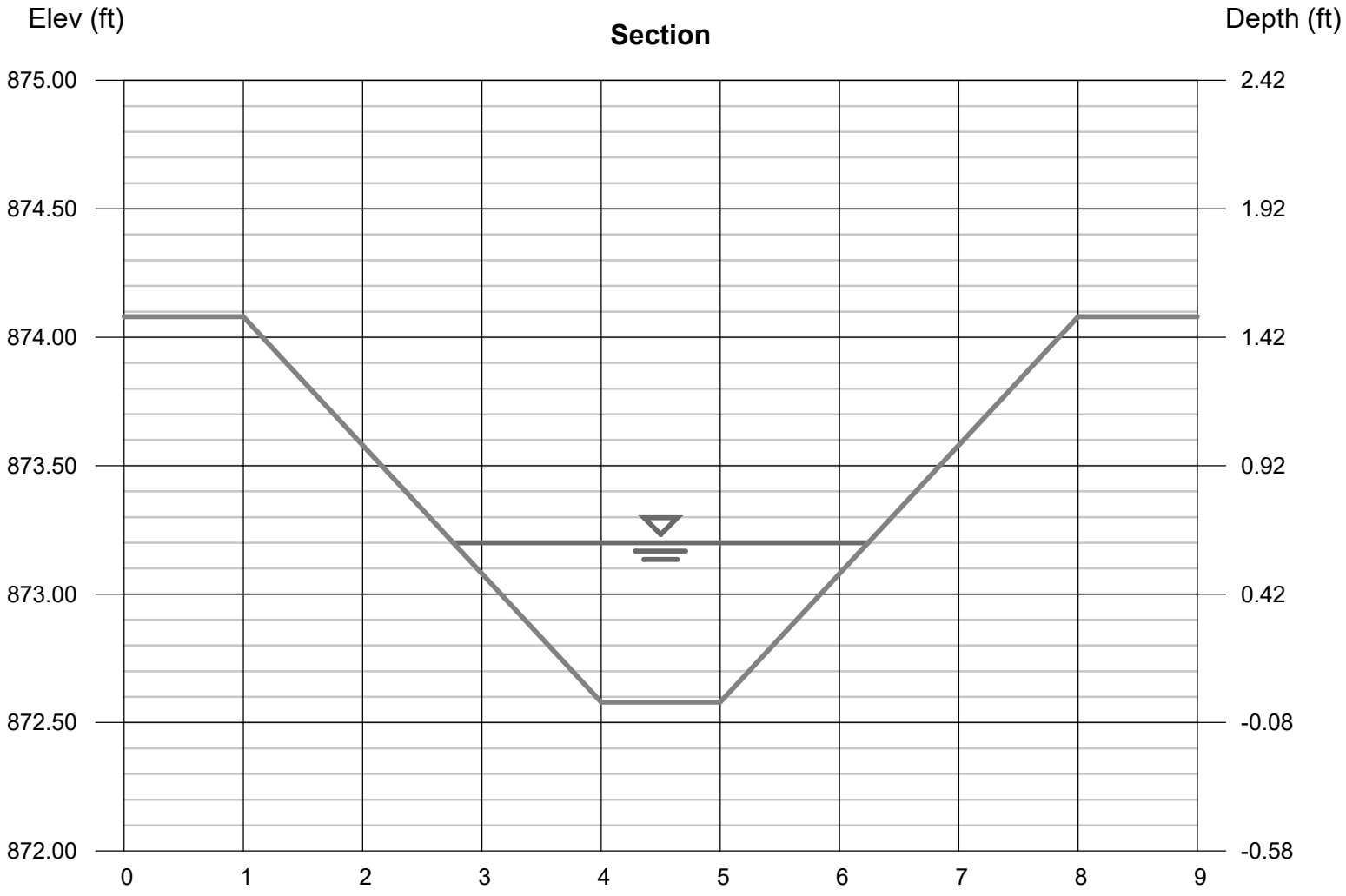
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 872.58
Slope (%)	= 3.90
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.14

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 6.140
Area (sqft)	= 1.39
Velocity (ft/s)	= 4.42
Wetted Perim (ft)	= 3.77
Crit Depth, Yc (ft)	= 0.69
Top Width (ft)	= 3.48
EGL (ft)	= 0.92



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 31+65

Trapezoidal

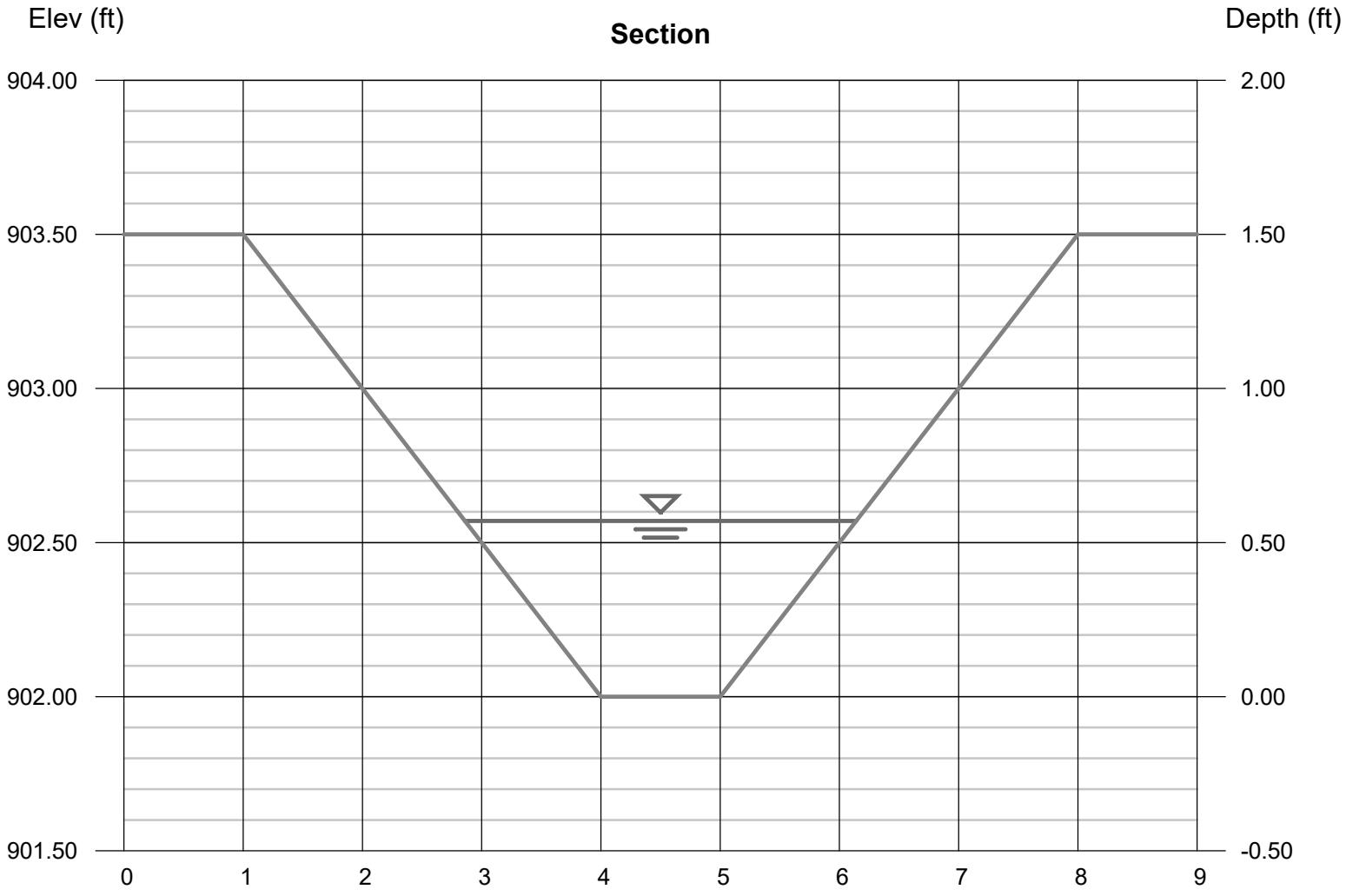
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 902.00
Slope (%)	= 4.70
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.66

Highlighted

Depth (ft)	= 0.57
Q (cfs)	= 5.660
Area (sqft)	= 1.22
Velocity (ft/s)	= 4.64
Wetted Perim (ft)	= 3.55
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 3.28
EGL (ft)	= 0.90



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 43+70

Trapezoidal

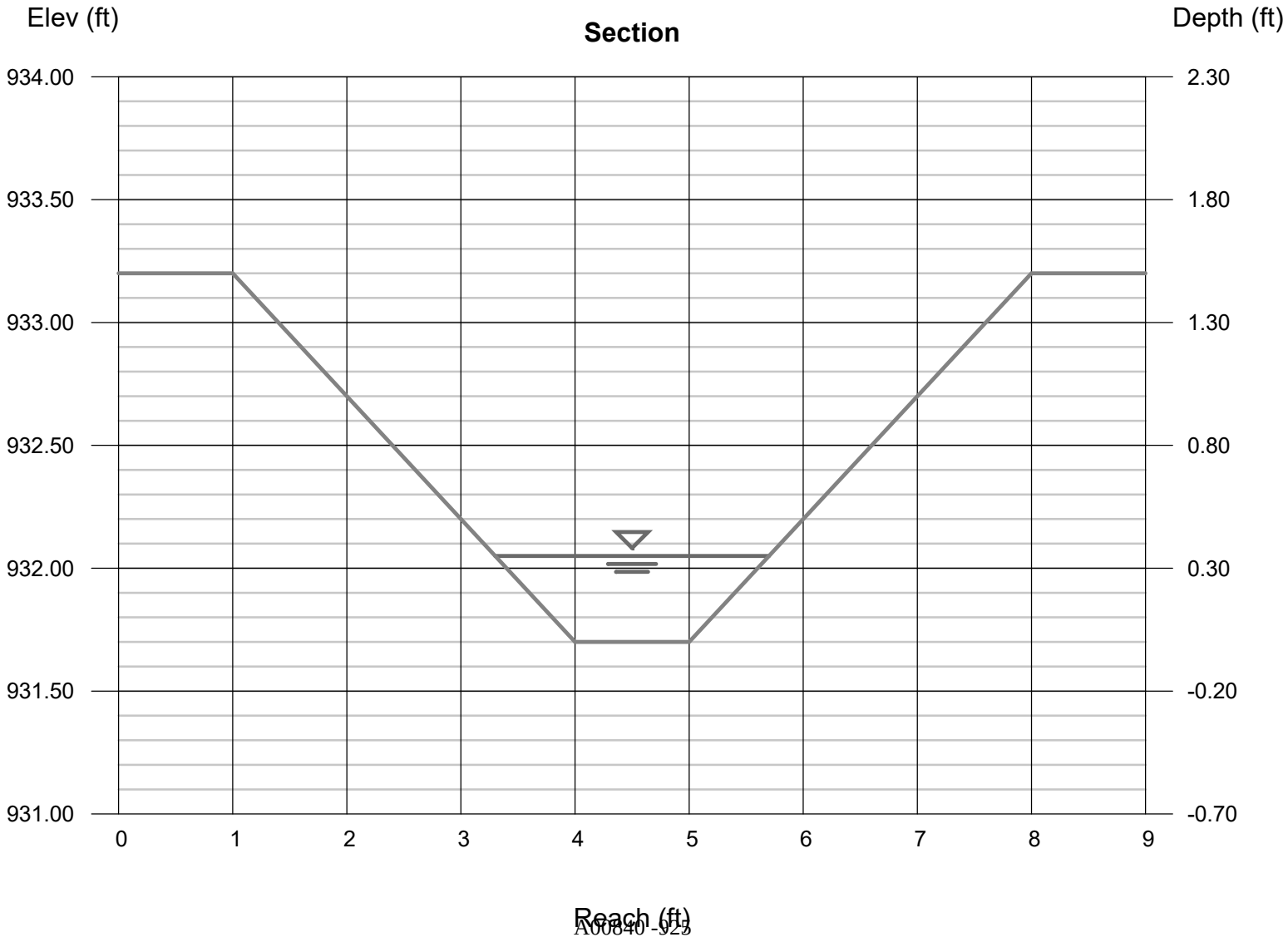
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 931.70
Slope (%)	= 1.60
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.23

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 1.230
Area (sqft)	= 0.59
Velocity (ft/s)	= 2.07
Wetted Perim (ft)	= 2.57
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 2.40
EGL (ft)	= 0.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 30 2023

Sta. 46+65

Triangular

Side Slopes (z:1)	= 6.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 930.00
Slope (%)	= 0.66
N-Value	= 0.033

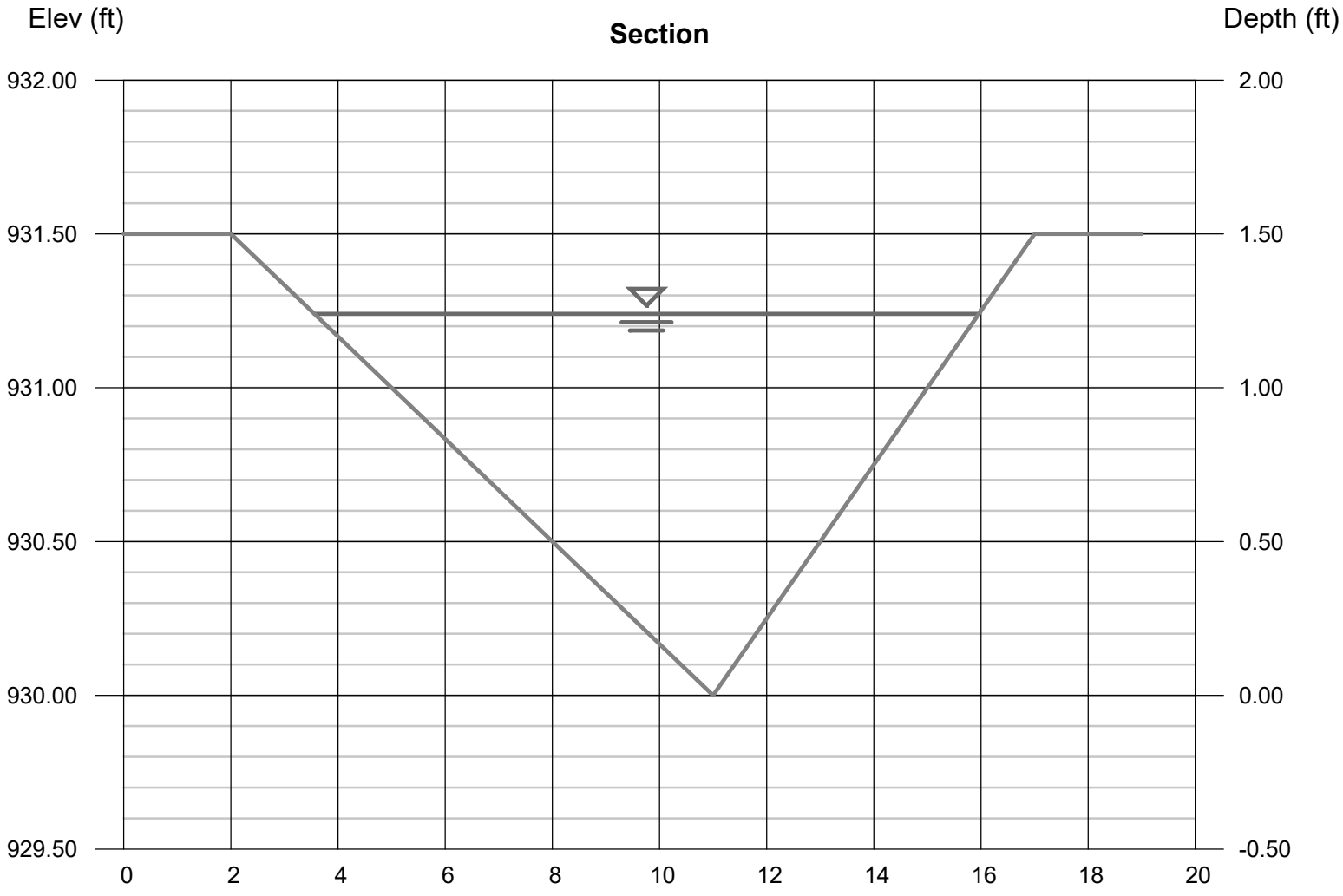
Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 20.00
Area (sqft)	= 7.69
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 12.66
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 12.40
EGL (ft)	= 1.35

Assuming diverted flow from Sta. 43+76 crossing - normal flow without diversion is 1.60 cfs



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

STA 72+75

Trapezoidal

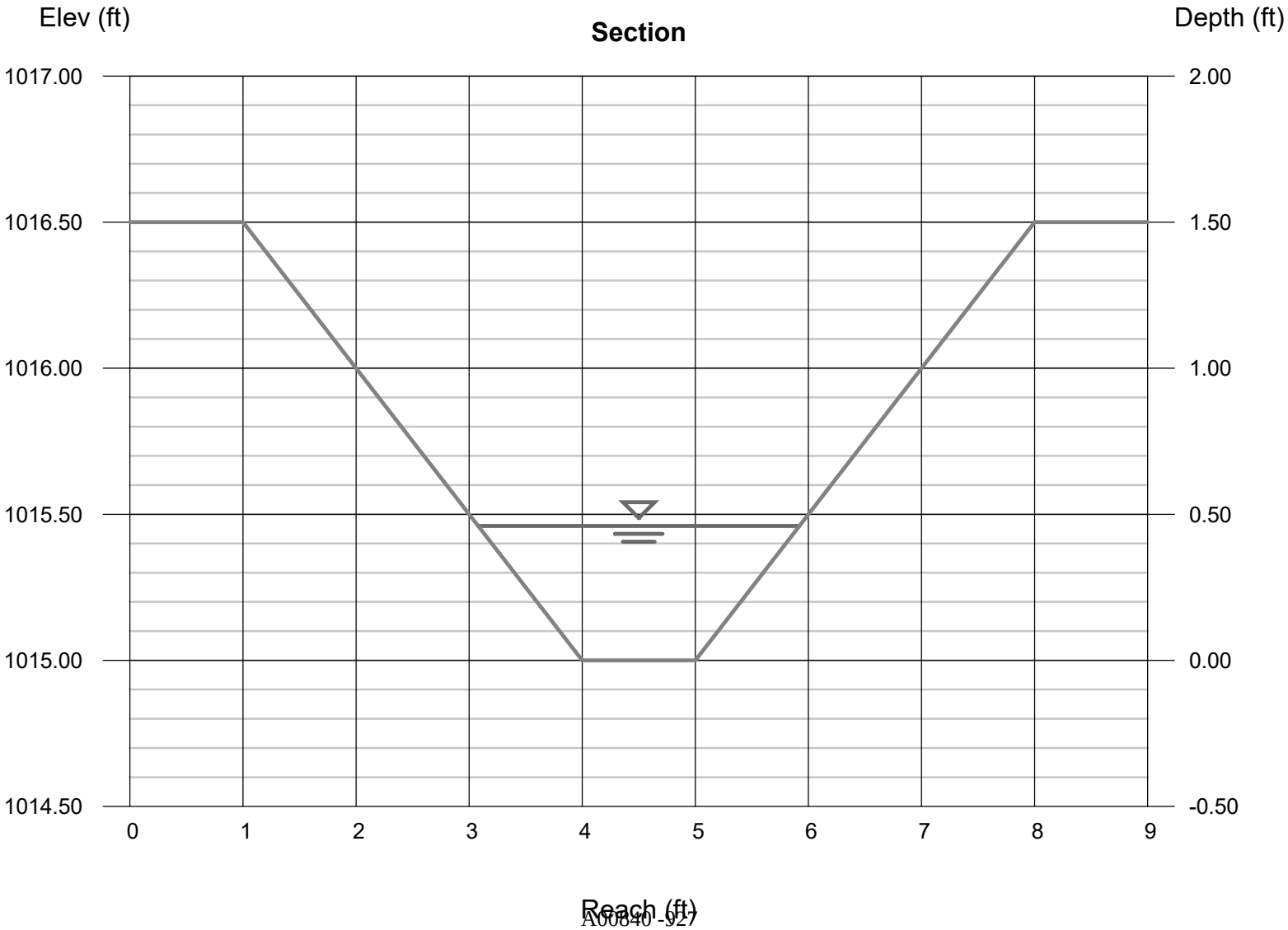
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1015.00
Slope (%)	= 3.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.94

Highlighted

Depth (ft)	= 0.46
Q (cfs)	= 2.940
Area (sqft)	= 0.88
Velocity (ft/s)	= 3.33
Wetted Perim (ft)	= 3.06
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 2.84
EGL (ft)	= 0.63



Monson Road Reconstruction
Wales, MA

Weston&Sampson ENGINEERS, INC.

Date: 4/8/2024
By: NSD
Checked By: RSV

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

i = 7.21 for 5 min
i = 4.00 for 15 min. Tc
10-yr Storm

Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)	Q=CiA
Proposed Drainage System									
	STA 11+50								
Swale		146,424	**3.361**	5,227	141,197		0.32	15	4.32
	STA 15+30								
Swale		263,398	**6.047**	14,906	88,478	160,014	0.27	15	6.61
	STA 31+65								
Swale		261,651	**6.007**	16,212	18,800	226,639	0.25	15	6.02
	STA 43+70								
Swale		33,770	**0.775**	9,772	6,265	17,733	0.42	15	1.31
	STA 46+65								
Swale		48,946	**1.124**	2,570	13,201	33,175	0.26	8	1.76
	STA 72+75								
Swale		161,325	**3.704**	5,642	6,630	149,053	0.23	15	3.39

NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover		C
Impervious		0.9
Grass		0.3
Unimproved (Woods)		0.2

APPENDIX G

Outlet Protection

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 15+33					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.29	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	9.86			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.74	ft	8.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT
Depth=	$3.3D_{50}$	2.45	FT
W1= 3Wo	(min.)	4.5	FT
W2=3Wo + 2/3L		11.17	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	4	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 22+25					
Wo	pipe diameter or span	(ft)	1.25			Input
Q	pipe(design) discharge	(cfs)	5.55	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1.25			

Velocity	(ft/s)	5.36

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.44	ft	17.31	in

Calculated Riprap Apron Dimensions

L=	4D	5.00	FT
Depth=	$3.3D_{50}$	4.76	FT
W1= 3Wo	(min.)	3.75	FT
W2=3Wo + 2/3L		7.08	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 25+00					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.22	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	4.53

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.26	ft	3.09	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	0.85	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	7.5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 43+76	Twin 12" diameter pipes				
Wo	pipe diameter or span	(ft)	2			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.32	(HY-8)		
D	pipe rise	(ft)	2			

Velocity	(ft/s)	6.27

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.71	ft	8.54	in

Calculated Riprap Apron Dimensions

L=	4D	8.00	FT
Depth=	$3.3D_{50}$	2.35	FT
W1= 3Wo	(min.)	6	FT
W2=3Wo + 2/3L		12.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	16	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 46+65					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.94	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	6.75			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.61	ft	7.32	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.01	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	3	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 50+55					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	2.05	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	3.5			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.51	ft	6.18	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	1.70	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 51+20					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.75	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	5.83

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.15	ft	13.82	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.80	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 73+25					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.58	10-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	3.38

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.73	ft	8.73	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.40	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	9.5	FT
Depth	1.5	FT
W1	10	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 81+97					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.31	10-yr storm		Output
TW	tailwater depth	(ft)	0.1			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	6.12

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.98	ft	11.70	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.22	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 82+07					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.14	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	7.72			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.54	ft	18.48	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	5.08	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	2	FT
W1	5	FT
W2	14	FT

Project	Monson Road	Date:	4/8/2024
Project Number:	ENG23-0621	By:	NSD
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 85+72					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.78	25-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	3.96			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.85	ft	10.24	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	2.81	FT			
W1= 3Wo	(min.)	3	FT			
W2=3Wo + 2/3L		9.67	FT			

Proposed Modified Rockfill Scour Hole

Ls	8	FT
Depth	2	FT
W1	4.5	FT
W2	7	FT

Dimensions based on site conditions and proposed headwall configuration

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 1+50					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	1	25-yr storm		Output
TW	tailwater depth	(ft)	0.15	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	4.96			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.08	ft	0.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	0.25	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed

Existing Wetlands to Remain. Velocity is under 5 ft/s.

ATTACHMENT D

Operation and Maintenance Plan

LONG-TERM POLLUTION PREVENTION PLAN/
OPERATION AND MAINTENANCE PLAN
Town of Wales

I. Purpose and Scope

The purpose of this plan is to provide the maintenance staff of the Town of Wales guidelines and procedures for the operation and maintenance of the drainage systems for the Monson Road Transportation Improvement Project. Checklists will be utilized during the inspection and cleaning process and kept on file in the maintenance office.

The proposed site plan includes the following stormwater structures:

- Catch Basins
- Drainage Manholes
- Drainage Swales
- Discharge Points

II. Ownership

The Town of Wales Highway Department operates and maintains Town-wide roadways and drainage systems.

III. Responsible Party

The following individual is the primary contact for the implementation of this plan.

Name: Vernon Jackson, Interim Highway Superintendent

Phone #: (413) 245-7494

IV. Schedule for Inspection and Maintenance Activities

Note: DEP's handbook represents goals for public works agencies seek to meet. However due to funding constraints and low staffing levels, it is very challenging to meet the stated frequencies. MassDOT will continue to strive to meet DEPs frequencies listed in the table below until a programmatic operation and maintenance plan is established, which will supersede this project-specific O&M plan.

A. Inspection

i. Structures, swales, and outfalls will be inspected annually for excess accumulation of sediment and debris, erosion or other problems.

ii. Deep sump catch basins will be inspected four times per year.

B. Routine and Non-Routine Maintenance

i. Structures, swales, and outfalls shall be cleaned at least once a year, at a minimum, after the snow and ice removal season and before spring rainfall events or as required due to conditions noted during inspections.

ii. Deep sump catch basins shall be cleaned four times per year, or whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

iii. Street sweeping: The roadways shall be swept once a year after the snow and ice removal season has ended and prior to spring rains.

iv. Erosion repairs will be completed on an as-needed basis.

V. Access to System

The drainage system is located within the Town right-of-way.

VI. Funding

The Highway Department maintains a budget as required to complete all highway related services. Inspection and maintenance of the systems is part of this yearly budget process.

VII. Illicit Discharges

No illicit discharges to watercourses or drainage structures are permitted in the Town of Wales.

VIII. Operation and Maintenance Log Forms

See attached sheets.

STORMWATER MANAGEMENT SYSTEM INSPECTION CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
STRUCTURES				

STRUCTURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

ATTACHMENT E

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

For Construction Activities At:

Monson Road Transportation Improvement Project
Wales, MA

Prepared For:

Town of Wales
3 Hegan Street
Wales, MA
(413) 245-7494– Christopher Ryan

Prepared By:

Weston & Sampson Engineers, Inc.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
(860) 513-1473

Site Contractor:

To Be Determined

1. Narrative

The purpose of this plan is to provide general guidelines and operation and maintenance procedures to the contractor during construction specifically with regards to erosion and sediment control.

The proposed project includes construction activities in, or close to, the limit of work includes bordering vegetated wetlands, mean annual high water and top of bank to perennial and intermittent stream). Activities includes excavation within existing pavement limits for the installation of storm drainage systems and the reconstruction of the existing paved roadways. Soils in the project area per the NRCS Web Soil Survey include:

- 307C – Paxton fine sandy loam, 8 to 15 percent slopes –Hydrologic Soil Group C
- 316B – Scituate fine sandy loam , 3 to 8 percent slopes, very stony – Hydrologic Soil Group C/D

Imported fill material will likely be limited to new road base and pipe bedding material unless excessive unsuitable materials are encountered within the paving limit.

2. Operation and Maintenance

A. The work covered by this plan consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this plan apply to all land disturbing activities required for this project

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as all other stated requirements.

D. The proposed erosion and sediment control measures that are to be installed are located on the construction drawings.

E. A rain gauge shall be placed at the project in a workable location and monitored during rainfall periods until all disturbed areas are stabilized. In the event, there is a rainfall greater than 1/2" in a 12 hour period, all erosion control measures shall be checked and repaired as required. If no rain gauge is used, all erosion control measures shall be checked after all rainfall events. A checklist (sample provided at the end of this plan) will be filled out by the contractor each week. The contractor shall designate a party to be responsible for the maintenance of all erosion and sediment control measures for the duration of the project. Inspections shall be completed weekly or

within 24 hours of a rain event as described above. When maintenance is required it shall be completed within 24 hours of being identified.

Designated Party: _____

F. All soil erosion and sediment control measures shall be installed, maintained, and implemented as shown on the construction drawings. It is the intent of this plan that soil erosion control measures are the first to be installed and the last to be removed. Surface waters on and adjacent to the site and abutting properties are to be protected from degradation and sedimentation. If other watercourses, streams, drainage-ways or abutting properties are jeopardized by construction, it shall be the contractor's responsibility to protect those waters and properties.

G. Make all necessary repairs to erosion control facilities as soon as possible. Silt fences and straw bale barriers, temporary sediment traps, and inlet protection which accumulate sediment and debris shall be cleaned and re-set as needed.

3. Notification

The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions. The Contractor shall, after receipt of such notice, 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 to act promptly, the Engineer may order stoppage of all or part of the work until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

4. Implementation

A. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer and the Conservation Commission to develop mutual understandings relative to compliance of the environmental protection program.

B. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands and 200 feet of watercourses.

C. Once a construction schedule has been established a person shall be named and will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials,

installation, and maintenance of erosion and sediment structures, the communication and detailed explanation to all people involved in the site work of the requirements and objective of the erosion and sediment control measures.

D. The Engineer shall be notified of any proposed alteration to the erosion and sediment control plan, prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

5. Area of Construction Activity

Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

6. Protection of Water Resources

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

C. All projects that have the potential to impact critical areas shall implement a source control and pollution prevention program that includes proper management of snow and deicing chemicals. To protect critical areas, road salt must be properly stored within a Zone II or Interim Wellhead Protection Area or near an Outstanding Resource Water, Special Resource Water, shellfish growing area, bathing beach or cold-water fishery. The use of salt for the deicing of impervious surfaces must be minimized within water supply protection areas and any area near an Outstanding Resource Water, Special Resource Water, fresh water beach, or cold-water fishery.

7. Location of Storage Areas

A. The location of the Contractor's storage areas for equipment and/or materials shall be as negotiated with the Owner. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled hay or straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

8. Spill Prevention Measures

A. Vehicle Maintenance: Vehicles and equipment maintenance shall occur at the off-site staging area over a spill containment pallet or sufficiently impervious surface. Only minor maintenance shall be conducted. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets inside a materials storage container. Fluids shall be removed from the site and dispose of in accordance with applicable regulations as soon as feasible. All vehicles and equipment including subcontractor vehicles shall be checked for leaking oil and fluids. Vehicles leaking fluid shall not be allowed onsite.

B. Spill Kits: Spill kits will be stored within the designated fueling area and concrete washout areas. Spill kits shall be readily available during all fueling operations. Spill kits must contain absorbent pads or other sorbent materials. Spill kits shall be inspected weekly to insure that adequate cleanup materials are on site at all times.

C. Spills: All spills will be cleaned up immediately upon discovery. Spent absorbent materials and rags will be hauled offsite immediately after the spill is cleaned up for disposal at an approved location. Spills large enough to discharge to surface water will be reported to the National Response Center at 1-800-424-8802.

D. Material safety data sheets: A material inventory and emergency contact information shall be maintained onsite.

9. Vehicle Fueling Operations

A. Several types of vehicles and equipment will be used on-site throughout the project, including graders, excavators, loaders, concrete equipment, rollers,

trucks and trailers, backhoes, and forklifts. Equipment/vehicle fueling will be performed onsite. Fueling activities are to be situated so that drainage facilities or watercourses located in the area are not at risk from potential infiltration. Fueling shall take place on an impervious surface and shall be conducted at least 100 feet from a drainage structure, wetland or watercourse. Absorbent, spill-cleanup materials and spill kits will be available at the designated fueling areas. Fuel will be delivered to the site on an as needed basis by a fuel delivery service.

B. Maintenance and Inspection: Inspect equipment/vehicle storage areas and fueling area weekly. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately or the problem vehicle(s) or equipment will be removed from the project site. Keep ample supply of spill-cleanup materials onsite and immediately clean up spills and dispose of materials properly.

10. Washing of Equipment and Vehicles

Washing of equipment and vehicles is prohibited. Vehicle and equipment washing shall occur off-site at a permitted facility.

11. Materials Storage and Staging Area

A. Construction equipment and maintenance materials will be stored at a designated staging area and materials storage areas. A watertight shipping container will be used to store hand tools, small parts, and other construction materials. All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the storage container, until such time they can be properly disposed of. Very large items, such as piping, valves, and structures, will be stored in the open in the materials storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

B. The storage areas will be inspected weekly. The storage areas will be kept clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners will be repaired or replaced as needed to maintain proper function.

C. It is not anticipated that pesticides, herbicides, insecticides, fertilizers and landscape materials will be stored on site. These materials will be delivered as needed during the installation of the limited landscaping features. If it is determined that these materials are required to be stored on site they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

D. It is not anticipated that diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals will be stored on site. These materials will be delivered as needed over the course of construction. If it is determined that these materials are required to be stored on site, they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

E. All hazardous waste materials including oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers, within a hazardous materials storage area in a designated staging area. Hazardous waste materials will be stored in appropriate and clearly marked containers and segregated from other non-waste materials. Secondary containment will be provided for all waste materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous waste materials will be disposed of in accordance with federal, state, and local regulations. Hazardous waste materials will not be disposed of into the on-site dumpsters. The hazardous waste materials area will be inspected weekly and after storm events. The storage area will be kept clean, well-organized and equipped with ample cleanup supplies as appropriate for the materials being stored. Material safety datasheets, material inventory, and emergency contact numbers will be maintained on site.

F. All waste materials will be collected and disposed of into a dumpster in the designated staging area. Dumpsters will have a secure tight lid, be placed away from stormwater drains and structures, and will meet all federal, state, and local regulations. Only trash and construction debris will be placed in the dumpsters. Construction materials will not be buried on site. The dumpsters will be inspected weekly and immediately after storm events. The dumpsters will be emptied weekly, or more frequently if needed, and taken to the appropriate disposal facility.

12. Sanitary Waste

Portable toilets, located in the staging area, will be provided at the site throughout all the phases. The toilets will be located away from concentrated drainage flow paths. Sanitary waste will be collected a minimum of once a week and shall be inspected weekly for evidence of leaking holding tanks.

13. Concrete Truck Washout Procedures

A. A designated temporary, above-grade concrete washout area will be constructed at an approved onsite location. The washout area shall be constructed in a location approved by the engineer. The temporary concrete washout area will be constructed using staked hay bales with a recommended minimum length and minimum width of 10 feet, but with sufficient quantity and volume to contain all liquid and concrete waste

generated by washout operations. The washout area will be lined with plastic sheeting at least 10 mils thick and free of holes or tears.

B. Concrete pours will not be conducted during or before an anticipated storm event. Concrete mixer trucks and chutes will be washed in the designated area or concrete wastes will be properly disposed of offsite. When the temporary washout area is no longer needed for the construction project, the hardened concrete and materials used to construct the area will be removed and disposed as described below and the area will be stabilized.

C. The washout areas will be inspected weekly and each day of use to ensure that all concrete washing is being discharged into the washout area, no leaks or tears are present and to identify when concrete wastes need to be removed. The washout areas will be cleaned out once the area is filled to 75 percent of the holding capacity. Once the area's holding capacity has been reached, the concrete wastes will be allowed to harden, the concrete will be broken up, removed, and taken to the appropriate landfill for disposal. The plastic sheeting will be replaced if tears occur during removal of concrete wastes from the washout area.

14. Recycling Practices

Wood pallets, cardboard boxes, and other recyclable construction scraps will be disposed of in a separate designated dumpster for recycling. The dumpster will have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all local and state solid waste management regulations. Only solid recyclable construction scraps from the site will be deposited in the dumpster. The recycling dumpster will be inspected weekly. The recycling dumpster will be emptied when full and taken to an approved recycling center by the contractor. If recyclable construction wastes are exceeding the dumpster's capacity, the dumpsters will be emptied more frequently.

15. Construction in Areas Designated as Wetland Resources on the Drawings

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetland resources. Total construction widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetland resources shall not be unduly disturbed by the Contractor's operations. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

16. Protecting and Minimizing Exposed Areas

A. The Contractor shall limit the area of land which is exposed and erodible during construction. In areas where the period of exposure will be greater than two (2) months, temporary stabilization or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

17. Protection of Landscape

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as required.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. 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.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled, and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their

growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

18. Clearing and Grubbing

A. The Contractor shall clear and grub only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.

B. The Contractor shall not remove trees without permission of the Engineer.

19. Discharge of Dewatering Operations

A. Any water that is pumped and discharged as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to an approved filtration method before discharging to the nearest drainage system, stream, or waterway.

C. The pumped water shall be filtered through baled hay, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

20. 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 streets as necessary, to minimize creation and dispersion of dust.

B. Per Section 9.1.2.k of the Environmental Protection Agency Construction General Permit, dust control shall be limited to the use of water only. Calcium Chloride or other techniques will not be permitted.

21. Separation and Replacement of Topsoil

Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

22. Compost Filter tubes

To trap sediment and to prevent sediment from discharging downhill, compost filter tubes shall be used where shown on the drawings. The tubes should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

23. Sediment Fence

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

B. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a 22-foot wide, continuous length support netting, and stapled to pre-weathered oak posts installed as shown on the drawings. The oak posts shall be 1½-inches by 1½-inches (Minimum Dimension) by 48 inches and shall be tapered. The support netting shall be industrial strength polypropylene. The bottom edge of the sediment control fabric shall be buried as shown on the drawings. The sediment control fabric shall conform to the following properties:

Property	Value	Test Method
1. Grab Strength (lbs.)	124	ASTM D-4632
2. Elongation (%)	15%	ASTM D-4632
3. Puncture Strength (lbs.)	65	ASTM D-4833
4. Burst Strength (psi)	300	ASTM D-3786
5. Trapezoid Tear (lbs.)	60	ASTM D-4533
6. Equivalent Opening Size (U.S. Sieve)	No. 30	ASTM D-4571
7. Permittivity (sec^{-1})	0.10	ASTM D-4491
8. Water Flow Rate (gal/min/sf.)	10	ASTM D-4491
9. UV Resistance (%)	70	ASTM D-4355

C. The silt fence shall be Mirafi Envirofence manufactured by Mirafi, Inc. or approved equal.

24. Inlet Protection

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall install and maintain inlet protection. At a minimum inlet protection is required on all drainage structures in the project area. The inlet protection shall be SiltSack or approved equal. The inlet protection shall be cleaned or replaced as needed to insure proper operation for the duration of construction.

EROSION CONTROL MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Sediment Barriers				
Inlet Protection				
Discharge Points				

A00840 -962

Proposal No. 608163-128112

POLLUTION PREVENTION MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Trash Dumpster with Cover				
Recycling Dumpster with Cover				
Staging Area				
Bulk Material Storage Area				
Material Storage Containers				
Fueling Area				
Equipment Storage Area				
Sanitary Facilities				
Concrete Washout Area				
Spill Kits				

A00840 -963

Proposal No. 608163-128112

Appendix C

NHESP No Take Determination

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

July 01, 2024

John Grasso
Town of Wales
3 Hollow Road
Wales, Massachusetts 01081

Wales Conservation Commission
Box 834
Wales, MA 01081

RE: Applicant: John Grasso, Town of Wales
Project Location: Monson Road
Project Description: Transportation improvement Project
DEP Wetlands File No.: 314-0183
NHESP File No.: 24-18601
Heritage Hub Form ID: RC-86199

Dear Commissioners & Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received a Notice of Intent with site plans (dated June 2024, revised date N/A) in compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.58(4)(b), 10.59). The Division also received the MESA Review Checklist and supporting documentation for review pursuant to the MA Endangered Species Act Regulations (321 CMR 10.18).

WETLANDS PROTECTION ACT (WPA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not adversely affect** the actual Resource Area Habitat of state-protected rare wildlife species. Therefore, it is our opinion that this project meets the state-listed species performance standard for the issuance of an Order of Conditions.

Please note that this determination addresses only the matter of rare wildlife habitat and does not pertain to other wildlife habitat issues that may be pertinent to the proposed project.

MASSACHUSETTS ENDANGERED SPECIES ACT (MESA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site

plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at Melany.Cheeseman@mass.gov, (508) 389-6357.

Sincerely,

Jesse Leddick
Assistant Director

cc:

THIS PAGE IS INTENTIONALLY LEFT BLANK

401 Water Quality Certificate Application
Project Narrative

Introduction

On behalf of the Town of Wales, Weston and Sampson is submitting this application for coverage under the Massachusetts Department of Environmental Protection (MassDEP) Section 401 Water Quality Certification (WQC) for the Monson Road Transportation Improvement Project (the project). This application is being filed pursuant to Section 401 of the federal Clean Water Act (33 U.S.C. 1341), Massachusetts General Laws c. 21, §§ 26-53, and the Massachusetts Department of Environmental Protection's (DEP) Water Quality Certification Regulations at 314 CMR 9.00 (Water Quality Certification Regulations).

The purpose of the project is to make roadway, shoulder, and drainage improvements to an approximately 1.5-mile stretch of Monson Road in Wales. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The project proposes several roadway improvements including full depth pavement reconstruction, new four-foot-wide shoulders along Monson Road for pedestrian and bicycle use, minor adjustments to the alignment to improve safety, and roadway drainage improvements. The project additionally will involve upgrades to several of the existing stream crossings along this stretch of Monson Road, as many of the culverts are undersized and do not currently meet the Massachusetts Stream Crossing Standards.

A Notice of Intent (NOI) is being filed with the Wales Conservation Commission for proposed impacts to Bordering Vegetated Wetlands (BVW) and the 200-foot Riverfront Area (RFA) associated with the roadway reconstruction work. It is important to note that the stream crossing work (culvert upgrades and replacements) that is proposed as part of the overall project is subject to Section 24 of the 2014 Transportation Bond Bill (approved 4/18/2014) and is therefore considered "bridge exempt." Accordingly, the proposed stream crossing work is not subject to Section 61 and Sections 62A to 62I, inclusive, of Chapter 30 of General Laws (the Massachusetts Environmental Policy Act), Chapter 91 (Waterways Act) of the General Laws and Section 40 of Chapter 131 of the General Laws (Wetlands Protection Act).

Because the stream crossing work is not subject to review under the Wetlands Protection Act (WPA), this work requires permitting under the Water Quality Certification Regulations. The stream crossing activities will result in unavoidable impacts to BVW and Land Under Water (LUW) and require a 401 WQC application pursuant to 314 CMR 9.04(4). Specifically, the stream crossing improvements will result in approximately 2,186 square feet (SF) of permanent alteration to LUW, 1,943 SF of temporary impacts to LUW, 653 SF of permanent impacts to BVW, and 184 SF of temporary impacts to BVW. A Major Project

Certification (BRP WW 10) is required due to the proposed impacts to Waters of the U.S. within the Commonwealth (BVW and LUW) that will exceed 5,000 square feet.

Additionally, approximately 89 cubic yards of dredge impacts are proposed within LUW to facilitate the culvert replacement work. Because the project will not result in greater than 100 cubic yards of dredging within Waters of the U.S., a 401 WQC Dredge Permit is not required.

The project is anticipated to be advertised for construction in August or September of 2024 with the start of construction in Mid-March of 2025. Construction of the project is anticipated to be complete by Fall of 2026.

Additional anticipated permits and regulatory reviews include:

- Massachusetts Environmental Policy Act (MEPA) Environmental Notification Form (ENF) (roadway work)
- Notice of Intent (MA Wetlands Protection Act) – Wales Conservation Commission (roadway work only)
- Massachusetts Endangered Species Act (MESA) Review – concurrent with NOI filing
- Section 404 Pre-Construction Notification (PCN) (roadway and culvert work)

Impacts to wetlands and waterways have been avoided and minimized to the maximum extent practicable; however, due to the nature of the project and the need to improve existing stream crossings and alleviate flooding conditions, certain impacts were unavoidable. Proposed impacts to LUW and BVW associated with the stream crossing work are detailed in the narrative below and on the plans provided in Appendix J. The project proposes to mitigate for the proposed impacts to BVW through the construction of a wetland replication area adjacent to the project site, as described in more detail below.

Existing Conditions

Monson Road is a two-lane, Rural Major Collector. The Project is approximately 1.5 miles long and is located in the western part of Wales, beginning at the Monson Town line and continuing east just beyond the intersection of Monson Road and Reed Hill Road. The land use within the project route includes paved roadway and associated gravel shoulders, adjacent residential properties, wetlands and undeveloped woodlands. Refer to the locus maps provided in Appendix C for a depiction of the project site.

There are a number of wetland resource areas and stream crossings located adjacent to Monson Road within the project limits, including vegetated wetlands, intermittent streams, and perennial streams. A wetland delineation was conducted by Weston & Sampson in October 2023 and March 2024. A wetland delineation report including mapping depicting the limits of the delineated resource areas, along with wetland determination data forms, is included in Appendix I.

Currently the existing site has an open “country” drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The existing outfalls are in relatively stable condition; however, adjacent to the outfalls in several areas the existing banks experience significant erosion which is contributing to poor water quality within the immediately adjacent resource areas.

Nine culvert crossings convey streams (unnamed except for the crossing at Sta. 50+72 which is locally known as Dunham Brook or Schoolhouse Brook) under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta. 15+32, Sta. 24+92, Sta. 43+75, Sta. 46+60, Sta. 50+72, Sta. 55+00, Sta. 82+07, and Sta. 86+00-87+00 (two culverts at this location, one under Monson Road and one under Reed Hill Road). These streams eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road.

The site is not located within the mapped 100-year floodplain, according to the current FEMA FIRM maps (refer to Figures 3.1 through 3.4 in Appendix C).

There is a discrete area of Priority and Estimated Habitat for Rare Species mapped by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) between Peck Road and Maynard Road (see Figure 4 in Appendix C). The applicant is coordinating with NHESP under the streamlined Massachusetts Endangered Species Act (MESA) review through the NOI filing for the roadway work.

Three of the stream crossings, which are perennial watercourses, within the project corridor are designated as coldwater fisheries resources by the Massachusetts Division of Fisheries and Wildlife (MADFW) (refer to Figure 4 in Appendix C). None of the streams are mapped as Outstanding Resource Waters. The project site is not located within an Area of Critical Environmental Concern (ACEC).

The proposed work area is not within 0.25 miles up or downstream of the designated main stem of, or in tributaries within 0.25 miles of the designated main stem of a National Wild and Scenic River; in “bordering and contiguous wetlands” that are adjacent to the designated main stem of a National Wild and Scenic River; and does not have the potential to alter flows within a river within the National Wild and Scenic River System including rivers officially designated by Congress as study rivers for possible inclusion while such rivers are in official study status.

The proposed work area is not within any federal lands including National Wildlife Refuges, National Forests, National Marine Sanctuaries, National Parks, or any other areas administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service, and USACE project lands and easements.

Stream Crossings:

Existing conditions information on each stream crossing is provided in Table 1 below. Six of these stream crossings (seven pipes/culverts) are proposed to be replaced due to structural deficiencies and being undersized, as discussed more in the Proposed Conditions section of this narrative.

Table 1. Summary of Existing Stream Crossings

Location (Station)	Existing Culvert	Stream Classification	Existing Bankfull Width
15+32	40 feet of 12-inch corrugated plastic pipe (CPP)	Intermittent	No bankfull indicators. Wetted width 1-2 feet.
24+92	54 feet of 30-inch PVC 49 feet of 36-inch corrugated metal pipe (CMP)	Perennial	11.5 feet
43+75	49 feet of 12-inch CMP	Perennial	No bankfull indicators. Wetted width 1-2 feet.
46+60	41 feet of 12-inch CPP	Perennial	No bankfull indicators Wetted width 1-2 feet
50+72	61 feet of 36-inch PVC lined CMP	Perennial	15.0 feet
55+00	48 feet of 12-inch CMP	Intermittent	No bankfull indicators. Wetted width 2-3 feet upstream and 5-6 feet downstream.
82+07	43 feet of 12-inch CMP	Intermittent	No bankfull indicators. Wetted width 1-2 feet.
86+00-87+00	54 feet of 24-inch stone box culvert 108 feet of 24-inch stone box culvert	Intermittent	10.5 feet

The following sections describe the existing conditions at each stream crossing in more detail.

Station 15+32

The westernmost stream crossing located at Station 15+32 is a small drainage swale that originates northeast of Lynch Road and flows west beneath Lynch Road, and along the north side of Monson Road before crossing south under Monson Road via the culvert. The existing culvert consists of a 12" corrugated plastic pipe (CPP). Bankfull indicators did not

exist in the channel at the time of field evaluation. The channel was delineated and is depicted on the plans as bank flag series TOB C, TOB D, TOB BB, and TOB CC. Based on a site visit conducted with the U.S. Army Corps of Engineers on August 26, 2024, the reviewers determined that this channel would not be jurisdictional under Section 404 of the Clean Water Act as it is a non-relatively permanent watercourse, and does not contain definable banks.

Station 24+92

The stream crossing at Station 24+92 conveys an unnamed, perennial tributary to Vinica Brook south under Monson Road. The existing crossing consists of a 30" PVC culvert which conveys the unnamed perennial stream and an adjacent 36" CMP relief culvert for storm water whose invert is located 1 ft higher than the perennial stream culvert. The existing relief culvert is regularly dry with no flow present except for during storm events. The stream was delineated and is depicted on the plans as bank flag series TOB E and TOB F. Bankfull width was measured and determined to be approximately 11.5 feet. The stream is mapped by the Massachusetts Division of Fisheries and Wildlife (MADFW) as a coldwater fisheries resource.

Stations 43+75 and 46+60

The stream crossing located at Station 43+75 consists of an existing 12" CMP culvert which conveys an unnamed perennial stream. This existing culvert is collapsed and due to roadway flooding, the stream has diverted its flow path along the north side of Monson Road towards a secondary existing culvert which is a 12" CPP (Station 46+60). Bankfull indicators did not exist in the channel at the time of field evaluation. This stream was delineated and is depicted on the plans as bank flag series TOB I and TOB J. A portion of this stream is located within areas of Priority and Estimated Habitats for Rare Species mapped by the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

Station 50+72

The stream crossing located at Station 50+72 consists of an existing 36" PVC lined CMP culvert which conveys an unnamed, perennial tributary to Vinica Brook. Bankfull width was measured to be approximately 15.0 feet. The stream was delineated and is depicted on the plans as bank flag series TOB K and TOB L. The stream is mapped by the MADFW as a coldwater fisheries resource. This culvert is not proposed to be replaced as part of this project.

Station 55+00

The intermittent stream crossing is located just west of Maynard Road. The stream originates in a wetland south of Monson Road and flows north under Monson Road via a 12-inch CMP culvert. The stream was delineated and is depicted on the plans as bank flag series TOB M / TOB N and TOB AA / TOB BB. Bankfull indicators do not exist at this location. The typical wetted width of the channel is approximately 2 to 3 feet upstream and 5 to 6 feet downstream. Stream substrate consisted of mucky material. This stream crossing is not proposed to be replaced.

Station 82+07
The stream crossing at Station 82+07 conveys an unnamed intermittent stream south under Monson Road via a 12-inch CMP. The stream originates from a small farm/residential pond on the north side of Monson Road. The existing culvert is deteriorated and undersized. Bankfull indicators do not exist at this location. Based on observations by SLR Consulting on March 19, 2024 under normal spring flow, the typical wetted width of the channel is 1 to 2 feet, and the depth of the channel is 4 to 6 inches. The stream was delineated and is depicted on the plans as bank flag series TOB CC and TOB DD.

Station 86+00 - 87+00
An unnamed intermittent tributary to Vinica Brook flows south under Monson Road into a small depression at the intersection of Reed Hill Road and then flows under Reed Hill Road. This easternmost stream crossing located at Stations 86+00 through 87+00 consists of two disconnected sections of culvert which convey an unnamed intermittent tributary to Vinica Brook. The upstream culvert is a 24" concrete culvert which travels beneath Monson Road and daylights briefly before entering a second 24" concrete culvert that travels beneath Reed Hill Road. This stream was delineated and is depicted on the plans as flag series TOB KK and TOB LL (on the north side of Monson Road) and flag series TOB EE and TOB FF (on the south side of Monson Road). Bankfull width was measured and is approximately 10.5 feet at this crossing. This stream is mapped by the MADFW as a coldwater fisheries resource.

It is important to note that a small, roadside drainage ditch was also GPS-located on the north side of Monson Road, adjacent to intermittent stream TOB Series KK and TOB Series LL. The ditch is depicted as Series "WET N" on the plans, but was determined to be a non-jurisdictional upgradient intermittent stream channel. The channel receives roadway runoff from Monson Road, which discharges into intermittent stream Series KK/LL. The roadside drainage ditch did not contain wetland vegetation, nor did it contain hydric soils when examined during the delineation. The channel was also dry at the time of the delineation and did not contain any standing water.

The existing stream crossings are also described further in the Maximum Extent Practicable (MEP) Analysis in Appendix G.

Proposed Conditions

Roadway Improvements:

The project consists of full depth reconstruction of Monson Road within the project limits and widening of the road from 22 feet to 28 feet (10-foot wide lanes and 4-foot wide shoulders). The 4-foot wide shoulders will allow for safer bicycle and pedestrian use. The project includes sections of bituminous curb and new guardrail with up-to-date terminals for increased safety, proper signage, and new pavement markings. In order to complete the proposed roadway improvements, some tree clearing will be required adjacent to the existing roadway. Limited tree and vegetation removal is proposed within the BVW areas,

which is being mitigated to the maximum extent practicable with the proposed BVW replication areas, as shown on the plans.

Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. The intersection with Reed Hill Road will be realigned to improve sight lines. Superelevation is also proposed along horizontal curves. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. In total, 57 new catch basins are proposed where no catch basins and closed drainage systems currently exist within the project limits.

Stream Crossings:

Six of the existing crossing (seven pipes/culverts) are proposed for replacement due to structural deficiencies and being undersized. In accordance with the Massachusetts Transportation Bond Bill of 2014, the proposed stream crossing work is exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00). Therefore, while the roadway reconstruction and widening work will be permitted under a Notice of Intent application with the Wales Conservation Commission, the stream crossing work, which is subject to the bridge exemption, is the subject of this 401 Water Quality Certificate application.

A maximum extent practicable alternatives analysis and stream geomorphic assessment were conducted to assess the conditions at each stream crossing and develop proposed solutions for crossing replacements that would improve drainage and meet the Massachusetts Stream Crossing Standards to the maximum extent practicable. The MEP analysis is included in Appendix G.

Six of the existing stream crossings (seven pipes/culverts) are proposed for replacement due to being undersized. The proposed culvert replacements are summarized in Table 2 below. The selection of each stream crossing replacement is also discussed in more detail in the Culvert Alternatives Analysis included in Appendix B.

Table 2. Summary of Proposed Culvert Replacements

Location (Station)	Existing Culvert	Proposed Culvert
15+32	40 feet of 12-inch CPP	44 feet of 18-inch RCP
24+92	54 feet of 30-inch PVC 49 feet of 36-inch CMP	31.5 feet of 9-ft 10-inch (W) x 5-ft (H) Concrete Box Culvert embedded two-ft below stream with wingwalls, parapets and natural streambed material restoration
43+75	49 feet of 12-inch CMP	41 feet of twin 12-inch RCPs

46+60	41 feet of 12-inch CPP	44 feet of 12-inch RCP
82+07	43 feet of 12-inch CMP	43 feet of 18-inch RCP Concrete headwalls and endwalls
86+45	54 feet of 24-inch stone box culvert 108 feet of 24-inch stone box culvert	46.8 feet of 8-ft (W) x 4.5-ft (H) Concrete Box Culvert embedded two-ft below stream with wingwalls, parapets and natural streambed material restoration

The following sections describe the proposed work at each stream crossing location. Please refer to the Project Plans provided in Appendix J for additional detail.

Station 15+32

Impacts to the intermittent stream at this station will be for the installation of a new culvert and modified rock fill apron to replace the existing 12" CPP. The proposed crossing will consist of an 18" RCP culvert. As described above, based on a site visit conducted with the U.S. Army Corps of Engineers on August 26, 2024, it was determined that this drainage channel would not be jurisdictional under Section 404 of the Clean Water Act as it is a non-relatively permanent watercourse, and does not contain definable banks.

Station 24+92

The proposed work at this stream crossing includes the installation of a 9-foot 10-inch wide 5-foot high box culvert which will replace both existing culverts. Both the upstream and downstream headwalls will be removed and replaced with wingwalls. This work will result in approximately 282 SF of permanent impacts to LUW, 341 SF of temporary impacts to LUW, 41 SF of permanent BVW impacts, and 9 SF of temporary BVW impacts. Natural streambed material will be placed to restore the impacted watercourse within the construction limits and the culvert will be submerged 2-feet to allow for the installation of stream bed material.

Station 43+75 and Station 46+60

The intention at this split stream crossing is to restore perennial stream flow to the natural channel location at Station 43+75, which was diverted to Station 46+60 due to pipe failure, and allow for a secondary intermittent stream to remain on the north side of Monson Road to handle excess stormwater. Station 43+70 is being replaced with two 12" class five RCPs given the shallow elevations of the watercourse and related roadway profile. At 46+60, the existing pipe is being replaced with one 12" class five RCP. Modified rock fill aprons will provide permanent outlet protection and reduce sediment that is discharged into the streams at both locations.

Collectively, this work to restore the perennial stream back to its pre-existing configuration will result in 1,342 square feet of permanent impact to Land Under Water, 328 square feet of temporary impacts to LUW (related to sediment control measures), and 289 square feet

of permanent impacts to BVW. While the impact to LUW is fairly high, this diverted perennial watercourse along the northern side of the road didn't exist prior to the failure of the crossing at 43+75. The resulting condition will increase the amount of Land Under Water associated with the intermittent stream by approximately 391 square feet.

Station 82+07

The proposed project will replace the culvert with an 18" RCP with modified rock fill at the outlet and new headwalls at both the inlet and outlet. This work will result in approximately 43 SF of permanent alterations to LUW, 88 SF of temporary alterations to LUW (from the dewatering activities), 75 SF of permanent alterations to BVW, and 65 SF of temporary impacts to BVW (from the sediment control installation).

Station 86+45

The proposed work at this crossing includes consolidating the two existing culverts between Stations 86+00 and 87+00 into a single box culvert at Station 86+45. Specifically, proposed work to this crossing includes relocating the intersection of Reed Hill Road such that only a single culvert will be needed to convey the intermittent stream. The proposed single culvert will be an 8-foot wide x 5-foot high, 47 foot long concrete box. There is currently no headwall on the upstream side, a proposed wingwall will be added. A headwall will also be incorporated into the downstream extent of the culvert as part of the Reed Hill Road relocation. This work will result in approximately 519 SF of permanent impacts to LUW, 1,186 SF of temporary impacts to LUW, and 248 SF of permanent impacts to BVW, and 110 SF of temporary impacts to BVW.

Construction Access and Sequencing:

During construction, Monson Road will remain open to traffic at all times since there is no convenient detour route available for traffic. The majority of the roadway and drainage work can be constructed while maintaining two-way traffic. However, at the two larger box culvert crossings, staged construction and alternating one-way traffic through the use of temporary traffic signalization will be required. Detailed staged construction and temporary control of water plans have been provided with the permit documents.

Dewatering is not anticipated as part of the roadway work, but will be required for the stream crossing activities/culvert replacements. To facilitate the culvert replacement work, flow will be diverted through cofferdams and a temporary pipe downstream, and cofferdams and pumping will be used to dewater the excavation areas. All dewatering and related earthwork shall be conducted in such a manner as to prevent siltation or contamination of the waterway. The pumping discharge shall not be allowed to enter directly into the waterway. The water from the work areas shall be pumped to a settling tank before discharging into the bypass pipe. The tank shall be constructed so as to allow for the pumped water to pass through the tank with sediments settling out before outletting to an area enclosed by hay bales. Please refer to the Water Control plan sheets in the Project Plans in Appendix J (Plan Sheets 178 and 179) for additional detail regarding dewatering.

The means and methods of construction for this project will involve the use of various heavy equipment to ensure efficient and effective execution of the roadway improvements. Key equipment that will be utilized includes excavators for full-depth road reconstruction and the culvert replacements, bulldozers for grading and earthmoving activities, and

graders to achieve precise grading for the roadway base and shoulder construction. Paving machines will be used for the application of new bituminous pavement, and rollers will compact the new pavement and subgrade materials.

Backhoes will be employed for trenching and drainage system installation, while dump trucks will transport materials such as gravel, asphalt, and excavation debris. Chainsaws and wood chippers will be used for tree and vegetation removal, and concrete mixers will be used for constructing the bituminous curb and other concrete elements. A crane or large excavator will be used for installing new guardrails and other heavy precast components, and hydroseeding equipment will be used for applying grass linings in drainage swales. Construction activities will be staged to minimize disruption to traffic and ensure safety. Traffic control measures will be implemented as necessary, including temporary signage, barriers, and flagging operations.

No long-term on-site stockpiling is planned as part of the proposed project. Materials will be brought in and taken from site on a daily basis. Short term stockpiling of materials immediately adjacent to the specific work area will be required at times.

Construction of the project is anticipated to begin in Spring of 2025 and is anticipated to continue through the Fall of 2026.

Proposed Impacts to Waters of the United States

Portions of the project will result in impacts to BVW and LUW. This project proposes a total of 837 SF of impacts to BVW (653 SF permanent and 184 SF temporary) and 4,129 SF of impacts to LUW (2,186 SF permanent and 1,943 SF temporary) in order to facilitate the culvert replacements and associated headwalls and rip rap aprons. The proposed impacts to Waters of the U.S. are summarized in Table 3 below. Bank impacts associated with the stream crossing improvements at each location are also included in the table as well.

Table 3. Summary of Proposed Impacts associated with the Stream Crossing Work

Location (Station)	Proposed Activity	BVW Impact (SF)	Bank Impact (LF)	LUW Impact (SF)
24+92	Box culvert installation replacing both existing culverts. Both upstream & downstream headwalls will be removed / replaced with wingwalls	41 SF (permanent), 9 SF (temporary)	19 LF (temporary)	282 SF (permanent), 341 SF (temporary)
43+75 and 46+60	Culvert replacement, modified rockfill apron, temporary cofferdam	289 SF (permanent)	299 LF (permanent), 33 LF (temporary)	1,342 (permanent), 328 SF (temporary)

82+07	Culvert replacement with modified rock fill at the outlet and new inlet/outlet headwalls, temporary cofferdam	75 SF (permanent), 65 SF (temporary)	14 LF (temporary)	43 SF (permanent), 88 SF (temporary)
86+45	Box culvert installation, temporary cofferdam	248 SF (permanent), 110 SF (temporary)	18 LF (permanent), 72 LF (temporary)	519 SF (permanent) 1,186 SF (temporary)
CUMULATIVE		**653 SF (permanent), 184 SF (temporary)**	**317 LF (permanent), 138 LF (temporary)**	**2,186 SF (permanent), 1,943 SF (temporary)**

Permanent impacts to BVW and LUW will result from excavation and fill needed to remove the existing culverts and install the new, larger culverts, rockfill aprons, and wingwalls.

The proposed temporary impacts to LUW are associated with the temporary cofferdams needed during dewatering operations. The proposed temporary impacts to BVW are associated with sediment control installation along the limits of work during construction.

The proposed culvert crossing at Station 86+45 will result in the creation of new streambed within the new proposed box culvert. The proposed concrete box culvert will have 2 feet of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting new upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. This will result in the addition of approximately 1,000 SF of new/additional streambed/LUW at this crossing.

The culvert replacement work will also result in dredging below LUW at some of the stream crossing locations, which is quantified below in Table 4.

Table 4. Summary of Proposed Dredge Below Land Under Water

Location (Station)	Waterbody Type	Total Impact (SF)	Total Dredge (CY)
24+92	Perennial	613	16
82+07	Intermittent	173	3
86+00 – 87+00	Intermittent	1,517	70
CUMULATIVE		**2,303 SF**	**89 CY**

Mitigation

The proposed project has been designed to minimize impacts to Waters of the U.S. to the maximum extent practicable by utilizing more narrow culvert crossings wherever possible and by reducing the amount of impervious surface being added to the roadway to the extent practicable. The roadway design includes 10-foot travel lanes and 4-foot shoulders. This required a design criteria exception to provide the 4-foot shoulders instead of 5-foot bikes lanes/shoulders or 5-foot buffered bike lanes/shoulders, which most MassDOT projects must provide in accordance with MassDOT's complete streets requirements. This limited the widening of the road to 28 feet wide instead of 30 feet or 34 feet. Additionally, structural best management practices (BMPs) including deep sump catch basins have been incorporated into the stormwater design to reduce roadway erosion while improving stormwater quality.

The overall project (including both the roadway improvements and stream crossing work) will result in the alteration of 674 SF of permanent alteration and 535 SF of temporary alteration to BVW. Of this, 21 SF of permanent alterations to BVW and 351 SF of temporary alterations to BVW will occur as a result of the roadway work, and permitted through the NOI as described above. The remaining proposed 653 SF of permanent BVW alteration and 184 SF of temporary BVW alteration impacts are associated with the stream crossing work and are subject to this application. The proposed permanent impacts to wetlands will be mitigated through the construction of two wetland replication areas, one 217 SF replication area and one 1,204 SF replication area. The mitigation areas have been designed to provide significantly greater than 1:1 mitigation for the proposed permanent vegetated wetland impacts (674 SF permanent BVW impacts proposed; 1,421 SF wetland replacement area proposed).

A planting schedule for the 1,204 SF wetland replication area initially depicted on Sheet 21 is provided on the Wetland Replication Area Detail plan (Sheet 180) in the plans in Appendix K. Proposed plantings include highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and a native wetland seed mix. The smaller 217 SF wetland replication area on Sheet 16 references the same native wetland seed mix indicated on Sheet 180 to be used for this small replication area.

Proposed temporary impacts areas within BVW will be restored in situ after construction from the removal of sediment controls and restoration of these areas to pre-existing grades.

The project also proposes to plant 53 shade trees along the roadway corridor to provide additional mitigation for the roadway widening work. A summary of the proposed species is provided in Table 5 below. Please refer to the project plans in Appendix J for specific planting locations.

Table 5. Summary of Proposed Shade Tree Plantings along the Project Corridor

Scientific Name	Common Name	Caliper	Container	Remarks
Cercis canadensis	Eastern Redbud	2-2.5”	B&B	Single-stem
Amelanchier x grandiflora	Serviceberry	2-2.5”	B&B	Single-stem
Ulmus americana	American Elm	2-2.5”	B&B	

Additional mitigation proposed seeks to address roadside erosion. The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling has led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway.

Under existing conditions many areas within the limit of work are experiencing significant roadside erosion which is entering adjacent wetland resource areas. The proposed project has been designed for anticipated flows with alterations to the overall grade of the roadway and the addition of closed drainage throughout the corridor. This drainage includes 57 new deep sump catch basins and approximately 3,500 linear feet (LF) of new pipe to support the closed drainage. All discharges adjacent to wetland resources include preformed scour holes to reduce unwanted erosion.

Sediment controls (compost filter tubes or similar) will be installed between the limits of work and adjacent wetlands to protect them during construction. Sediment controls are depicted on the project plans provided in Appendix J.

Stormwater Management

As a redevelopment project, the proposed project has been designed to meet the Massachusetts Stormwater Management Standards to the maximum extent practicable.

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. Approximately 0.88 acres of increase in impervious surface (pavement) is proposed as part of the project. The watershed areas remain consistent with the existing drainage patterns, as only slight modifications to the existing vertical and horizontal alignments are proposed.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. In total, 57 new catch basins are proposed where no catch basins and closed drainage systems currently exist within the project limits.

Seven closed storm sewer systems are proposed along Monson Road. These systems will outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

Of the nine drainage crossings, six of the crossings (seven pipes/culverts) will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained.

Please refer to the Stormwater Management Report in Appendix H for additional information.

Compliance with Massachusetts Stream Crossing Standards

The project has been designed to meet the stream crossing standards to the maximum extent practicable. Compliance with the stream crossing standards is discussed below. Please refer to the MEP Analysis in Appendix G for additional information about the stream crossing design that was selected for each crossing.

1. **Type of Crossing – Spans (bridges, 3-sided box culverts, open-bottom culverts or arches) are strongly preferred.**

   The two proposed box culverts at Stations 24+92 and 86+45 (consolidating the two existing culverts between Stations 86+00 and 87+00) will be four-sided box culverts for ease of installation, but will have natural streambed material placed along the bottom of the culvert to mimic an open bottom crossing. Thus, this standard is being met to the maximum extent practicable.

   Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs, as described in Table 2 above. Open bottom culverts are not feasible at these locations given site constraints and the intermittent nature of the stream crossings. Additionally, the replacement pipes will not be anticipated to have an effect on wildlife habitat, nor will they create habitat fragmentation since the channels are too small to have instream habitat. Wildlife in this area would be anticipated to cross the road.

2. **Embedment – All culverts should be embedded (sunk into stream) a minimum of 2 feet, and round pipe culverts at least 25%. When embedment material includes elements >15 inches in diameter, embedment depths should be at least twice the D_{84} (particle width larger than 84% of particles) of the embedment material.**

The two proposed box culverts will have 2-foot embedment.

Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the fact that no bankfull width indicators were observed at these crossings, the crossings have been designed to improve hydraulic capacity. It is not feasible to achieve 25% embedment with pipes of this small size.

3. **Crossing Span – Spans channel width (a minimum of 1.2 times the bankfull width of the stream).**

This standard is met to the maximum extent practicable.

For the crossings at Stations 24+92 and 86+45, meeting the 1.2 bankfull standard was considered, but was determined to be cost and timeline-prohibitive.

Therefore, a concrete box with a span of 9-ft 10-inches and rise of 5.0 feet with 2 feet embedment (0.85 x bankfull width) is proposed at Station 24+92, which will have many benefits of a 1.2 bankfull structure such as passing sediment, large wood, and the design flood, yet at a reduced cost.

At Station 86+45, a single concrete box with a width of 8 feet (0.8 x bankfull channel width) is proposed. The proposed stream crossing will only cross Monson Road and replace the existing pair of culverts. The proposed alignment will allow for shortening of the crossing by daylighting approximately 100 LF of the channel upstream and approximately 80 LF of the channel downstream. This will reduce the size, costs, and impacts of the proposed structure. This proposed structure will have many benefits of a 1.2 bankfull structure such as transport of sediment and large wood at a reduced cost.

Enlarging the structures at Stations 24+92 and 86+45 to approximately 0.9 times the bankfull channel width achieves many of the benefits of a larger crossing structure. Flood conveyance, sediment transport, and large wood movement will all be improved. Fish passage will be restored, and small mammals will be able to pass through the structures during low flows.

Some of the stream crossings, including those at Stations 15+32, 43+75, 46+60, and 82+07 did not exhibit strong bankfull indicators. For this reason, the proposed replacement crossings at Stations 15+32, 43+75 and 46+60 have been designed to pass the design flow through the structures. At the proposed crossing at Station 82+07, the typical wetted channel width of the channel was observed to be between 12-24 inches and the depth of the channel is 4 to 6 inches based on observations made by SLR Consulting on March 19, 2024 under normal spring flow. To meet the stream crossing standards at this location, the proposed structure was sized based on the required hydraulic capacity to convey the design flood.

4. **Openness - Openness ratio (cross-sectional area/crossing length) of at least 0.82 feet (0.25 meters). The crossing should be wide and high relative to its length.**

   The proposed box culvert at Station 24+92 will exceed the required openness ratio, as the proposed culvert has an openness ratio of 0.93 feet.

   The proposed box culvert at Station 86+45 meets this standard to the maximum extent practicable, but ultimately could not achieve the 0.82-foot openness ratio. Several alternative alignments were evaluated for this crossing, given the skewed alignment of the channel and multiple pipe configuration of the existing crossings.

   Initially the original watercourse inlet to outlet alignment was evaluated for the new culvert. However, given the skew angle and length of culvert needed to cross the realigned intersection, to meet a maximum span width no longer than 10', the resulting culvert opening width would be approximately 6' and well below the recommended width in the original MEP analysis. The extended length of the culvert would also negatively reduce the openness ratio.

   A second alignment analysis pursued a more perpendicular crossing of Monson Road to achieve a culvert span just under 10' in length. While possible, this alternative created several sharp turns in the realigned channel both upstream and downstream of the culvert crossing which were deemed undesirable and inconsistent with the stream crossing standards, and furthermore would have increased wetland impacts and right-of-way impacts to private properties.

   The third and preferred alignment for the crossing at Station 86+45 represents a balance of the two previous alternatives which strives to properly and more naturally align the stream and resulting channel trough the culvert, maximize the culvert opening width to 8', and reduce the culvert length as much as possible to maximize the resulting openness ratio. The outcome advances the design of the proposed 8' wide x 4.5' high concrete box culvert with 2' of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. Therefore, the openness ratio at Station 86+45 has been maximized to the extent practicable, based on site conditions.

   Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the fact that no bankfull width indicators were observed at these crossings, meet the stream crossing standards at this location, the crossings have been designed to improve hydraulic capacity.

5. **Substrate - Natural bottom substrate should be used within the crossing and it should match the upstream and downstream substrates. The substrate and design should resist displacement during floods and maintain an appropriate bottom during normal flows.**

   The two proposed box culverts will contain 2 feet of natural streambed material.

   Relative to the rest of the proposed crossings at Stations 15+32, 43+75, 46+60, and 82+07, these crossings will be replaced with 12" and 18" RCPs. Due to the size of the replacement pipes, natural bottom substrate is not proposed. The replacement pipes will not be anticipated to have an effect on habitat, nor will they create habitat fragmentation since the channels are too small to have instream habitat. Wildlife in this area would be anticipated to cross the road.

6. **Water Depth and Velocity - Water depths and velocities are comparable to those found in the natural channel at a variety of flows.**

   Water depth and velocity at each stream crossing location will be comparable to those found in the natural channels. The culvert crossings have been designed to match the existing gradient of the watercourses between upstream and downstream.

<u>Compliance with Criteria for Evaluation for Discharge of Dredged or Fill Material</u>

Under 314 CMR 9.06(1) through (8), the proposed activities conform to the 401 WQC criteria as follows.

314 CMR 9.06(1) (in part) - No discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences …

The proposed project has minimized and mitigated impacts to wetland resource areas to the maximum extent practicable, while meeting the project goal of upgrading the existing stream crossings to alleviate flooding and drainage issues along this section of Monson Road. The project has minimized impacts by proposing more narrow culvert crossings wherever possible, and by proposing a 28-foot wide roadway which meets the design standards with the smallest increase in impervious area. Please refer to the Alternatives Analysis provided in Appendix B for additional detail.

314 CMR 9.06(2) - No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will avoid and minimize potential adverse impacts to the bordering or isolated vegetated wetlands, land under the water or ocean, or the intertidal zone. For discharges to bordering or isolated vegetated wetlands, such steps shall include a minimum of 1:1 restoration or replication. The Department may waive the requirement for 1:1 restoration or replication for projects which will restore or

otherwise improve the natural capacity of any wetland or other water of the Commonwealth pursuant to 314 CMR 9.06(8). However, no such project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species as specified in 310 CMR 10.00.

The project proposes to construct two wetland replication areas, one 217 SF replication area and one 1,204 SF wetland replication area, which will significantly exceed the 1:1 replication requirement for the proposed permanent BVW alterations.

Additionally, the project will result in stream channel restoration and creation of new LUW at Station 86+45, as the proposed concrete box culvert will have 2 feet of natural streambed material placed within it. The streambed material will be a continuation of the material incorporated into the design of the resulting upstream and downstream channels which will transition to the existing bankfull width dimensions, provide low flow channel features and significantly increase the area of new land under water associated with this watercourse. This will result in the addition of approximately 1,000 SF of additional streambed/LUW at this crossing.

A portion of the roadway work falls within NHESP-mapped Priority and Estimated Habitat for rare species. The applicant is coordinating this work through the Natural Heritage & Endangered Species Program through the Massachusetts Endangered Species Act (MESA) to ensure that the project will not adversely affect rare species or their habitat.

314 CMR 9.06(3)(a) through (k) (in part) - No discharge of dredged or fill material shall be permitted to Outstanding Resource Waters, except for the activities specified in 314 CMR 9.06(3)(a) through (k), which remain subject to an alternatives analysis and other requirements of 314 CMR 9.06 and/or 314 CMR 9.07 …

Not applicable. The project does not propose discharge of dredged or fill material within ORW.

314 CMR 9.06(4) - Discharge of dredged or fill material to an Outstanding Resource Water specifically identified in 314 CMR 4.06(1)(d) (e.g., vernal pools, within 400 feet of a water supply reservoir and any other areas so designated) is prohibited as provided therein unless a variance is obtained under 314 CMR 9.08.

Not applicable. The project does not propose discharge of dredged or fill material within ORW.

314 CMR 9.06(5) - No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater for purposes of controlling sedimentation or other pollutant attenuation. Discharge of dredged or fill material may be permitted to manage stormwater for flood control purposes only where there is no practicable alternative and provided that best management practices are implemented to prevent sedimentation or other pollution. No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater in Outstanding Resource Waters for any purpose.

The project does not propose the discharge of dredged or fill material for the impoundment or detention of stormwater. The project proposes several culvert upgrades/replacements which will minimize and mitigate impacts to Waters of the U.S. to the maximum extent practicable.

314 CMR 9.06(6)(a) through (f) (in part) - Except as otherwise provided in 314 CMR 9.06(6), stormwater discharges shall be provided with stormwater best management practices to attenuate pollutants and to provide a setback from the receiving water or wetland in accordance with the following Stormwater Management Standards as further defined and specified in the Massachusetts Stormwater Handbook …

Stormwater discharges will be managed in accordance with MassDEP's Stormwater Standards. Refer to the Stormwater Report included in Appendix H for additional information. As a redevelopment project, the project will meet the Stormwater Standards to the maximum extent practicable.

314 CMR 9.06(7) - No discharge of dredged or fill material shall be permitted in the rare circumstances where the activity meets the criteria for evaluation but will result in substantial adverse impacts to the physical, chemical, or biological integrity of surface Waters of the Commonwealth.

The project will not result in substantial adverse impacts on the physical, chemical, or biological integrity of surface Waters of the Commonwealth.

314 CMR 9.06(8) - Notwithstanding the provisions of 314 CMR 9.06(1) through (7), the Department may allow a project which will restore or otherwise improve the natural capacity of any wetland or other water of the Commonwealth. Such projects include, but are not limited to, dam removal, salt marsh restoration, stream restoration, nutrient management, control or removal of aquatic nuisance vegetation, or vegetation management to improve wildlife habitat.

Not applicable.

Conclusion

Weston and Sampson is submitting this Water Quality Certification (WQC) on behalf of the Town of Wales and MassDOT for the Monson Road Transportation Improvement Project. The purpose of the project is to make roadway, shoulder, and drainage improvements to Monson Road. A description of the proposed culvert upgrades has been provided, and proposed impacts to BVW and LUW have been quantified. This project will greatly improve drainage conditions along Monson Road, and will result in stream crossings that have been designed to current standards.

The project has been designed to avoid and minimize impacts to Waters of the U.S. and Commonwealth to the extent practicable. Our opinion is that the proposed project was

designed, and will be constructed, to meet the standards established in 314 CMR 9.00 et seq. as described above. Whereas this work is “exempt” from the WPA, a Section 401 WQC is required pursuant to 314 CMR 9.04(4) - Activities Exempt under MGL c. 131, § 40. The applicant respectfully requests that MassDEP find these measures adequately protective of the interests identified in the 401 Water Quality Regulations and issue a Water Quality Certificate approving the work shown on the accompanying plan set.

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE TOWN OF

WALES

HAMPDEN COUNTY

100% SUBMITTAL

401 ENVIRONMENTAL PERMIT PLAN SET

WALES
MONSON ROAD

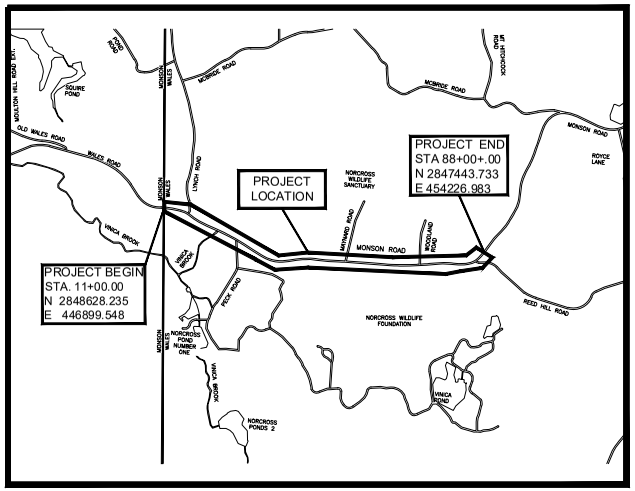
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

TITLE SHEET & INDEX

THESE PLANS ARE SUPPLEMENTED BY THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2024, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND, ABBREVIATIONS & GENERAL NOTES
4	TYPICAL SECTIONS
5-12	CONSTRUCTION PLANS
13-18	PROFILES
19-26	CROSS SECTIONS
27-35	STRUCTURAL PLANS
36	CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION
37-38	CULVERT 3 CHANNEL CROSS SECTIONS
39-40	TEMPORARY WATER HANDLING PLAN
41	WETLAND REPLICATION AREA DETAIL



2000 0 2000 4000

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

August 2024

COMMONWEALTH OF MASSACHUSETTS
SCOTT R. BRUSO
STRUCTURAL
No. 48661
REGISTERED PROFESSIONAL ENGINEER

Weston & Sampson
712 Brook Street, Suite 103
Rocky Hill, CT 06067
860.513.1473
www.westonandsampson.com

DATE	DESCRIPTION	REV #

MassDOT Massachusetts Department of Transportation Highway Division

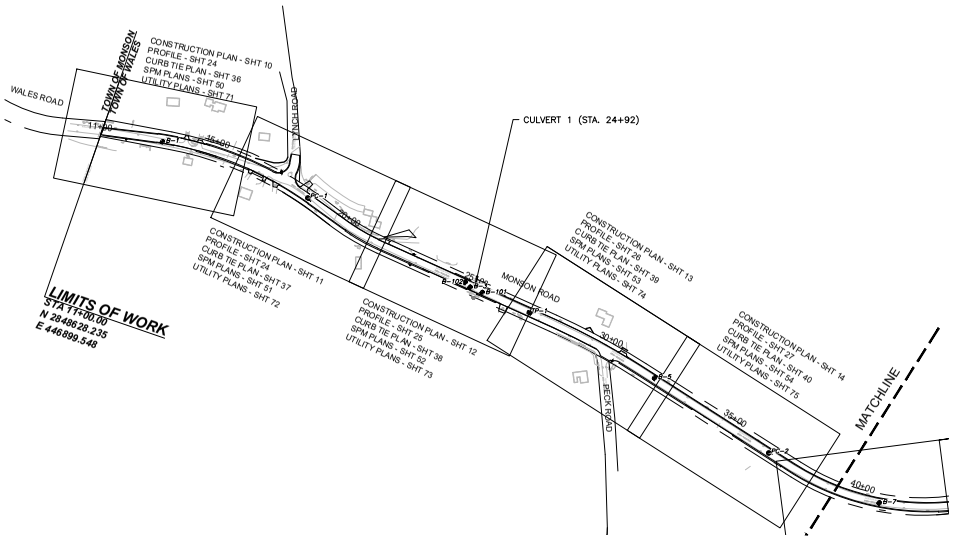
APPROVED

CHIEF ENGINEER DATE

608163_HDI\TITLE_LEGEND, KEY & TYPICAL SECTIONS\401.DWG Plotted on 8-Aug-2024 11:59 AM
Project No. 608163.13212
A08840 389

NOTES:

1. BENCH MARK:
   MAGNAIL U.P.L. LOCATED EAST OF NORTH STREET AT STATION 12+79.94 AND EL. 869'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 21+37.43 AND EL. 877'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 29+56.65 AND EL 900'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 29+94.76 AND EL 902'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 38+22.13 AND EL 938'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 56+22.73 AND EL 957'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 65+94.25 AND EL 1007'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 74.95.16 AND EL 1022'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 81+31.62 AND EL 1006'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 87+05.97 AND EL 1008'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 87+15.35 AND EL 1001'



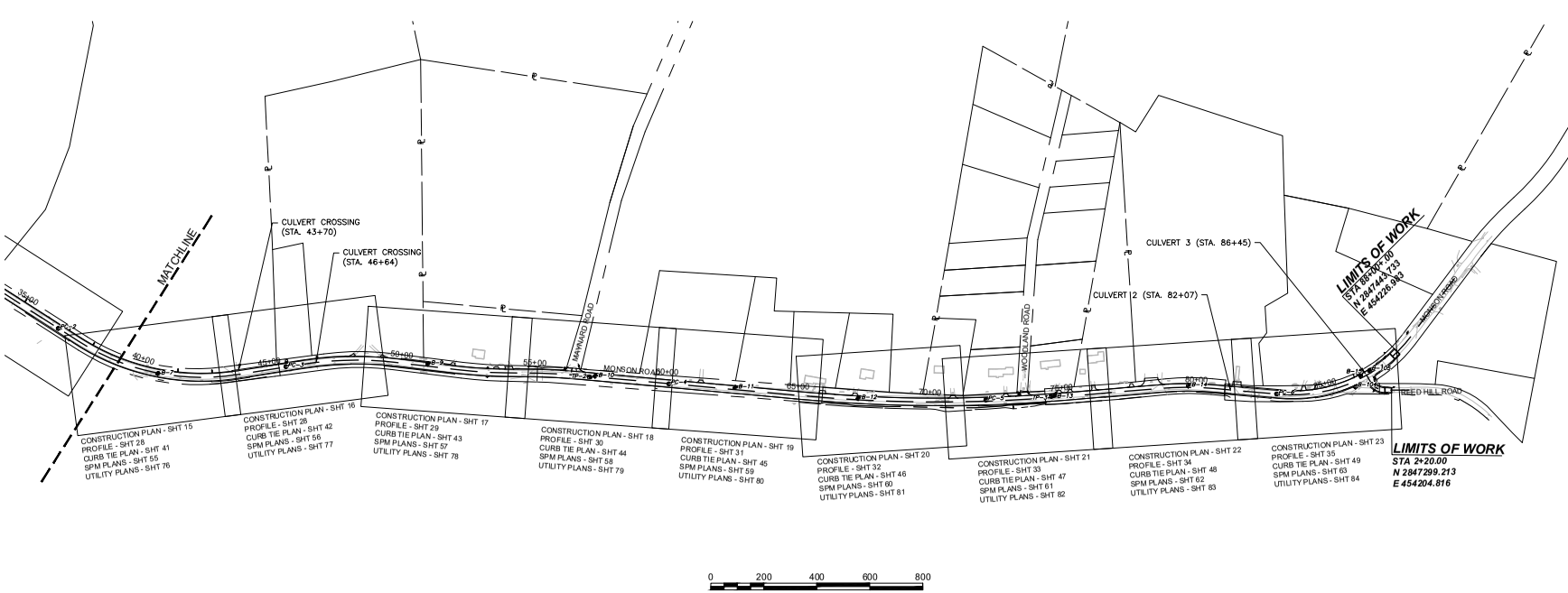
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

KEY PLAN

BORING LOCATIONS (FEET)

BORING	NORTHING	EASTING	STATION	OFFSET	SURFACE EL.	H.B.E.
B-1	2,848,584	447,074	12+80	22.4 RT	868.0	861.5
B-3	2,848,121	448,154	24+56	10.0 LT	877.0	865.2
B-5	2,847,789	448,792	31+89	10.8 LT	902.0	897.5
B-7	2,847,423	449,318	38+27	18.1 RT	941.0	937.0
B-9	2,847,397	450,584	51+05	9.6 LT	933.0	916.5
B-10	2,847,355	451,197	57+19	6.7 LT	956.0	951.5
B-11	2,847,315	451,727	62+51	14.1 LT	989.0	984.5
B-12	2,847,272	452,354	68+80	16.0 LT	1011.0	1007.0
B-13	2,847,294	452,969	74+98	19.4 LT	1019.0	1014.5
B-14	2,847,322	453,443	79+72	12.1 LT	1009.0	1004.5
B-15	2,847,355	454,092	86+37	9.1 LT	1002.0	999.1
B-101	2,848,098	448,155	24+80	4.2 RT	877.1	861.9
B-102	2,848,103	448,186	25+06	12.85 LT	877.5	849.0
B-104	2,847,316	454,080	86+09	20.6 RT	1002.4	974.4
B-105	2,847,367	454,110	85+59	11.0 RT	1001.8	987.7



608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-136112
A08840 - 999

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
	CBCI	CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
	OHU	OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		EROSION AND SEDIMENT CONTROL BARRIER
		TREE LINE
		LIMITS OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT AREA BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
		SIGN AND POST
		SIGN AND DOUBLE POST

ABBREVIATIONS

GENERAL	
AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CBCI-DB	DOUBLE GRATE CATCH BASIN W/ CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN

ABBREVIATIONS (cont.)

GENERAL	
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCCE	REINFORCED CONCRETE CULVERT END
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STA
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
SWTU	STORMWATER TREATMENT UNIT
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
	SL	12"-WIDE STOP LINE
	SWL	6"-WIDE SOLID WHITE LINE
	DBYL	DOUBLE YELLOW LINE (2 - 6"-WIDE YELLOW LINES)

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

LEGEND, ABBREVIATIONS & GENERAL NOTES

GENERAL NOTES:

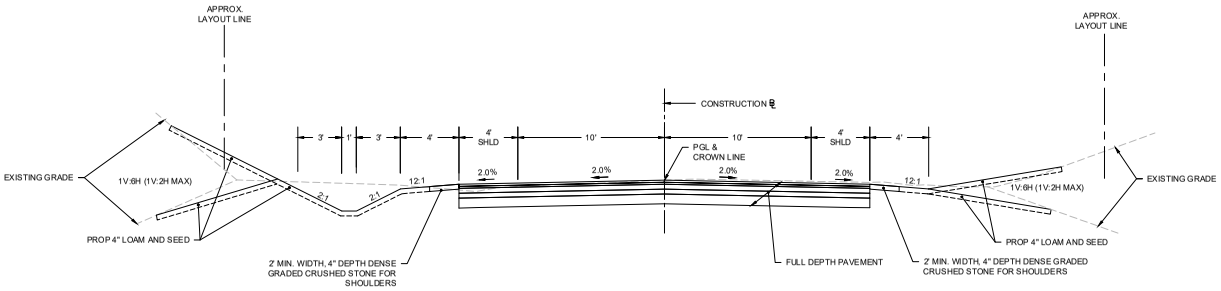
1. TOPOGRAPHICAL INFORMATION BASED ON AN ON-THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ON DECEMBER 2017 AND SUPPLEMENTED BY CHAPPELL ENGINEERING IN OCTOBER 2023. WETLAND FLAGGING WAS PERFORMED BY WESTON & SAMPSON IN NOVEMBER 2020 AND REFLAGGED IN SEPTEMBER OF 2023.
2. THE HORIZONTAL COORDINATES ARE BASED ON NAD 83, THE VERTICAL DATUM IS NAVD 88.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL DIG TEST PITS WITH THE LOCATIONS BEING APPROVED BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK TO EXACTLY LOCATE EXISTING UTILITIES.
4. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY OWNER. ANY ALTERATIONS SHALL BE INCIDENTAL TO THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY SUPPORT OF ALL UTILITIES TO REMAIN IN PLACE AND SHALL DESCRIBE IN WRITING, TO THE SATISFACTION OF THE ENGINEER, HIS METHOD OF TEMPORARY SUPPORT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. THE TERM "PROPOSED (PROP)" INDICATES WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET (R&R)".
8. ALL EXISTING STATE, COUNTY AND TOWN LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
9. ALL EXCESS MATERIAL FROM ROADWAY RECONSTRUCTION OR THE EXCAVATION PROCESS SHALL BE REUSED ON SITE OR REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL AND PROPER MANNER.
10. THE CONTRACTOR SHALL CALL DIGSAFE AT 1-888-344-7233 AT LEAST 72 HOURS, SATURDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE TOWN PRIOR TO EXCAVATION.
11. JOINTS BETWEEN HOT MIX ASPHALT TRENCH PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.
12. IF DEEMED NECESSARY DUE TO THE WORK, THE CONTRACTOR SHALL COORDINATE WITH THE TOWN OF WALES HIGHWAY DEPARTMENT, THE WALES FIRE DEPARTMENT, AND THE ENGINEER FOR APPROVAL OF SHUTTING DOWN ANY EXISTING WATER MAINS AND SHALL ALSO OBTAIN APPROVAL FOR DISRUPTING ANY EXISTING SEWER FLOWS.
13. THE CONTRACTOR SHALL BE AWARE THAT ONLY TOWN PERSONNEL ARE ALLOWED TO OPERATE WATER GATES AND HYDRANTS. ANY REQUESTS TO OPERATE THE GATES SHALL BE COORDINATED THROUGH THE ENGINEER.
14. THE CONTRACTOR SHALL COORDINATE ANY WORK FOR THE PROJECT WITH ALL ADJACENT/CONCURRENT PROJECTS AND CONTRACTORS.
15. THE CONTRACTOR SHALL INSTALL PRIOR TO COMMENCEMENT OF WORK, MAINTAIN, AND REMOVE AT THE END OF THE PROJECT INLET SEDIMENT CONTROL BAGS IN ALL CATCH BASINS, WITHIN OR ADJACENT TO THE PROJECT LIMITS. THE CONTRACTOR SHALL ALSO MAINTAIN SILT FENCE AND COMPOST FILTER TUBES AS SHOWN ON THE PLANS THROUGHOUT THE DURATION OF THE PROJECT AND REMOVE AT THE END.
16. ANY GRASS AREAS DISTURBED BY THE WORK SHALL BE RESTORED WITH LOAM AND SEED.
17. ANY LANDSCAPED AREAS DISTURBED BY THE WORK SHALL BE RESTORED TO EXISTING CONDITIONS WITH EXISTING OR NEW GROUND COVER MATERIALS AS DIRECTED BY THE ENGINEER. ANY PLANTS, SHRUBS, OR FLOWERS DISTURBED BY THE WORK SHALL BE RESET TO EXISTING CONDITIONS OR REPLACED WITH NEW PLANTS, SHRUBS, OR FLOWERS AS DIRECTED BY THE ENGINEER. ALL WORK TO RESTORE LANDSCAPE AREAS, NEW GROUND COVER MATERIALS, NEW PLANTS, NEW SHRUBS, OR NEW FLOWERS REQUIRED BY THE ENGINEER SHALL BE INCIDENTAL TO THE PROJECT.
18. CONTRACTOR TO COORDINATE WITH UTILITY POLE OWNERS IN AREAS WHERE UNDERGROUND UTILITY WORK IS WITHIN CLOSE PROXIMITY AND POSSIBLE UTILITY POLE SHORING IS REQUIRED WHILE INSTALLING PROPOSED UTILITIES.
19. RAISE AND ADJUST FRAMES AND GRATES, FRAMES AND COVERS AND GATE BOXES PRIOR TO PAVEMENT OVERLAY, IF REQUIRED.
20. CONTRACTOR IS RESPONSIBLE FOR REPLACING ANY PROPERTY PINS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION, TO THEIR LOCATION JUST PRIOR TO CONSTRUCTION.
21. ALL TRAFFIC SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS OTHERWISE NOTED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
22. CONTRACTOR TO ESTABLISH TEMPORARY BENCHMARKS EVERY 1000 FEET BASED ON THE PERMANENT BENCHMARKS LOCATED AT STA 29+85.04, 24.73 LEFT AND STA 87+27.18, 41.17 LEFT OR AS REQUIRED BY THE ENGINEER.
23. CONTRACTOR TO PROVIDE ADDITIONAL TRAVERSE POINTS AND TRAVERSE LINES IN THE VICINITY OF EXISTING TRAVERSE POINTS WHERE THE EXISTING TRAVERSE POINT IS LOCATED IN "SOFT GROUND" OR AS REQUIRED BY THE ENGINEER.
24. ALL EXISTING STONE WALLS PROPOSED FOR RELOCATION SHALL NOT BE REMOVED FROM THE IMMEDIATE AREA SHOWN ON THE PLANS.

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-128112
A0840-391

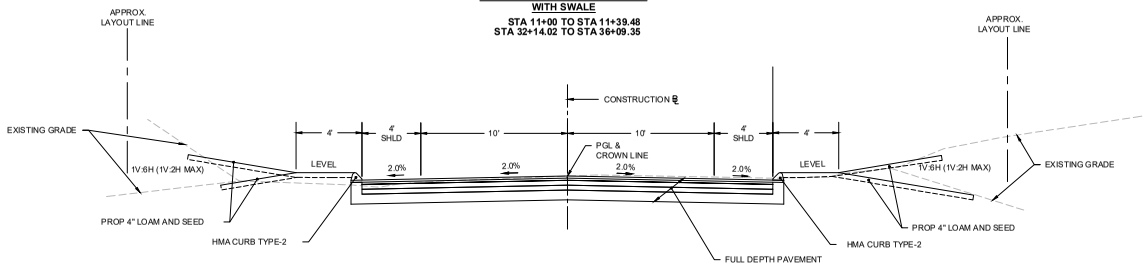
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

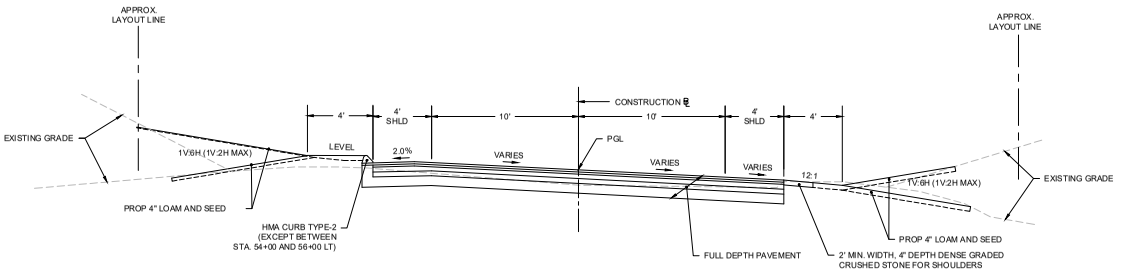
TYPICAL SECTIONS



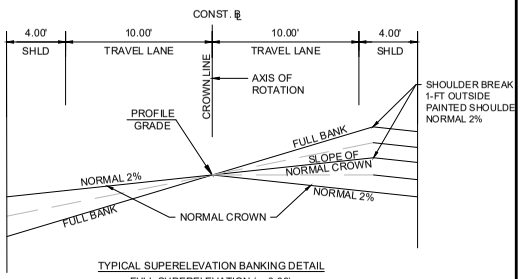
MONSON ROAD TYPICAL SECTION
WITH SWALE
STA 11+00 TO STA 11+39.48
STA 32+14.02 TO STA 36+09.35



MONSON ROAD TYPICAL SECTION
WITH CURBING
STA 22+70.43 TO STA 26+98.72
STA 57+46.79 TO STA 64+41.04
STA 75+70.50 TO STA 77+39.51



MONSON ROAD TYPICAL SECTION
FULL SUPERELEVATION AND TRANSITIONS
STA 11+39.48 TO STA 22+70.43
STA 26+98.72 TO STA 32+14.02
STA 36+09.35 TO STA 57+46.79
STA 64+41.04 TO STA 75+70.50
STA 77+39.51 TO STA 88+00



TYPICAL SUPERELEVATION BANKING DETAIL
FULL SUPERELEVATION (e=0.06)
N.T.S.

PAVEMENT NOTES

PROPOSED PAVEMENT MILLING AND OVERLAY:

1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.50" PAVEMENT MILLING

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).

BASE COURSE: 3.25" SUPERPAVE INTERMEDIATE COURSE 19 (SIC-19.0) PLACED IN ONE LAYER.

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT A RATE OF 0.07 TO 0.09 GAL/SY OVER MILLED SURFACES AND 0.06 TO 0.08 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY :

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2.50" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5)

FOUNDATION: 8" GRAVEL BORROW, TYPE B

PROPOSED GRAVEL DRIVEWAY:

8" GRAVEL BORROW, TYPE B

PROPOSED CEMENT CONCRETE WALK

4" CEMENT CONCRETE OVER

8" GRAVEL BORROW, TYPE B

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Aug-2024 8:17 AM
Proposal No. 608163-136127
A08840 .SIZ

HIGHWAY GUARD DETAILS

STA 14+65 TO STA 14+78 LT TANGENT END TREATMENT TL-3
STA 14+78 TO STA 16+88 LT (TL-3)
STA 14+50 TO STA 14+63 RT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	QTY (MASTER TOTAL)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	13	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	27	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	13	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

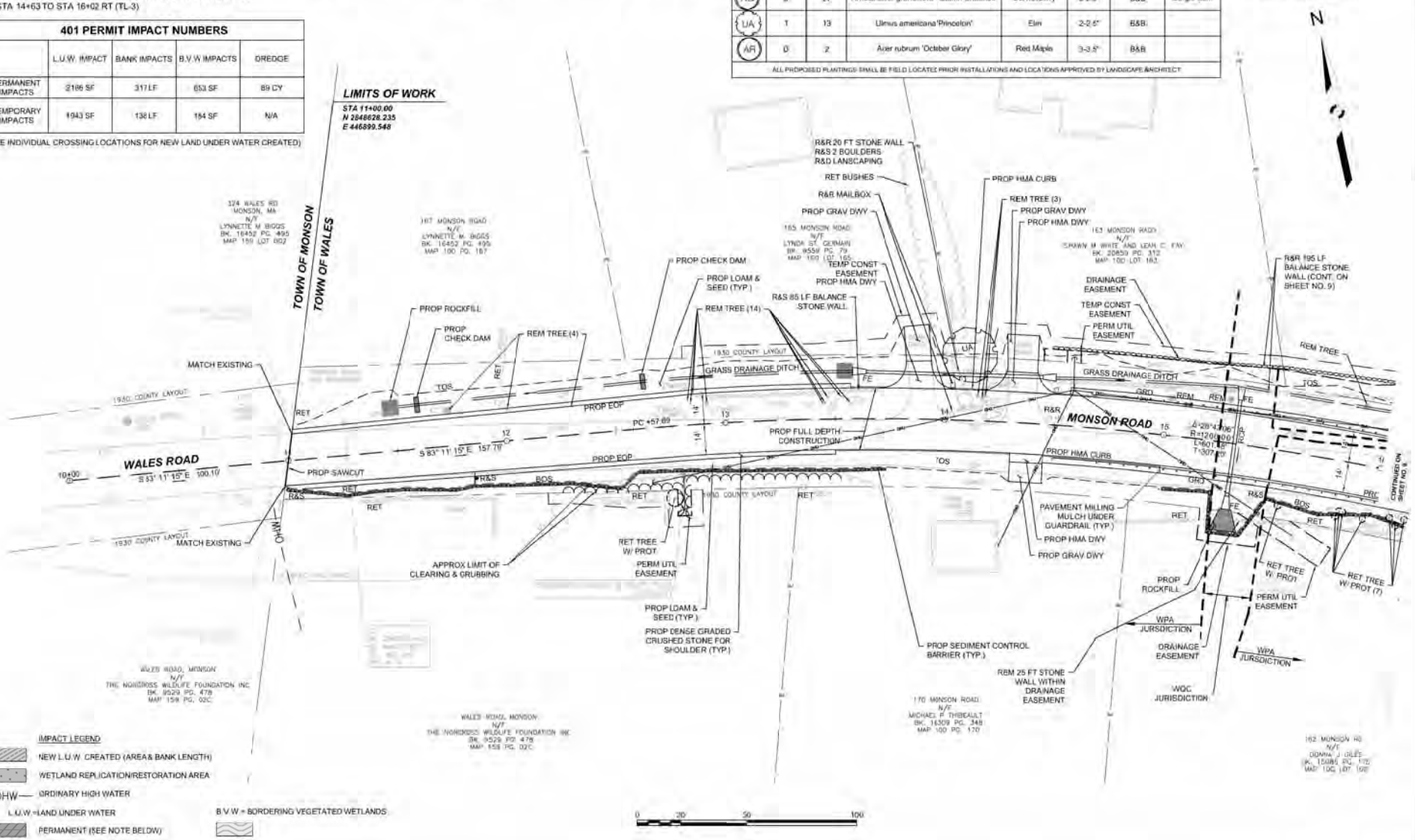
401 PERMIT IMPACT NUMBERS

	L.U.W. IMPACT	BANK IMPACTS	B.V.W IMPACTS	DREDGE
PERMANENT IMPACTS	2186 SF	317 LF	653 SF	89 CY
TEMPORARY IMPACTS	1943 SF	138 LF	184 SF	N/A

(SEE INDIVIDUAL CROSSING LOCATIONS FOR NEW LAND UNDER WATER CREATED)

WALES
MONSON ROAD

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 22

Proposal No. 608163.128212

HIGHWAY GUARD DETAILS

STA 14+78 TO STA 16+88 LT (TL-3)
STA 16+88 TO STA 17+00 LT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)
STA 16+02 TO STA 16+14 RT TANGENT END TREATMENT TL-3
STA 20+25 TO STA 20+37 RT TANGENT END TREATMENT TL-3
STA 20+37 TO STA 23+10 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

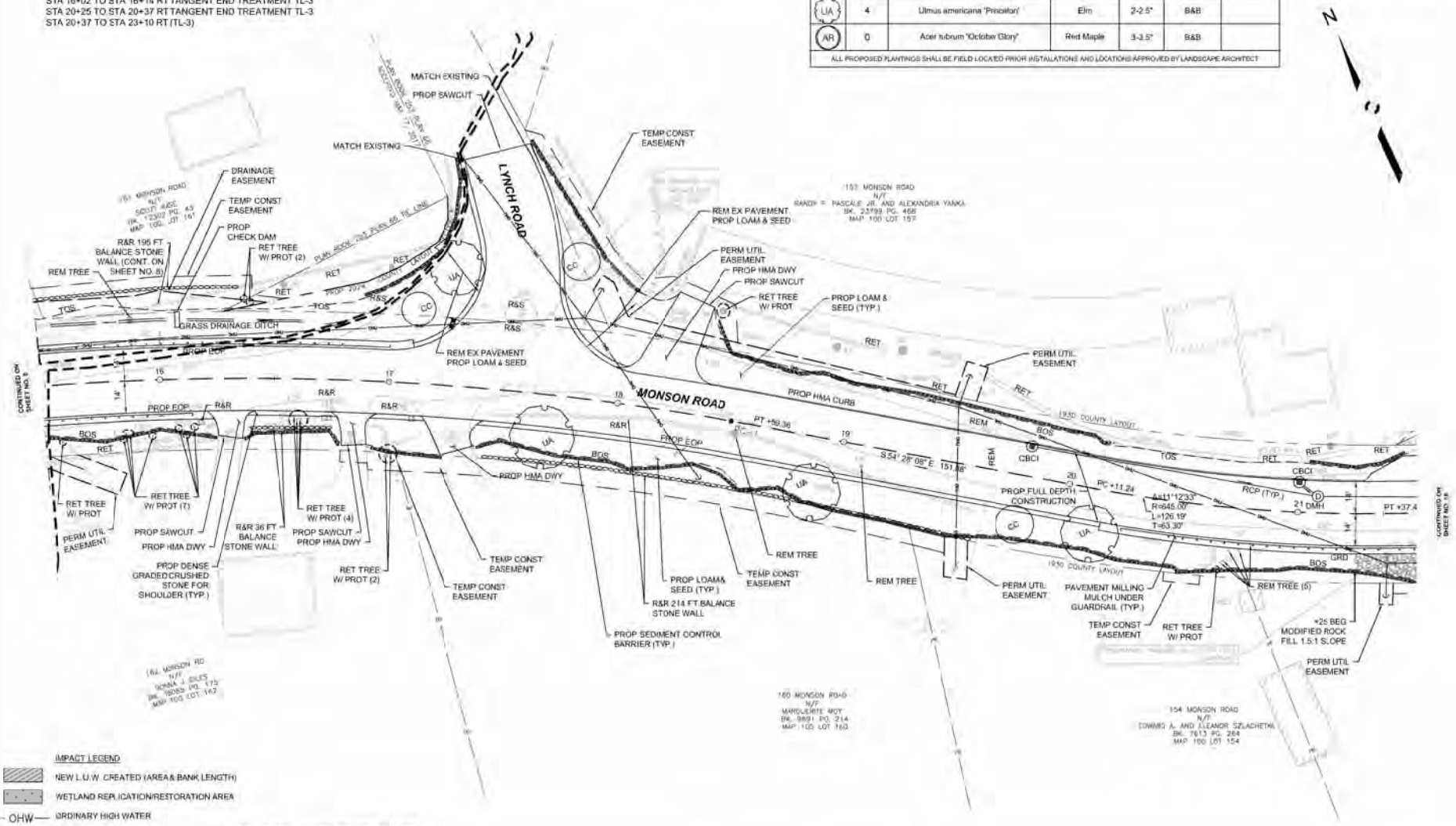
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	4	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



IMPACT LEGEND

NEW L.U.W. CREATED (AREA & BANK LENGTH)

WETLAND REPLICATION/RESTORATION AREA

OHW ORDINARY HIGH WATER

L.U.W. = LAND UNDER WATER

PERMANENT (SEE NOTE BELOW)

TEMPORARY

B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 22

Proposal No. 608163.121212

HIGHWAY GUARD DETAILS

STA 20+37 TO STA 23+10 RT (TL-3)
STA 23+10 TO STA 23+22 RT TANGENT END TREATMENT TL-3
STA 23+86 TO STA 23+98 RT TANGENT END TREATMENT TL-3
STA 23+98 TO STA 25+61 RT (TL-3)
STA 24+25 TO STA 24+37 RT TANGENT END TREATMENT TL-3
STA 24+25 TO STA 24+37 LT TANGENT END TREATMENT TL-3
STA 24+37 TO STA 24+77 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 24+37 TO STA 24+77 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+46 TO STA 25+60 RT (TL-3)
STA 25+46 TO STA 25+79 LT (TL-3)
STA 25+60 TO STA 25+72 RT TANGENT END TREATMENT TL-3
STA 25+79 TO STA 25+91 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

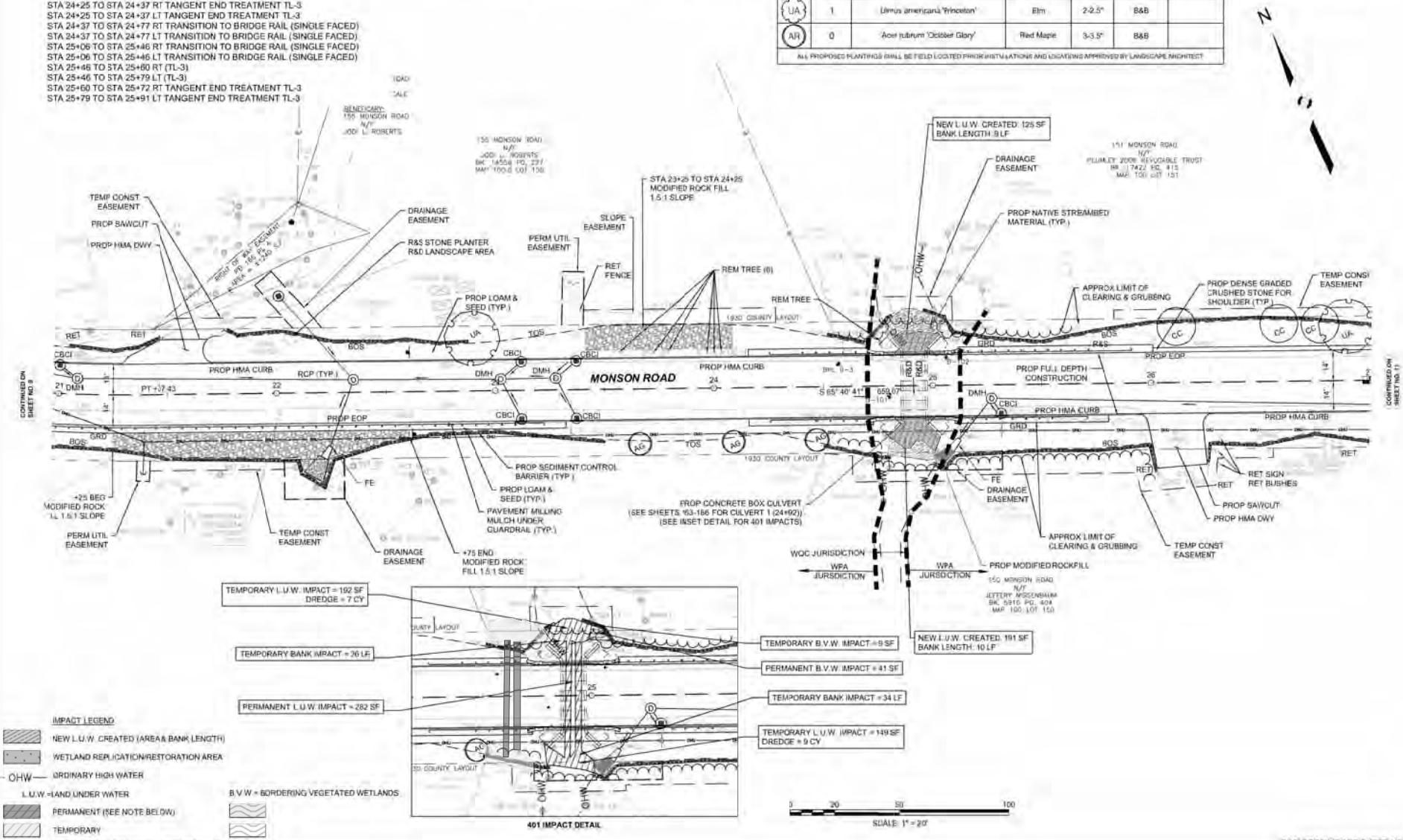
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR TO INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

CONSTRUCTION PLANS



401 IMPACT DETAIL

IMPACT LEGEND

- NEW L.U.W. CREATED (AREA & BANK LENGTH)
- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- L.U.W. = LAND UNDER WATER
- PERMANENT (SEE NOTE BELOW)
- TEMPORARY
- B.V.W. = BORDERING VEGETATED WETLANDS

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 23

Proposal No. 608163 (32)12

HIGHWAY GUARD DETAILS
STA 42+75 TO STA 42+87 RT TANGENT END TREATMENT TL-3
STA 42+87 TO STA 43+86 RT (TL-3)

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY. (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'OctoberGlory'	Red Maple	3-3.5"	B&B	

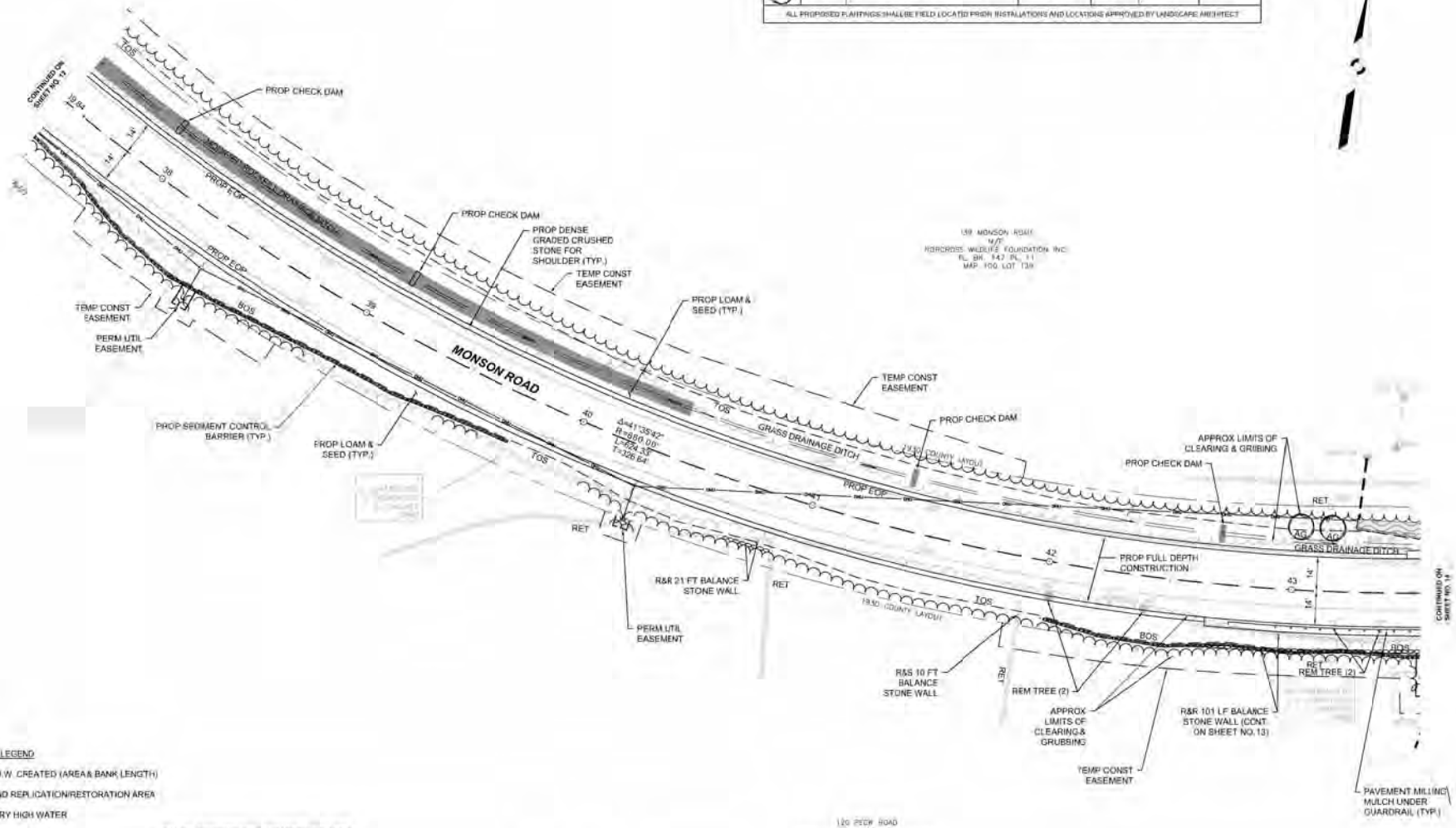
ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CONSTRUCTION PLANS

N



IMPACT LEGEND

- NEW L.U.W. CREATED (AREA & BANK LENGTH)
- WETLAND REPLICATION/RESTORATION AREA
- OHW — ORDINARY HIGH WATER
- L.U.W. = LAND UNDER WATER
- B.V.W. = BORDERING VEGETATED WETLANDS
- PERMANENT (SEE NOTE BELOW)
- TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

FOR PROFILE SEE SHEET NO. 26

Proposal No. 608163(128)12

HIGHWAY GUARD DETAILS
STA 42+87 TO STA 43+86 RT (TL-3)
STA 43+86 TO STA 43+98 RT TANGENT END TREATMENT TL-3
STA 43+57 TO STA 43+70 LT TANGENT END TREATMENT TL-3
STA 43+70 TO STA 44+57 LT (TL-3)
STA 44+57 TO STA 44+70 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	6	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
LIA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	2-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT.

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

135 MONSON ROAD
N/T
NORCROSS WILDLIFE FOUNDATION, INC.
BK. 9082 PG. 212
MAP 100 MAP 135

111 MONSON ROAD
N/T
STANLEY (AND BARBARA) KUSTRA
BK. 5611 PG. 309
MAP 100 LOT 111

PERMANENT B.V.W. IMPACT = 243 SF
TEMPORARY L.U.W. IMPACT = 44 SF
TEMPORARY BANK IMPACT = 8 LF
PERMANENT L.U.W. IMPACT = 35 SF
PERMANENT BANK IMPACT = 285 LF
PERMANENT L.U.W. IMPACT = 1231 SF
PROP LOAM & SEED (TYP.)
12" RCP - CLASS V REM EXIST PIPE
PROP HMA DWY
TEMP CONST EASEMENT
APPROX LIMITS OF CLEARING & GRUBBING
FE
TEMP CONST EASEMENT
PERM UTIL EASEMENT
PROP GRAV DWY
PROP HMA DWY
TEMP CONST EASEMENT
PROP GRAV DWY
RET
FE (2)
1930 COUNTY LAYOUT
1931 COUNTY LAYOUT
GRASS DRAINAGE DITCH
OHW
BOS
PROP EOP
R&S
REM
N 81° 02' 14" E 250.18'
PROP FULL DEPTH CONSTRUCTION
MONSON ROAD
PC=14+35
Δ=15°45'55"
R=1300.00'
L=357.70'
T=179.99'
PROP HMA CURB
CBCI
TOS
DMH
RCP (TYP.)
CONTINUED ON SHEET NO. 15
REM TREE (2)
TEMP CONST EASEMENT
PERMANENT L.U.W. IMPACT = 55 SF
PERMANENT BANK IMPACT = 14 LF
PROP 12" RCP FLARED ENDS
TEMPORARY L.U.W. IMPACT = 215 SF
DRAINAGE EASEMENT
PROP MODIFIED ROCKFILL
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 101 FT BALANCE STONE WALL (CONT. ON SHEET NO. 12)
TEMPORARY BANK IMPACT = 13 LF
R&R 103 LF BALANCE STONE WALL
APPROX LIMITS OF CLEARING & GRUBBING
PROP LOAM & SEED (TYP.)
R&S 12 FT BALANCE STONE WALL
PROP MODIFIED ROCKFILL
TEMP CONST EASEMENT
DRAINAGE EASEMENT
PERMANENT B.V.W. IMPACT = 19 SF
PERMANENT L.U.W. IMPACT = 41 SF
TEMPORARY BANK IMPACT = 12 LF
PROP MODIFIED ROCKFILL
PERMANENT B.V.W. IMPACT = 31 SF
TEMPORARY L.U.W. IMPACT = 69 SF
TEMP CONST EASEMENT
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
PROP SEDIMENT CONTROL BARRIER (TYP.)

120 PECK ROAD
N/T
NORCROSS WILDLIFE SANCTUARY, INC.
BK. 2052 PG. 38
BK. 2099 PG. 244
BK. 2158 PG. 397
BK. 2168 PG. 183
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 130

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT (SEE NOTE BELOW)
TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 26

Proposal No. 608163 (8212)

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

121 MONSON ROAD
N/F
MICHAEL P. & VIRGINIA S. LITO
Bk. 8951 Pg. 267
MAP 100 LOT 121

ACCEPTED MAY 17, 2011

ACCEPTED MAY 17, 2011

MAYNARD ROAD

R&R 132 FT BALANCE STONE WALL
TEMP CONST EASEMENT
RET CBLP
REM TREE
RET CBLP
PROP GRAV DWY
MATCH EXISTING
PROP HMA DWY
REM TREE
RET TREE W/ PROT
OHW
1971 COUNTY LAYOUT
1932 COUNTY LAYOUT
BOS
CBCI
RET CONC. POST
RET TREE W/ PROT
PROP LOAM & SEED (TYP.)
MATCH EXISTING
PROP HMA DWY
TEMP CONST EASEMENT
R&R 127 LF BALANCE STONE WALL
WETLAND RESTORATION AREA 1 = 217 SF ±
NOTE: SEE WETLAND SEED MIX ON SHEET 18b AND SEE SPECIAL PROVISION.
PROP LOAM & SEED (TYP.)
APPROX LIMITS OF CLEARING & GRUBBING
RET
CBCI
PROP HMA CURB
R&S
BOS
MONSON ROAD
PROP FULL DEPTH CONSTRUCTION
DMH
CBCI
PROP HMA CURB
R&S
BOS
RET
CBCI
DMH
CONTINUED ON SHEET NO.15
CONTINUED ON SHEET NO.17
54
55
56
57
58
59
60
14"
S89° 18' 18" E 130.61'
PC +09.11
Δ=4°26'52"
R=1680.00'
L=131.40'
T=65.73'
PT +40.51
R&R
Bnk 5-10
TP-2
RCP (TYP.)
105
OHW
1971 COUNTY LAYOUT
RET
1932 COUNTY LAYOUT
PERM UTIL EASEMENT
TEMP CONST EASEMENT
THE PROPOSED TREELINE REPRESENTS LIMITED OVER-HEAD TREE CANOPY TRIMMING ONLY ALONG THE EXISTING OVERHEAD UTILITY LINES. NO DIRECT GROUND WETLAND IMPACTS ARE PROPOSED OR REQUIRED.
PERM UTIL EASEMENT
TEMP CONST EASEMENT
PROP SEDIMENT CONTROL BARRIER (TYP.)
PROP LOAM & SEED (TYP.)
APPROX LIMITS OF CLEARING & GRUBBING
R&R 7 FT. BALANCE STONE WALL

100 PECK ROAD
N/F
MONTGOMERY WILDLIFE SANCTUARY INC.
Bk. 2082 Pg. 58
Bk. 2099 Pg. 244
Bk.2158 Pg. 302
Bk. 2168 Pg. 103
Bk. 2433 Pg. 283
Bk. 2815 Pg. 564
Bk. 3184 Pg. 407
Bk. 3217 Pg. 19
MAP 100 LOT 120

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT (SEE NOTE BELOW)
TEMPORARY
NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 28

Proposal No. 608163 (32)12

HIGHWAY GUARD DETAILS

STA 80+08 TO STA 80+21 RT TANGENT END TREATMENT TL-3
STA 80+21 TO STA 82+59 RT (TL-3)
STA 81+79 TO STA 81+92 LT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

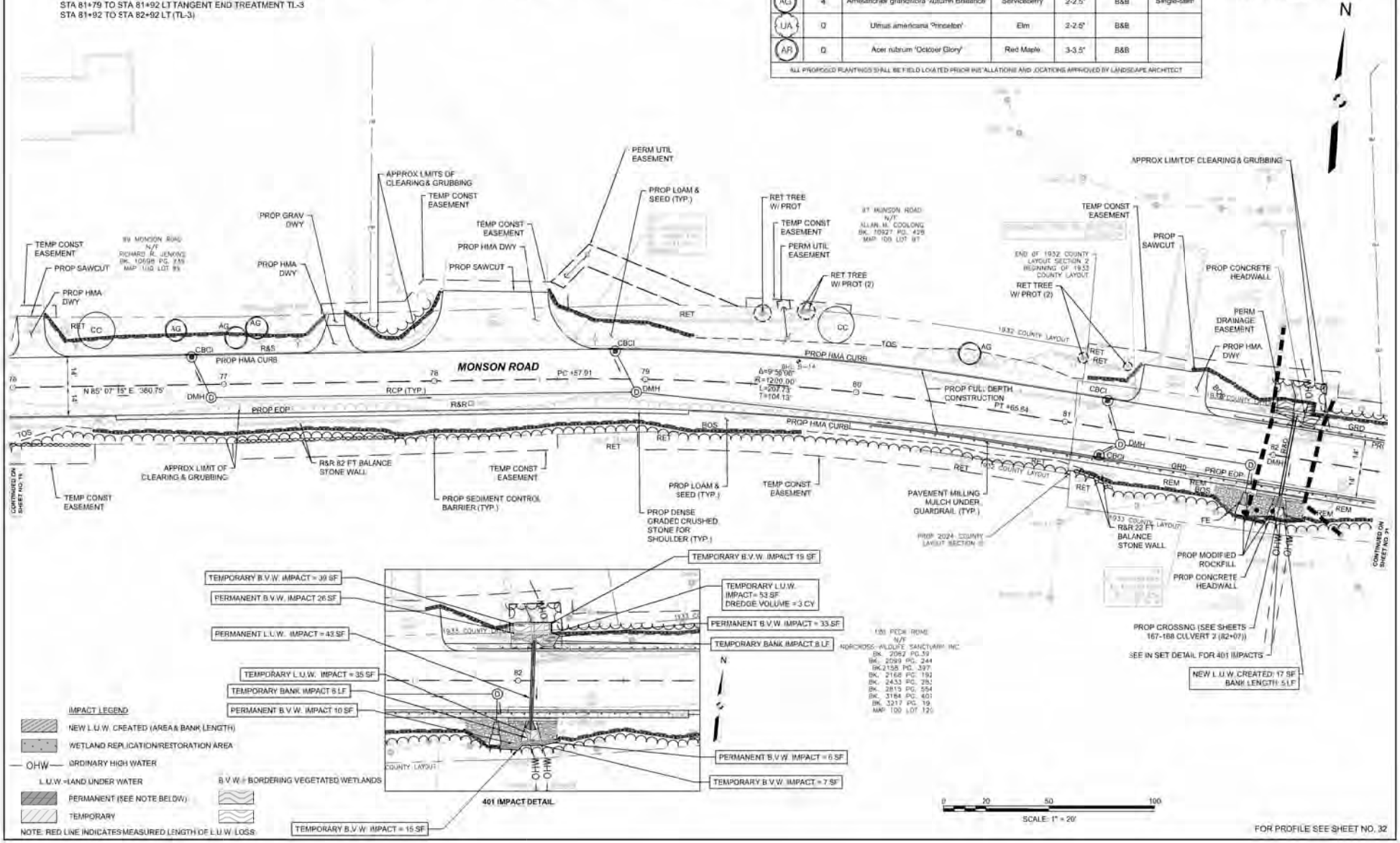
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	2	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	4	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	0	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR INSTALLATION AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



HIGHWAY GUARD DETAILS

STA 80+21 TO STA 82+59 RT (TL-3)
STA 82+59 TO STA 82+72 RT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)
STA 82+92 TO STA 83+04 LT TANGENT END TREATMENT TL-3
STA 84+54 TO STA 84+66 RT TANGENT END TREATMENT TL-3
STA 84+66 TO STA 85+84 RT (TL-3)
STA 85+64 TO STA 86+04 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+43 TO STA 1+83 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+83 TO STA 2+07 RT (TL-3)
STA 02+07 TO STA 02+20 RT TANGENT END TREATMENT TL-3

STA 02+20 TO STA 02+07 LT TANGENT END TREATMENT TL-3
STA 02+07 TO STA 87+79 RT (TL-3)
STA 87+79 TO STA 87+92 RT TANGENT END TREATMENT TL-3
STA 87+02 TO STA 87+42 LT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 87+42 TO STA 87+87 LT (TL-3)
STA 87+87 TO STA 88+00 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	5	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	
AR	2	Acer rubrum 'October Glory'	Red Maple	3-3.5"	B&B	

ALL PROPOSED PLANTINGS SHALL BE FIELD LOCATED PRIOR TO INSTALLATIONS AND LOCATIONS APPROVED BY LANDSCAPE ARCHITECT

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

LIMITS OF WORK
STA 88+00+.00
N 2847443.733
E 454226.983

LIMITS OF WORK
STA 2+20.00
N 2847299.213
E 454204.815

REED HILL ROAD
N 89° 39' 48" E 51.84'
2+85.20

MONSON ROAD
S 84° 57' 39" E 247.63'
PC +13.27

TEMP CONST EASEMENT
DRAINAGE EASEMENT
APPROX LIMIT OF CLEARING & GRUBBING
PROP LOAM & SEED (TYP.)
PROP HMA DWY
PROP SAWCUT
12" RCP TYP.
R&S BOLLARD (7)
PROP FULL DEPTH CONSTRUCTION
PROP HMA CURB
PROP EOP
PROP SEDIMENT CONTROL BARRIER (TYP.)
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
R&R 65 FT BALANCE STONE WALL
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
WETLAND REPLICATION AREA 1 = 1204 SF ±
R&S 12 FT BALANCE STONE WALL
WPA JURISDICTION
PROP BOX CULVERT
(SHEETS 169-171 CULVERT 3 (85+45))
INSET DETAILS FOR 401 IMPACTS)
STA 86+53.83 MONSON RD = STA 1+00.00 REED HILL ROAD
N 2847355.444
E 454111.012
PROP EOP
PROP SAWCUT
PROP HMA DWY
PROP LOAM & SEED
MATCH EXISTING
PROP PAVEMENT MILLING AND RESURFACING
25' PAVEMENT TRANSITION
R&S BOLLARD (9)
APPROX LIMITS OF CLEARING & GRUBBING
TEMP CONST EASEMENT
PROP UTIL EASEMENT
PROP SAWCUT
MATCH EXISTING
PROP PAVEMENT MILLING AND RESURFACING
TEMP CONST EASEMENT
PAVEMENT MILLING MULCH UNDER GUARDRAIL
BANK IMPACT = 7 LF
DRAINAGE EASEMENT
TEMPORARY L.U.W. IMPACT = 65 SF
DREDGE VOLUME = 4 CY
TEMPORARY B.V.W. IMPACT = 86 SF
PERMANENT B.V.W. IMPACT = 72 SF
TEMPORARY B.V.W. IMPACT = 24 SF
PERMANENT B.V.W. IMPACT = 176 SF
NEW L.U.W. CREATED 541 SF
BANK LENGTH 68 LF
TEMPORARY L.U.W. IMPACT = 1031 SF
DREDGE VOLUME = 86 CY
BANK IMPACT = 54 LF
NEW L.U.W. CREATED 477 SF
BANK LENGTH 60 LF
PERMANENT L.U.W. IMPACT = 216 SF
PERMANENT BANK IMPACT 18 LF
PERMANENT L.U.W. IMPACT = 195 SF
DREDGE VOLUME = 6 CY
TEMPORARY BANK IMPACT 11 LF
TEMPORARY L.U.W. IMPACT = 90 SF
PERMANENT L.U.W. IMPACT = 108 SF
401 IMPACT DETAIL

IMPACT LEGEND
NEW L.U.W. CREATED (AREA & BANK LENGTH)
WETLAND REPLICATION/RESTORATION AREA
OHW — ORDINARY HIGH WATER
L.U.W. = LAND UNDER WATER
PERMANENT (SEE NOTE BELOW)
TEMPORARY
B.V.W. = BORDERING VEGETATED WETLANDS
PERMANENT
TEMPORARY

NOTE: RED LINE INDICATES MEASURED LENGTH OF L.U.W. LOSS

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 33

Proposal No. 608163-128212

608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NOS. 10 AND 11

CONTINUED BELOW

CONTINUED ON SHEET NO. 25

CONTINUED ABOVE

TOWN OF MONSON

TOWN OF WALES

LIMIT OF WORK
STA. 11+00.00
N 2848862.235
E 446899.548
EL = 862.87

MONSON ROAD

PROPOSED 18" RCP

EXISTING 12" CPP

EXISTING GRADE

PROPOSED GRADE

2.00%

1.61%

-1.35%

-4.25%

MATCH EXISTING PROFILE

GRADE BREAK STA = 11+00.00

ELEV = 862.87

GRADE BREAK STA = 11+52.00

ELEV = 863.71

NORMAL CROWN

EXIST 12" STONE BOX CULVERT

SUPERELEVATION TRANSITION
NORMAL CROWN TO e=5.0%

FULL SUPERELEVATION RIGHT
e=5.0%

SUPERELEVATION TRANSITION
e=5.0% TO e=0%

SUPERELEVATION TRANSITION
e=0% TO e=6.0%

SUPERELEVATION TRANSITION
e=6.0% TO NORMAL CROWN

FULL SUPERELEVATION LEFT
e=6.0%

BENCHMARK
MAGNAIL IN UTILITY POLE
ELEV = 869.98'
STA. 12+79.94
OFF 1534'RT

BENCHMARK
MAGNAIL IN UTILITY POLE
ELEV = 877.63'
STA. 21+17.43
OFF 16.88'RT

LYNCH ROAD

HIGH POINT ELEV = 880.20
HIGH POINT STA = 18+36.94
PVI STA = 17+75.00
PVI ELEV = 881.76
A.D.T. = 4,340 VC
K = 80.05
424.1' SSD

PVC: 16+05
ELEV: 876.81

PVT: 19+45
ELEV: 879.47

STA	EXIST. ELEVATION	PROP. ELEVATION
10+00	864.2	862.9
11+00	862.87	862.9
12+00	865.10	865.0
13+00	868.00	867.8
14+00	870.90	871.4
15+00	873.79	873.5
16+00	876.69	875.1
17+00	879.02	879.7
18+00	880.11	880.2
19+00	879.35	879.2
20+00	878.72	878.0
21+00	877.37	877.4

NAVD 88
BASE ELEV
865.00

HOR SCALE IN FEET
0 20 40

VER. SCALE IN FEET
0 4 8

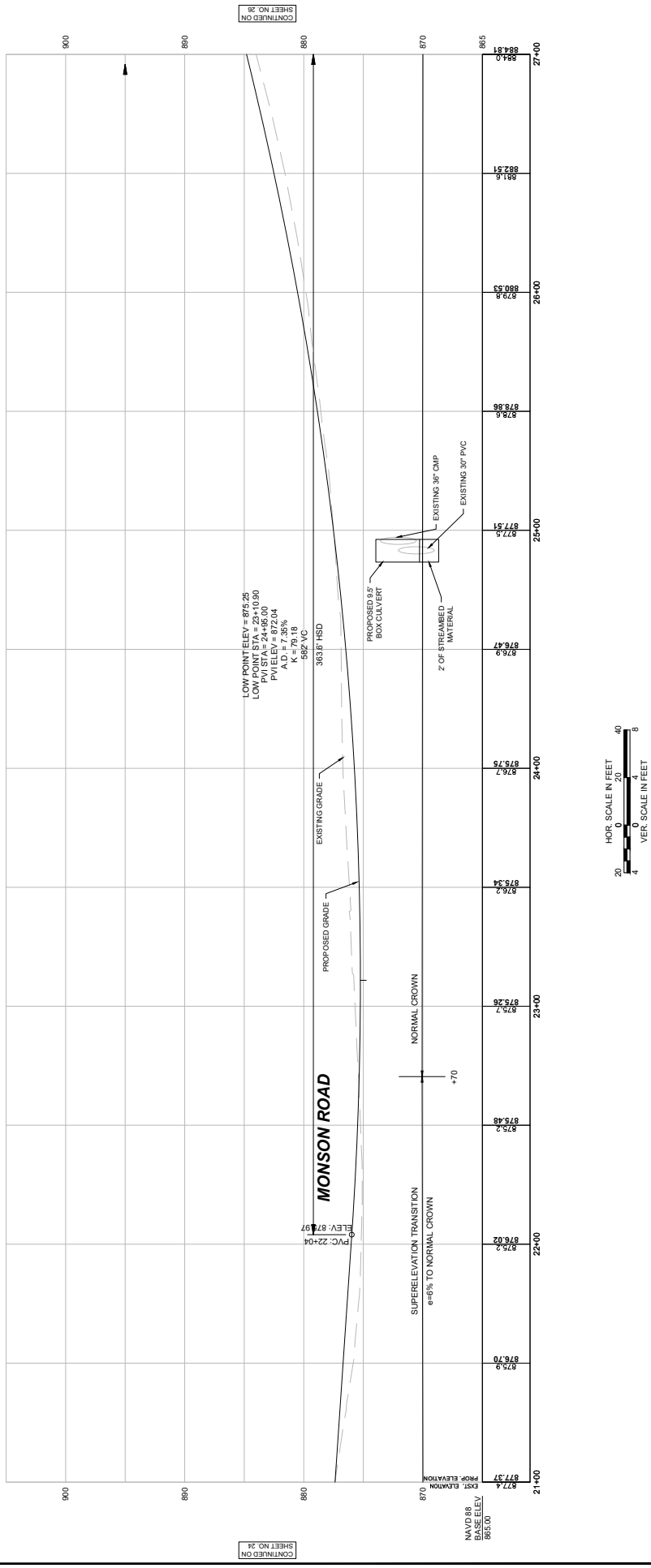
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:44 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 12



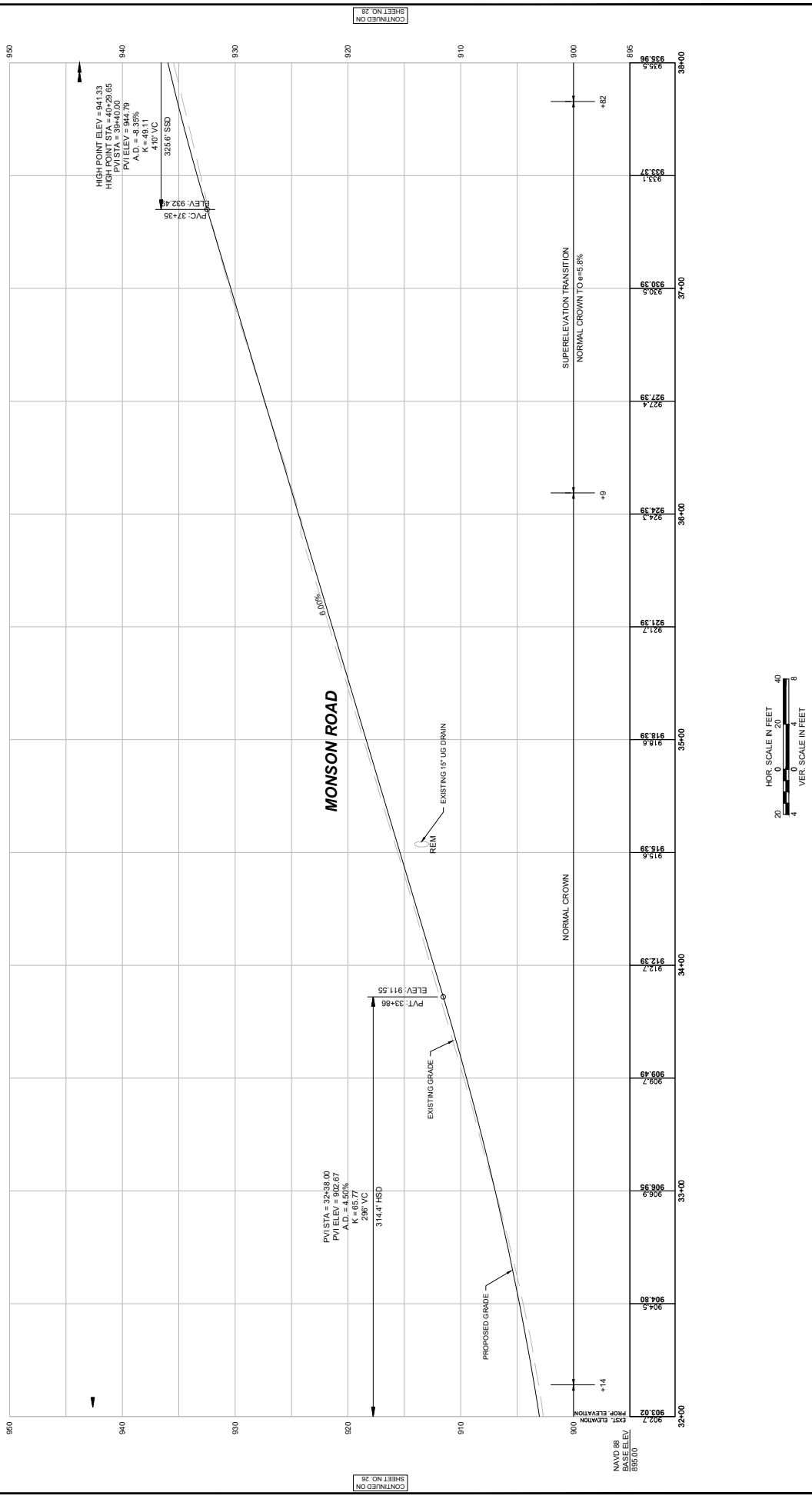
608163_HDAPROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD

FOR CONSTRUCTION PLANS
SEE SHEET NO. 14

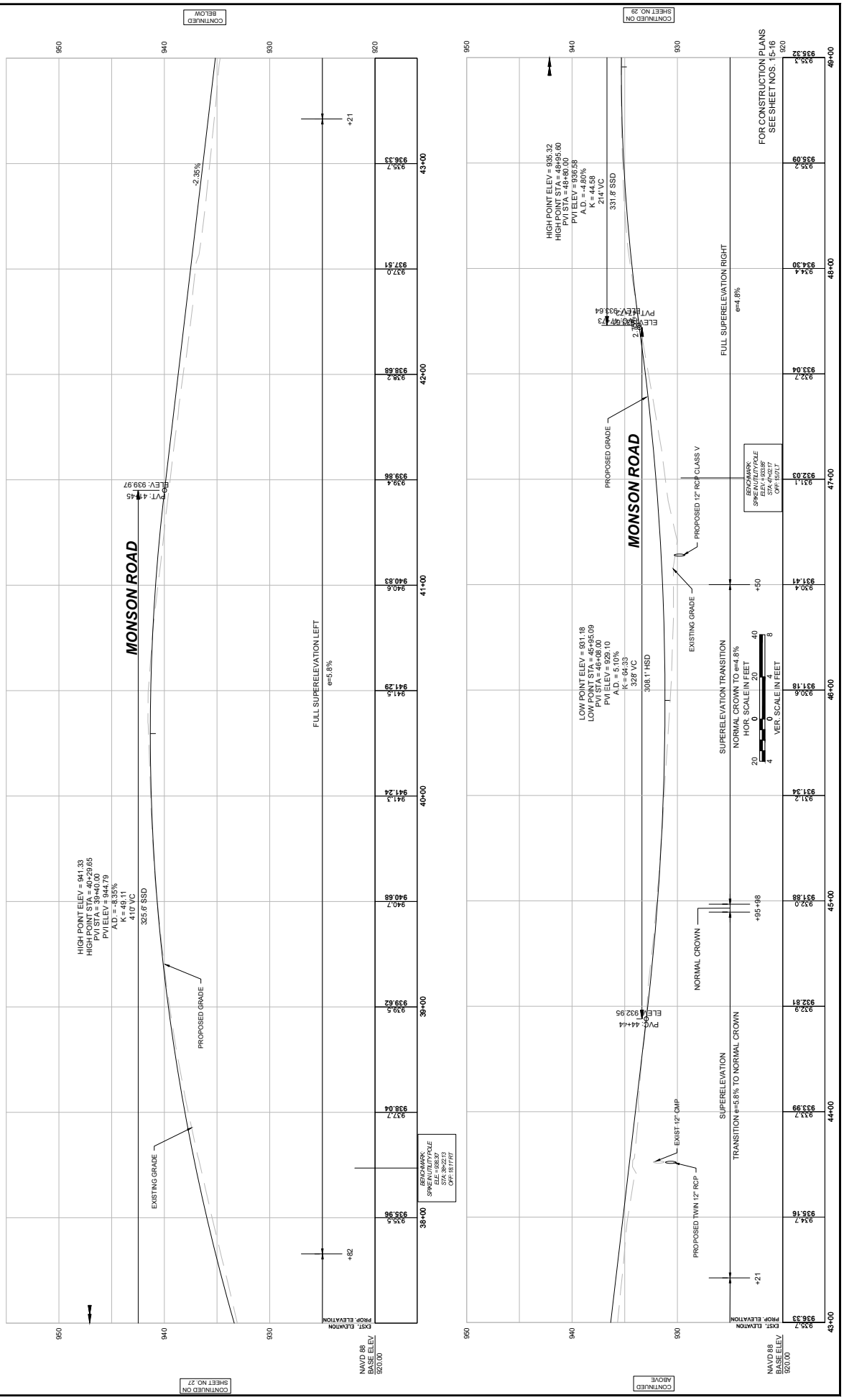


608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO. 608163		

PROFILE - MONSON ROAD

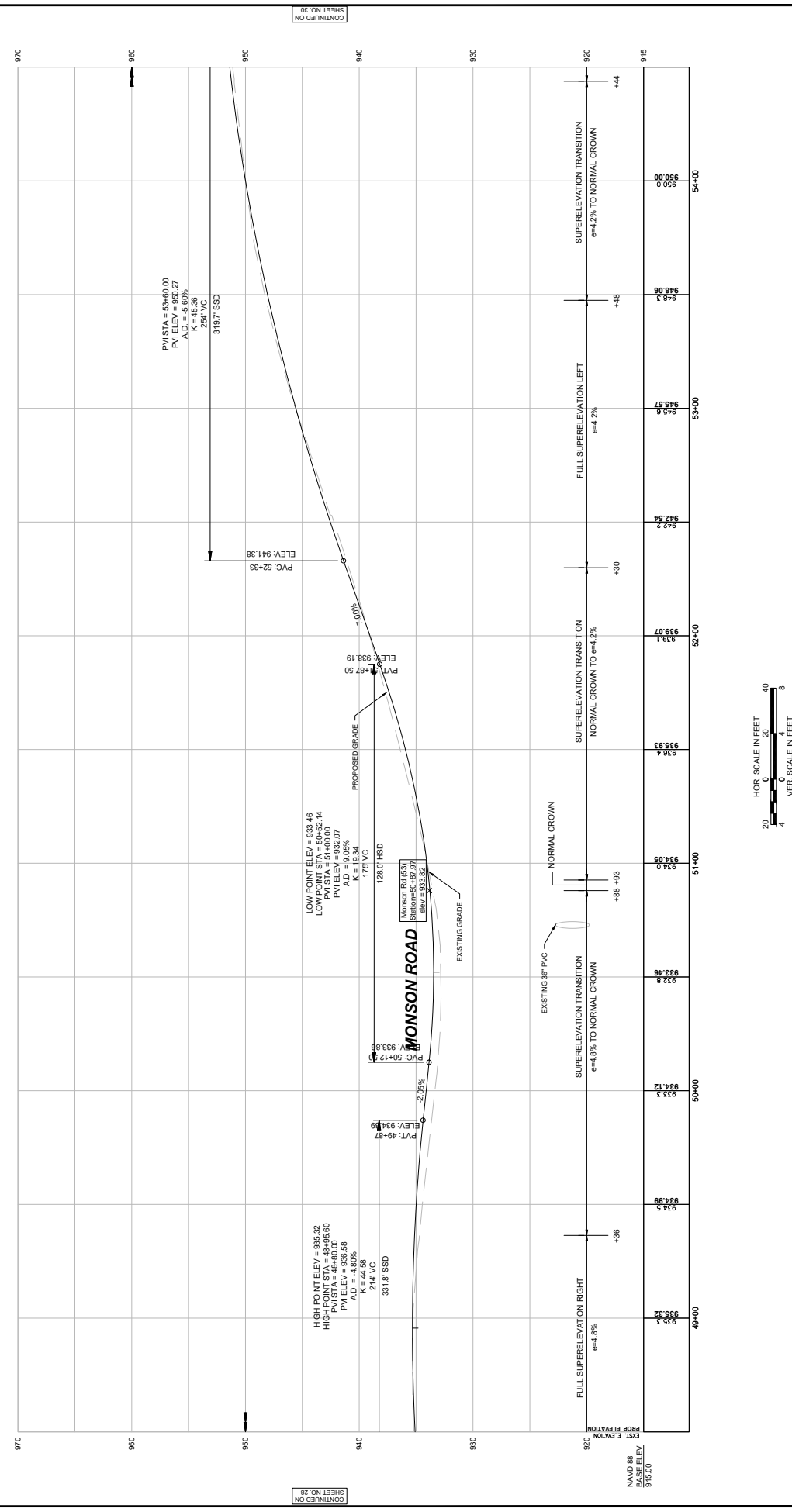


608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:45 AM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD



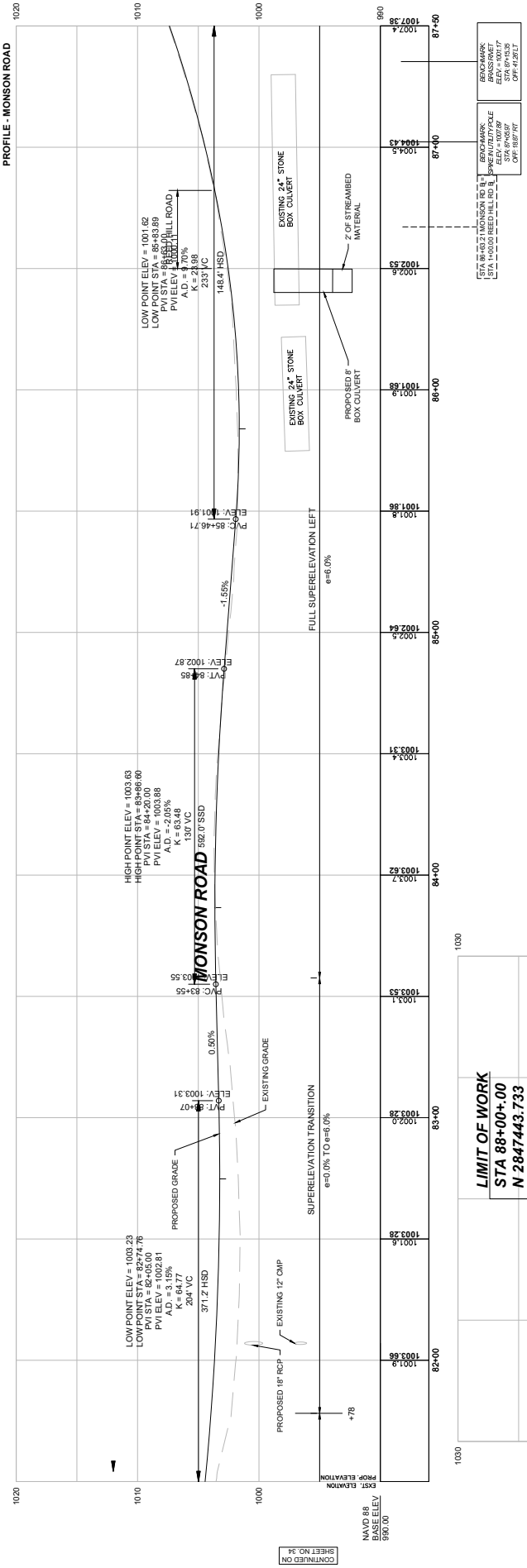
FOR CONSTRUCTION PLANS
SEE SHEET NO. 17

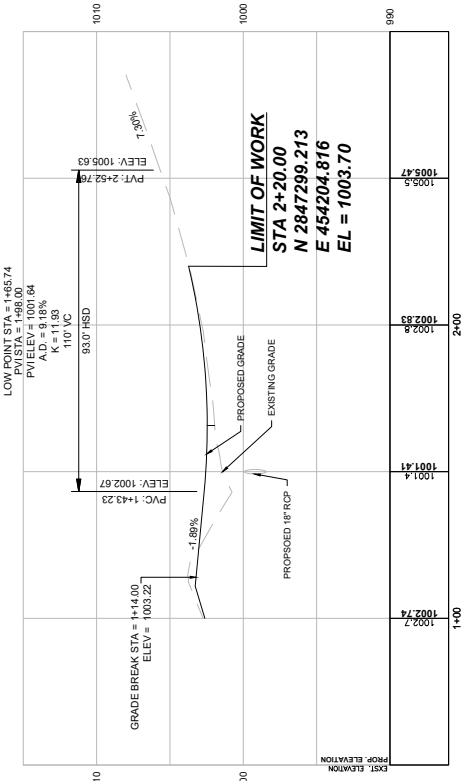
608163_HD4PROFILE.DWG Plotted on 5-Aug-2024 10:47 AM

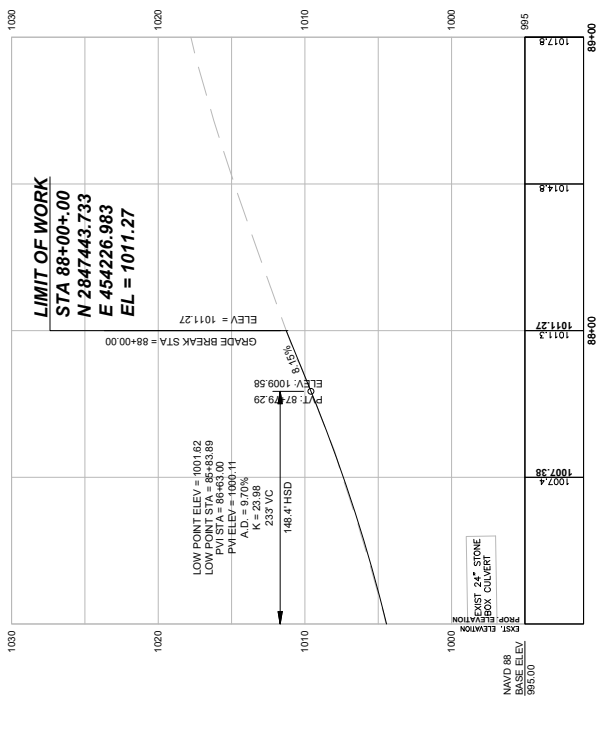
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

PROFILE - MONSON ROAD







HOR. SCALE IN FEET
0 20 40
VER. SCALE IN FEET
0 4 8

FOR CONSTRUCTION PLANS
SEE SHEET NO. 23

608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:29 PM

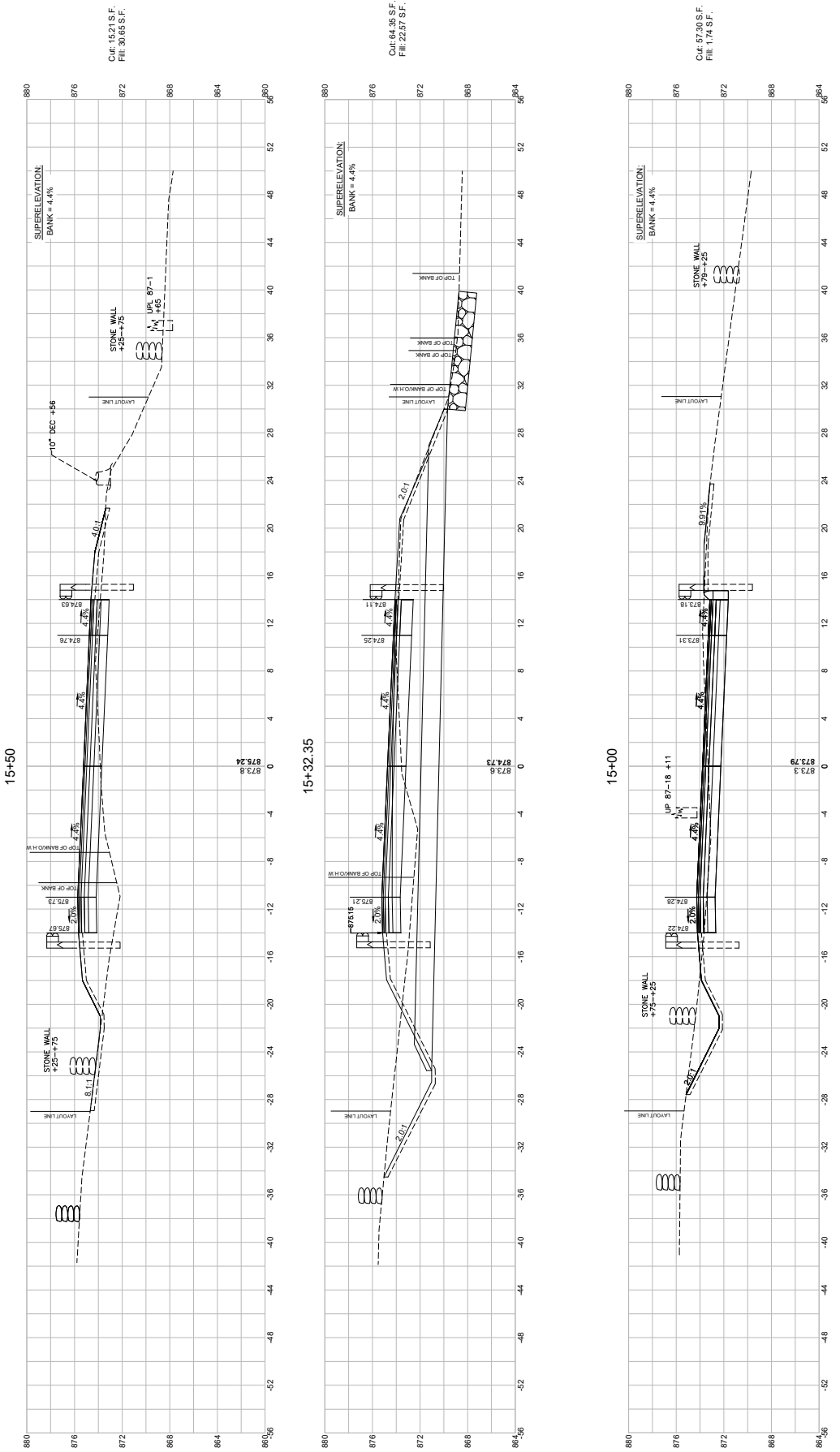
WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8

VER. SCALE IN FEET
4 0 4 8



608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 3:57 PM

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X	4	
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 8 4 0 4 8
VER. SCALE IN FEET 4 0 4

Cut: 33.06 S.F.
Fill: 27.18 S.F.

25+50

878.6
878.86

Cut: 121.15 S.F.
Fill: 0.00 S.F

25+00

877.5
877.51

EXIST. STONE HEADWALL
+77--+07

24+91.52

877.4
877.31

608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 3:59 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET
0 4 8
VER. SCALE IN FEET
0 4 8

43+94.64

Cut: 39.15 S.F.
Fill: 8.87 S.F.

SUPERELEVATION:
BANK = 2.0%

STONE WALL
+25—+75

LAYOUT LINE

TOP OF BANK

TOP OF BANK

2.0:1

2.0%

953.13

953.19

2.0%

953.63

2.6:1

STONE WALL
+75—+77

953.67

2.0%

2.0%

2.0%

933.8

934.11

0

(SECTION CUT ALONG CENTERLINE OF PROPOSED CULVERT)

43+70

Cut: 96.36 S.F.
Fill: 12.89 S.F.

WETLAND LIMIT

2.0:1

2.0%

3.2%

3.2%

3.2%

WETLAND LIMIT O.H.W

TOP OF BANK O.H.W

934.7

934.69

0

43+50

Cut: 35.54 S.F.
Fill: 16.37 S.F.

SUPERELEVATION:
BANK = 4.1%

LAYOUT LINE

2.0:1

20° DEC +37

STONE WALL
+25—+75

2.0%

935.56

935.62

4.1%

4.1%

4.1%

934.58

934.70

WETLAND LIMIT

LAYOUT LINE

STONE WALL
+25—+75

934.7

935.16

0

43+28.17

Cut: 33.29 S.F.
Fill: 14.32 S.F.

SUPERELEVATION:
BANK = 5.2%

LAYOUT LINE

12° DEC +18

STONE WALL
+75—+25

2.0:1

2.0%

936.18

936.24

5.2%

5.2%

5.2%

934.84

935.10

WETLAND LIMIT

LAYOUT LINE

STONE WALL
+75—+25

935.1

935.67

0

608163_HD10XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:44 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

Cut: 15.09 S.F.
Fill: 19.53 S.F.

47+00

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
931.42
931.55
4.4%
902.52
2.0%
902.46
UPL 72"-33"
+02
1.0:1
932.03
931.1

Cut: 85.75 S.F.
Fill: 36.70 S.F.

46+64.76

(SECTION CUT ALONG CENTERLINE OF EXISTING 12" CPP PIPE)

TOP OF BANK/O.H.W
WETLAND LIMIT
1.5:1
4.2%
2.1%
931.57
931.6

Cut: 7.89 S.F.
Fill: 32.80 S.F.

46+50

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.80
930.93
4.4%
931.84
2.0%
TOP OF BANK
1.0:1
931.41
930.4

Cut: 8.27 S.F.
Fill: 30.60 S.F.

46+44.68

SUPERELEVATION:
BANK = 4.4%

LAYOUT LINE
2.0:1
930.75
930.88
4.4%
931.85
2.0%
TOP OF BANK/O.H.W
1.0:1
931.79
931.37
930.4

608163_HD10XSC_GRADINGCALC.DWG Plotted on 9-Aug-2024 4:04 PM

WALES
MONSON ROAD

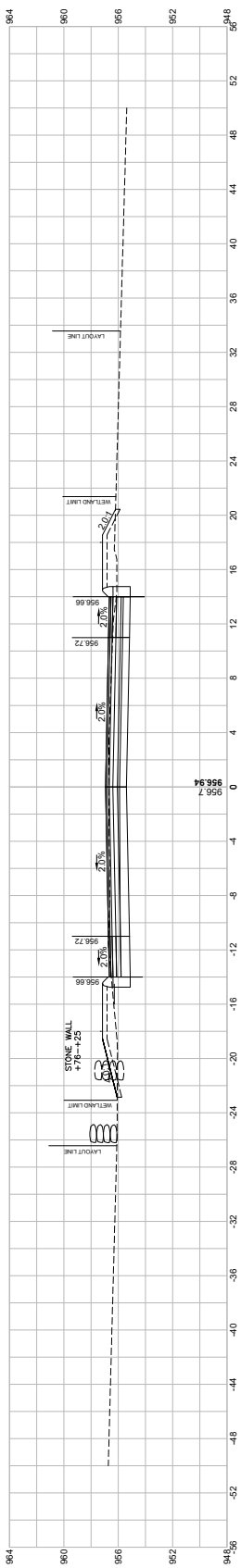
STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X	4	
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8

57+34.75

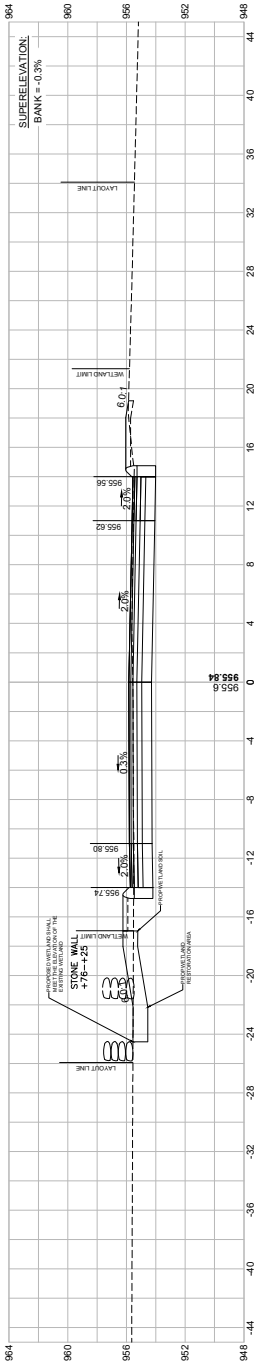
Cut: 39.6 S.F.
Fill: 10.37 S.F.



57+00

Cut: 40.32 S.F.
Fill: 5.17 S.F.

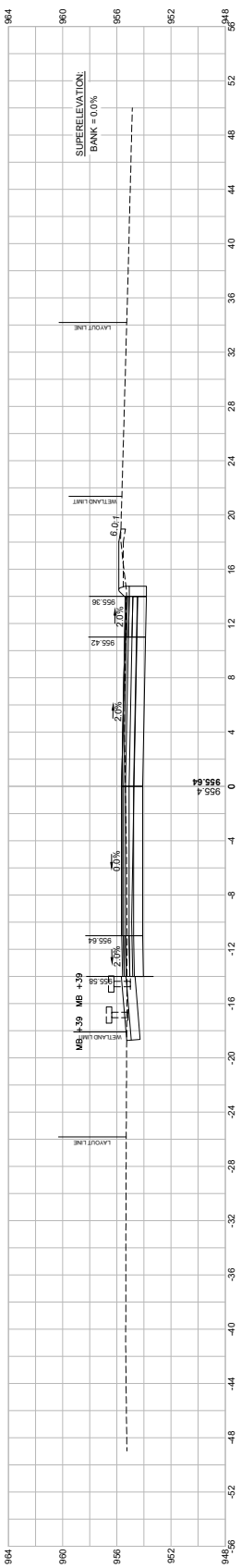
SUPERELEVATION:
BANK = -0.3%



56+93.18

Cut: 41.77 S.F.
Fill: 1.19 S.F.

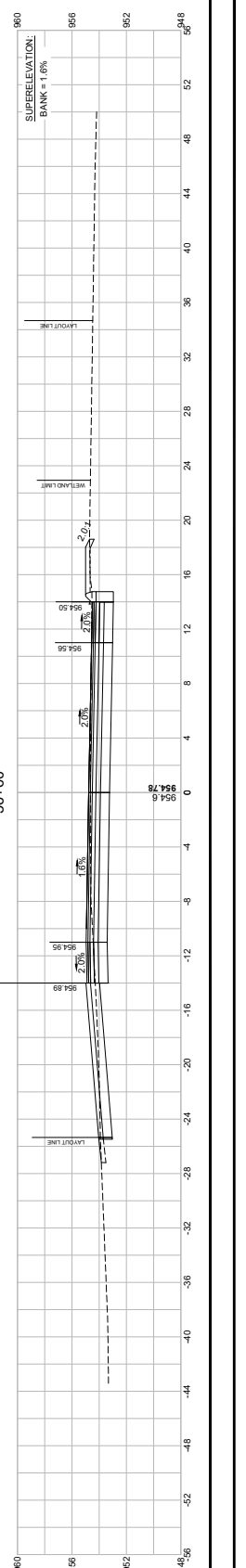
SUPERELEVATION:
BANK = 0.0%



56+60

Cut: 46.38 S.F.
Fill: 1.33 S.F.

SUPERELEVATION:
BANK = 1.6%



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:25 PM

WALES
MONSON ROAD

CROSS SECTIONS

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

82+50

Cut: 0.26 S.F.
Fill: 36.63 S.F.

SUPERELEVATION:
BANK = 0.9%

LAYOUT LINE
WETLAND LIMIT
2.0:1
2.0%
0.5%
1003.32
1003.38
1003.06
1003.00
1001.6
1003.28

82+30.60

Cut: 0.25 S.F.
Fill: 50.43 S.F.

SUPERELEVATION:
BANK = 0.0%

LAYOUT LINE
WETLAND LIMIT
2.0:1
2.0%
0.0%
1003.32
1003.38
1003.16
1003.10
1001.6
1003.38

82+07.06 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

R = 560.00'
BANK = -1.1%

TOP OF BANK
LAYOUT LINE
TOP OF BANK
WETLAND LIMIT
LAYOUT LINE
2.0:1
2.0%
1.1%
1003.40
1003.46
1003.36
1003.30
1001.9
1003.59

82+00

Cut: 0.0 S.F.
Fill: 27.77 S.F.

SUPERELEVATION:
BANK = -1.5%

LAYOUT LINE
WETLAND LIMIT
LAYOUT LINE
2.0:1
2.0%
1.5%
1003.44
1003.50
1003.38
1003.44
1001.9
1003.66

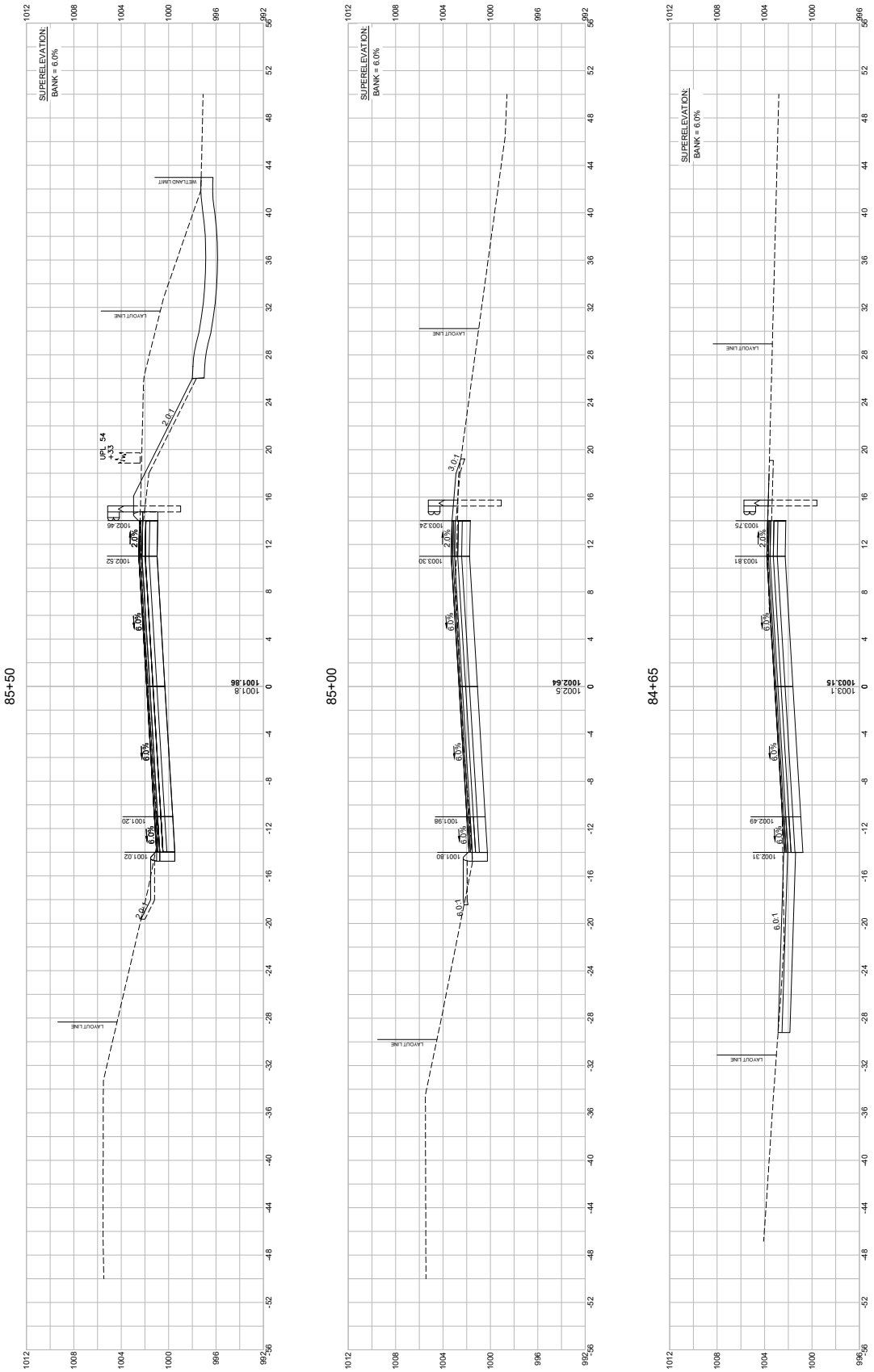
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 9-Aug-2024 4:15 PM

WALES
MONSON ROAD

STATE	FED.AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
	PROJECT FILE NO.	608163	

CROSS SECTIONS

HOR. SCALE IN FEET 4 0 4 8
VER. SCALE IN FEET 4 0 4 8



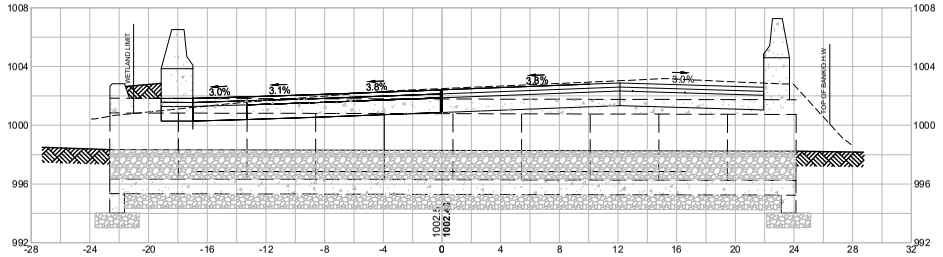
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

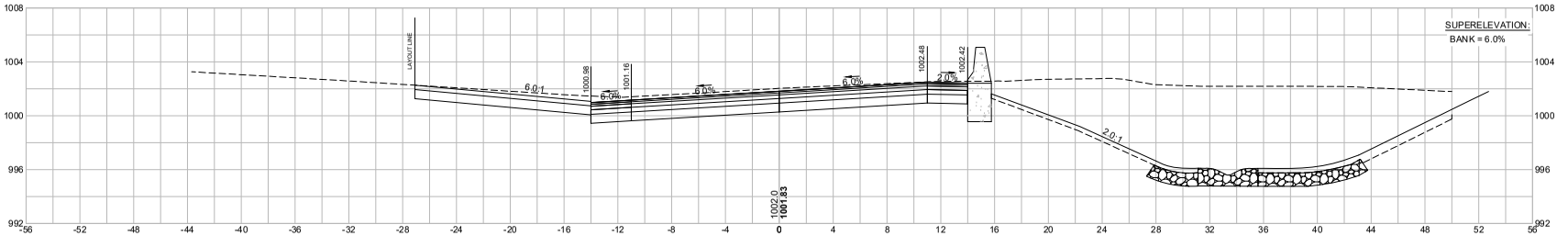
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CROSS SECTIONS

86+45.09 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

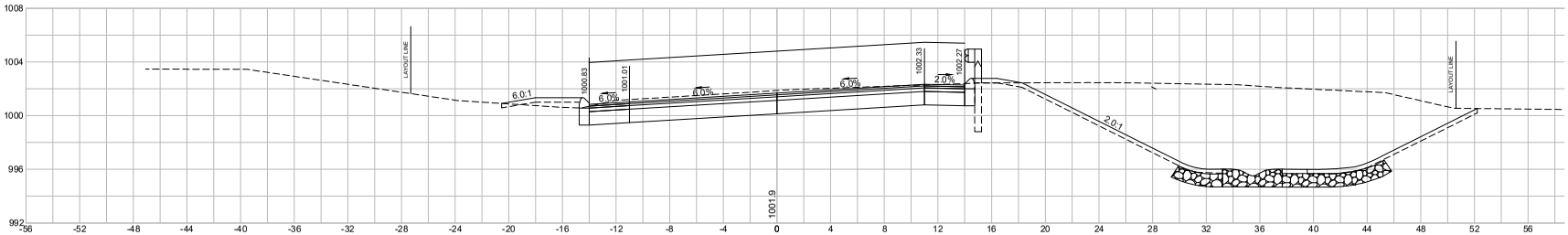


86+15



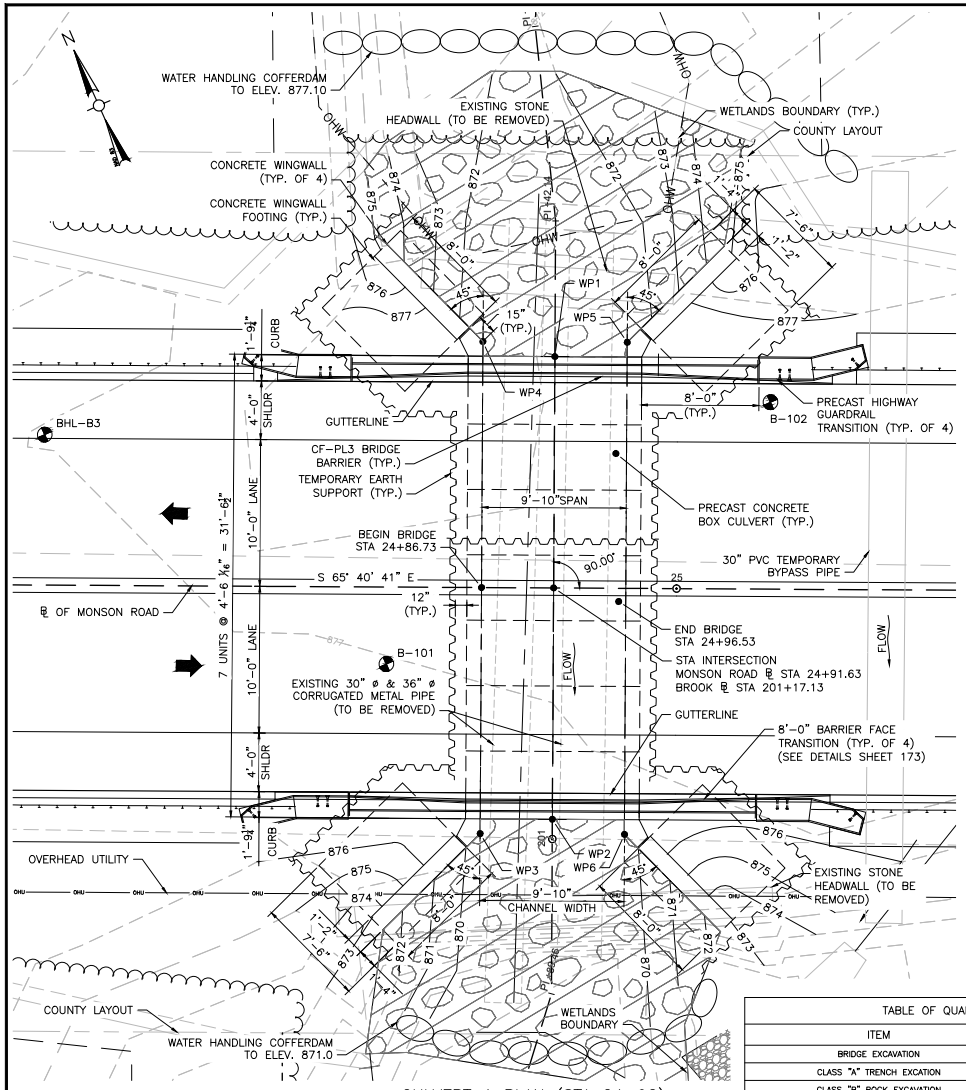
Cut: 238.87 S.F.
Fill: 0.0 S.F.

86+00



Cut: 202.10 S.F.
Fill: 4.42 S.F.

608163_HD10XSC_GRADINGCALC1.DWG Plotted on 9-Aug-2024 4:27 PM
Proposal No. 608163 (SB12)
A08940 .1014



CULVERT 1 PLAN (STA 24+92)

SCALE: 1" = 4'

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2848111.9174	448173.3849
2	2848083.1730	448160.3979
3	2848084.2791	448155.5221
4	2848114.8452	448169.3343
5	2848110.8082	448178.2683
6	2848080.2408	448164.4559

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	443
CLASS "A" TRENCH EXCATION	C.Y.	69
CLASS "B" ROCK EXCAVATION	C.Y.	30
NATURAL STREAMBED MATERIAL	C.Y.	26
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	300
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	18
PRECAST GUARDRAIL HIGHWAY TRANSITION	EA.	4
5000 PSI, ¾", 685 HP CEMENT CONCRETE	C.Y.	27
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	17050
DAMPPROOFING	S.F.	1244
PRECAST CONCRETE BOX CULVERT – SITE 1	L.S.	1
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 1	L.S.	1

DESIGN:

IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS 9TH EDITION, 2020, FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 21+38± (RT) MAGNAIL IN UTILITY POLE: EL. 876.92 FT

BENCHMARK STA 29+60± (RT) MAGNAIL IN UTILITY POLE: EL. 900.23 FT

BENCHMARK STA 29+90± (LT) MAGNAIL BRASS RIVET: EL. 901.72 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 CEMENT CONCRETE.....WINGWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 1 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S.)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

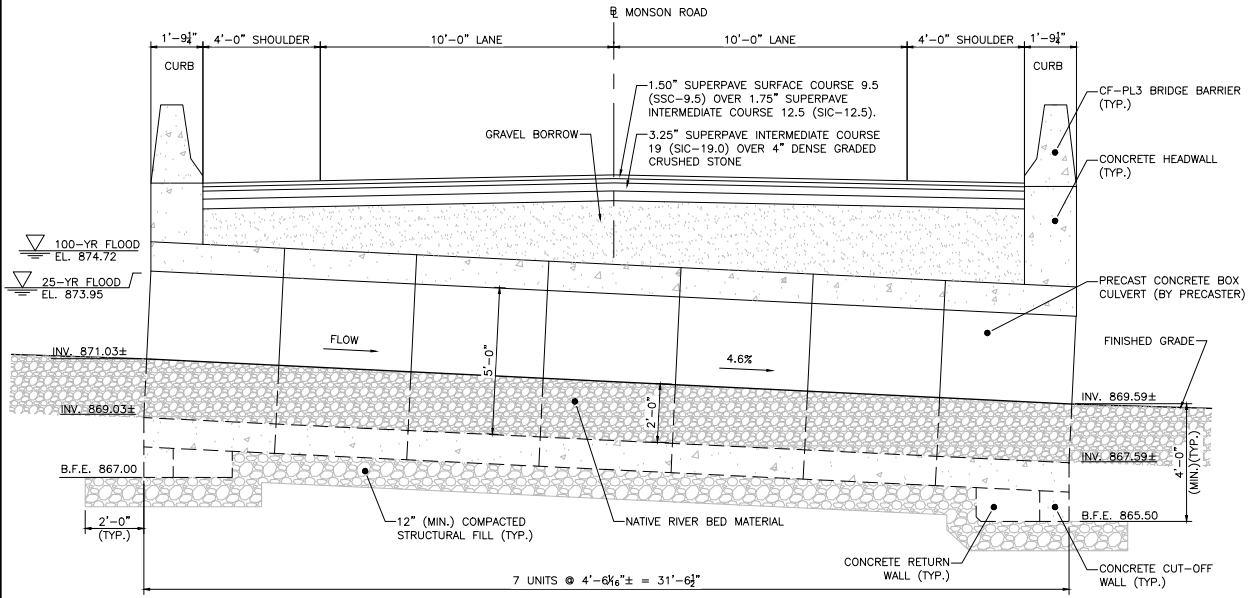
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	7.72
DESIGN FLOOD ELEVATION (FEET, NAVD)	876.1

608163_HD1\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:14 AM
Proposal No. 608163-128127
A08840 .1015

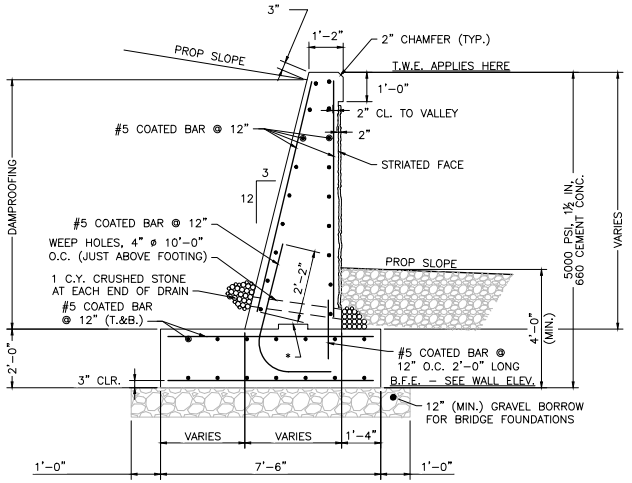
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 SECTION & DETAILS



CULVERT 1 LONGITUDINAL SECTION
SCALE: ½" = 1'-0"



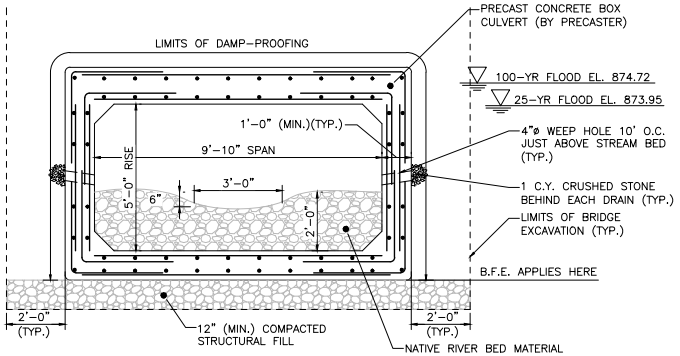
WINGWALL TYPICAL SECTION
SCALE: ½" = 1'-0"

PRECAST BOX CULVERT NOTES:

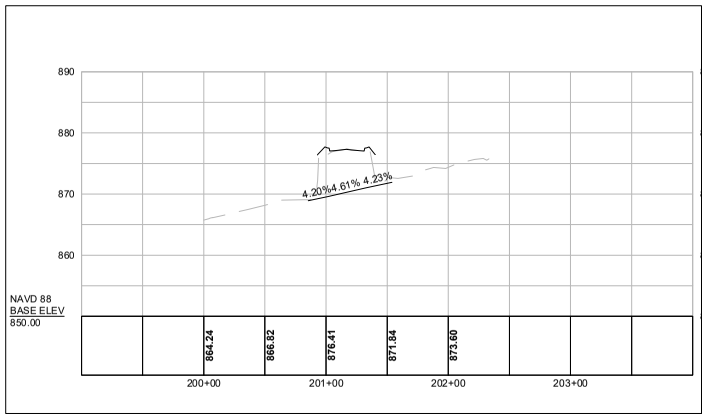
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 9'-10" WIDE, 5'-0" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO 9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

1. FOR CULVERT 1 HEADWALL ELEVATIONS, SEE SHEET NO. 165.
2. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
3. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 1 TRANSVERSE SECTION
SCALE: ½" = 1'-0"



NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.13 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

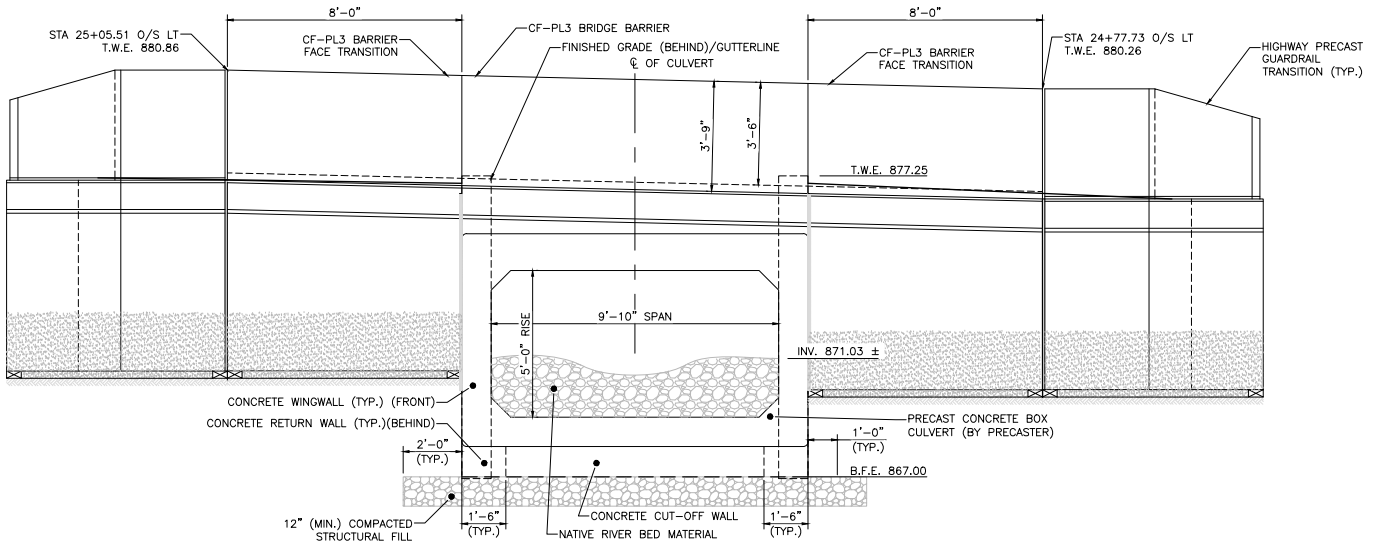
   FACTORED BEARING RESISTANCE = 5.01 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:15 AM
Proposal No. 608163-128312
A08840 .1016

WALES
MONSON ROAD

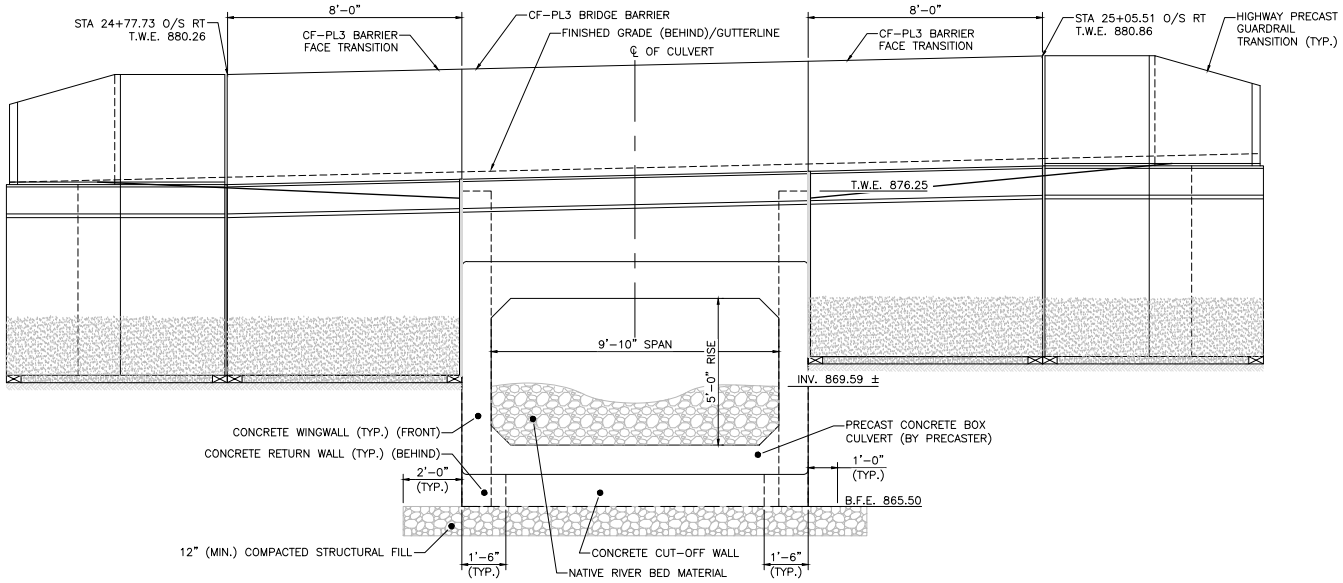
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 1 HEADWALL ELEVATIONS



CULVERT 1 INLET ELEVATION

SCALE: ½" = 1'-0"



CULVERT 1 OUTLET ELEVATION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

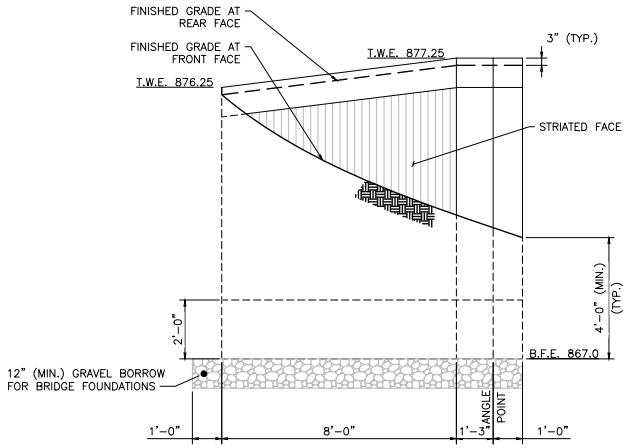
1. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
2. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11\STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:16 AM
A08840.107
Proposal No. 608163-132812

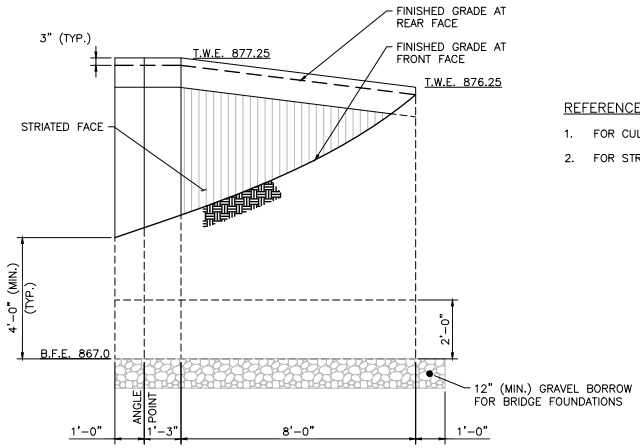
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

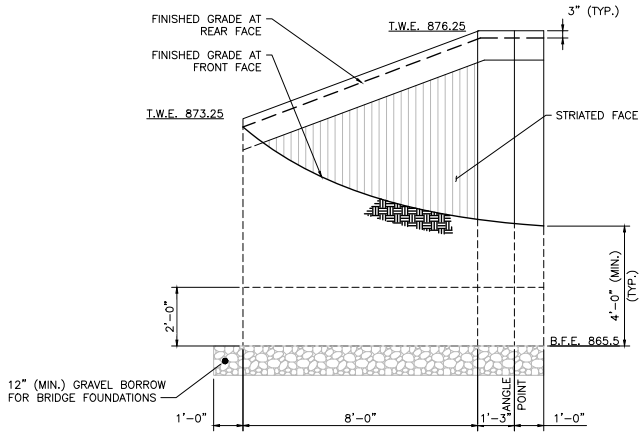
CULVERT 1 WINGWALL ELEVATIONS



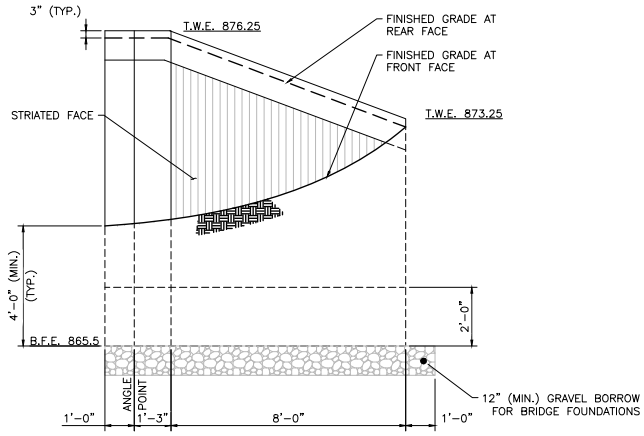
NORTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



NORTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

REFERENCE NOTES:

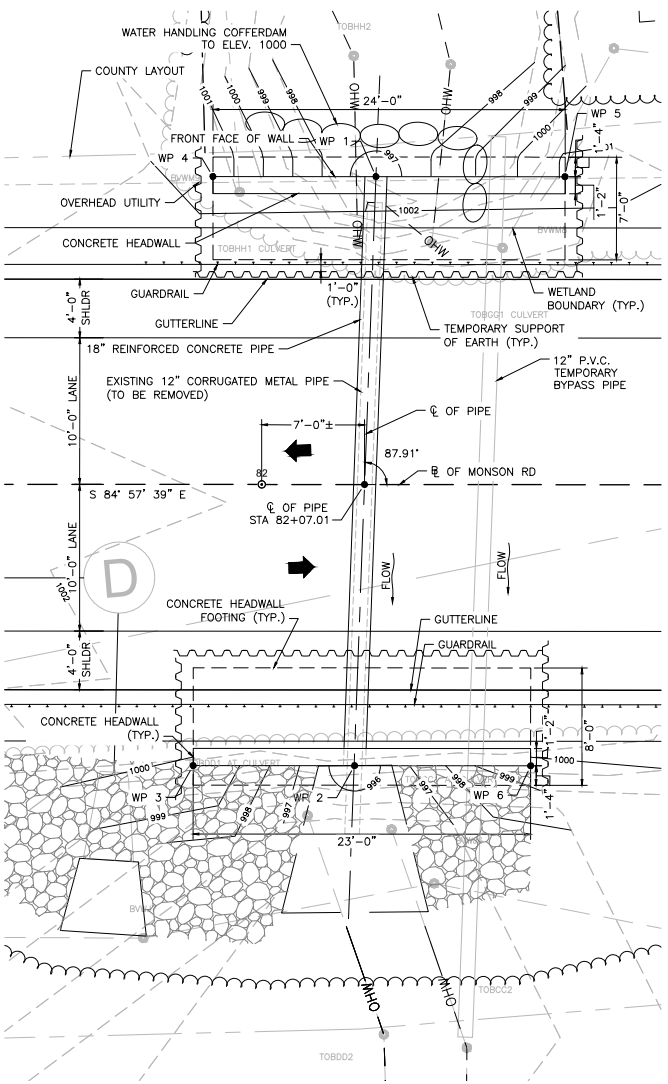
1. FOR CULVERT 1 WINGWALL SECTION, SEE SHEET NO. 164.
2. FOR STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD11STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:18 AM
Project No. 608163-138112
A0004G .1016

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 2 KEY PLAN AND NOTES



CULVERT 2 PLAN (STA 82+07)

SCALE: 1" = 4'

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 81+25± (LT) SPIKE IN UTILITY POLE: EL. 1005.74

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 685 HP CEMENT CONCRETE.....HEADWALLS

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING PIPES.
4. INSTALL THE PROPOSED PIPE & HEADWALLS.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE PROPOSED CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	167
CLASS "A" TRENCH EXCAVATION	C.Y.	11
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	150
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	20
5000 PSI ¾" 685 HP CEMENT CONCRETE	C.Y.	52
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	10010
DAMPPROOFING	S.F.	426
TEMPORARY SUPPORT OF EARTH	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 2	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847313.7204	453680.2286
2	2847273.8336	453675.2733
3	2847274.8008	453664.3163
4	2847314.6939	453669.1581
5	2847312.5891	453693.0567
6	2847272.7828	453687.1995

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	10.24
DESIGN FLOOD DISCHARGE (C.F.S.)	9
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	0.14
DESIGN FLOOD ELEVATION (FEET, NAVD)	996.14
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	9
BASE FLOOD ELEVATION (FEET, NAVD)	999.20
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

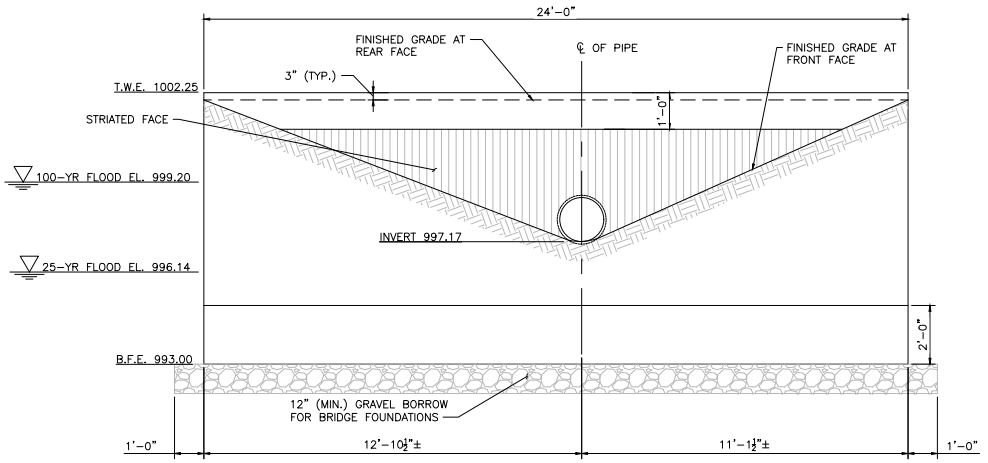
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	5
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	6.70
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.46

608163_HD11\STRUCTURAL PLAN\.DWG Plotted on 5-Aug-2024 11:18 AM
Proposal No. 608163-1.36.12
A09840 .1019

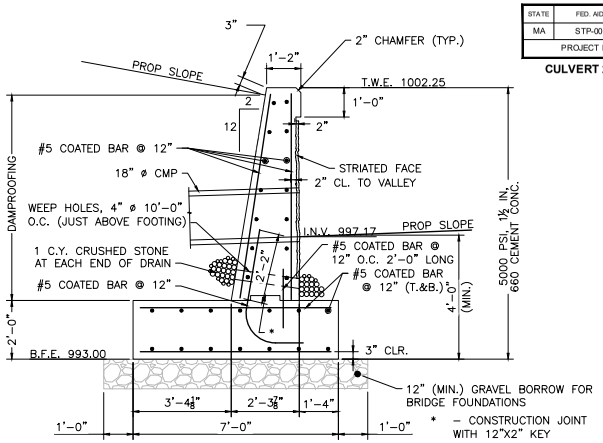
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 2 WALL DETAILS



NORTH INLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"

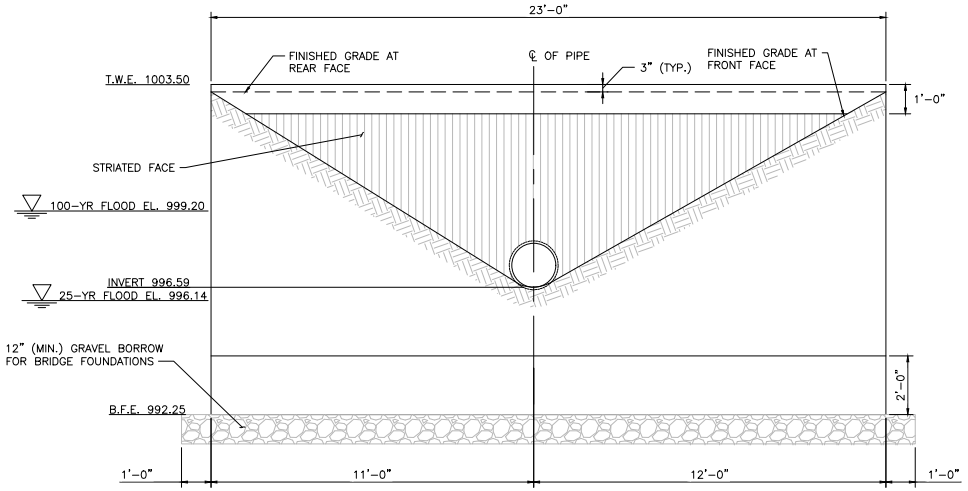


NORTH INLET HEADWALL SECTION
SCALE: ½" = 1'-0"

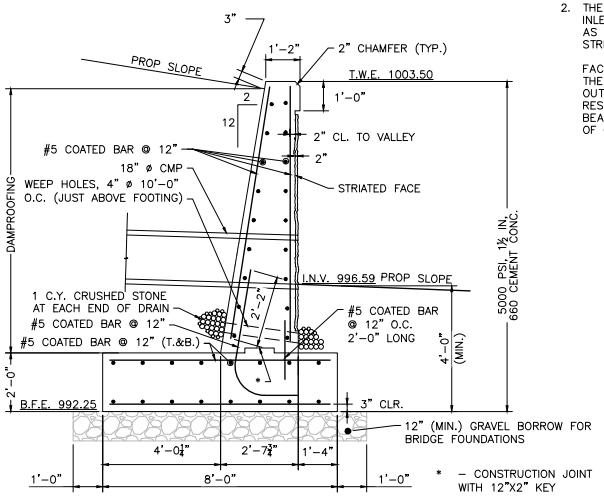
NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 2.18 KSF AT THE INLET HEADWALL AND 2.65 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

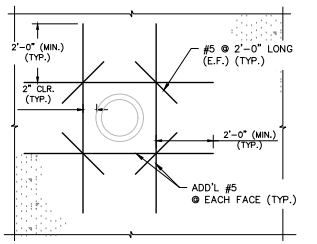
   FACTORED BEARING RESISTANCE = 5.23 KSF AT THE INLET HEADWALL AND 5.33 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



SOUTH OUTLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"



SOUTH OUTLET HEADWALL SECTION
SCALE: ½" = 1'-0"

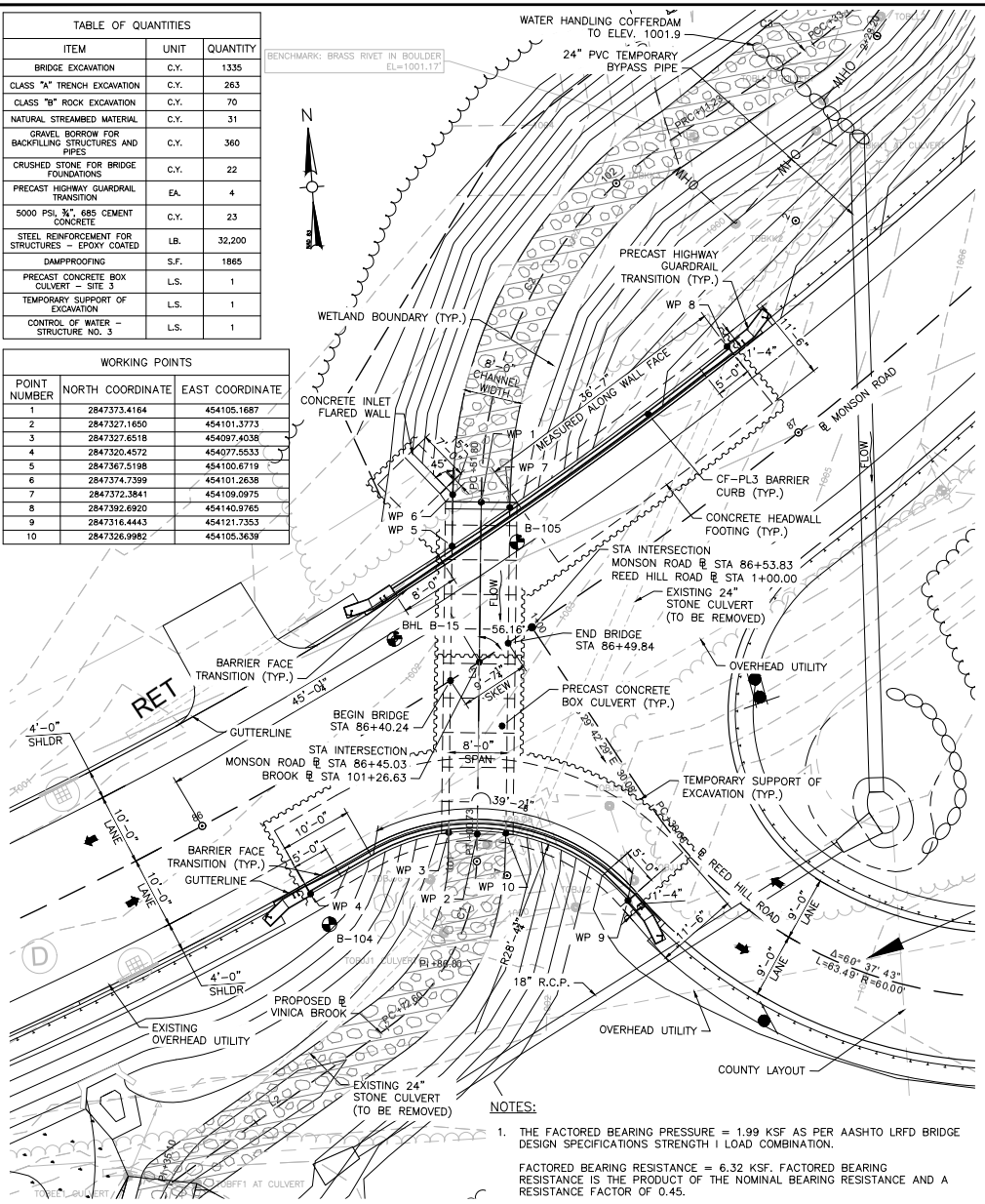


ADDITIONAL REINFORCEMENT AT PIPE
SCALE: ½" = 1'-0"

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 5-Aug-2024 11:21 AM
Proposal No. 608163-138112
A0084B-.ADDN

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	1335
CLASS "A" TRENCH EXCAVATION	C.Y.	263
CLASS "B" ROCK EXCAVATION	C.Y.	70
NATURAL STREAMBED MATERIAL	C.Y.	31
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	360
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	22
PRECAST HIGHWAY GUARDRAIL TRANSITION	EA.	4
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	23
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	32,200
DAMPPROOFING	S.F.	1865
PRECAST CONCRETE BOX CULVERT – SITE 3	L.S.	1
TEMPORARY SUPPORT OF EXCAVATION	L.S.	1
CONTROL OF WATER – STRUCTURE NO. 3	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847373.4164	454105.1687
2	2847327.1650	454101.3773
3	2847327.6518	454097.4038
4	2847320.4572	454077.5533
5	2847367.5198	454100.6719
6	2847374.7399	454101.2638
7	2847372.3841	454109.0975
8	2847392.6920	454140.9765
9	2847316.4443	454121.7353
10	2847326.9982	454105.3639



CULVERT 3 PLAN (STA 86+45)

SCALE: 1" = 8'

NOTES:

1. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 87+10± (RT) SPIKE IN UTILITY POLE: EL. 1007.89 FT

BENCHMARK STA 87+20± (LT) BRASS RIVET: EL. 1001.17 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

5000 PSI, ¾", 610 CEMENT CONCRETE.....HEADWALLS, CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S.)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.40
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

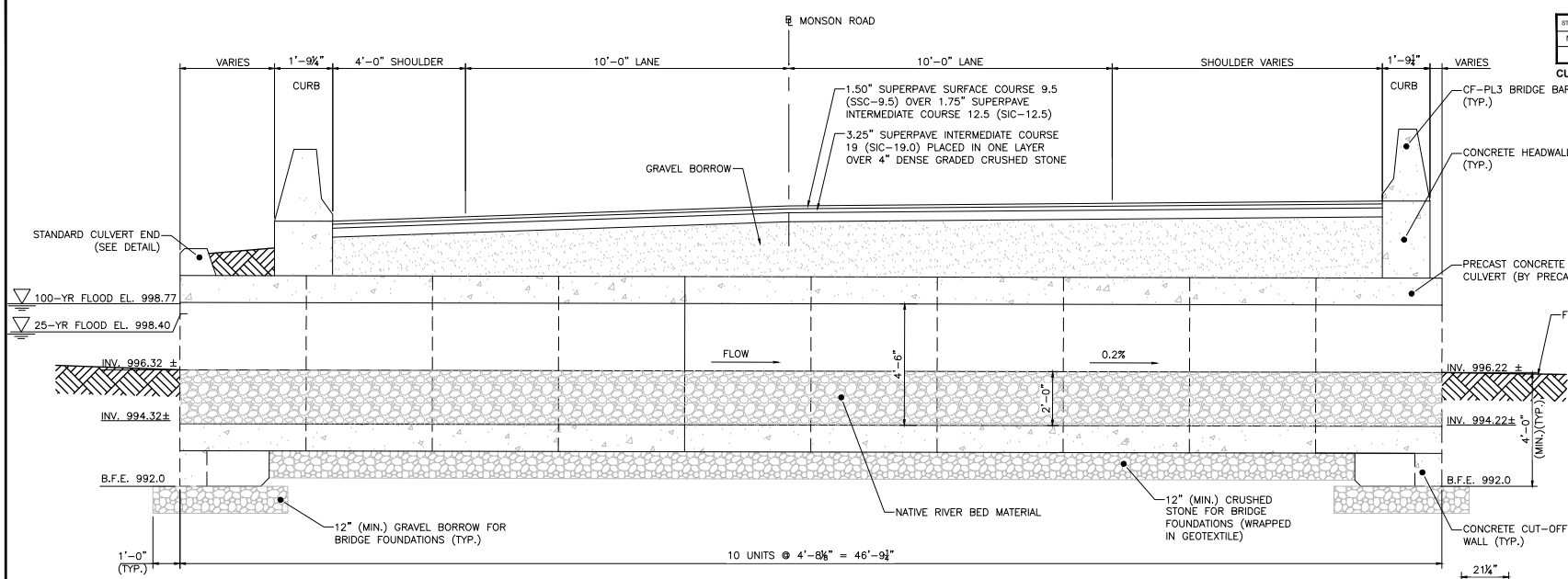
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	8.91
DESIGN FLOOD ELEVATION (FEET, NAVD)	1001.42

608163_HD11\STRUCTURAL PLAN1.DWG Plotted on 6-Aug-2024 1:14 PM
Proposal No. 608163-132612
A09840 .A021

WALES
MONSON ROAD

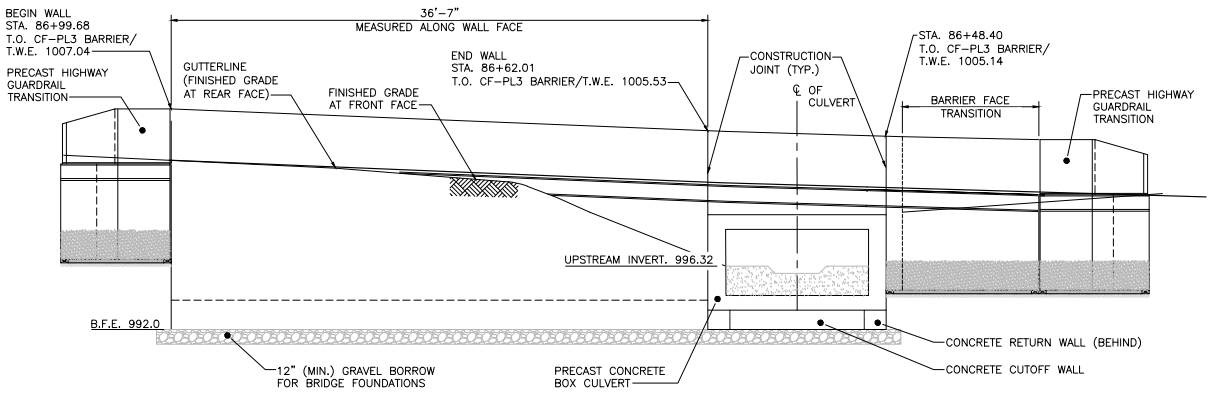
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 SECTION AND DETAILS



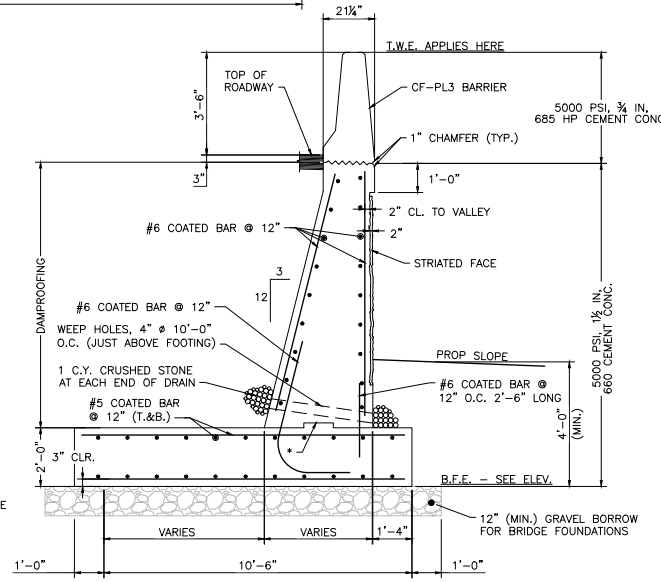
CULVERT 3 LONGITUDINAL SECTION – ALONG STREAM BASELINE

SCALE: ½" = 1'-0"



CULVERT 3 INLET NORTH ELEVATION

SCALE: ¼" = 1'-0"



RETAINING WALL SECTION

SCALE: ½" = 1'-0"

* – CONSTRUCTION JOINT WITH 12"X2" KEY

REFERENCE NOTES:

1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.99 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

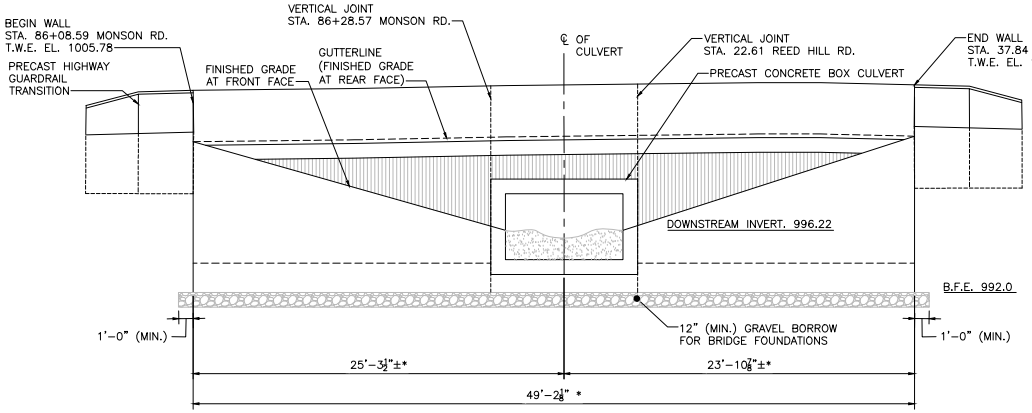
   FACTORED BEARING RESISTANCE = 6.32 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:23 AM
Proposal No. 608163-138112
A0084B-.1022

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 3 WALL ELEVATION AND DETAILS



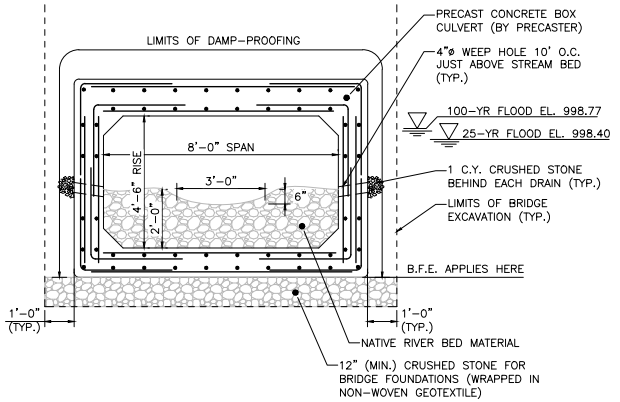
CULVERT 3 OUTLET/SOUTH ELEVATION
SCALE: ¼" = 1'-0"

PRECAST BOX CULVERT NOTES:

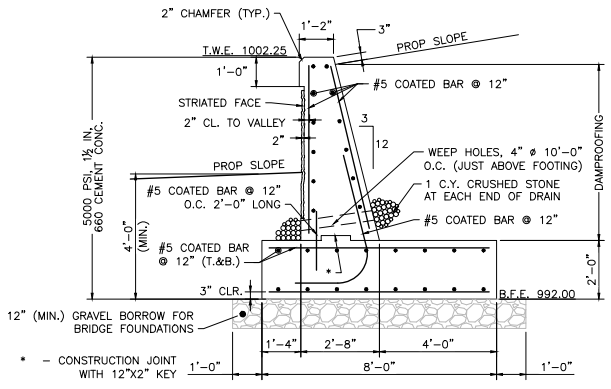
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 8'-0" WIDE, 4'-6" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

REFERENCE NOTES:

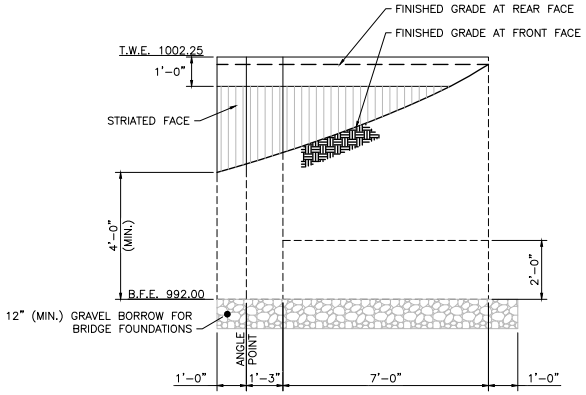
1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.



CULVERT 3 TRANSVERSE SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - SECTION
SCALE: ½" = 1'-0"



CULVERT 3 INLET FLARED WALL - ELEVATION
SCALE: ½" = 1'-0"

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. THE FACTORED BEARING PRESSURE = 1.96 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

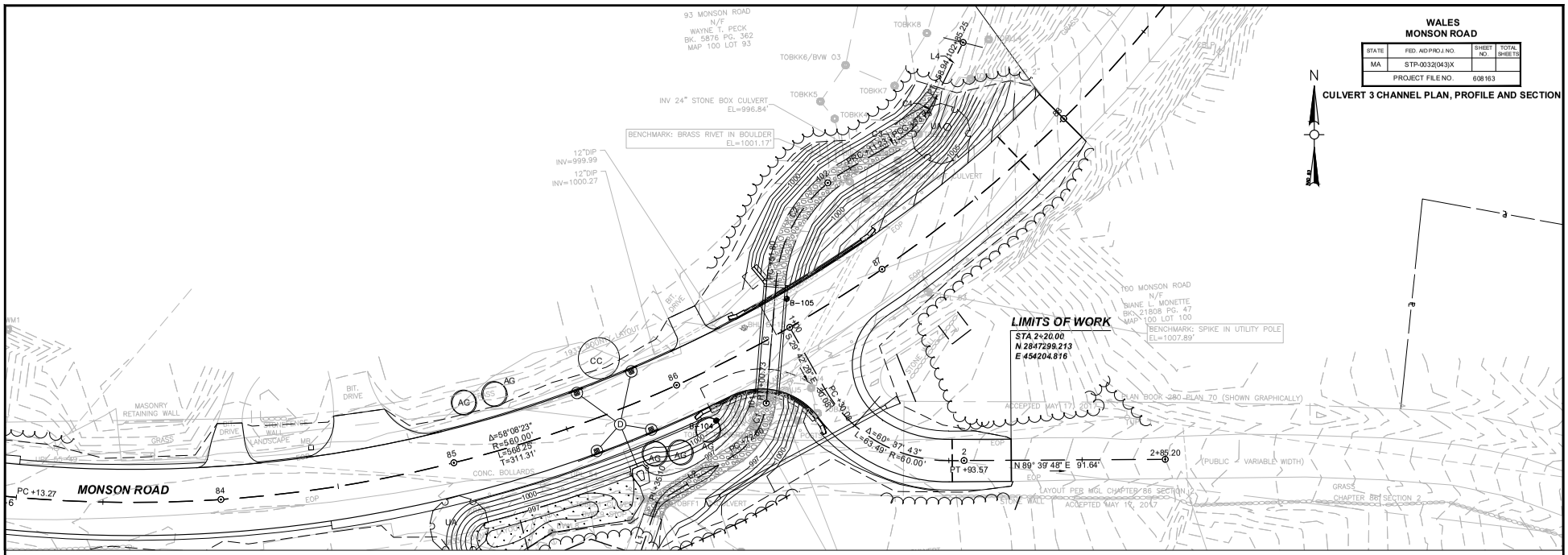
   FACTORED BEARING RESISTANCE = 5.26 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

608163_HD11STRUCTURAL PLAN.DWG Plotted on 5-Aug-2024 11:25 AM
A0004B-.1023
Proposal No. 608163-136112

WALES
MONSON ROAD

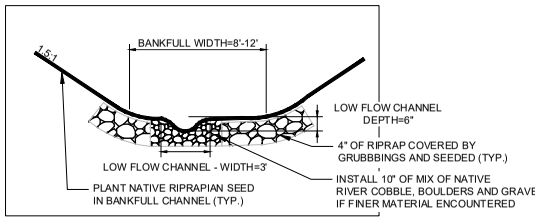
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION

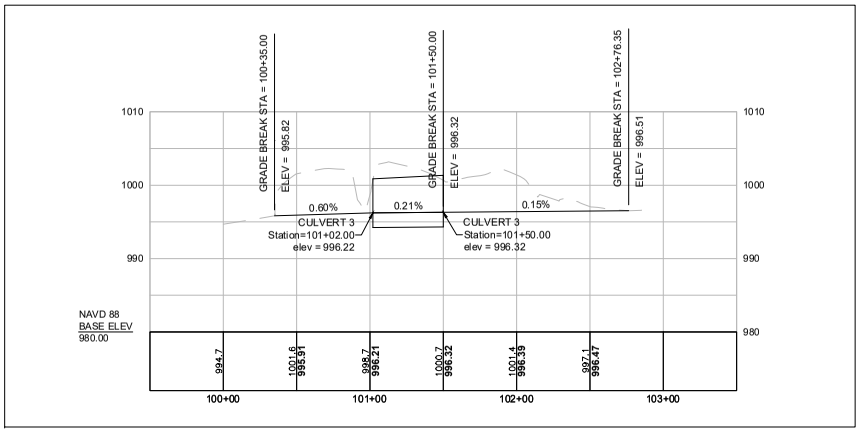


CULVERT 3 CHANNEL PLAN

SCALE: 1" = 20'



CULVERT 3 CHANNEL TYPICAL SECTION



CULVERT 3 CHANNEL PROFILE

HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

608163_HD12\WATER HANDLING\.DWG Plotted on 6-Aug-2024 1:19 PM

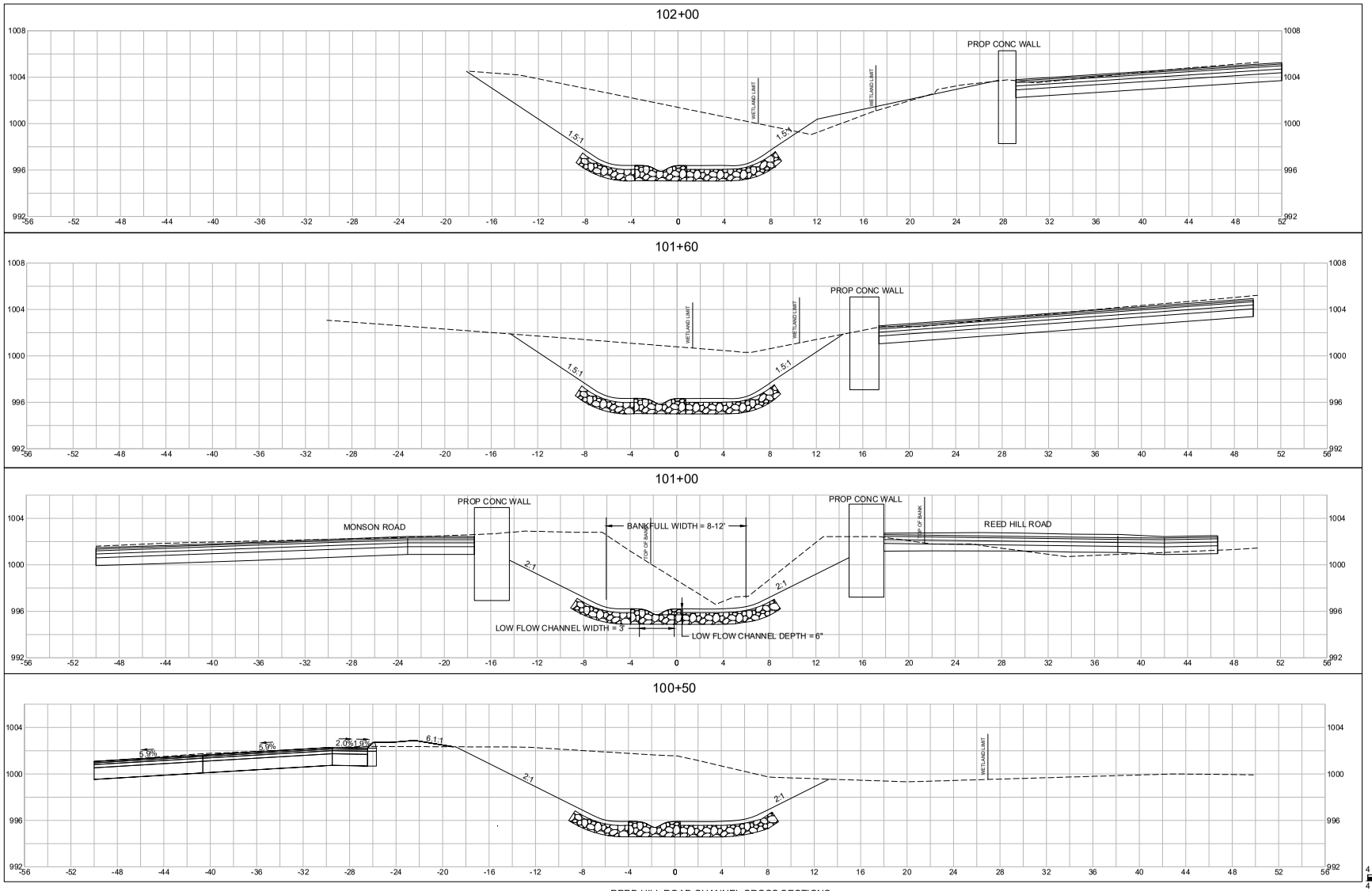
Proposal No. 608163-132612

A08840 .1024

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS



REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

608163_HD12\WATER HANDLING\1.DWG Plotted on 5-Aug-2024 11:49 AM

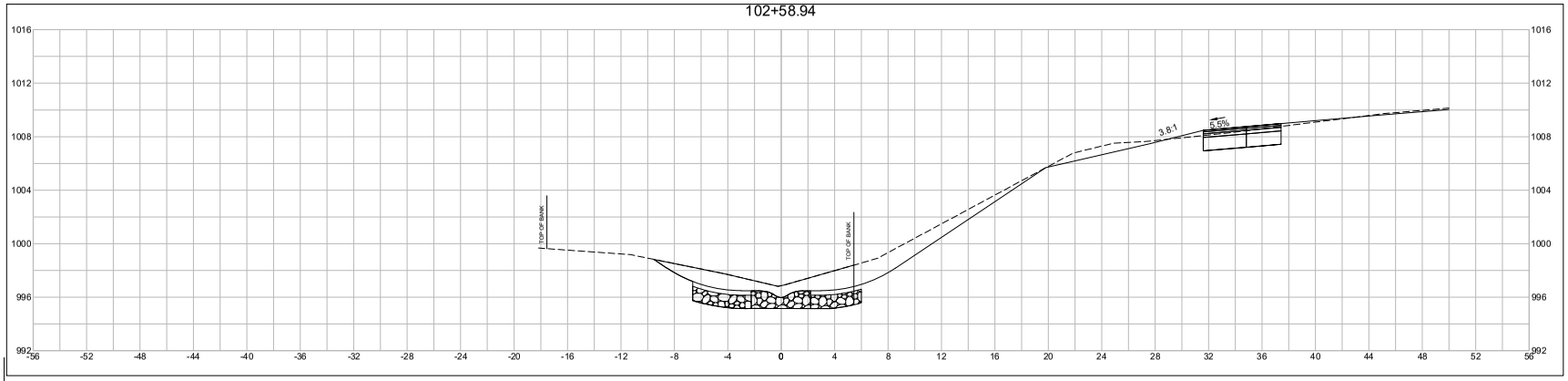
Project No. 608163.13812

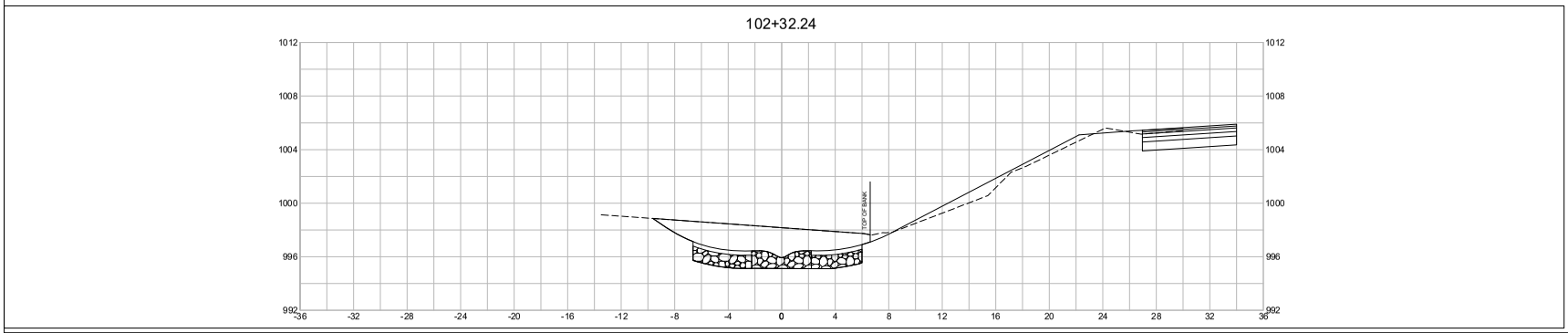
A08840 .1025

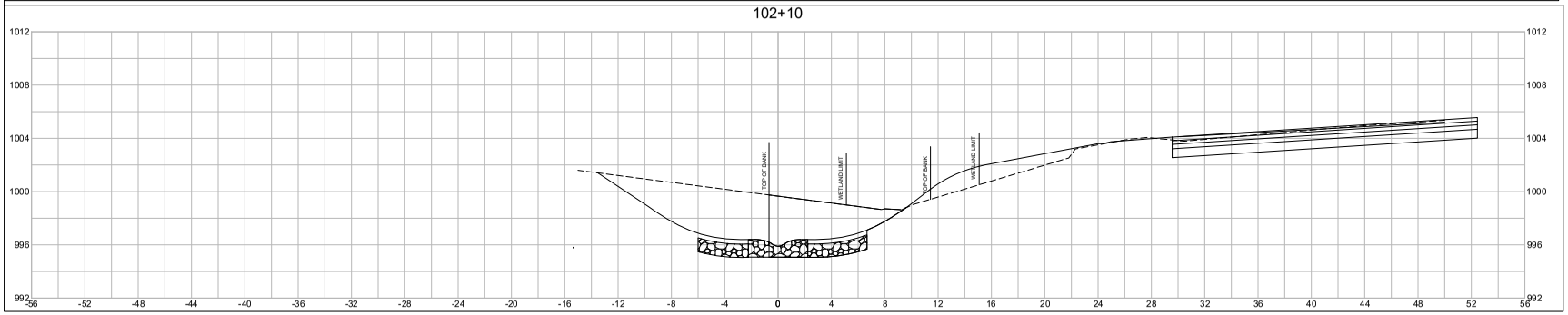
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO. 608163			

CULVERT 3 CHANNEL CROSS SECTIONS







HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

REED HILL ROAD CHANNEL CROSS SECTIONS

608163_HD12\WATER HANDLING\.DWG Plotted on 5-Aug-2024 11:50 AM

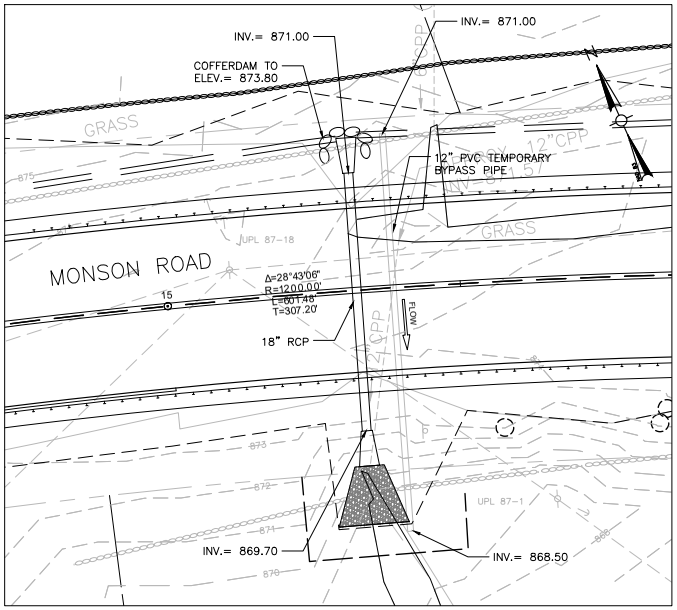
Project No. 608163-1301212

A08840 .1026

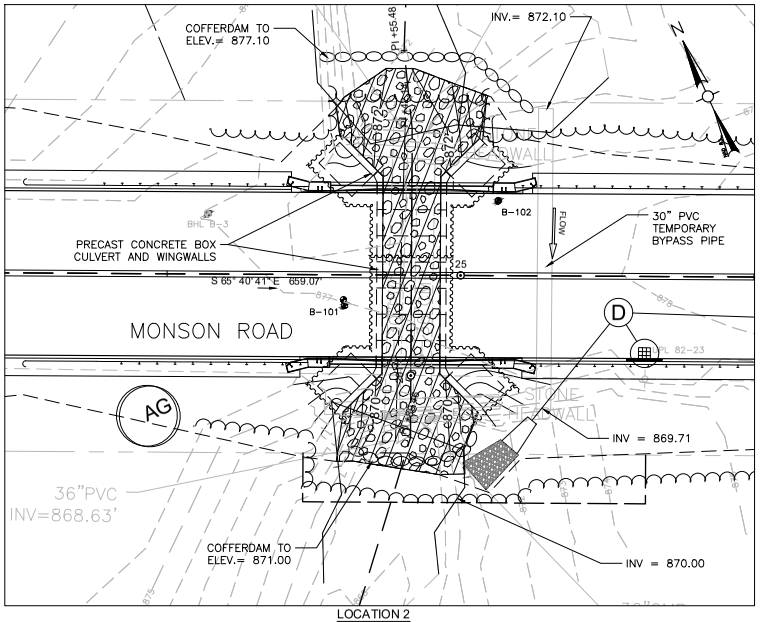
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

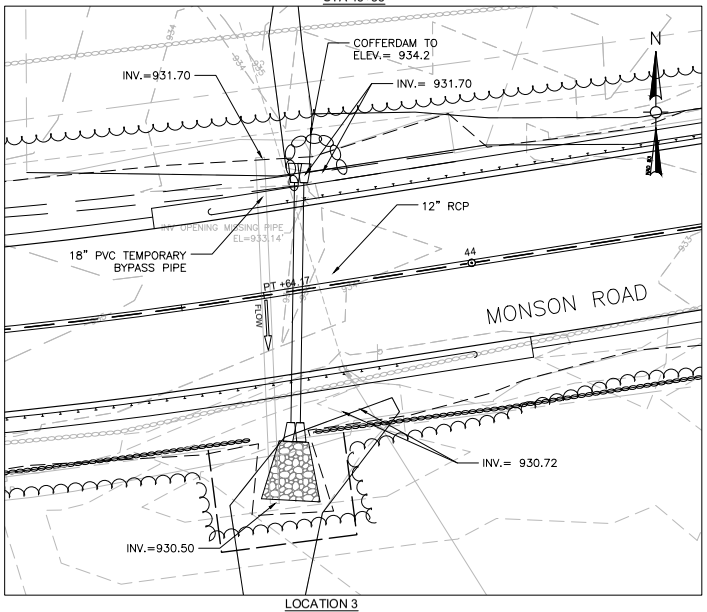
CONTROL OF WATER PLANS



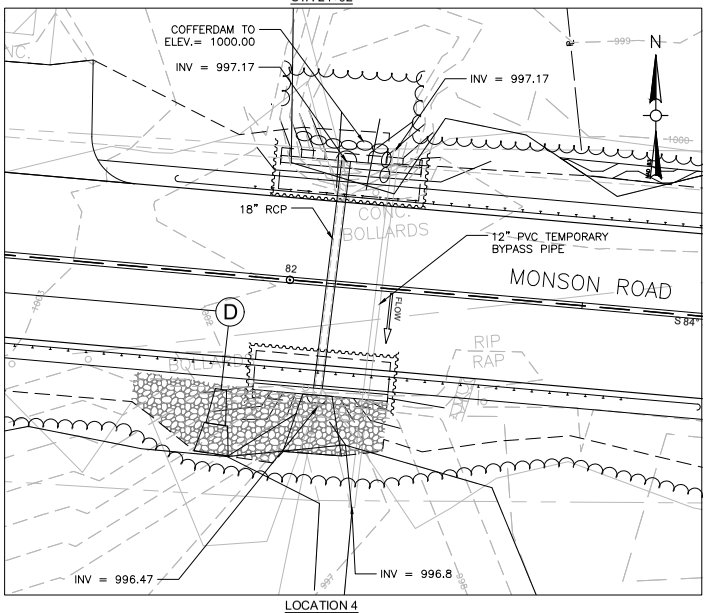
LOCATION 1
STA 15+33



LOCATION 2
STA 24+92



LOCATION 3
STA 43+76



LOCATION 4
STA 82+07

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS:

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS AND END WALLS

PLANS AND CALCULATIONS FOR ALL SANDBAGGING, DIKES,OPTIONAL SHEETING AND OTHER WATER CONTROL MEASURES SHALL BE DEVELOPED BY THE CONTRACTOR. THESE PLANS AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE SUBMITTED FOR APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRCUTION.

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE) AND INSTALL THE COFFERDAMS IN THE STREAM ON BOTH ENDS OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND ENDWALLS.
4. INSTALL THE NEW CULVERT.
5. INSTALL THE END WALLS.
6. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT. RECONFIGURE THE COFFERDAMS AROUND THE SIDE THAT WILL BE CONSTRUCTED NEXT.
7. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
8. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

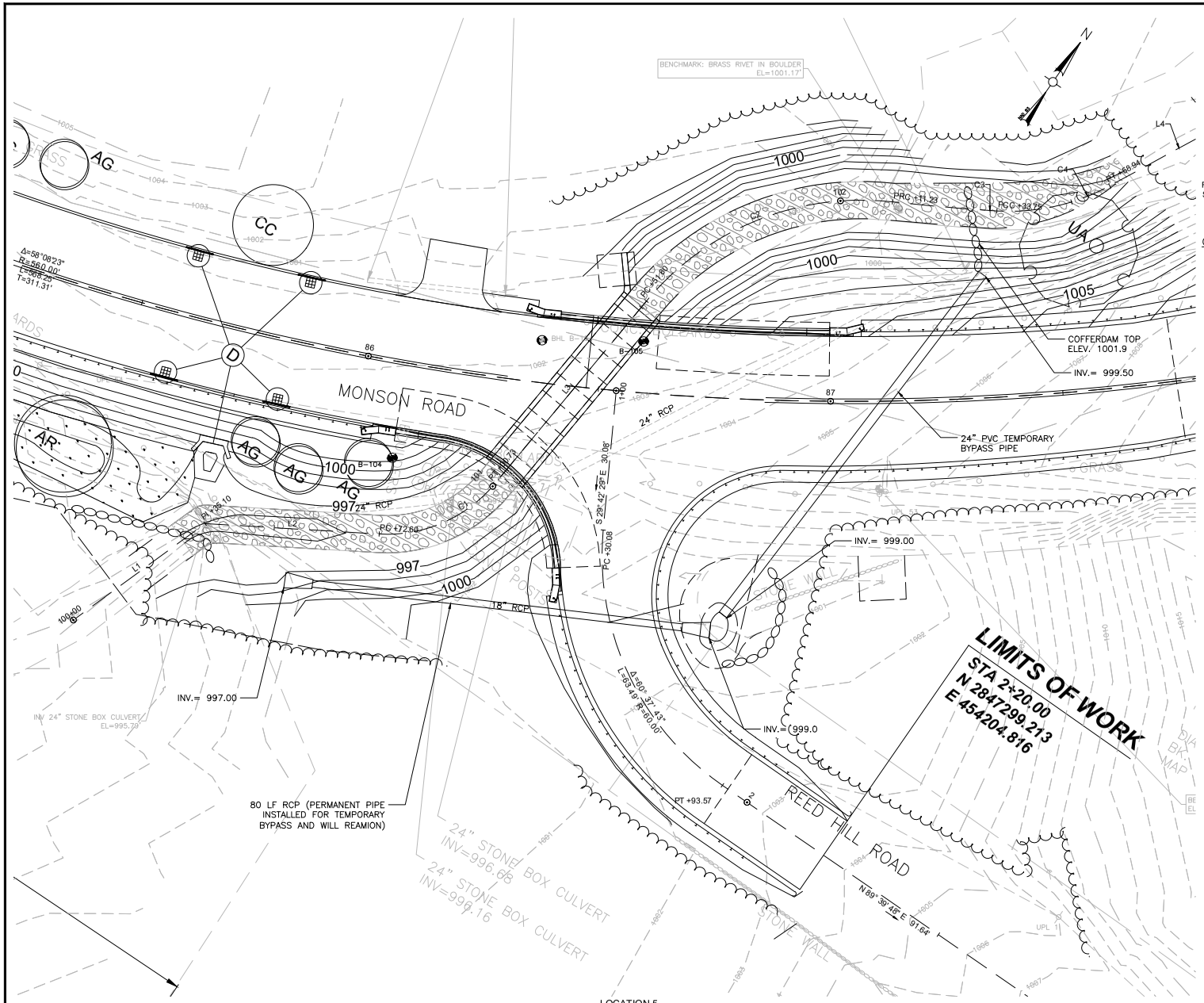
0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING.DWG Plotted on 5-Aug-2024 11:52 AM
A08840.ADD7
Proposal No. 608163-132612

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

CONTROL OF WATER PLAN - CULVERT 3



LOCATION 5
STA 87+00 and STA 1+33

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

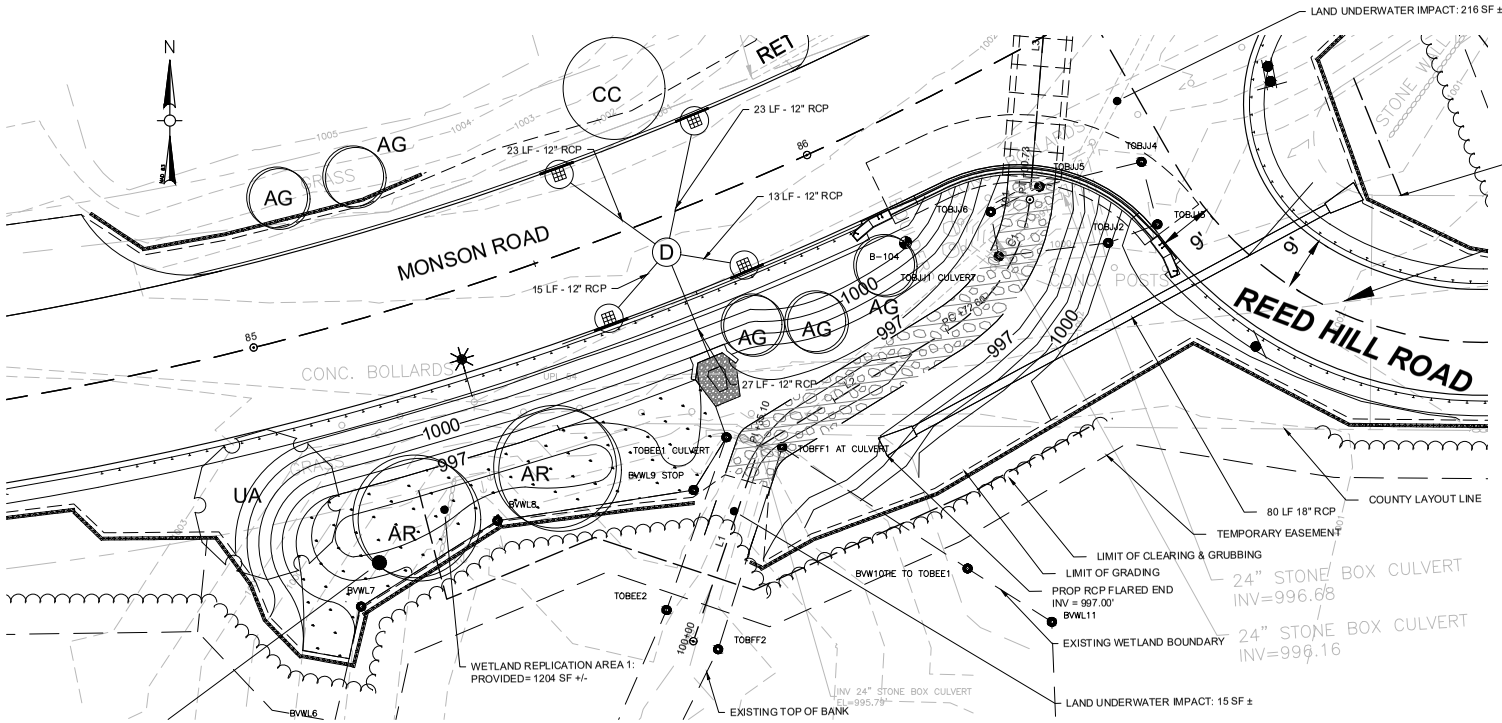
0 10 20 30 40
SCALE: 1" = 10'

608163_HD12\WATER HANDLING.DWG Plotted on 8-Aug-2024 9:29 AM
A09840 .J028
Proposal No. 608163-132612

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	STP-0032(043)X		
PROJECT FILE NO.	608163		

WETLAND REPLICATION AREA DETAIL



WETLAND REPLICATION AREA 1 GRADING PLAN

0 10 20 30 40

SCALE: 1" = 10'

WETLAND SEED MIX - OBLIGATE MIX

BOTANICAL

GRASS	COMMON NAME	%PLS BY WEIGHT
CAREX VULPINOIDEA	FOX SEDGE	26.50%
CAREX LURIDA	SHALLOW SEDGE	15.00%
SAPERGANIUM EURYCARPUM	GIANT BUR REED ECO PA	10.00%
CAREX LUPULINA	HOP SEDGE	7.00%
CAREX CRINITA	FRINGED SEDGE	6.00%
SCRIPUS CYPERINUS	WOOLGRASS	4.00%
JUNCUS EFFUSUS	SOFT RUSH	3.00%
CAREX COMOSA	BEAREDED SEDGE	3.00%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3.00%
SPARGANIUM AMERICANUM	BURRWEED	2.50%
SCIRPUS VALIDUS	BULRUSH, SOFT-STEM	2.00%
CAREX STRICTA	TUSSOCK SEDGE	1.00%
GLYCERIA CANADENISIS	MANNA GRASS	1.00%
		86.00%
VERBENA HASTATA	BLUE VERVAIN	4.00%
ASTER PUNICEUS	ASTER - SWAMP	2.00%
EUPATORIUM MACULATUM	JOE-PYE WEED	1.50%
EUPATORIUM PERFOLIATUM	BONESET	2.00%
IRIS VERSICOLOR	BLUE FLAG IRIS	2.00%
ALISMA SUBCORDATUM	MUD PLAINTAIN	1.00%
VERONIA NOVEBORACENSIS	NEW YORK IRONWEED	1.00%
BUDENS CERNUA	NODDING BURR MARIGOLD	1.00%
SOLIDAGO PATULA	ROUGHLEAF GOLDENROD	0.50%
MIMULUS RINGENS	MONKEY FLOWER	0.50%
CHELONE GLABRA	WHITE TURTLEHEAD	0.50%
		14.00%
		100.00%

SEED RATING:
SPECIES ECOTYPE SHALL BE AS NATIVE TO NEW ENGLAND REGION AS POSSIBLE. APPLY THIS MIX AT 20 LBS PLS/ACRE.

WETLAND REPLACEMENT AREA 1 NOTES:

1. A WETLAND SCIENTIST SHALL BE PROVIDED ON-SITE TO MONITOR CONSTRUCTION OF THE WETLAND MITIGATION AREA TO ENSURE COMPLIANCE WITH THE MITIGATION PLAN.
2. AT LEAST 12 INCHES OF NATURAL OR MANMADE WETIAND SOIL SHALL BE INSTALLED IN THE WETLAND REPLICATION AREA.
3. ONLY PLANT MATERIALS NATIVE AND INDIGENOUS TO THE REGION SHALL BE USED. SPECIES NOT SPECIFIED IN THE REPLICATION PLAN SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE REGULATORY AUTHORITIES. PLANT SPECIES ON THE INVASIVE SPECIES PLANT LIST IN THE CORPS MITIGATION INTRODUCTION: PERFORMANCE STANDARDS AND SUPPLEMENTARY INFORMATION DATED 2/21/01 SHALL NOT BE USED IN AND WITHIN 100 FEET OF MITIGATION SITES.
4. A SUPPLY OF DEAD AND DYING WOODY DEBRIS SHALL COVER between 5%-20% OF THE GROUND THROUGHOUT THE MITIGATION SITE AFTER THE COMPLETION OF CONSTRUCTION OF THE MITIGATION SITE. THESE MATERIALS SHOULD NOT INCLUDE INVASIVE SPECIES.
5. TEMPORARY DEVICES AND STRUCTURES TO CONTROL EROSION AND SEDIMENTATION IN AND AROUND MITIGATION SITES SHALL BE DISASSEMBLED AND PROPERLY DISPOSED OF NO LATER THAN NOVEMBER 1 THREE FULL GROWING SEASON AFTER PLANTING. SEDIMENT COLLECTED BY THESE DEVICES SHALL BE REMOVED AND PROPERLY DISPOSED OF IN A MANNER THAT PREVENT ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.

WETLAND REPLICATION AREA 1 PLANTING PLAN

SHRUBS
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM
WINTERBERRY (ILEX VERTICILLATE): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM

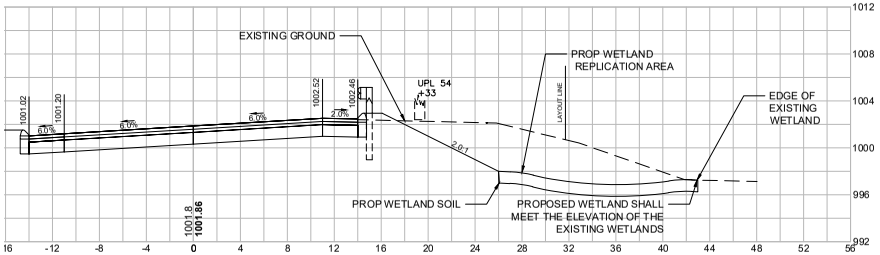
FERNS
CINNAMON FERN (OSMUNDA CINNAMOMEA): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.
SENSITIVE FERN (ONOCLEA SENSIBILIS): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUSTERS OF AT LEAST 5 TOGETHER IN SAME AREA TO PROVIDE A NATURAL PATTERN.

SEED MIX
IN WETLAND REPLICATION AREA: SEE WETLAND SEED - OBLIGATE MIX - THIS SHEET
(SAME MIX TO BE USED ON PLAN SHEET 16 FOR WETLAND RESTORATION AREA 1)

FOR ALL AREA OUTSIDE AND ADJACENT TO WETLAND RESTORATION AND/OR REPLICATION AREAS PROVIDE PART SHADE ROADSIDE SEED MIX AS INDICATED ON CONSTRUCTION DETAIL SHEET 84.

TREES
OCTOBER GLORY (ACER RUBRUM): 2 TREES SPACED 25 FEET ON CENTER, WITH A 3 INCH TO 3.5 INCH CALIPER, TO PROVIDE A NATURAL PATTERN.
PRINCTON (ULMUS AMERICANA): 1 TREE WITH A 2 INCH TO 2.5 INCH CALIPER.

85+50



WETLAND REPLICATION AREA CROSS SECTION

608163_H013\WETLAND REPLICATION.DWG Plotted on 8-Aug-2024 4:01 PM
Proposal No. 608163 13012
A008940 .1029

Weston & Sampson

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Wetland Delineation Report

October 2023
Updated August 2024

Monson Road
Wales, MA

Wetland Delineation Conducted By:
Devin Herrick, CWS on 10/31/2023

Delineation Report Reviewed By:
Megan Kearns, PWS

TABLE OF CONTENTS

Page

1.0 SITE DESCRIPTION....1-1

2.0 DELINEATION OF WETLAND RESOURCES....2-1
2.1 Site Observations....2-1
2.2 Wetland Delineation Methodology....2-1
2.3 Bordering Vegetated Wetlands (BVW)....2-2
2.4 Isolated Vegetated Wetland (IW)....2-3
2.4 Bank....2-4
2.5 Other Protected Areas....2-7

3.0 SUMMARY....3-1

4.0 REFERENCES....4-1

FIGURES

Figure 1.1-1.6....Wetlands Field Map
Figure 2....USGS Topographic Map
Figure 3.1-3.4....FEMA FIRM Map
Figure 4....Environmental Resources Map

APPENDICES

Appendix A ....ACOE Wetland Determination Data Forms

1.0 SITE DESCRIPTION

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA on a section of road approximately 1.5 miles in length. The western limit of investigation terminated at the intersection with Lynch Road while the eastern limit terminated at the intersection with Reed Hill Road. The area under consideration is in a rural community within a topographically variable landscape composed of glacial till transected by numerous streams running with north/south trajectories. Please see Figure 1.1-1.6 (Wetlands Field Map) and Figure 2 (USGS Topographic Map) attached to this report for the investigation area.

Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field using pink flagging by a Weston & Sampson employee who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) and the US Army Corps of Engineers methodologies. A further description of these wetland resource areas is presented in the following sections.

2.0 DELINEATION OF WETLAND RESOURCES

2.1 Site Observations

The Weston & Sampson wetland scientist, trained in the ACOE Wetland Delineation Manual and Massachusetts Department of Environmental Protection (MassDEP) Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetland Protection Act guidance document, observed the following protected wetland resources at the site:

- Bordering Vegetated Wetlands (BVW)
- Isolated Vegetated Wetland (IW)
- Bank – Perennial Stream
- Bank – Intermittent Stream
- Bank – Non-Jurisdictional Intermittent Stream

Field data were recorded on U.S. Army Corps of Engineers (ACOE) Wetland Determination Data Forms which are included in Appendix A.

2.2 Wetland Delineation Methodology

A wetland delineation assessment was conducted in accordance with the Massachusetts Wetland Protection Act Regulations (310 CMR 10.55(2)(c)), Massachusetts Department of Environmental Protection (MassDEP) Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands (Second Edition, September 2022), and ACOE Wetland Manual (Technical Report Y-87-1).

The bordering vegetated wetlands (BVW) delineation methodology included the characterization of vegetation, hydrologic conditions, and soil in both wetland and upland areas to identify the transitional area, which was used as the wetland limit. Pink flags with distinct flag numbers were left in the field to show wetland resource area limits.

Vegetation, hydrology and soils were assessed in both wetland and upland areas to accurately place the wetland limits at each site. The percentage of vegetative species was estimated by creating sample plots. Sample plot radius for trees, saplings, shrubs, groundcover and woody vine strata was 30', 15', 15', 5' and 30', respectively. After creating the sample plot areas, the percent basal area coverage of

each species within the monitoring plot was recorded. Using these field observations, the percent dominance of each species within its stratum was calculated. The 50/20 Rule was then used to determine dominance. Dominant species were considered the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceeds 50% of the total dominance measure (basal area) for the stratum, plus any additional species comprising 20% or more of the total dominance measure for the stratum. Once the dominant species were determined, they were treated equally to determine the presence of hydrophytic vegetation. If the number of dominant species with a Wetland Indicator Status of FAC (excluding FAC-), FACW or OBL is greater than, or equal to, the number of remaining dominant species, the area was considered a jurisdictional wetland resource area based on vegetation.

A soil sample from each wetland sample plot were also taken. Each soil sample goes to a depth of at least 12-24 inches. The soil was characterized to determine if the soil sample was considered a hydric (wetland) soil. Soil samples, including mottles, were characterized based on color using Munsell Soil-Color charts as a color reference.

The general area was then assessed for hydrologic conditions, including, but not limited to, site inundation, depth to free water, depth of soil saturation, water marks, drift lines, sediment deposits, water stained leaves.

2.3 Bordering Vegetated Wetlands (BVW)

A total of sixteen BVW series were delineated at the site. The limits of the BVW resource areas were determined by locating the transitional areas between wetlands and uplands vegetation, soils and hydrologic conditions. Wetland flags left in the field included:

- BVW-A1 through BVW-A6 (Bordering Vegetated Wetland “A” Series)
- BVW-B1 through BVW-B10 (Bordering Vegetated Wetland “B” Series)
- BVW-C1 through BVW-C6 (Bordering Vegetated Wetland “C” Series)
- BVW-D1 through BVW-D4 (Bordering Vegetated Wetland “D” Series)
- BVW-E1 through BVW-E6 (Bordering Vegetated Wetland “E” Series)
- BVW-F1 through BVW-F3 (Bordering Vegetated Wetland “F” Series)
- BVW-G1 through BVW-G11 (Bordering Vegetated Wetland “G” Series)

- BVW-H1 through BVW-H12 (Bordering Vegetated Wetland “H” Series)
- BVW-I1 through BVW-I10 (Bordering Vegetated Wetland “I” Series)
- BVW-J1 through BVW-J13 (Bordering Vegetated Wetland “J” Series)
- BVW-K1 through BVW-K4 (Bordering Vegetated Wetland “K” Series)
- BVW-L1 through BVW-L15 (Bordering Vegetated Wetland “L” Series)
- BVW-M1 through BVW-M10 (Bordering Vegetated Wetland “M” Series)
- BVW-O1 through BVW-O3 (Bordering Vegetated Wetland “O” Series)
- BVW-AA1 through BVW-AA4 (Bordering Vegetated Wetland “AA” Series)
- BVW-BB1 through BVW-BB4 (Bordering Vegetated Wetland “BB” Series)

Dominant vegetation within this resource area included red maple (*Acer rubrum*), winterberry (*Ilex verticillate*), crested fern (*Dryopteris cristata*), sensitive fern (*Onoclea sensibilis*), and riverbank grape (*Vitis riparia*), all species that thrive in wet conditions. Soils within the BVW were considered sandy mucky mineral. Other indicators of wetland hydrology included surface water, water-stained leaves, drainage patterns, highwater table and saturation.

Dominant upland vegetation next to this BVW included red oak (*Quercus rubra*) and Japanese barberry (*Berberis thunbergii*). Soil in the upland area consisted of dry sandy loam, with no evidence of mottling or hydrology within the top 12 inches.

BVWs are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.4 Isolated Vegetated Wetland (IW)

Two isolated wetlands were delineated at the site. The limit of the IW resource area was determined by locating the transitional area between wetland and upland vegetation, soils and hydrologic conditions. Vegetation, hydrology and soils were assessed in the same manner as described above for identifying BVW. Wetland flags left in the field included:

- WET-A1 through WET-A10 (Isolated Wetland “A” Series)
- WET-B1 through WET-B11 (Isolated Wetland “B” Series)

Dominant vegetation within this resource area included reed canary grass (*Phalaris arundinacea*), rough-leaved goldenrod (*Solidago patula*), and grass-leaved goldenrod (*Euthamia graminifolia*), all species that thrive in wet conditions. Soils within the wetland limits were considered sandy loam (sandy redox). Indicators of wetland hydrology included surface water, soil saturation, and oxidized rhizospheres.

Dominant upland vegetation next to this isolated wetland included red oak (*Quercus rubra*). Soil in the upland area consisted of dry sandy loam. No indicators of wetland hydrology were observed.

The Massachusetts Wetland Protection Act does not protect isolated vegetated wetlands.

2.4 Bank

Water bodies, including perennial streams, intermittent streams, ponds and lakes, have banks which are protected by the Massachusetts Wetland Protection Act. Bank is a wetland resource area defined by 310 CMR 10.54(2)(a) as "the portion of land surface which normally abuts and confines a water body. It occurs between a waterbody and a vegetated bordering wetland and adjacent floodplain, or, in absence of these, it occurs between a waterbody and an upland." Vegetated banks provide valuable functions such as flood control, stormwater prevention, fisheries protection, and water quality protection. The limit of this resource area is identified by Top of Bank (TOB) which is located at the first observable break in slope or the Mean Annual Flood Level (MAFL), whichever is lower. TOB is easily identified in the field so that indicator was utilized for this wetland delineation.

Perennial Stream Banks

Three perennial streams were identified within the investigation area. All three of these perennial streams are unnamed. These streams are shown as perennial on the current United States Geographical Survey (USGS) map which classifies them as perennial per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the perennial streams were identified by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-E1 through TOB-E8 (Perennial Stream Bank "E" Series)
- TOB-F1 through TOB-F9 (Perennial Stream Bank "F" Series)
- TOB-I1 through TOB-I17 (Intermittent Stream Bank "I" Series)
- TOB-J1 through TOB-J18 (Intermittent Stream Bank "J" Series)

- WET-C1 through WET-C8 (Perennial Stream Bank “C” Series)
- TOB-K1 through TOB-K6 (Perennial Stream Bank “K” Series)
- TOB-L1 through TOB-L6 (Perennial Stream Bank “L” Series)

Perennial streams are subject to a 200-foot Riverfront Area under the Massachusetts Wetland Protection Act per 301 CMR 10.58(2)(a)(2)(c).

Intermittent Stream Banks (Jurisdictional)

Five jurisdictional intermittent streams were identified within the investigation area. Four of these intermittent streams are unnamed and not shown on the current United States Geographical Survey (USGS) map. The easternmost intermittent stream is shown on the current United States Geographical Survey (USGS) map and called Vinica Brook. These intermittent streams have a watershed size less than 0.5 square miles in size according to USGS Stream Stats which classifies the streams as intermittent per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the intermittent streams were identified in the field by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-A1 through TOB-A5 (Intermittent Stream Bank “A” Series)
- TOB-B1 through TOB-B5 (Intermittent Stream Bank “B” Series)
- TOB-C1 through TOB-C5 (Intermittent Stream Bank “C” Series)
- TOB-D1 through TOB-D5 (Intermittent Stream Bank “D” Series)
- TOB-CC1 through TOB-CC3 (Intermittent Stream Bank “CC” Series)
- TOB-DD1 through TOB-DD3 (Intermittent Stream Bank “DD” Series)
- TOB-GG1 through TOB-GG2 (Intermittent Stream Bank “GG” Series)
- TOB-HH1 through TOB-HH2 (Intermittent Stream Bank “HH” Series)
- TOB-AA1 through TOB-AA3_March 2024 (Intermittent Stream Bank “AA” Series)
- TOB-BB1 through TOB-BB15_March 2024 (Intermittent Stream Bank “BB” Series)
- TOB-CC1 through TOB-CC16_March 2024 (Intermittent Stream Bank “CC” Series)
- TOB-KK1 through TOB-KK9 (Intermittent Stream Bank “KK” Series)
- TOB-LL1 through TOB-LL6 (Intermittent Stream Bank “LL” Series)
- TOB-EE1 through TOB-EE6 (Intermittent Stream Bank “EE” Series)
- TOB-FF1 through TOB-FF6 (Intermittent Stream Bank “FF” Series)
- TOB-M1 through TOB-M4 (Intermittent Stream Bank “M” Series)

- TOB-N1 through TOB-N4 (Intermittent Stream Bank "N" Series)
- TOB-AA1 through TOB-AA3 (Intermittent Stream Bank "AA" Series)
- TOB-BB1 through TOB-BB3 (Intermittent Stream Bank "BB" Series)
- TOB-JJ1 through TOB-JJ6 (Intermittent Stream Bank "JJ" Series)

Intermittent stream banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

The westernmost stream crossing is a small drainage swale that originates northeast of Lynch Road and flows west beneath Lynch Road, and along the north side of Monson Road before crossing south under Monson Road via the culvert. Bankfull indicators did not exist in the channel at the time of field evaluation. The channel was delineated and is depicted on the plans as bank flag series TOB C, TOB D, TOB BB, and TOB CC. Based on a site visit conducted with the U.S. Army Corps of Engineers on August 26, 2024, the reviewers determined that this channel would not be jurisdictional under Section 404 of the Clean Water Act as it is a non-relatively permanent watercourse, and does not contain definable banks.

Intermittent Stream Banks (Non-Jurisdictional)

Three intermittent streams were identified within the investigation area which do originate within a wetland resource area. Per 310 CMR 10.04 Stream means "*a body of running water, including brooks and creeks, which moves in a definite channel in the ground due to a hydraulic gradient, and which flows within, into or out of an Area Subject to Protection under M.G.L. c. 131, § 40. A portion of a stream may flow through a culvert or beneath a bridge. Such a body of running water which does not flow throughout the year (i.e., which is intermittent) is a stream except for that portion upgradient of all bogs, swamps, wet meadows and marshes*". Since these streams are located upgradient of any wetland there are non-jurisdictional. Wetland flags left in the field included:

- TOB-G1 through TOB-G2 (Intermittent Stream Bank "G" Series)
- TOB-H1 through TOB-H2 (Intermittent Stream Bank "H" Series)
- WET-N1 through WET-N8 (Intermittent Stream Bank "N" Series)
- TOB-DD1 through TOB-DD2_March 2024 (Intermittent Stream Bank "DD" Series)
- TOB-EE1 through TOB-EE2_March 2024 (Intermittent Stream Bank "EE" Series)

Pond Bank

A single unnamed pond was located within the investigation area. According to the Massachusetts Wetland Protection Act a pond is defined as “any body of fresh water with a surface area observed or recorded within the last ten years of at least 10,000 square feet”. Based on aerial imagery the unnamed pond identified on site is approximately 14,000 SF. According to the Massachusetts Wetland Protection Act “ponds may be either naturally occurring or human made by impoundment, excavation or otherwise”. Wetland flags left in the field included:

- TOB-II1 through TOB-II3 (Pond Bank “II” Series)

Pond banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.5 Other Protected Areas

Weston & Sampson created environmental resources maps (see Figure 4) of the site to determine the presence of other protected areas. The data source of these map layers was the Massachusetts Geographic Information System (MassGIS). These areas included:

- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Certified and Potential Vernal Pools
- Areas of Critical Environmental Concern (ACEC)
- Outstanding Resource Waters (ORW)
- Coldwater Fisheries
- Article 97 Land

Wetland resources identified in the field were also added to these maps. Based on the MassGIS information, a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

FEMA Flood Insurance Rate Maps (FIRM) were created online from the FEMA website to determine if there is a 100-year flood zone at the site. See Figure 3 for FIRM map. Based on FEMA flood maps the investigation area is not located within the 100-year flood zone.

3.0 SUMMARY

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA. Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field.

Additional environmental mapping was conducted using MassGIS data layers and FEMA FIRM mapping. This additional mapping indicates that a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

4.0 REFERENCES

Massachusetts Department of Environmental Protection. September 2022. "Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands – Second Edition".

Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. Massachusetts Natural Heritage Atlas, 13th Edition with 2017 web updates. Accessed on 1/23/2024.

Massachusetts Geographic Information System. January 2009. Outstanding Resource Waters. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Massachusetts Geographic Information System. December 2003. Areas of Critical Environmental Concern. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Newcomb, Lawrence. 1977. Newcomb's Wildflower Guide. Little, Brown and Company.

Web Soil Survey of Hampden County, Massachusetts. United States Department of Agriculture, Soil Conservation Service, in cooperation with Massachusetts Agricultural Experiment Station

United States Department of Agriculture, Natural Resources Conservation Service. *2018. Field Indicators of Hydric Soils in the United States, Version 8.2.* L. M. Vasilas, G. W. Hurt, and J.F. Berkowitz (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.

USACOE, January 1987, Corps of Engineers Wetlands Delineation Manuel, Wetlands Research Program Technical Report Y-87-1.

FEMA Flood Map Service Center, online at msc.fema.gov/portal Assessed on 1/23/2024.
Tiner, Jr., Ralph W., 2005, Field Guide to Nontidal Wetland Identification

Tiner, Jr., Ralph W, 2009, Field Guide to Tidal Wetland Plants of the Northeastern United States and Neighboring Canada.

Wojtec, Michael, Bard – A field Guide to Trees of the Northeast.

New England Hydric Soils Technical Committee, 2019, Version 4, *Field Indicator of Identifying Hydric Soils in New England*. New England Interstate Water Pollution Control Commission, Lowell, MA.

.

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.1
MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1043

Proposal No. 608163-128112

2

100 50 0 100 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.2

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1044

Proposal No. 608163-128112

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.3

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1045

Proposal No. 608163-128112

2

100 50 0 100 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.4

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1046

Proposal No. 608163-128112

2

100 50 0 100 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.5

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1047

Proposal No. 608163-128112

2

100 50 0 100 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.6

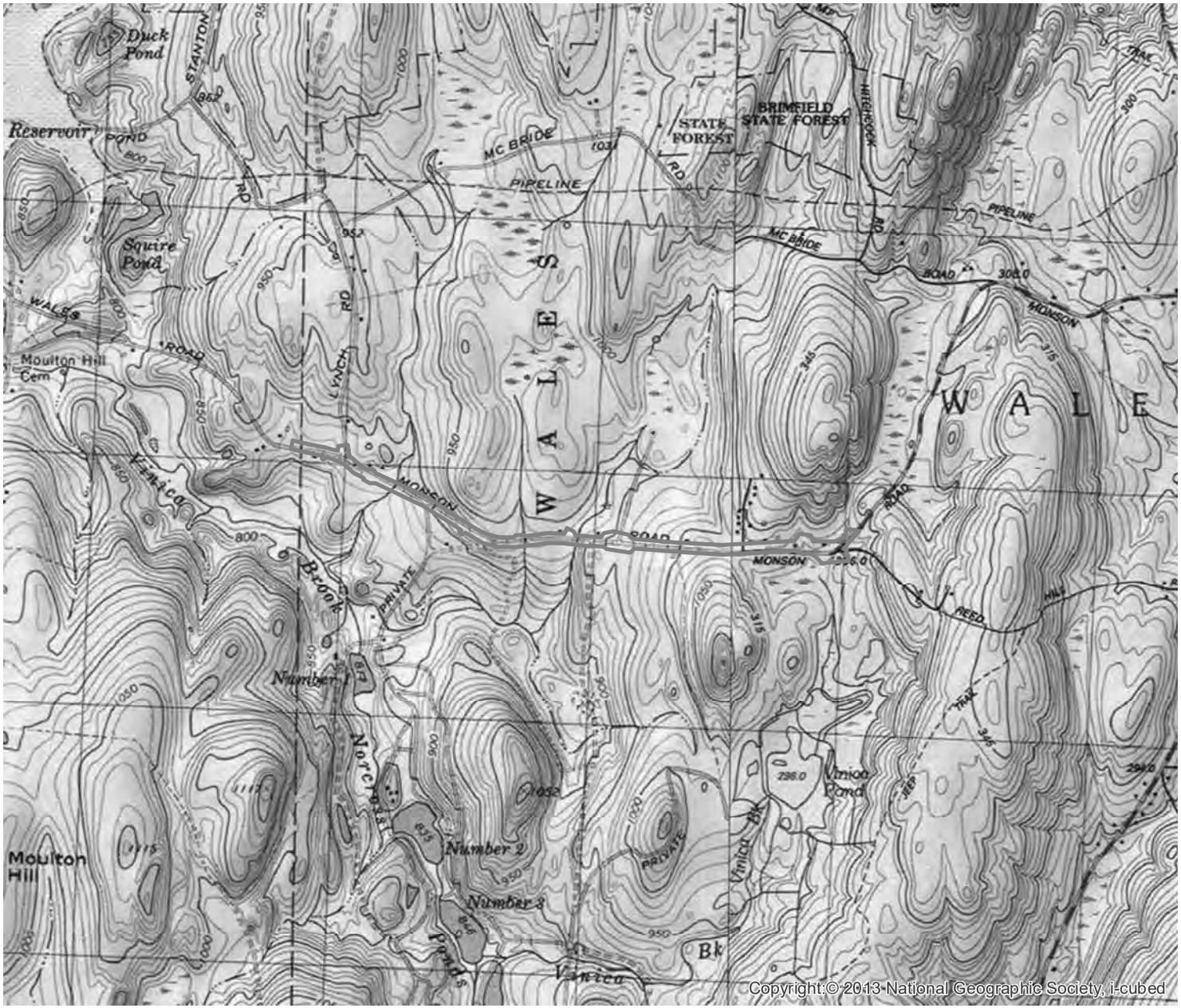
MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00840 -1048

Proposal No. 608163-128112



2

1,000 500 0 1,000
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

Investigation Area

FIGURE 2

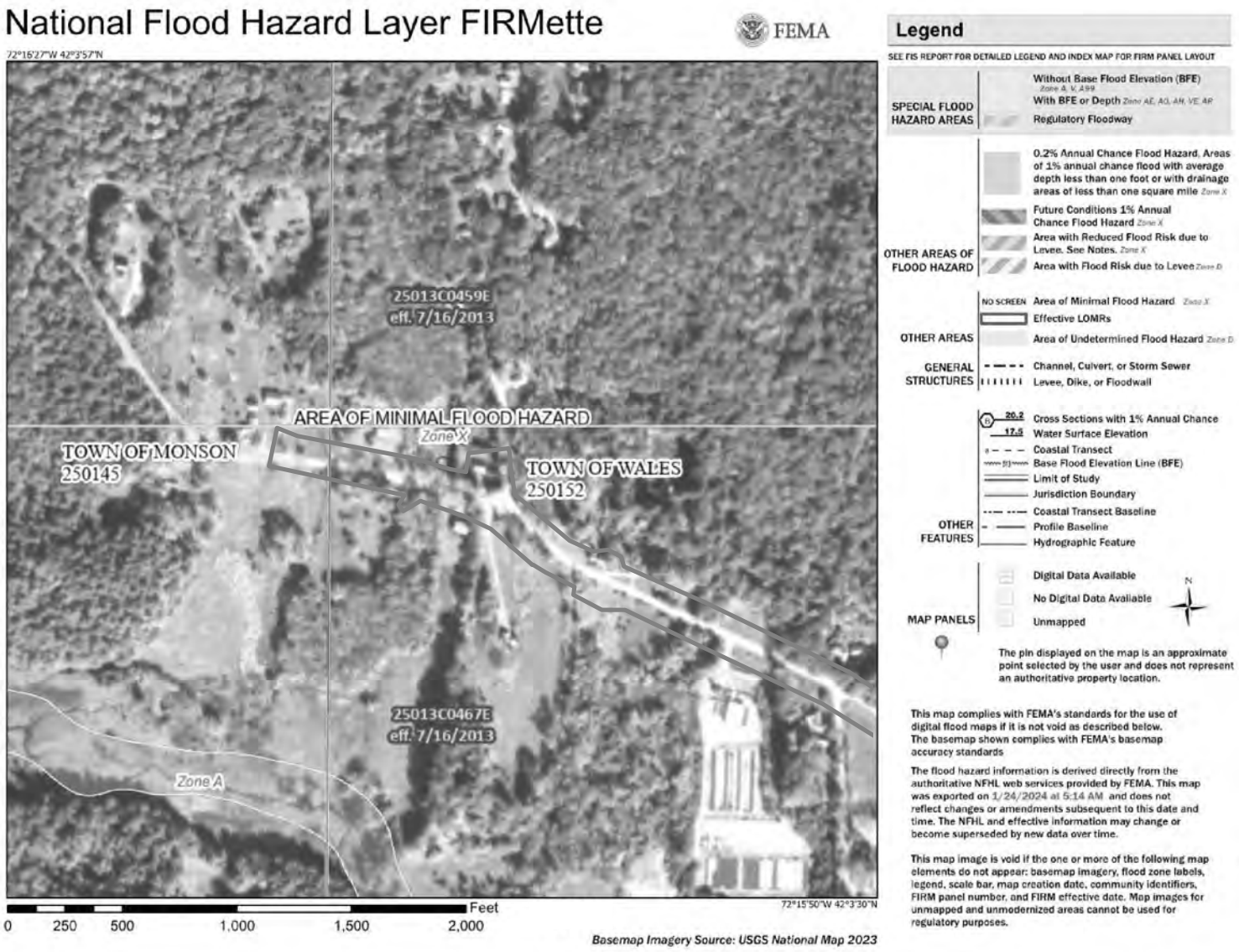
MONSON ROAD
WALES MA

USGS TOPOGRAPHIC MAP

Weston & Sampson

A00840 -1049

Proposal No. 608163-128112



Legend

Investigation Area

FIGURE 3.1

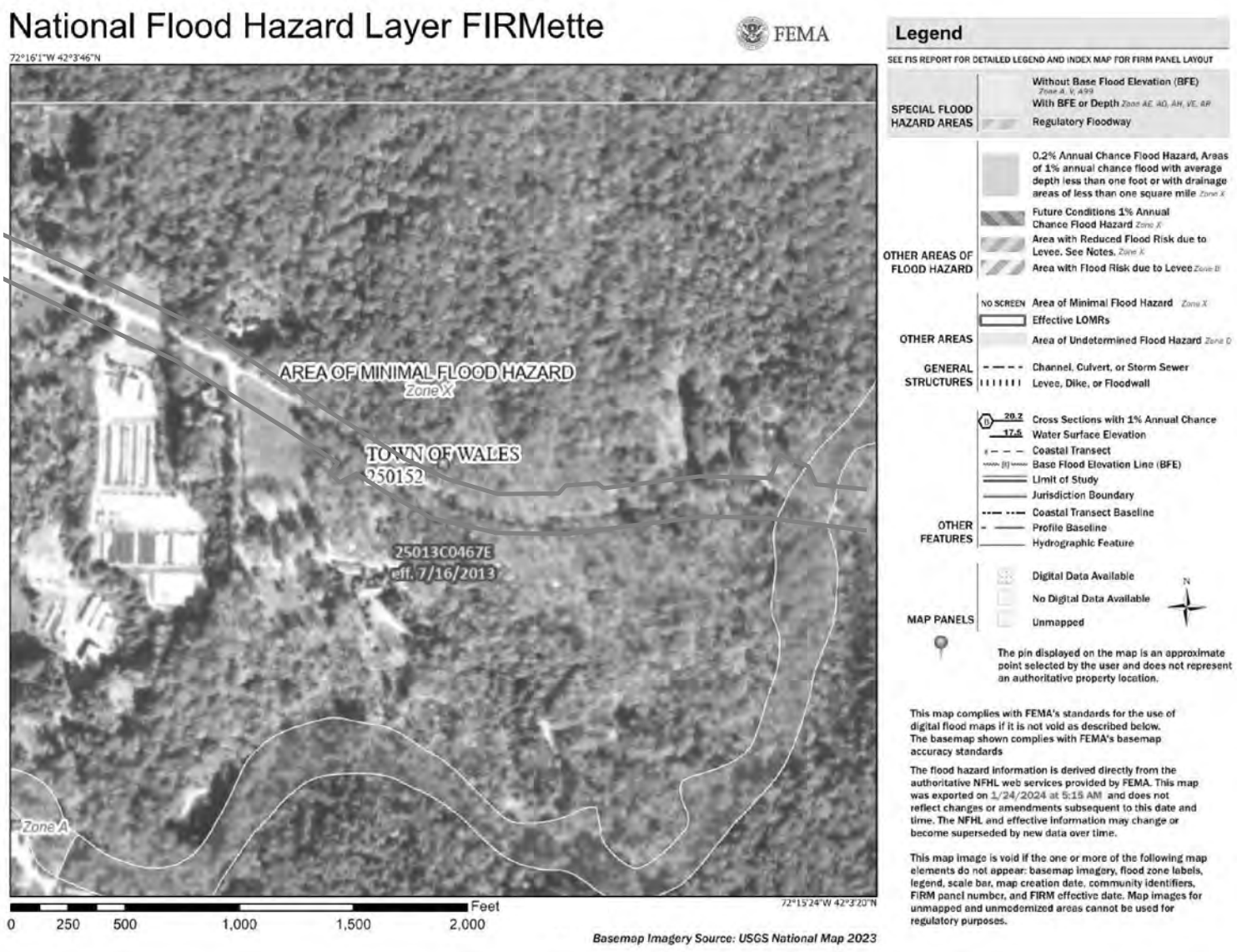
MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson

A00840 -1050

Proposal No. 608163-128112



Legend

Investigation Area

FIGURE 3.2

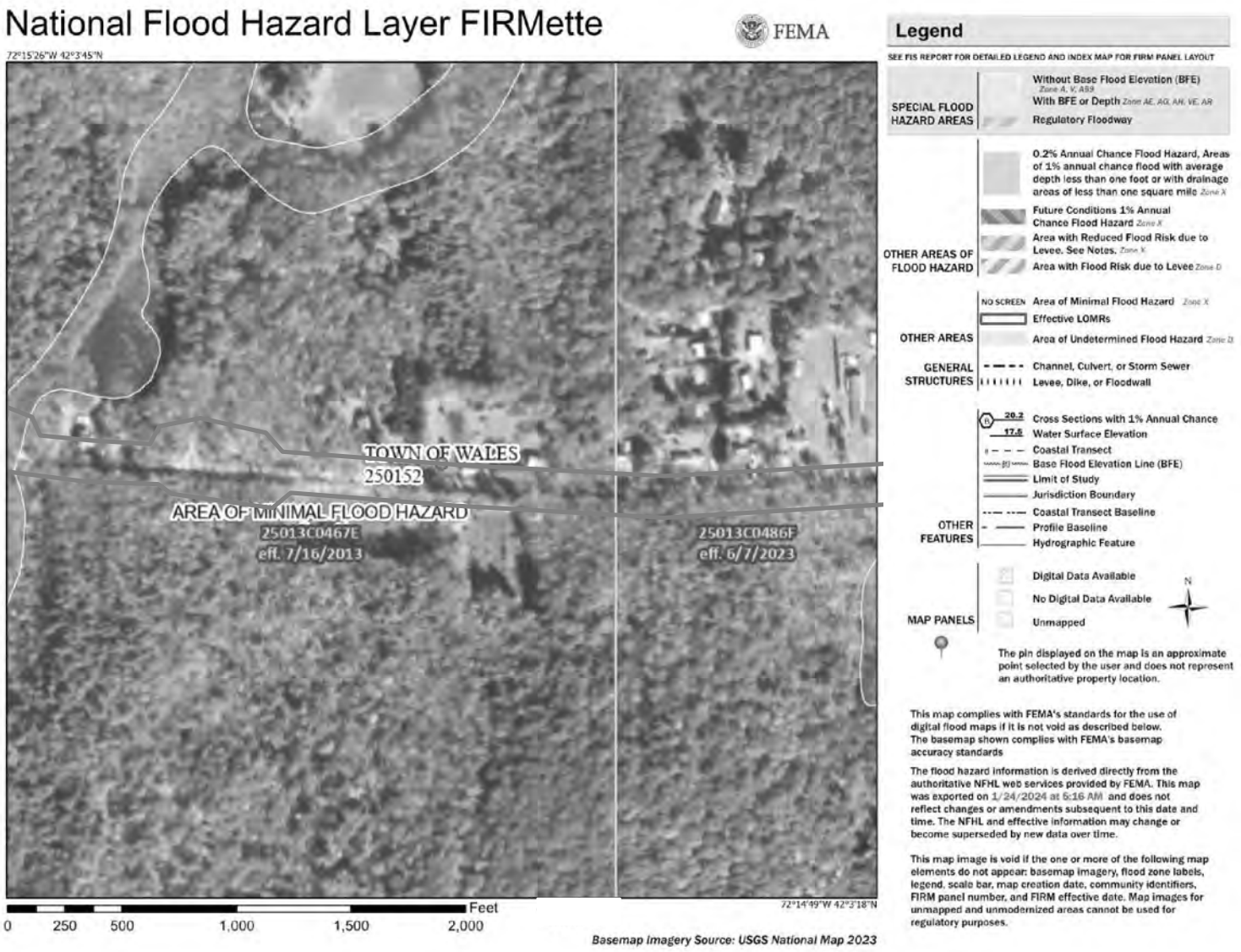
MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson

A00840 -1051

Proposal No. 608163-128112



Legend

Investigation Area

FIGURE 3.3

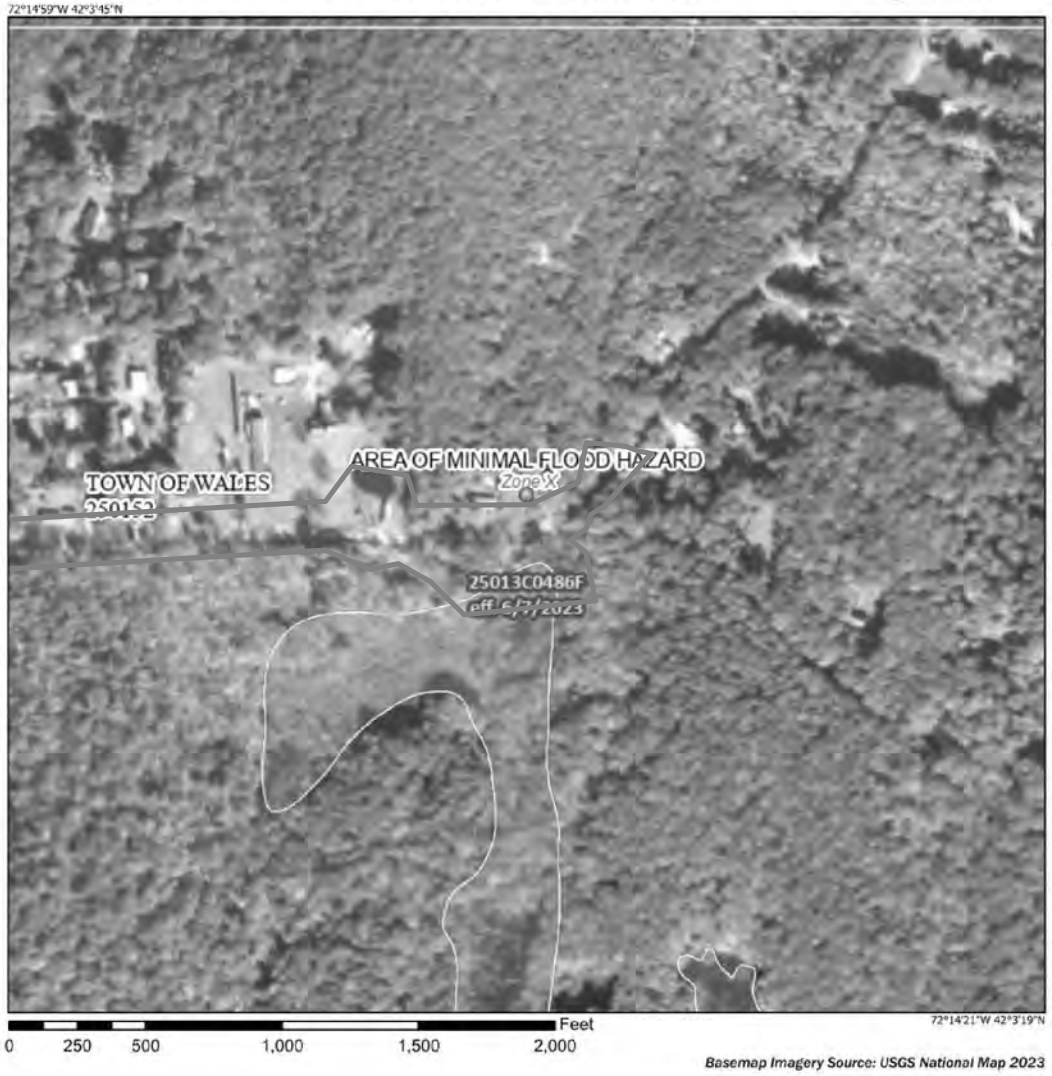
MONSON ROAD
WALES MA

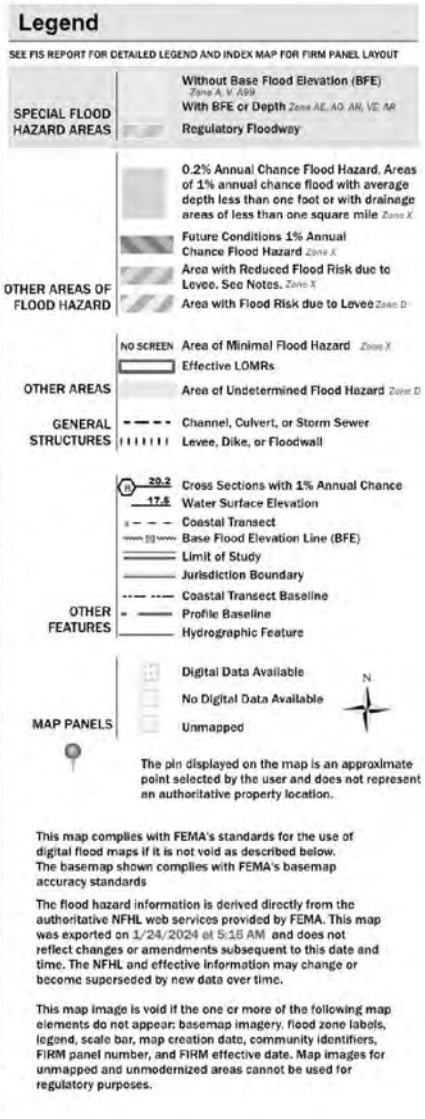
FEMA MAP

Weston & Sampson

A00840 -1052

Proposal No. 608163-128112





Legend

Investigation Area

FIGURE 3.4

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Environmental Receptor.mxd **User:** Herrick.Devin **Saved:** 4/15/2024 4:07:31 AM **Opened:** 4/15/2024 4:07:54 AM

2

1,000 500 0 1,000 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- MassDOT Roads
- ACECs
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- Cold Water Fisheries
- Public Water Supply Contributor
- ORW for ACEC
- ORW for both Water Supply and Other
- Article 97 Land
- Community Groundwater Source

FIGURE 4

MONSON ROAD
WALES MA

ENVIRON. RESOURCES MAP

Weston & Sampson

A00840 -1054

Proposal No. 608163-128112

APPENDIX A

ACOE Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	90	Yes	FAC
2. green ash (*Fraxinus pennsylvanica*)	10	No	FACW
3. white pine (*Pinus Strobus*)	10	No	FACU
4. shagbark hickory (*Carya ovata*)	10	No	FACU
5.			
6.			
7.			
	120	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. common winterberry (*Ilex verticillata*)	80	Yes	FACW
2. Japanese barberry (*Berberis thunbergii*)	15	No	FACU
3.			
4.			
5.			
6.			
7.			
	95	= Total Cover	

Herb Stratum (Plot size: 5 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. crested fern (*Dryopteris cristata*)	30	Yes	FACW
2. sensitive fern (*Onoclea sensibilis*)	20	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50	= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. riverbank grape (*Vitis riparia*)	10	Yes	FAC
2.			
3.			
4.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	140	x 2 =	280
FAC species	100	x 3 =	300
FACU species	35	x 4 =	140
UPL species		x 5 =	
Column Totals:	275 (A)		720 (B)

Prevalence Index = B/A = 2.61

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 8	10YR 2/1	90	10YR 5/2 & 2.5YR 2.5/4	10	C/D	M	sandy muck	could not get below 8" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 8 inches as materials were very stoney.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (Quercus rubra)	70	Yes	FACU
2. white pine (*Pinus Strobus*)	20	No	FACU
3. shagbark hickory (*Carya ovata*)	20	No	FACU
4.			
5.			
6.			
7.			
	110	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 125	x 4 = 500
UPL species	x 5 =
Column Totals: 125 (A)	500 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 4/3	100					sandy loam	soils moist to dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Marshes, depressions, kettles, bogs, swamps Local relief (concave, convex, none): Concave

Slope (%): 0 - 1 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Freetown muck NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. common winterberry (*Ilex verticillata*)	30	Yes	FACW
2. highbush blueberry (*Vaccinium corymbosum*)	30	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. unidentified sedge	60	Yes	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 60	x 2 = 120
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 130 (A)	330 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/1	100					muck	saturated soils

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer rubrum*)	60	Yes	FAC
2. shagbark hickory (*Carya ovata*)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 60	x 3 = 180
FACU species 55	x 4 = 220
UPL species	x 5 =
Column Totals: 115 (A)	400 (B)

Prevalence Index = B/A = 3.47

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-C1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. mulitflora rose (Rosa multiflora)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. broad-leaved cattail (*Typha latifolia*)	10	Yes	OBL
2. sensitive fern (*Onoclea sensibilis*)	15	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1. riverbank grape (*Vitis riparia*)	10	Yes	FAC
2.			
3.			
4.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	15	x 2 =	30
FAC species	70	x 3 =	210
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	115 (A)		330 (B)

Prevalence Index = B/A = 2.87

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: BVW-C1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	30	Yes	FAC
2. red oak (*Quercus rubra*)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1. manicured lawn	60		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	30	x 3 =	90
FACU species	40	x 4 =	160
UPL species		x 5 =	
Column Totals:	70 (A)		250 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 6	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-D5 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. highbush blueberry (*Vaccinium corymbosum*)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. crested fern (*Dryopteris cristata*)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 30	x 2 = 60
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 100 (A)	270 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					saturated loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-D5 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer rubrum*)	40	Yes	FAC
2. red oak (*Quercus rubra*)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	100	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	40	x 3 =	120
FACU species	160	x 4 =	640
UPL species		x 5 =	
Column Totals:	200 (A)		760 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/2	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 2	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-E1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. crested fern (*Dryopteris cristata*)	15	Yes	FACW
2. sensitive fern (*Onoclea sensibilis*)	10	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 25	x 2 = 50
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 95 (A)	260 (B)

Prevalence Index = B/A = 2.74

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/2	95	10YR 5/6	5	C/CS		sandy loam	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: BVW-E1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	30	Yes	FAC
2. red oak (*Quercus rubra*)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	30	x 3 =	90
FACU species	60	x 4 =	240
UPL species		x 5 =	
Column Totals:	90 (A)		330 (B)

Prevalence Index = B/A = 3.67

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 16' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 3	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (*Acer Rubrum*)	50	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. silky dogwood (*Cornus amomum*)	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 40	x 2 = 80
FAC species 50	x 3 = 150
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 90 (A)	230 (B)

Prevalence Index = B/A = 2.56

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 2/2	100					sandy muck	could not get below 5" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 5 inches as materials were very stony.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 15' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. black cherry (*Prunus serotina*)	20	Yes	FACU
2. white pine (*Pinus Strobus*)	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (*Berberis thunbergii*)	10	Yes	FACU
2. American red raspberry (*Rubus idaeus*)	15	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	25	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1. American bittersweet (*Celastrus scandens*)	15	Yes	FACU
2.			
3.			
4.			
	15	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	70	x 4 =	280
UPL species		x 5 =	
Column Totals:	70 (A)		280 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Materials stony below 10 inches.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-C4 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	80	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	No	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	No	FAC
4. broadleaf cattail (*Typha latiifolia*)	20	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	140 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	80	x 2 =	160
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	140 (A)		260 (B)

Prevalence Index = B/A = 1.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-C4 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. white pine (*Pinus strobus*)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 15	x 4 = 60
UPL species 90	x 5 = 450
Column Totals: 105 (A)	510 (B)

Prevalence Index = B/A = 4.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 44.81" N Long: 72° 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-A3 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	60	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	Yes	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	60	x 2 =	120
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 44.81" N Long: 72° 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-A3 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (*Quercus rubra*)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 20	x 4 = 80
UPL species 90	x 5 = 450
Column Totals: 110 (A)	530 (B)

Prevalence Index = B/A = 4.82

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: IW-B6 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (*Phalaris arundinacea*)	70	Yes	FACW
2. rough-leaved goldenrod (*Solidago patula*)	20	No	OBL
3. grass-leaved goldenrod (*Euthamia graminifolia*)	20	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 20	x 1 = 20
FACW species 70	x 2 = 140
FAC species 20	x 3 = 60
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 110 (A)	220 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: IW-B6 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species 90	x 5 = 450
Column Totals: 90 (A)	450 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00841

MASSACHUSETTS
Department of Environmental Protection

Water Quality Certificate

THIS PAGE IS INTENTIONALLY LEFT BLANK

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

September 24, 2024

Town of Wales
3 Hollow Road
Wales, MA 01081
ATTN: Mr. John Grasso, Board of Selectmen Chair

RE: 401 WATER QUALITY CERTIFICATION
BRP WW 10, Major Fill Project
Monson Road Transportation Improvement Project
Wales, MA

401 WQC Filing Number: 24-WW10-0037-APP
USACE Application No. NAE-2024-01688
MassDOT File Number: 608163

Dear Mr. Grasso:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed your application for a Water Quality Certification (WQC), as referenced above; this application was deemed complete on August 23, 2024. In accordance with the provisions of MGL Ch. 21, §§26-53 and Section 401 of the Federal Clean Water Act as amended (33 U.S.C. §1251 et seq.), it has been determined there is reasonable assurance the proposed project will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law.

The proposed project primarily consists of upgrades and replacement of six stream crossings under Monson Road and Reed Hill Road involving four streams (the Project), as described below. The Project also involves relocation of the intersection of Monson Road and Reed Hill Road; roadway widening and full depth reconstruction; changes to the roadway horizontal and vertical alignments; wetland and stream replication and restoration; and stormwater infrastructure improvements. The Project purpose is to improve the roadway, shoulder, stormwater drainage, and stream crossings which are stated as being in poor condition and deteriorating. The Project proponent states that the existing culverts are undersized and overtopping of the roadway during large storms. Changes to the horizontal and vertical alignments will also meet current design standards and improve sight lines.

This work is a portion of the larger roadway improvements proposed along an approximately 1.5-mile section of Monson Road from the Monson town line to the Monson Road intersection with Reed Hill Road. However, as the stream crossing replacements and approach work are exempt from the

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

Massachusetts Wetlands Protection Act (MGL Ch.131, §40), those portions of the Project require a WQC per 314 CMR 9.04(4). The activities permitted by this WQC include all work associated with the six stream crossing replacements and associated approach work described in the Project Description below, and the entirety of the stormwater improvements which were reviewed as a single and complete project per 314 CMR 9.06(6)(d).

It should be noted the stream that crosses under Monson Road at Station 15+32 has been deemed non-jurisdictional as a non-relatively permanent water by the U.S. Army Corps of Engineers (USACE). Two other stream crossings at Stations 50+72 and 55+00 will not be replaced or improved. As such, these three additional stream crossings are discussed in the Existing Conditions section below for site context but are not discussed further.

Existing Conditions

Monson Road is classified as a Rural Major Collector and is oriented in an east/west alignment. It consists of one 11-foot-wide lane in each direction with no shoulders, sidewalks, or bicyclist accommodations, for a total roadway width of 22 feet. Reed Hill Road intersects Monson Road at the eastern end of the Project. Stormwater runoff flows untreated to roadside swales, Bordering Vegetated Wetlands (BVWs), and streams via country drainage.

Seven streams in the Project area flow south through culverts under Monson Road and Reed Hill Road and are tributaries to Vinica Pond or Vinica Brook. In addition to the culverts being undersized causing overtopping of the roadway, roadside sediment deposits block water from sheeting off the roadway which exacerbates flooding. Existing culvert outfalls are stable; however, significant bank erosion is present along the outfalls in several areas. BVWs are present in several areas along the Project corridor. In addition to the stream crossings identified below, a 12-inch diameter CMP at Station 55+20 connects BVWs on either side of the roadway.

Portions of the Project are located within Zone II Wellhead Protection Area and Coldwater Fishery Critical Areas. Portions of the Project are also located within Massachusetts Natural Heritage and Endangered Species Program (NHESP) Priority and Estimated Habitats of Rare Species.

Intermittent Streams

Intermittent streams cross under Monson Road and Reed Hill Road via culverts at Stations 15+32, 55+00, 82+07, and 86+00 to 87+00 (two culverts).

The non-jurisdictional intermittent stream at Station 15+32 flows west parallel to the north side of Monson Road before flowing under the roadway via a 40-foot-long 12-inch diameter corrugated plastic pipe (CPP). The intermittent stream at Station 82+07 flows under Monson Road through a 43-foot-long 12-inch diameter corrugated metal pipe (CMP). The intermittent stream at Station 55+00 flows through a 48-foot-long 12-inch diameter CMP. Bankfull width indicators are not present at any of these streams.

At Stations 86+00 to 87+00, an intermittent stream flows through two culverts; first through a 108-foot-long 24-inch stone box culvert under Monson Road to a daylighted depression at its intersection with Reed Hill Road; then through a 54-foot-long 24-inch stone box culvert under Reed Hill Road. Bankfull width is approximately 10.5 feet. This stream is a Coldwater Fishery Critical Area.

Perennial Streams

Perennial streams cross under Monson Road via culverts at Stations 24+92, 43+75 and 46+60 (two culverts), and 50+72.

The perennial stream at Station 24+92 flows under Monson Road via a 54-foot-long 30-inch diameter polyvinyl chloride (PVC) pipe and a 49-foot-long 36-inch diameter relief CMP with an invert one foot higher than the 30-inch culvert. The relief culvert only receives flow during storm events. Bankfull width is approximately 11.5 feet. This stream is a Coldwater Fishery Critical Area.

The perennial stream at Station 43+75 flowed under Monson Road via a 49-foot-long 12-inch diameter CMP but collapsed due to roadway flooding. The stream was diverted and currently flows east along the north side of Monson Road then under the roadway via a 41-foot-long 12-inch diameter CPP at Station 46+60. Bankfull width indicators are not present. The western portion of this stream crossing is located within Massachusetts Natural Heritage and Endangered Species Program (NHESP) Priority and Estimated Habitats of Rare Species.

The perennial stream at Station 50+72 flows through a 61-foot-long 36-inch diameter PVC-lined CMP. Bankfull width is 15 feet, and this stream is a Coldwater Fishery Critical Area.

Project Description

Improvements to Monson Road include full depth reconstruction and widening from 22 feet to 28 feet to allow for a 10-foot-wide lane in each direction and four-foot-wide shoulders, as well as changes to the horizontal and vertical alignments. A portion of Reed Hill Road will be realigned and its intersection with Monson Road will be shifted northeast approximately 75 feet to improve sight lines.

The stream crossing at Station 24+92 will be replaced with a 31.5-foot long by 9.8-feet-wide by five-foot-high concrete box culvert. Both headwalls will be replaced with wingwalls. Two feet of native streambed material will be placed within the box culvert, and a three-foot-wide by six-inches-high low flow channel will be shaped in the center.

The two culverts under Monson Road and Reed Hill Road from Stations 86+00 to 87+00 will be replaced with a single 46.8-foot-long by eight-foot-wide by five-foot-high concrete box culvert under Monson Road at Station 86+45. A wingwall will be constructed on the upstream end and a headwall will be constructed on the downstream end. Two feet of native streambed material will be placed within the box culvert, and a three-foot-wide by six-inches-high low flow channel will be shaped in the center. The stream will be realigned to have sinuosity and match the new box culvert alignment. Ten inches of native streambed material will be placed in the realigned channel beyond the box culvert, and it will also have a three-foot-wide by six-inches-high low flow channel in the center. Realignment of Reed Hill Road and relocation of the stream crossing will daylight 1,018 sf of new LUW at this location.

The stream crossing at Station 43+75 will be replaced with double 12-inch diameter reinforced concrete pipes (RCPs), and the associated culvert at Station 46+60 will be replaced with a single 12-inch RCP. The intent is to re-establish flow at its original location at Station 43+75, while retaining the culvert at Station 46+60 as an overflow during storm events. The stream crossing at Station 82+07 will be replaced with an 18-inch RCP. Modified rock fill aprons will be installed at the outlet of all of these culverts.

Stormwater infrastructure improvements consist of new sections of curbing and installation of deep sump catch basins as described below.

BVW and LUW Impacts

In total, 5,338 square feet (sf) of fill impacts to BVWs and Land Under Water (LUW) are required to construct the Project. The Project will result in 674 sf of permanent and 550 sf of temporary BVW impacts, and 2,186 sf of permanent and 1,943 sf of temporary LUW impacts. The Project will result in 89 cubic yards (cy) of dredging. Permanent BVW and LUW impacts, and dredging are required primarily for the culvert replacements and associated headwall/wingwall and outlet protection installations. Temporary impacts are required primarily for temporary work areas and associated access.

Alternatives Analysis

Constraints adjacent to Monson Road including but not limited to residential properties, wetlands and waters, Norcross Wildlife Sanctuary, and utilities make realigning Monson Road to further avoid BVW and LUW impacts not practicable. Lanes and shoulders have been designed to be the minimum practicable width and sidewalks and bike lanes are not proposed. The Stream Crossing Standards section below describes the alternatives analysis relative to the Project stream crossing replacements.

BVW and LUW Replication and Restoration

A 1,204 sf BVW replication area will be constructed south of Monson Road between approximate Stations 85+00 to 85+75, adjacent to BVW L and the realigned stream southwest of the Monson Road and Reed Hill Road intersection. The area will be excavated to 12 inches below the adjacent BVW elevation to allow for installation of 12 inches of wetland soil. Native trees and shrubs will be planted, and a native wetland seed mix will be applied. Temporary BVW impacts will be restored in place with a native wetland seed mix. All BVW replication and restoration areas will be constructed under the supervision of a qualified Wetland Scientist. LUW replication and restoration as described in the Project Description will take place under the supervision of a qualified Fluvial Geomorphologist (FGM).

Stormwater Management Standards

The Project will increase impervious surface by 0.88 acres and qualifies as a redevelopment project as defined at 314 CMR 9.02. Seven new closed drainage systems consisting of curbing and 57 deep sump catch basins will be installed. All new outfalls will have modified rockfill outlet protection. Stormwater in remaining areas will flow via country drainage through one-foot-wide grass-lined or modified rockfill-lined roadside drainage channels. A complete evaluation concluded that additional locations for Stormwater Control Measures (SCMs) are not practicable within the Project area.

Stream Crossing Standards

A qualified FGM performed a rapid stream geomorphic assessment and Stream Crossing Standards maximum extent practicable alternatives analysis for the Project stream crossing replacements. Priority was given to the three streams identified as Coldwater Fishery Critical Areas. Given the size of the structure required for the crossing at Station 50+72, proper replacement of the crossing was deemed impracticable and was not considered further.

Spans at Stations 24+92 and 86+45 were deemed impracticable; however, these crossings will be improved. The proposed box culverts will have spans of 0.9 and 0.8 times the bankfull width, respectively, and will be embedded with two feet of native streambed material. The box culvert at Station 24+92 will exceed the openness ratio Stream Crossing Standard; however, due to the required length of the crossing, the box culvert at Station 86+45 will meet the openness ratio Stream Crossing Standard to the maximum extent practicable (MEP). The geomorphic assessment and alternatives analysis concluded the box culverts will achieve many of the benefits of a larger crossing structure including improved flood conveyance, sediment transport, large wood movement, and fish and wildlife movement. The streams at Stations 43+75, 46+60, and 82+07 have been designed to improve hydraulic capacity and meet the Stream Crossing Standards to the MEP. As such, the Project is in compliance with the Stream Crossing Standards to the MEP in accordance with 314 CMR 9.06(2)(b)4.

Rare Species

As previously discussed, the western portion of the stream crossing at Stations 43+75 and 46+60 is located within NHESP Priority and Estimated Habitats of Rare Species. In a letter dated July 1, 2024, NHESP concluded that the Project will not adversely affect the actual Resource Area Habitat of state-protected rare wildlife species and will not result in a prohibited Take of state-listed rare species. Therefore, the Project is in compliance with 314 CMR 9.06(2).

Based on a review of information provided by the applicant, MassDEP finds that this project complies with the standards described under 314 CMR 9.06. Public notice was provided in the Journal Register on July 4, 2024, and in the MEPA Environmental Monitor on July 10, 2024. No comment letters were received during the public comment period.

Therefore, based on information currently in the record, MassDEP grants a WQC for this project subject to the following conditions to maintain water quality, to minimize impact on waters and wetlands, and to ensure compliance with appropriate state law. The Department further certifies in accordance with 314 CMR 9.00 that there is reasonable assurance the project or activity will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law. Finally, the Department has determined that upon satisfying the conditions and mitigation requirements of this approval, the project provides a level of water quality necessary to protect existing uses and accordingly finds that the project to be implemented satisfies the Surface Water Quality Standards at 314 CMR 4.00.

Pursuant to 314 CMR 9.09(1)(d); 314 CMR 9.06(6)(a); 310 CMR 9.06(2); 314 CMR 9.07; 314 CMR 9.07(1); 314 CMR 9.09(7)(5)(c); 314 CMR 9.11; and 314 CMR 9.09(1)(e), the following Special Conditions are necessary to ensure that construction practices and stormwater controls are implemented in such a manner as to prevent degradation to wetlands and waters; ensure that practicable steps have been

taken which will avoid and minimize impacts to wetlands and waters; minimize turbidity and sediment caused by construction activities; ensure that water quality is not degraded, and that biology of the waters are not negatively impacted by potential discharges; and/or maintain a record of the dredged material for reference and to ensure accountability in its transportation.

Those Special Conditions that require direct submittals to MassDEP for either review, or review and approval, are denoted by the following notation (Submittal) at the end of the condition and are summarized in Attachment A. In addition, those conditions with the (Submittal) designation shall be included in the Special Provisions and, as applicable, reviewed at the Pre-Construction Meeting.

1. All work shall be performed in accordance with the following documents and plans:

    - Application for Water Quality Certification. Prepared by Weston & Sampson Engineers, Inc. on behalf of the Town of Wales, with cover letter and attachments. 401 WQC Filing Number: 24-WW10-0037-APP. Dated June 26, 2024.
    - Plans entitled: "Massachusetts Department of Transportation Highway Division Plan and Profile of Monson Road Improvements in the Town of Wales, Hampden County. 100% Submittal, 404 Environmental Permit Plan Set." Prepared by Weston & Sampson Engineers, Inc. Sheets 1 through 41. Last revised August 2024.
    - MassDEP Administrative Completeness and Technical Deficiency Review. Monson Road Transportation Improvement Project. 401 WQC Transmittal No: 24-WW10-0037-APP. Dated July 17, 2024.
    - Response to Technical Review – Monson Road Transportation Improvements Project, Wales Massachusetts (401 WQC Transmittal No. 24-WW10-0037-APP). Prepared by Weston & Sampson Engineers, Inc. on behalf of the Town of Wales. Dated August 9, 2024.
    - Updated Project Description. Prepared by Weston & Sampson Engineers, Inc. on behalf of the Town of Wales. Submitted via email August 28, 2024.
    - Updated Wetland Delineation Report. Prepared by Weston & Sampson Engineers, Inc. on behalf of the Town of Wales. Submitted via email August 28, 2024.
    - NHESP MESA Review. Monson Road Transportation Improvement Project. NHESP File No. 24-18601. Dated July 1, 2024.

Pre-Construction

2. The permittee shall employ an **Environmental Monitor** (EM) to oversee all project activities with the potential to have an adverse impact on BVWs and LUW and to ensure compliance with this WQC and the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CP/PP) as required herein. The EM shall have a minimum of five years of professional experience with construction site CP/PP compliance. The EM shall complete the U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) Inspector Training, or other training that meets the CGP requirements, and provide proof of completion prior to the start of work. The name, contact information, and qualifications of the proposed EM shall be provided to MassDEP for approval prior to the Pre-Construction Meeting required in Condition

6. The name and contact information of the approved EM shall be provided to the Wales Conservation Commission prior to the start of work. **(Submittal)**

3. A qualified **Wetland Scientist** (WS) with a minimum of five years of relevant professional experience with wetland and stream replication and restoration projects shall be employed to oversee all BVW and LUW replication and restoration activities, including but not limited to grading, placement of substrate, seeding, vegetation plantings, and placement of wildlife habitat features. The name, contact information, and qualifications of the WS shall be provided to MassDEP for approval prior to the Pre-Construction Meeting required in Condition 6. The name and contact information of the approved WS shall be provided to the Wales Conservation Commission prior to the start of work. The EM may also be the WS if the qualifications are met. **(Submittal)**

4. A qualified **Fluvial Geomorphologist** (FGM) with a minimum of five years of relevant professional experience in stream replication and restoration projects shall be employed to oversee all LUW replacement and restoration activities as proposed by MassDOT. The name, contact information, and qualifications of the FGM shall be provided to MassDEP for approval with a copy to the Wales Conservation Commission prior to the Pre-Construction Meeting required in Condition 6. **(Submittal)**

5. Prior to the Pre-Construction Meeting required in Condition 6, the proponent shall provide MassDEP with the name and contact information of the Resident Engineer (RE) responsible for ensuring that all work complies with the conditions of this WQC. **(Submittal)**

6. A minimum of 21 days prior to the start of work, the proponent shall contact MassDEP to schedule an onsite Pre-Construction Meeting to review the approved plans and terms and conditions of this WQC. The RE, the construction contractor, the EM, the WS a representative from the MassDOT Environmental Section and/or the District Environmental Engineer shall attend the Pre-Construction Meeting.

7. A minimum of 14 days prior to installation of the new culverts, the FGM shall meet with the contractor to determine the suitability of stockpiled streambed material for reuse.

8. MassDEP shall be copied on applicable submittals to the U.S. Army Corps of Engineers (USACE). These include but are not limited to: Self-Verification Notification Form (SVNF); Pre-Construction Notification (PCN); Work-Start Notification Form; Mitigation Work-Start Notification Form; and Compliance Certification Form. The Work-Start Notification Form shall be submitted at least 14 days before the anticipated start of work and the Compliance Certification Form shall be submitted within 30 days following the completion of the authorized work. **(Submittal)**

9. A CP/PP shall be developed and implemented as required by 314 CMR 9.06(6)(a)8. A minimum of 14 days prior to the start of work, the applicant shall submit the CP/PP for review and approval. If the EPA CGP applies, the Stormwater Pollution Prevention Plan (SWPPP) may serve as the CP/PP, providing it includes the measures required to be in the CP/PP per these Special Conditions, in addition to the measures specifically required by the CGP. Any subsequent

changes to the Final CP/PP (defined herein as including the construction period SWPPP if applicable) must be approved by MassDEP. **(Submittal)**

10. Training regarding erosion and sedimentation controls is required. The RE, CP/PP Inspector, and any other relevant personnel responsible for erosion and sedimentation controls shall complete the EPA CGP Inspector Training, or other training that meets the CGP requirements, as well as complete a comprehensive review of the Final CP/PP. Verification of proof of completion of the training shall be submitted to MassDEP prior to the start of work. **(Submittal)**

11. The CP/PP shall identify, but shall not be limited to, staging and laydown areas in relation to BVWs and LUW, proposed dewatering locations, proposed stockpile locations and their proximity to catch basins or other drainage conveyances that discharge to wetland resource areas, and the location of construction-period erosion and sedimentation controls.

12. A minimum of 14 days prior to the start of work, a Control of Water Plan shall be submitted for review and approval. The Plan shall include proposed methods to manage construction-period water including but not limited to dewatering methods and locations, specifications for any water bypass systems, and dredge and debris material dewatering prior to shipment off site, as applicable. The plan shall meet requirements of the CP/PP and be specific to the Project. Dewatering and water bypasses shall be conducted under the supervision of the EM and comply with the applicable conditions identified herein. **(Submittal)**

13. Prior to the start of work, approved erosion and sedimentation control measures shall be installed per the approved CP/PP and as applicable, the manufacturer specifications. Erosion and sedimentation control measures may consist of, but are not limited to, silt fence, staked straw bales, silt/turbidity curtains, compost filter tubes, etc.

14. Prior to the Pre-Construction Meeting, the boundaries of BVWs and LUW shall be re-flagged where they are within 50 feet of the limits of work. In the event BVW and LUW boundaries overlap, the outermost boundary (i.e., closest to the proposed work) shall be flagged. All boundary markers, once in place, shall remain in place throughout construction until all disturbed surfaces have been permanently stabilized. Boundary markers shall be fully evaluated annually and refreshed where needed. Implementation of and compliance with this requirement shall be documented by the EM. All construction personnel shall be made aware of these markers.

Construction Period

15. No more than **674 sf** of permanent and **550 sf** of temporary impacts to BVWs shall occur. No more than **2,186 sf** of permanent and **1,943 sf** of temporary impacts to LUW shall occur. No more than **89 cy** of dredging in LUW shall occur. All work shall avoid unapproved impacts to BVW and LUW.

16. The EM duties shall include, but are not limited to, oversight of installation and maintenance of erosion and sedimentation controls and SCMs, dewatering activities, cofferdam installation and removal, concrete washout containment, dust control, and hazardous or toxic material containment, as applicable. The EM shall only be responsible for the oversight of hazardous and

toxic materials to the extent that the CP/PP requires. All erosion and sedimentation controls shall be inspected by the EM prior to the start of work in each area, and all dewatering methods and locations shall be inspected by the EM prior to use. The EM shall have the authority to require modifications to or additional erosion and sedimentation controls or dewatering controls as they deem necessary to comply with this WQC and the CP/PP.

17. CP/PP inspections shall occur at least once every seven calendar days and within 24 hours of a storm event that produces 0.5 inches or more of rain within a 24-hour period, or at a more stringent frequency if the CP/PP requires.

18. Copies of CP/PP Inspection and Maintenance Log Forms shall be submitted to MassDEP within 14 days upon request.

19. The EM shall submit to MassDEP and the Wales Conservation Commission at least one report every two calendar weeks during active construction and once every month while work is shut down until the site achieves final stabilization. The permittee shall not participate in the preparation of any EM report. The report shall include:

    a. Relevant weather information including storm event amounts and durations since the last inspection;

    b. A general description of current and foreseeable construction activities;

    c. The status and effectiveness of erosion and sedimentation controls, stormwater control measures, and dewatering methods;

    d. Evidence of erosion, sedimentation, or improper material containment or spills;

    e. A description of any unauthorized discharges to BVWs or LUW, and actions taken to immediately stop the discharge;

    f. Recommendations to correct any deficiencies identified during the inspection;

    g. Due dates to resolve corrective actions as specified in the CP/PP and WQC, and dates and descriptions of the resolutions as they are completed;

    h. Representative photos of current site conditions, erosion and sedimentation controls, stormwater control measures, and dewatering methods;

    i. Specific photos of any unauthorized discharges to BVWs or LUW, deficiencies or non-compliance requiring corrective actions, and corrective actions that have been undertaken; and

    j. Any other recommendations for site management to promote compliance with this WQC and the CP/PP.

20. The EM shall immediately report any unauthorized discharges to BVWs or LUW, or any other significant non-compliance with this WQC or the CP/PP to MassDEP, MassDOT, the RE, and the

Wales Conservation Commission. The EM shall have stop-work authority in the event of significant non-compliance with this WQC and/or the CP/PP. The EM shall be authorized to respond to and communicate directly with MassDEP on all matters related to compliance with this WQC. MassDEP may make any requests directly to the EM and copy MassDOT, and MassDOT shall authorize the EM to fulfill such request in direct coordination with MassDEP.

21. Inspection and maintenance of erosion and sediment controls in work areas shall be the responsibility of both the Contractor and RE or MassDOT project staff. Maintenance is the responsibility of the Contractor; however, the applicant is ultimately responsible for erosion and sedimentation control failure. All recommendations of the lead inspector shall be followed. The project team individual with lead responsibility for inspections shall have at least three years of experience with construction period erosion and sedimentation controls. The RE and/or contractor shall immediately notify MassDEP and the Wales Conservation Commission if any unauthorized discharges to wetland resource areas occur.

22. Disturbed areas shall be stabilized immediately after activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. The installation of stabilization measures shall be implemented as soon as practicable, but no later than 14 calendar days after stabilization has been initiated.

23. Work within LUW shall be conducted in low or no-flow conditions to the extent practicable. Notice shall be provided to MassDEP and the Wales Conservation Commission within 24 hours prior to the commencement of dewatering. Dewatering methods and location(s) shall be approved by the EM prior to use, and shall be documented in the CP/PP. There shall be no discharge of untreated dewatered stormwater or groundwater to BVWs or LUW. Any discharges shall be visibly free of sediment.

24. Additional erosion and sedimentation control materials shall be stored on-site at all times for emergency and routine replacement. Materials shall be kept covered, dry, and accessible at all times. The RE and EM shall be responsible for anticipating the need for and installation of additional erosion and sedimentation controls and shall have the authority to require additional erosion control measures to protect wetland resource areas beyond what is shown on the plans if field conditions, or professional judgment dictate that additional protection is necessary.

25. Any storm drains with potential to receive discharge from stockpiled materials or construction operations shall be managed to inhibit the inflow of sediment while not increasing the likelihood of roadway flooding during periods of precipitation. Stockpiles shall be located no less than 50 feet from BVWs, LUW, catch basins, or other drainage conveyances that discharge to BVWs or LUW. The CP/PP shall specify measures to implement this. Filter fabric stretched under storm drain inlet grates are not acceptable for this purpose.

26. The contractor shall have designated washout areas for concrete equipment that will be comprised of impermeable material and sized to contain project concrete wastes and wash water. Concrete wash out areas shall be located no less than 50 feet from BVWs, LUW, and catch basins or other drainage conveyances that discharge directly or indirectly to BVWs or LUW.

27. Refueling, washing, and cleaning of vehicles and other construction equipment shall not take place within 50 feet of BVWs or LUW and any wash water shall be contained such that it does not drain toward BVWs or LUW. MassDEP shall explicitly approve in writing any deviation to this condition for oversized stationary vehicles.

28. The contractor shall have spill containment kits on site. In the event of a release of fuels and/or oils, the local fire department and MassDEP shall be notified.

29. If applicable, sheet piles shall be fully removed from BVW and LUW upon stabilization of the area as required. No portion of sheet piles shall remain unless approved by MassDEP in writing prior to installation. A request to leave sheet piles shall include, but not be limited to, demonstration that full removal of the sheet piles is not feasible or practicable, and an alternatives analysis demonstrating alternative methods to isolate the work area(s) are not feasible or practicable. At no time shall sheet piles be allowed to remain in LUW of a waterway that provides aquatic organism passage.

Wetland Mitigation

30. A minimum of 1,204 sf of wetland replication shall be completed in coordination with an approved WS. The WS shall oversee all BVW replication and restoration, including final grading, seeding, and planting. The WS shall confirm that constructed BVW replication and restoration areas have adequate soils and hydrology to promote wetland plant species prior to seeding and installation of plantings and shall recommend measures to amend soils and promote wetland hydrology as needed.

31. Planting and seeding shall not take place between November 15th and April 15th, except as allowed by MassDEP in writing. The WS shall inspect trees and shrubs to ensure they are healthy prior to planting. Trees and shrubs deemed unhealthy in the professional judgment of the WS shall be replaced. Plantings and seed mixes shall consist of native and non-invasive species. Species may be substituted at the recommendation of the WS, and review and approval by MassDEP.

32. At least 75% of the surface area of the BVW replication and restoration areas shall be vegetated with indigenous wetland plant species within two growing seasons, or the period required by the Section 404 permit, whichever is longer. Additionally, evidence of hydrology, including hydric soil formation shall be submitted at the same time. Annual monitoring reports shall be submitted by the WS no later than January 15th each year. Monitoring reports shall include an assessment based on the approved success criteria, representative photos, and recommended corrective actions as needed. **(Submittal)**

33. MassDEP reserves the right to determine the success or failure of the BVW replication and restoration areas, and reserves the right to require additional plantings, regrading, or other measures deemed necessary to promote success.

Stream Mitigation

34. The FGM shall oversee all LUW replication and restoration. Placement of streambed materials shall take place in no- or low-flow conditions. The Control of Water Plan required in Condition 12 shall include measures to create no-flow conditions for this work such as a pump bypass system or other dewatering method, if needed. Placement of streambed materials during greater than low-flow conditions shall require a placement plan, with a narrative describing turbidity control measures, submitted to MassDEP for review and approval.

35. Upon completion, the FGM shall provide photographs of the finished culvert installation and stream restoration along with a brief narrative describing the finished work to MassDEP and the Wales Conservation Commission.
(Submittal)

36. Water shall be slowly introduced back into the restored and dewatered LUW work areas as to not cause erosion and sedimentation. This work shall be overseen by the EM and/ or FGM.

37. MassDEP reserves the right to determine the success or failure of the LUW replication and restoration areas and reserves the right to require additional measures deemed necessary to promote success.

Post-Construction

38. All temporary erosion controls shall be removed at the conclusion of work once the surrounding area has achieved final stabilization.

General Conditions

39. Any proposed alterations, minor plan changes, or amendment requests, as well as any required submittals shall be sent by email for review and approval to heidi.davis@mass.gov and ryan.hale@mass.gov. **(Submittal)**

40. This WQC remains in effect for the same duration as the Section 404 permit that requires it.

41. No Special Condition set forth herein shall be construed or operate to prohibit MassDEP from taking enforcement against the Town of Wales or its contractors for any failure to comply with the terms and requirements of this WQC.

42. No activity authorized by this WQC may begin prior to expiration of the 21-day appeal period, or until a final decision is issued by MassDEP in the event of an appeal.

Failure to comply with this Certification is grounds for enforcement, including civil and criminal penalties, under MGL Ch. 21 §42, MGL Ch. 21A §16, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This Certification does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations.

NOTICE OF APPEAL RIGHTS

a.) Appeal Rights and Time Limits

Certain persons shall have a right to request an adjudicatory hearing concerning certifications by MassDEP when an application is required: (a) the applicant or property owner; (b) any person aggrieved by the decision who has submitted written comments during the public comment period; (c) any ten (10) persons of the Commonwealth pursuant to M.G.L. c.30A where a group member has submitted written comments during the public comment period; or (d) any governmental body or private organization with a mandate to protect the environment which has submitted written comments during the public comment period. Any person aggrieved, any ten (10) persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c.30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within twenty-one (21) days from the date of issuance of this Certificate, and addressed to:

Case Administrator
Department of Environmental Protection
100 Cambridge Street, 9th Floor
Boston, MA 02114

A copy of the request shall at the same time be sent by certified mail or hand delivery to the Department of Environmental Protection at:

Department of Environmental Protection
Commissioner's Office
100 Cambridge Street, Suite 900
Boston, MA 02114

b.) Contents of Hearing Request

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

3. the 401 Certification Transmittal Number;
4. the complete name of the applicant and address of the project;
5. the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
6. if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
7. a clear and concise statement that an adjudicatory hearing is being requested;
8. a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this Certificate, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief

sought through the adjudicatory hearing, including specifically the changes desired in the final written Certification; and

9. a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Conservation and Recreation (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

c.) Filing Fee and Address

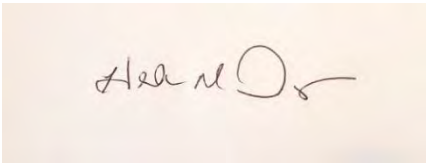
The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

Should you have any questions relative to this permit, please contact myself or Ryan Hale at heidi.davis@mass.gov and ryan.hale@mass.gov.

Very truly yours,



Heidi M. Davis
Highway Unit Supervisor

Ecc: DEP WERO – Michael McHugh
USACE – Dan Vasconcelos
USACE – Kevin Newton
MassDOT – Courtney Walker
MassDOT – Melissa Lenker
Weston & Sampson – Michael Joyce
Weston & Sampson – Rhianna Sommers

Wales Conservation Commission – Sarah Ryan conservation@townofwales.net

ATTACHMENT A
PRE-CONSTRUCTION SUBMITTAL CHECKLIST

Monson Road Transportation Improvement Project
Wales, MA

THIS CHECKLIST MUST BE COMPLETED PRIOR TO THE START OF WORK. NOTE THAT SOME CONDITIONS REQUIRE THAT INFORMATION BE SUBMITTED A SPECIFIC NUMBER OF DAYS PRIOR TO THE START OF WORK OR THE PRE-CONSTRUCTION MEETING.

Condition	Required Submittal	Due Date	Date Submitted	Date Approved
PRE-CONSTRUCTION SUBMITTAL REQUIREMENTS				
2, 3, and 4	Name, contact information, and qualifications of the EM, WS, and FGM, including specific experience and years to meet requirements	Prior to Pre-Construction Meeting		
5	Name and contact information of the RE	Prior to Pre-Construction Meeting		
7	USACE Work-Start Notification Form	14 days prior to work start		
8	CP/PP	14 days prior to work start		
9	EM Verification of SWPPP Training	Prior to work start		
12	Control of Water Plan	14 days prior to work start		

重要 महत्वपूर्ण σημαντικός Important կարեւոր quan trọng مهم

Communication for Non-English-Speaking Parties

This document is important and should be translated immediately.

If you need this document translated, please contact MassDEP's Director of Environmental Justice at the telephone number listed below.

Español Spanish

Este documento es importante y debe ser traducido inmediatamente. Si necesita traducir este documento, póngase en contacto con el Director de Justicia Ambiental de MassDEP (*MassDEP's Director of Environmental Justice*) en el número de teléfono que figura más abajo.

Português Portuguese

Este documento é importante e deve ser traduzido imediatamente. Se você precisar traduzir este documento, entre em contato com o Diretor de Justiça Ambiental do MassDEP no número de telefone listado abaixo.

繁體中文 Chinese Traditional

本文檔很重要，需要即刻進行翻譯。
如需對本文檔進行翻譯，請透過如下列示電話號碼與 MassDEP 的環境司法總監聯絡。

简体中文 Chinese Simplified

这份文件非常重要，需要立即翻译。
如果您需要翻译这份文件，请通过下方电话与 MassDEP 环境司法主任联系。

Ayisyen Kreyòl Haitian Creole

Dokiman sa a enpòtan epi yo ta dwe tradui l imedyatman. Si w bezwen tradui dokiman sa a, tanpri kontakte Direktè. Jistis Anviwònmantal MassDEP a nan nimewo telefòn ki endike anba a.

Việt Vietnamese

Tài liệu này và quan trọng và phải được dịch ngay. Nếu quý vị cần bản dịch của tài liệu này, vui lòng liên hệ với Giám Đốc Phòng Công Lý Môi Trường của MassDEP theo số điện thoại được liệt kê bên dưới.

ប្រទេសកម្ពុជា Khmer/Cambodian

ឯកសារនេះមានសារៈសំខាន់
ហើយគប្បីត្រូវបានបកប្រែភ្លាមៗ.
ប្រសិនបើអ្នកត្រូវការអោយឯកសារនេះបកប្រែ
សូមទាក់ទងនាយកផ្នែកយុត្តិធម៌បរិស្ថានរបស់
MassDEPតាមរយៈលេខទូរស័ព្ទដែលបានរាយដូចខាងក្រោម។

Kriolu Kabuverdianu Cape Verdean

Es dokumentu sta important i tenki ser tradusidu immediatamenti. Se nho ta presisa ke es dokumentu sta tradisidu, por favor kontata O Diretor di Justisia di Environman di DEP ku es numero di telifoni menxionadu di baixo.

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Русский Russian

Это чрезвычайно важный документ, и он должен быть немедленно переведен. Если вам нужен перевод этого документа, обратитесь к директору Департамента экологического правосудия MassDEP (MassDEP's Director of Environmental Justice) по телефону, указанному ниже.

العربية Arabic

هذه الوثيقة مهمة وتجب ترجمتها على الفور.

إذا كنت بحاجة إلى ترجمة هذه الوثيقة، فيرجى الاتصال بمدير العدالة البيئية في MassDEP على رقم الهاتف المذكور أدناه.

한국어 Korean

이 문서는 중대하므로 즉시 번역되어야 합니다.
본 문서 번역이 필요하신 경우, 매사추세츠 환경보호부의 "환경정의" 담당자 분께 문의하십시오. 전화번호는 아래와 같습니다.

հայերեն Armenian

Այս փաստաթուղթը կարևոր է, և պետք է անհապաղ թարգմանել այն:
Եթե Ձեզ անհրաժեշտ է թարգմանել այս փաստաթուղթը, դիմեք Մասաչուսեթսի շրջակա միջավայրի պահպանության նախարարության (MassDEP) Բնապահպանական հարցերով արդարադատության ղեկավարին (Director of Environmental Justice)՝ ստորև նշված հեռախոսահամարով

فارسی Farsi Persian

این نوشتار بسیار مهمی است و باید فوراً ترجمه شود.
اگر نیاز به ترجمه این نوشتار دارید لطفاً با مدیر عدالت محیط زیستی MassDEP در شماره تلفن ذکر شده زیر تماس بگیرید.

Français French

Ce document est important et doit être traduit immédiatement. Si vous avez besoin d'une traduction de ce document, veuillez contacter le directeur de la justice environnementale du MassDEP au numéro de téléphone indiqué ci-dessous.

Deutsch German

Dieses Dokument ist wichtig und muss sofort übersetzt werden. Wenn Sie eine Übersetzung dieses Dokuments benötigen, wenden Sie sich bitte an MassDEP's Director of Environmental Justice *(Direktor für Umweltgerechtigkeit in Massachusetts)* unter der unten angegebenen Telefonnummer.

Ελληνική Greek

Το έγγραφο αυτό είναι πολύ σημαντικό και πρέπει να μεταφραστεί αμέσως. Αν χρειάζεστε μετάφραση του εγγράφου αυτού, παρακαλώ επικοινωνήστε με τον Διευθυντή του Τμήματος Περιβαλλοντικής Δικαιοσύνης της Μασαχουσέτης στον αριθμό τηλεφώνου που αναγράφεται παρακάτω

Italiano Italian

Questo documento è importante e deve essere tradotto immediatamente. Se hai bisogno di tradurre questo documento, contatta il Direttore della Giustizia Ambientale di MassDEP al numero di telefono sotto indicato.

Język Polski Polish

Ten dokument jest ważny i powinien zostać niezwłocznie przetłumaczony. Jeśli potrzebne jest tłumaczenie tego dokumentu, należy skontaktować się z dyrektorem ds. sprawiedliwości środowiskowej MassDEP pod numerem telefonu podanym poniżej.

हिन्दी Hindi

यह दस्तावेज महत्वपूर्ण है और इसका अनुवाद तुरंत किया जाना चाहिए। यदि आपको इस दस्तावेज का अनुवाद कराने की जरूरत है, तो कृपया नीचे दिए गए टेलीफोन नंबर पर MassDEP के पर्यावरणीय न्याय निदेशक से संपर्क करें।

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00855

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

CONCURRENCE VERIFICATION LETTER

THIS PAGE INTENTIONALLY LEFT BLANK

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: September 14, 2023
Project code: 2023-0006669
Project Name: 608163 -WALES- RECONSTRUCTION & IMPROVEMENTS ON MONSON ROAD, FROM THE MONSON T.L. TO REED HILL ROAD

Subject: Concurrence verification letter for the '608163 -WALES- RECONSTRUCTION & IMPROVEMENTS ON MONSON ROAD, FROM THE MONSON T.L. TO REED HILL ROAD' project under the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (NLEB).

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated September 14, 2023 to verify that the **608163 -WALES- RECONSTRUCTION & IMPROVEMENTS ON MONSON ROAD, FROM THE MONSON T.L. TO REED HILL ROAD** (Proposed Action) may rely on the concurrence provided in the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action is within the scope and adheres to the criteria of the PBO, including the adoption of applicable avoidance and minimization measures, and may affect, but is not likely to adversely affect (NLAA) the endangered Indiana bat (*Myotis sodalis*) and/or the endangered northern long-eared bat (*Myotis septentrionalis*). Consultation with the Service pursuant to section 7(a)(2) of ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) is required.

The Service has 14 calendar days to notify the lead Federal action agency or designated non-federal representative if we determine that the Proposed Action does not meet the criteria for a NLAA determination under the PBO. If we do not notify the lead Federal action agency or designated non-federal representative within that timeframe, you may proceed with the Proposed Action under the terms of the NLAA concurrence provided in the PBO. This verification period allows Service Field Offices to apply local knowledge to implementation of the PBO, as we may

identify a small subset of actions having impacts that were unanticipated. In such instances, Service Field Offices may request additional information that is necessary to verify inclusion of the proposed action under the PBO.

For Proposed Actions that include bridge/culvert or structure removal, replacement, and/or maintenance activities: If your initial bridge/culvert or structure assessment documented signs of bat use or occupancy, or an assessment failed to detect Indiana bats and/or NLEBs, yet are later detected prior to, or during construction, please submit the Post Assessment Discovery of Bats at Bridge/Culvert or Structure Form (User Guide Appendix E) to this Service Office within 2 working days of any potential take. In these instances, potential incidental take of Indiana bats and/or NLEBs is covered under the Incidental Take Statement in the 2018 FHWA, FRA, FTA PBO (provided that the take is reported to the Service).

If the Proposed Action is modified, or new information reveals that it may affect the Indiana bat and/or northern long-eared bat in a manner or to an extent not considered in the PBO, further review to conclude the requirements of ESA Section 7(a)(2) may be required.

For Proposed Actions that include bridge/culvert or structure removal, replacement, and/or maintenance activities:
If your initial bridge/culvert or structure assessments failed to detect Indiana bats and/or NLEB use or occupancy, yet bats are later detected prior to, or during construction, please submit the Post Assessment Discovery of Bats at Bridge/Culvert or Structure Form (User Guide Appendix E) to this Service Office within 2 working days of the incident. In these instances, potential incidental take of Indiana bats and/or NLEBs may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species, and/or any designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please contact this Service Office.

The following species may occur in your project area and **are not** covered by this determination:

- Monarch Butterfly *Danaus plexippus* Candidate

PROJECT DESCRIPTION

The following project name and description was collected in IPaC as part of the endangered species review process.

NAME

608163 -WALES- RECONSTRUCTION & IMPROVEMENTS ON MONSON ROAD, FROM THE MONSON T.L. TO REED HILL ROAD

DESCRIPTION

608163 - WALES- RECONSTRUCTION & IMPROVEMENTS ON MONSON ROAD, FROM THE MONSON T.L. TO REED HILL ROAD (1.5 MILES)

This project will consist of roadway reclamation and pavement widening. The existing pavement will be widened for usable shoulder and improved bicycle accommodations, drainage deficiencies will be repaired, intersection and sight distance improvements, new signage and pavement markings.

Monarch Butterfly: Candidate Species only, no conservation measures at this time.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.060756049999995,-72.26589274528192,14z

DETERMINATION KEY RESULT

Based on your answers provided, this project(s) may affect, but is not likely to adversely affect the endangered Indiana bat and/or the endangered northern long-eared bat, therefore, consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required. However, also based on your answers provided, this project may rely on the concurrence provided in the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

QUALIFICATION INTERVIEW

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No

2. Is the project within the range of the northern long-eared bat[1]?

   [1] See northern long-eared bat species profile

   Automatically answered
   Yes

3. Which Federal Agency is the lead for the action?

   A) Federal Highway Administration (FHWA)

4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales)

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   No

5. Does the project include *any* activities that are **greater than** 300 feet from existing road/rail surfaces[1]?

   [1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

   No

6. Does the project include *any* activities **within** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]?

   [1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

   No

7. Is the project located **within** a karst area?

   No

8. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   [2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the User's Guide for the Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat.

   Yes

9. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat?

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   Yes

10. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail?

    No

11. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] **within** the suitable habitat located within your project action area?

    [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

    [2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    [3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

    [4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

    Yes

SUBMITTED DOCUMENTS

- *608163_rpt_wales1_nleb_survey_20221011.pdf https://ipac.ecosphere.fws.gov/project/UO7QGV44ZFEVBBYVIAZMOBVU2Y/projectDocuments/118296426*

12. Did the presence/probable absence (P/A) summer surveys detect Indiana bats and/or NLEB[1]?

    [1] P/A summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate home range) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    No

13. Were the P/A summer surveys conducted **within** the fall swarming/spring emergence range of a documented Indiana bat hibernaculum[1]?

    [1] Contact the local Service Field Office for appropriate distance from hibernacula.

    No

14. Does the project include activities **within documented NLEB habitat**[1][2]?

    [1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

    [2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

    No

15. Will the removal or trimming of habitat or trees occur **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors?

    Yes

16. What time of year will the removal or trimming of habitat or trees **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors occur?

    C) During both the active and inactive seasons

17. Will *any* tree trimming or removal occur **within** 100 feet of existing road/rail surfaces?

    Yes

18. Will *any* tree trimming or removal occur **between** 100-300 feet of existing road/rail surfaces?

    No

19. Are *all* trees that are being removed clearly demarcated?

    Yes

20. Will the removal of habitat or the removal/trimming of trees involve the use of **temporary** lighting?

    Yes

21. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing **permanent** lighting?

    No

22. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation?

    No

23. Does the project include slash pile burning?

    No

24. Does the project include *any* bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)?

    No

25. Does the project include the removal, replacement, and/or maintenance of *any* structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.)

    No

26. Will the project involve the use of *any* **temporary** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees), or bridge/structure removal, replacement or maintenance activities?

    Yes

27. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **temporary** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be used?

    Yes

28. Will the project install new or replace existing **permanent** lighting?

    No

29. Does the project include percussives or other activities (**not including tree removal/ trimming or bridge/structure work**) that will increase noise levels above existing traffic/ background levels?

    Yes

30. Will the activities that use percussives (**not including tree removal/trimming or bridge/ structure work**) and/or increase noise levels above existing traffic/background levels be conducted *during* the active season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

31. Will *any* activities that use percussives (**not including tree removal/trimming or bridge/ structure work**) and/or increase noise levels above existing traffic/background levels be conducted *during* the inactive season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

32. Are *all* project activities that are **not associated with** habitat removal, tree removal/ trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives, limited to actions that DO NOT cause any additional stressors to the bat species?

    Examples: lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.

    Yes

33. Will the project raise the road profile **above the tree canopy**?

    No

34. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, and conducted during the active season within undocumented habitat.

35. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) and/or increase noise levels above existing traffic/background levels consistent with a No Effect determination in this key?

    Automatically answered
    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, and conducted during the inactive season

36. Is the location of this project consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because no bats were detected during presence/probable absence surveys conducted during the summer survey season and outside of the fall swarming/spring emergence periods. Additionally, all activities were at least 0.5 miles from any hibernaculum.

37. **General AMM 1**
    Will the project ensure *all* operators, employees, and contractors working in areas of known or presumed bat habitat are aware of *all* FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable Avoidance and Minimization Measures?

    Yes

PROJECT QUESTIONNAIRE

1. Have you made a No Effect determination for *all* other species indicated on the FWS IPaC generated species list?

   N/A

2. Have you made a May Affect determination for *any* other species on the FWS IPaC generated species list?

   N/A

3. How many acres[1] of trees are proposed for removal between 0-100 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   4.5

AVOIDANCE AND MINIMIZATION MEASURES (AMMS)

This determination key result includes the committment to implement the following Avoidance and Minimization Measures (AMMs):

GENERAL AMM 1

Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

DETERMINATION KEY DESCRIPTION: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

This key was last updated in IPaC on July 27, 2023. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which may require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the endangered **northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

IPAC USER CONTACT INFORMATION

Agency: Massachusetts Department of Transportation
Name: Trevor Burns
Address: 10 Park Plaza
City: Boston
State: MA
Zip: 02116
Email trevor.b.burns@dot.state.ma.us
Phone: 8574885122

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

DOCUMENT A00856

NORTHERN LONG-EARED BAT PRESENCE/ABSENCE SURVEY

THIS PAGE INTENTIONALLY LEFT BLANK

Stantec Consulting Services Inc.
5 Dartmouth Drive Suite 200, Auburn NH 03032-3984

October 11, 2022

Attention: Tim Dexter
Fish & Wildlife Program Coordinator
Massachusetts Department of Transportation – Highway Division
Ten Park Plaza, Room 4260
Boston, MA 02116-3973

Dear Tim,

Project	Northern Long-eared Bat (NLEB) Presence/Absence Survey
MassDOT Project #	608163
Town	Wales, Massachusetts
Surveyor Name/Firm	Stantec Consulting Services Inc.
Detector Operation Dates	July 22–25, 2022
Survey Results	**NLEB DETECTED BUT NOT CONFIRMED**

The attached report contains the results of the Massachusetts Department of Transportation northern long-eared bat (*Myotis septentrionalis*; NLEB) summer presence/absence survey performed for proposed reconstruction and improvements on Monson Road (MassDOT # 608163) in Wales, Massachusetts. Acoustic detectors deployed by Stantec Consulting Services Inc. recorded one or more files identified as NLEB. Automated U.S. Fish and Wildlife Service-approved software (Kaleidoscope Pro version 5.4.7 [KPro]) identified one NLEB pass but did not indicate presence based on nightly maximum likelihood estimate scores. Presence of NLEB was not confirmed based on our qualitative assessment. Seventy-three individual bat passes were autoclassified by KPro as the state-endangered little brown bat (*Myotis lucifugus*), and presence of this species was confirmed during visual vetting. Ten passes were autoclassified as the state-endangered tricolored bat (*Perimyotis subflavus*), and three passes were autoclassified as the state-endangered eastern small-footed bat (*Myotis leibii*), though presence of both species was not confirmed during visual vetting. The required USFWS Region 5 Bat Reporting Form and 2022_MassDOT_Batsurvey_Stantec shapefile will be provided to you under separate cover.

Regards,

Stantec Consulting Services Inc.

Alex Pries
Project Manager
Phone: (603) 260-7434
Fax: (207) 729-2715
Alex.Pries@stantec.com

Attachment: NLEB Survey Report for Wales 1, 608163

Design with community in mind

Stantec

Memo

To:	Tim Dexter, Fish and Wildlife Program Coordinator Massachusetts Department of Transportation	From:	Alex Pries Auburn, New Hampshire Office
File:	179410726	Date:	October 11, 2022

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

INTRODUCTION

The Massachusetts Department of Transportation (MassDOT) retained Stantec Consulting Services Inc. (Stantec) to conduct an acoustic survey for the presence or probable absence of populations of the federally threatened and state-listed endangered northern long-eared bat (*Myotis septentrionalis*; NLEB) for proposed reconstruction and improvements on Monson Road in Wales, Massachusetts (Project). The Project includes potential tree clearing along 1.89 kilometers (km) of forested habitat (Figure 1). The purpose of the survey was to determine if this species was using these forested areas at the Project during the 2022 summer maternity season. The survey was conducted according to methods outlined in the U.S. Fish and Wildlife Service's (USFWS) March 2022 *Range-wide Indiana Bat and Northern Long-eared Bat Summer Survey Guidelines* (USFWS Guidelines).[1] Stantec provided a Study Plan (Appendix A) for this acoustic survey to MassDOT on June 22, 2022, and USFWS on June 27, 2022, based on USFWS Guidelines. After USFWS indicated on July 11, 2022, that review of the Study Plan would be delayed, MassDOT approved commencement of field surveys on July 12, 2022, and Stantec conducted surveys on July 22–25. The USFWS Guidelines identified a survey window of May 15 to August 15 for acoustic surveys. This memorandum summarizes methods and results of the acoustic bat survey for the Project.

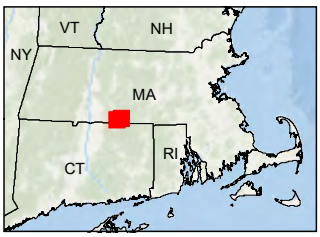
METHODS

FIELD SURVEY

Surveys were conducted according to the methods outlined in the Study Plan (Appendix A). The USFWS Guidelines specify survey effort for acoustic surveys based either on an area method or a linear method. Stantec determined that the linear method was appropriate for this Project given the linear nature of potential tree clearing limits. Per survey efforts outlined in the USFWS Guidelines: Phase 2 Acoustic Surveys for linear projects, at least four detector-nights per km of suitable summer habitat were required for the Project. For the purposes of this survey, we have conservatively assumed that all forested areas immediately adjacent to the Project provide potential roost habitat for NLEB (e.g., suitable summer habitat) and may potentially be cleared during project construction. Accordingly, Stantec conducted eight detector-nights (two detectors deployed for four nights each) of acoustic surveys as outlined in the Study Plan.

Stantec identified two survey locations based on review of aerial imagery during desktop analysis, taking into consideration land permission access to the MassDOT right-of-way associated with the Project. Stantec biologists determined detector placement in the field according to USFWS Guidelines, positioning the detectors in locations that could be suitable as potential NLEB foraging habitat and appropriate for recording search-phase bat echolocations appropriate for identification. The detector locations were positioned along forested edges next to open fields (Figure 1). We recorded the locations of the survey sites and habitat information using the Survey123 mobile app on an iPhone and photographed the sites (Appendix B).

[1] https://www.fws.gov/library/collections/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines



Legend

- Acoustic Survey Location
- Project Area

0 1,500 Feet

(At original document size of 8.5x11)
1:18,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Wales, Massachusetts

Prepared by MM on 2022-08-22
TR by KWH on 2022-08-22
IR Review by LJ on 2022-08-22

Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
1

Title
Northern Long-eared Bat Acoustic Survey Location – Wales 1

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-08-19 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Stantec used two full-spectrum acoustic bat detectors (Wildlife Acoustics© Song Meter Mini Bat) for the survey, inspecting the detectors and ensuring the built-in omnidirectional microphones met manufacturer calibration standards before deployment. The microphones were tested again in the field with the use of ultrasonic noise and inspection of proper microphone response. Each detector was deployed in an area with minimal vegetation within 10 meters (m) and at least 3 m away from obstructions in any direction. Detectors were placed at least 200 m apart from one another. Each detector was mounted approximately 3 m above ground level and oriented horizontally to the ground to sample an optimal volume of air space in accordance with the USFWS Guidelines. The audio and data storage settings on each detector were set according to defaults recommended by the manufacturer (e.g., detectors will operate in "triggered.wav" mode using default trigger threshold settings). Each detector was set to record from 30 minutes before sunset until 30 minutes after sunrise and was powered with alkaline batteries.

DATA ANALYSIS

Although acoustic surveys focused on detecting NLEB, bat detectors are designed to detect all bats vocalizing in the vicinity of the detectors. Therefore, additional listed bat species can be detected, including eastern small-footed bat *(Myotis leibii*; state-listed endangered), little brown bat (*Myotis lucifugus*; state-listed endangered), and tricolored bat (*Perimyotis subflavus*; state-listed endangered). Though the federally endangered Indiana bat (*Myotis sodalis*) is listed as endangered in Massachusetts, the state occurs outside the known range of this species and Stantec does not believe that this species occurs at the Project. Therefore, Indiana bat was not included in acoustic analysis.

Stantec performed an initial coarse visual analysis of data to confirm that high frequency bats were recorded. Data were then analyzed using Kaleidoscope Pro Software version 5.4.7 (KPro; classifier version 5.4.0), using a "-1" sensitivity setting and selecting the appropriate species list for the Massachusetts region (excluding Indiana bat). This analysis method has been approved by the USFWS as suitable for analyzing full-spectrum bat data collected by Song Meter units.

KPro analyzes each acoustic file and assigns it a bat species identification if the program determines it contains a bat call (pass) opposed to acoustic static. KPro also assigns a maximum likelihood estimate (MLE) to each species identified, at each detector site, for each night surveyed. According to the USFWS Guidelines, presence or probable absence of NLEB is based on the species' MLE generated by KPro for each detector site for each night surveyed. An MLE of less than 0.05 indicates probable presence and an MLE greater than 0.05 indicates probable absence of that species at that detector site for that night.

Stantec visually vetted all files recorded on nights with probable NLEB presence (MLE of less than 0.05) to evaluate the plausibility of NLEB presence on those nights. We also reviewed all high frequency files identified as any state-listed bat species by the program to evaluate the plausibility of additional bat species of interest.

RESULTS

HABITAT SURVEY

The Project area includes a rural road traversing forested habitat and rural residential land. The Project area also includes large open fields and a man-made pond (Figure 1). The forested habitat consists of mixed forest dominated by red oak (*Quercus rubra*), white birch (*Betula papyrifera*), eastern white pine (*Pinus strobus*), and red maple (*Acer rubrum*), with minimal canopy closure. Many potential bat flight and foraging corridors and potential roost habitat exist within the site and the surrounding area.

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

FIELD SURVEY

Stantec deployed acoustic detectors on July 22, 2022, and surveys took place during the nights of July 22–25. Stantec monitored weather conditions at weather station KMAWALES8 (Weather Underground, located approximately 1.2 miles northeast of the Project) after each night and confirmed that weather met the following parameters outlined in the USFWS Guidelines during the first 5 hours surveyed after sunset:

- Temperatures exceeded 50°F
- No precipitation or fog for 30 minutes or more
- Sustained wind speeds did not exceed 9 miles/hour for 30 minutes or more

The detectors were inspected in the field on July 26, 2022, to confirm proper operation during four nights of deployment. The detectors operated successfully during all nights of survey and were retrieved.

ACOUSTIC ANALYSIS

Coarse visual analysis confirmed presence of high-frequency bat passes at the site. We analyzed only the data from the first four nights of survey that met weather conditions, meeting the minimal level of survey effort according to the USFWS Guidelines. Analysis with KPro software identified one pass at WA1-1 as NLEB but did not indicate presence of NLEB based on nightly MLE scores. Visual QA/QC, performed by Laura Berube and Caroline Byrne (see resumes in Appendix C), indicated no presence of NLEB; instead, this pass was determined to be static (Table 1).

KPro identified 73 other passes as state-endangered little brown bat but did not indicate presence for the species based on nightly MLE scores. Visual QA/QC determined presence of this species at both detector sites (Table 1).

KPro identified three passes as state-endangered eastern small-footed bat but did not indicate presence of the species based on nightly MLE scores. Visual QA/QC did not determine presence of this species at either detector site (Table 1).

KPro also identified 10 passes as state-endangered tricolored bat but did not indicate presence of the species based on nightly MLE scores. Visual QA/QC did not determine presence at either detector site (Table 1).

Additional species recorded at the Project included big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and eastern red bat (*Lasiurus borealis*). Overall, big brown bats accounted for most recorded bat activity, followed by silver-haired bats and then eastern red bats. Of the two detector sites, site WA1-2 had the most bat activity overall.

See Appendix D for examples of bat passes documented at the Project. Original full-spectrum and converted zero-crossing data files have been archived electronically and can be made available upon request. We have populated the USFWS Region 5 Bat Reporting Form and the 2022_MassDOT_Batsurvey_Stantec shapefile as electronic attachments.

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

Table 1. Acoustic analysis results for state- and/or federally listed bat species based on KPro software and visual QAQC for acoustic surveys for Reconstruction and Improvements on Monson Road, Wales, Massachusetts.

Species	Night	Detector Site		Visual QA/QC Notes
		KPro Analysis		
		# Passes (Nightly MLE Score)		
		WA1-1	WA1-2	
northern long-eared bat	22-Jul	1 (1.00)	0 (1.00)	Presence not confirmed. Pass at WA-1 determined to be static based on visual QA/QC
	23-Jul	0 (1.00)	0 (1.00)	No passes/No presence
	24-Jul	0 (1.00)	0 (1.00)	No passes/No presence
	25-Jul	0 (1.00)	0 (1.00)	No passes/No presence
eastern small-footed bat	22-Jul	0 (1.00)	1 (0.42)	Presence not confirmed. Pass at WA1-2 determined to be unidentifiable fragment based on visual QA/QC
	23-Jul	0 (1.00)	1 (0.65)	Presence not confirmed. Pass at WA1-2 determined to be unidentifiable fragment based on visual QA/QC
	24-Jul	0 (1.00)	0 (1.00)	No passes/No presence
	25-Jul	1 (0.26)	0 (1.00)	Presence not confirmed. Pass at WA-1 determined to be eastern red bat based on visual QA/QC
little brown bat	22-Jul	10 (0.45)	13 (0.03)	Presence confirmed based on visual QA/QC
	23-Jul	9 (1.00)	15 (<0.01)	Presence confirmed based on visual QA/QC
	24-Jul	2 (1.00)	10 (1.00)	Presence confirmed based on visual QA/QC
	25-Jul	8 (1.00)	6 (0.87)	Presence confirmed based on visual QA/QC
tricolored bat	22-Jul	2 (1.00)	1 (1.00)	Presence not confirmed. Passes determined to be eastern red bat based on visual QA/QC
	23-Jul	1 (1.00)	1 (1.00)	Presence not confirmed. Passes determined to be eastern red bat based on visual QA/QC
	24-Jul	0 (1.00)	1 (1.00)	Presence not confirmed. Pass at WA1-2 determined to be eastern red bat based on visual QA/QC
	25-Jul	2 (1.00)	2 (1.00)	Presence not confirmed. Passes determined to be eastern red bat or fragments based on visual QA/QC

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

CONCLUSIONS

Acoustic surveys for the Project were conducted according to requirements outlined by the USFWS Guidelines and the approved Study Plan submitted to the USFWS and MassDOT prior to fieldwork. Although one file recorded during the survey was identified via automated analysis as NLEB, visual vetting did not confirm these identifications, indicating probable absence of maternity colonies of the species at the Project during the 2022 field season. Little brown bat presence was documented at the Project based on autoclassification, nightly MLE scores, and visual analysis. Tricolored bat and eastern small-footed bat were identified based on autoclassification, but not confirmed during visual vetting. Bat activity occurred at both surveyed sites, consisting primarily of big brown bats, silver-haired bats, and eastern red bats.

Stantec Consulting Services Inc.

Alex Pries
Project Manager
Phone: (603) 260-7434
Fax: (207) 729-2715
Alex.Pries@Stantec.com

Attachments:
APPENDIX A Study Plan
APPENDIX B Acoustic Detector Photographs
APPENDIX C Resumes of Laura Berube and Caroline Byrne
APPENDIX D Screenshots of Bat Passes

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

APPENDIX A Study Plan

2022 MassDOT Northern Long-Eared Bat Acoustic Surveys Study Plan

June 21, 2022

Prepared for:

Massachusetts Department of Transportation
10 Park Plaza, Room 4260
Boston, MA 02116

Prepared by:

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

Table of Contents

1.0 INTRODUCTION 1

2.0 SURVEY METHODS 3
2.1 DESKTOP ANALYSIS 3
2.2 FIELD SURVEYS 3
2.2.1 Acoustic Surveys 3
2.2.2 Bridge Assessments 6

3.0 ANALYSIS 6

4.0 REPORTING 7

LIST OF APPENDICES

APPENDIX A PROPOSED SURVEY LOCATION MAPS A.1

APPENDIX B STANTEC NLEB BAT PRESENCE/ABSENCE ACOUSTIC SURVEY DATASHEET AND USFWS PHASE 1 SUMMER HABITAT ASSESSMENTS DATASHEET B.1

APPENDIX C BRIDGE/STRUCTURE BAT ASSESSMENT FORM C.1

APPENDIX D RESUME OF BIOLOGIST TO PERFORM MANUAL VETTING OF RARE SPECIES CALLS D.1

2022 TRANSPORTATION PROJECTS – NORTHERN LONG-EARED BAT ACOUSTIC SURVEY STUDY PLAN

June 21, 2022

1.0 INTRODUCTION

The Massachusetts Department of Transportation (MassDOT) has retained Stantec Consulting Services Inc. (Stantec) to conduct acoustic surveys for the presence of northern long-eared bats (*Myotis septentrionalis;* NLEB) along the following 20 linear transportation improvement projects requiring tree clearing:

- Orange, MA: Reconstruction of North Main Street, from School Street to Lincoln Avenue, includes relocation of Fall Hill Brook culvert (MassDot Project #603371)
- West Brookfield, MA: Resurfacing and related work on Route 9, from Ware T.L. to 850 feet west of Welcome Road (MassDot Project #606517)
- Wales, MA (1): Reconstruction and improvements on Monson Road, from the Monson T.L. to Reed Hill Road (MassDot Project #608163)
- Wales, MA (2): Bridge replacement, W-02-002, Holland Road over Wales Brook (MassDot Project #608847)
- Hampden, MA: Bridge replacement, H-04-004, Rockadundee Bridge over Scantic River (MassDot Project #610779)
- Monson, MA: Bridge replacement, M-27-015, Old Wales Road over Conant Brook (MassDot Project #608846)
- Leverett, MA: Bridge replacement, L-09-003, Millers Road over Roaring Brook (MassDot Project #608849)
- Ludlow, MA: Bridge replacement, L-16-026, Piney Lane over Broad Brook (MassDot Project #609120)
- Hubbardston, MA: Bridge replacement, H-24-003, Williamsville Road over the Burnshirt River (MassDot Project #609187)
- Longmeadow, MA: Blueberry Hill Elementary School improvements (SRTS) (MassDot Project #609517)
- Andover, MA: Bridge rehabilitation – A-09-036, I-495 over 28 (SB); A-09-037, I-495 over B&M and MBTA; A-09-041, I-495 over 28 (NB) (MassDot Project #606522)
- Hamilton-Ipswich, MA: Superstructure replacement, H-03-002, I-01-006, Winthrop Street over Ipswich River (MassDot Project #609467)
- Wellfleet, MA: Intersection improvements and related work at Route 6 and Main Street (MassDot Project #607397)
- Cohasset, MA: Corridor improvements and related work on Justice Cushing Highway (Route 3a) from Beechwood Street to Henry Turner Bailey Road (MassDot Project #608007)

- North Andover, MA: Corridor improvements on Route 114 between Waverly Road & Willow/Mill Street (MassDot Project #608095)
- Beverly, MA: Reconstruction of Bridge Street (MassDot Project #608348)
- Middleton, MA: Bridge replacement, M-20-003, Route 62 (Maple Street) over Ipswich River (MassDot Project #608522)
- Provincetown, MA: Corridor improvements and related work on Shank Painter Road, from Route 6 to Bradford Street (MassDot Project #608744)
- Lawrence, MA: Lawrence Manchester Rail Corridor (LMRC) rail trail (MassDot Project #608930)
- Peabody, MA: Independence Greenway extension (MassDot Project #609211)

This study plan describes the proposed methods and level of effort for the acoustic survey to be conducted at each of the 20 project areas to determine the presence or probable absence of breeding populations of NLEB at each area using the methods described in the U.S. Fish and Wildlife Service's (USFWS) *March 2022 Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines* (USFWS Guidelines).[1] Although acoustic surveys will focus on detecting NLEB, bat detectors are designed to detect all bats vocalizing in the vicinity of the detectors. Therefore, additional listed bat species may be detected during surveys, including eastern small-footed bat (*Myotis leibii*; state-listed endangered), little brown bat (*M. lucifugus*; state-listed endangered), and tricolored bat (*Perimyotis subflavus*; state-listed endangered). Though the federally endangered Indiana bat (*Myotis sodalis*) is also listed as state-endangered in Massachusetts, the state occurs outside the known range of this species. Therefore, Stantec does not believe that this species occurs within the project areas and Indiana bat will not be included in acoustic analysis at these projects. The goal of the study is to assess if NLEB are utilizing potential habitat along each project location during the 2022 summer maternity season.

In addition to acoustic surveys, MassDOT has requested Stantec conduct bridge assessments for all projects involving bridge work, including bridge replacement, rehabilitation, and preservation. For bridge projects that do not require tree clearing (i.e., preservation projects), Stantec will conduct bridge assessments only, and no acoustic surveys. Bridge projects that meet this criteria include the following:

- Oxford, MA: Structural steel cleaning, painting, and various repairs of overhead bridges on I-395: O-06-033, O-06-034, O-06-035, and O-06-040
- Tewksbury, MA: Bridge preservation of T-03-014, I-495 over Route 133, and T-03-015, I-495 over route 38

[1] United States Fish and Wildlife Service (USFWS). 2022. Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines. March 2020.

2.0 SURVEY METHODS

2.1 DESKTOP ANALYSIS

Stantec conducted a desktop review of each project area to estimate the need and level of effort for acoustic surveys and/or bridge assessments. As outlined in the USFWS Guidelines, bridges and other human-made structures can provide artificial roosting habitat for NLEB, although acoustic detectors are to be placed at least 15 meters (m) from bridges when conducting acoustic presence/absence surveys. The USFWS Guidelines also indicate that projects less than 1 kilometer (km) in length should be considered non-linear, which would require 14 detector-nights and at least 2 survey sites no less than 200 m apart. Based on recent correspondence between MassDOT and the USFWS,[2] Stantec will include portions of the linear road corridors on either side of the bridges to be assessed (up to 1 km survey envelope total) in our survey to categorize the projects as linear and to allow for greater flexibility in acoustic detector placement. Stantec will consider all projects as linear projects and will allocate 4 detector-nights of survey per km per USFWS Guidelines. Figures for these project locations and proposed detector placements are included in Appendix A.

2.2 FIELD SURVEYS

2.2.1 Acoustic Surveys

Stantec will conduct the acoustic surveys at each study area within the USFWS approved survey dates (15 May–15 August) in 2022. Per the minimum survey efforts outlined in the USFWS Guidelines: Phase 2 Acoustic Surveys for linear projects, 4 detector-nights per km of suitable summer habitat that may be impacted are required for each study area. Finally, for the purposes of this study plan, Stantec has conservatively assumed that non-excluded forested areas immediately adjacent to each linear area provide potential roost habitat for NLEB (suitable summer habitat) and may potentially be cleared during project construction. Therefore, Stantec has determined the following level of effort for each project based on the amount of linear tree clearing.

Central Massachusetts Sites (Group 1):

- Orange, MA: (0.795 km of potential tree clearing), 4 detector-nights (1 detector deployed for 4 nights)
- West Brookfield, MA: (2.89 km [round up to 3.0 km] of potential tree clearing), 12 detector-nights (3 detectors deployed for 4 nights each)
- Oxford, MA: (no potential tree clearing, work at four bridges), bridge assessments only
- Wales, MA (1): (1.89 km [round up to 2.0 km] of potential tree clearing), 8 detector-nights (2 detectors deployed for 4 nights each)

[2] MassDOT Technical Memorandum to Susi Van Oettingen, USFWS. Re: NLEB Survey Protocol for Small Projects and Bridges. June 6, 2022. 2pp.

- Wales, MA (2): (0.212 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Hampden, MA: (0.122 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Monson, MA: (0.143 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Leverett, MA: (0.05 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Ludlow, MA: (0.137 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Hubbardston, MA: (0.195 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Longmeadow, MA: (0.673 km of potential tree clearing), 4 detector-nights (1 detector deployed for 4 nights)

Eastern Massachusetts Sites (Group 2):

- Tewksbury, MA: (no potential tree clearing, work at two bridges), bridge assessments only
- Andover, MA: (0.792 km of potential tree clearing), 4 detector-nights (1 detector deployed for 4 nights)
- Hamilton-Ipswich, MA: (0.145 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Wellfleet, MA: (1.02 km of potential tree-clearing), 4 detector-nights (1 detector deployed for 4 nights)
- Cohasset, MA: (1.54 km [round up to 2.0 km] of potential tree-clearing), 8 detector-nights (2 detectors deployed for 4 nights each)
- North Andover, MA: (3.64 km [round up to 4.0 km] of potential tree-clearing), 16 detector-nights (4 detectors deployed for 4 nights each)
- Beverly, MA: (2.05 km [round down to 0.13 km] of potential tree clearing), 4 detector-nights (1 detector deployed for 4 nights)
- Middleton, MA: (0.102 km of potential tree clearing, expanded project to 1 km survey envelope), 4 detector-nights (1 detector deployed for 4 nights)
- Provincetown, MA: (2.32 km [round down to 2.0 km] of potential tree clearing), 8 detector-nights (2 detectors deployed for 4 nights each)
- Lawrence, MA: (2.59 km [round down to 2.0 km] of potential tree clearing), 8 detector-nights (2 detectors deployed for 4 nights each)
- Peabody, MA: (1.83 km [round up to 2.0 km] of potential tree clearing), 8 detector-nights (2 detectors deployed for 4 nights each)

Based on this proposed level of effort, Stantec will deploy a total of 13 detectors (52 detector-nights) at Central Massachusetts sites and 17 detectors (68 detector-nights) at Eastern Massachusetts sites. Biologists will complete initial deployment in 2 days per site group (Days 1 and 2). Biologists will then retrieve all detectors over the course of 2 days per site group (Days 5 and 6) upon meeting the USFWS-required number of detector-nights under suitable weather conditions. This strategy of detector mobilization and demobilization assumes that nightly weather conditions remain appropriate during each night of survey according to USFWS Guidelines. If weather conditions do not meet USFWS Guidelines (e.g., 30 or more minutes of rain, excessive wind, and/or cold temperatures), additional day(s) will be required.

Stantec will use full-spectrum (e.g., Wildlife Acoustics© SM4BAT-FS) acoustic bat detectors for the surveys. Each detector will be fitted with an SMM-U1 or SMM-U2 ultrasonic omnidirectional microphone. Stantec will deploy detectors according to the criteria in the USFWS Guidelines, positioning detectors in potential flight corridors that could provide suitable NLEB foraging habitat. As USFWS Guidelines recommend, microphones will be deployed in areas without vegetation or with minimal vegetation within 10 m of the microphone, obstructions will be located at least 3 m away from microphones in any direction, and detectors will be placed at least 200 m apart.

Based on review of aerial imagery during the initial desktop analysis and assuming access to the right-of-way (ROW) associated with each area, Stantec has identified proposed detector locations for each project (Appendix A; Figures 1–22). The proposed locations along the edge of the ROW and adjacent to tree clearing areas are spread out across each area to target either large segments of forest or forested areas near a wetland, field, or bridge. Final detector deployment will be determined by the biologist in the field and is also subject to landowner permission and access. In areas without landowner permission or suitable access, final detector placement will be in the closest appropriate location within a town, municipal, or state ROW depending on the project. Final detector locations will also be based on a field assessment, following criteria in the USFWS Guidelines. Stantec will record coordinates of the final detector locations using a GPS unit, document the approximate accuracy of the location, and photograph each detector to show scale (e.g., include a vehicle or person in the photo) and the surrounding habitat and the “detector-view." For each detector site, Stantec will document relevant deployment and habitat information on a Stantec field datasheet and on the USFWS Guidelines Appendix A Phase 1 Summer Habitat Assessments datasheet (Appendix B).

Stantec will mount each detector so that the microphone is approximately 3 m above ground level and oriented horizontally to the ground to sample an optimal volume of air space in accordance with the USFWS Guidelines. Stantec will set the audio and data storage settings on each detector according to defaults recommended by the manufacturer (e.g., detectors will operate in “triggered .wav” mode using default trigger threshold settings recommended by the manufacturer). Stantec will program each detector to record from 30 minutes before sunset until 30 minutes after sunrise and will power each detector with alkaline batteries.

Stantec will leave detectors in place at each survey site until at least 4 calendar nights have been successfully surveyed during weather conditions that meet the parameters outlined in the USFWS Guidelines:

- Temperatures remain above 50° F during the first 5 hours of each survey night;
- Precipitation/fog persists for no more than 30 minutes during the first 5 hours of each survey night; and
- Sustained wind speeds do not exceed 9 miles/hour for 30 minutes or more during the first 5 hours of each survey night.

Stantec will verify weather conditions by reviewing hourly data recorded at the nearest weather station to each detector site, accessed online via Weather Underground (www.wunderground.com). Stantec will record the weather station ID for each station used on the corresponding field datasheet. Following the first four weather-appropriate nights of data collection, Stantec will inspect each detector as soon as practicable in the field to confirm that each operated for 4 nights (i.e., check battery voltage, verify presence of recorded files, and view system status log files). Once confirmed, Stantec will remove the detectors from the field. Stantec will analyze only those data from the first 4 nights that meet the weather criteria.

2.2.2 Bridge Assessments

To determine if bat species are using bridges, bridge assessments will be conducted at each bridge following the guidance available in the User's Guide for the *Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat*, version 5.0. Biologists will document favorable characteristics of bridges that support bats, including cracks in concrete, expansion joints, dark cave-like environments, and presence of waterbodies. Surveys will also include visual assessments to determine the presence of flying or roosting bats, guano, and staining on concrete, and auditory assessments for high-pitched squeaking or chirping. Biologists will use a flashlight or headlamp and may use binoculars when viewing higher areas. If a bridge assessment is not feasible due to safety or access issues (e.g., due to bridge height, traffic volume, fencing, or other safety considerations), the viability of following the non-linear project survey effort for these projects (e.g., 2 detectors deployed for a combined 14 detector-nights) will be discussed with MassDOT. For each bridge location, biologists will complete the USFWS Bridge/Structure Bat Assessment Form (Appendix C).

3.0 ANALYSIS

Stantec bat biologists will perform a coarse visual analysis of the data to confirm that high frequency bat calls were recorded; if so, Stantec will then analyze data using Kaleidoscope Pro Software version 5.4.1 or newer (Kaleidoscope),[3] with classifier version 5.4.0 using a "0" sensitivity setting and by selecting for the Massachusetts region. This analysis method has been approved by the USFWS as suitable for analyzing full-spectrum bat data collected by SM4 units once the data have been converted to zero-

[3] https://www.wildlifeacoustics.com/release-notes/kaleidoscope-pro

crossing format. Stantec will base presence or probable absence of NLEB on the maximum likelihood estimate (MLE) generated by Kaleidoscope for each night. An MLE of less than 0.05 indicates probable presence and an MLE greater than 0.05 indicates probable absence. Original full-spectrum and converted zero-crossing data files will be archived electronically and made available upon request.

Stantec will manually inspect each file recorded for each detector site/night that Kaleidoscope calculates probable presence (an MLE of less than 0.05) for NLEB. Stantec will also visually inspect each high frequency call sequence recorded by detectors, thereby manually vetting all high frequency call identification determinations (or lack of identification) made by Kaleidoscope. Though acoustic surveys will primarily focus on detecting NLEB and other high frequency species, calls from all bat species will be analyzed by the software and manually inspected. Stantec biologists with relevant experience and training in acoustic bat identification will conduct the manual vetting. Credentials and experience of biologists performing the manual vetting will be indicated in the survey report and are included in Appendix D.

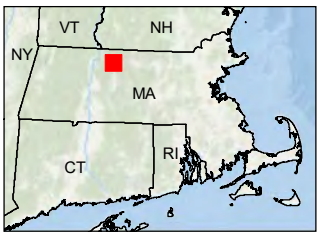
4.0 REPORTING

As requested by MassDOT, Stantec will prepare a single report for each project area describing the methods and results of the acoustic surveys as soon as possible after field work to ensure MassDOT meets their targeted transmittal to USFWS in late fall 2022. Each report will include completed Stantec and USFWS datasheets for the detector sites, maps showing the locations of each detector site, photos of the detector setups, screenshots of representative listed bat species' calls identified during analysis, tables summarizing the output from Kaleidoscope for all species identified, results of manual vetting, the resume of the biologist who conducted the manual vetting, the USFWS R5 Bat Reporting Form, and other information required by the USFWS Guidelines. Associated Geographic Information System (GIS) data, original acoustic data, status or log files, and software output will be retained and made available upon request. Stantec will also provide MassDOT with the results of the survey in excel format based on the 2022 MassDOT Bat Survey Consultant format. Additionally, Stantec will format acoustic data into a template suitable for inclusion into the North American Bat Monitoring Program database.

In addition, and as requested by MassDOT, Stantec will prepare a separate memo for each bridge site describing the methods and results of the bridge assessments as soon as possible after field work. Each memo will include maps showing the locations of the bridge sites, photos of the bridge characteristics and the completed USFWS Bridge/Structure Bat Assessment Form. As requested by MassDOT, memos will be submitted at least 15 days prior to the advertising date per project to allow for the minimal clearance time of 14 days. The memo for the Oxford project will be treated as higher priority because this project's advertising date has been moved up to July 9, 2022.

APPENDICES

APPENDIX A PROPOSED SURVEY LOCATION MAPS



Legend

- Proposed Acoustic Survey Location
- Project Area

0 420 Feet

(At original document size of 8.5x11)
1:5,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Orange, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

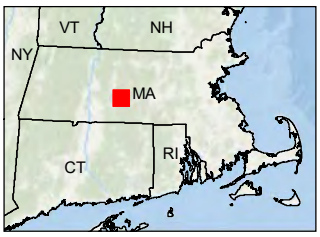
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
1

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Orange

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 1,500 Feet

(At original document size of 8.5x11)
1:18,000

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
West Brookfield, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

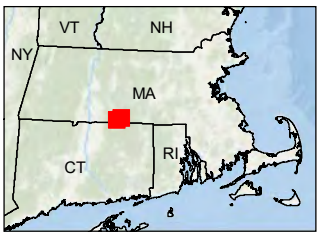
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
2

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – West Brookfield

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 1,500 Feet

(At original document size of 8.5x11)
1:18,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Wales, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

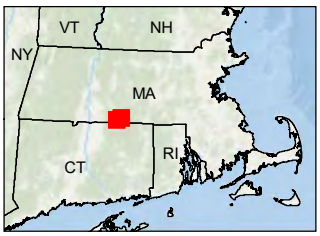
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
3

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Wales 1

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
Wales, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

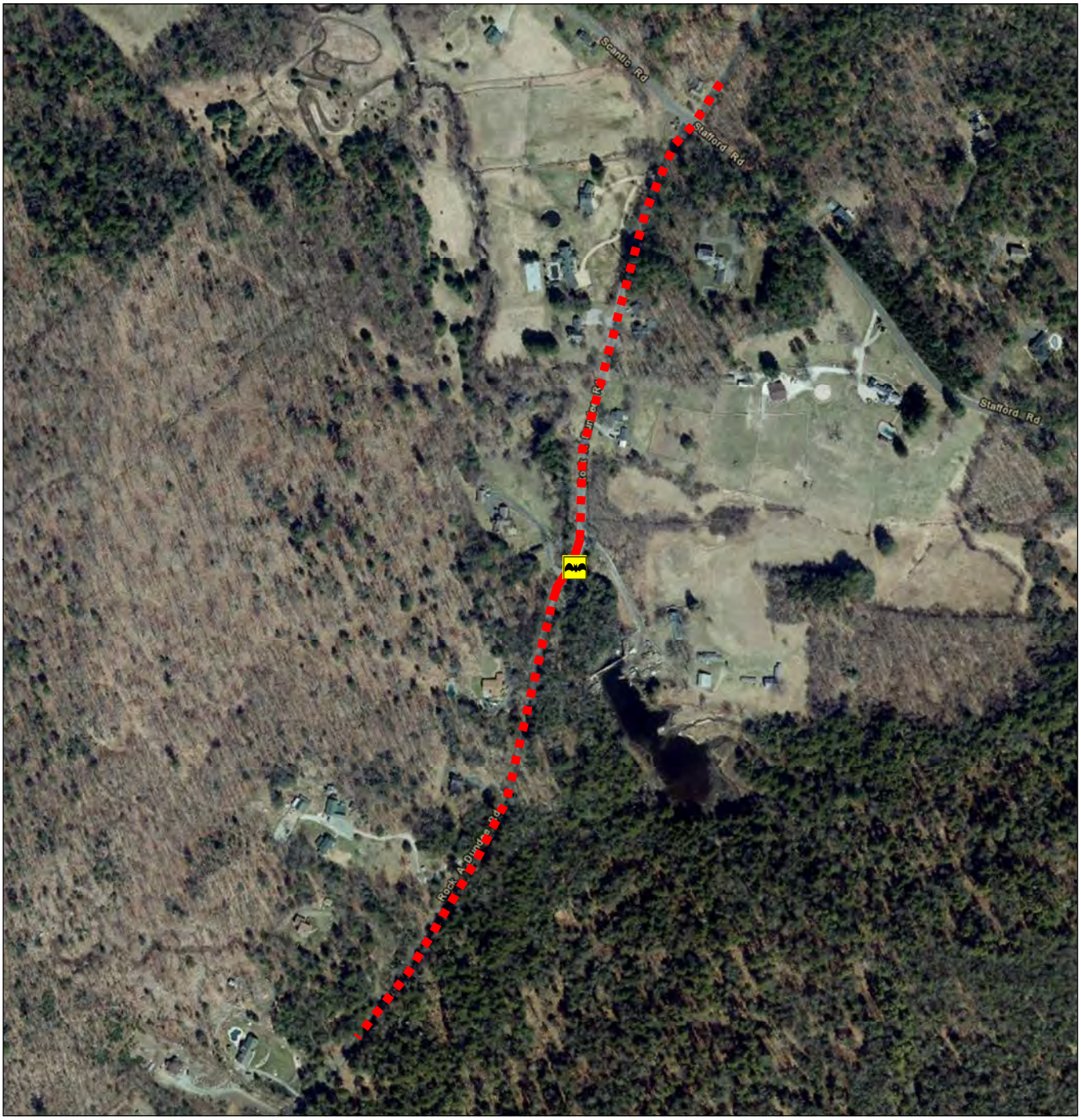
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

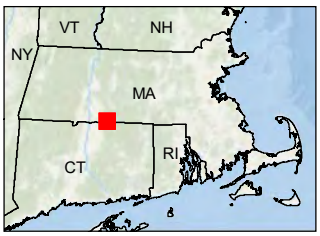
Figure No.
4

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Wales 2

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
Hampden, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

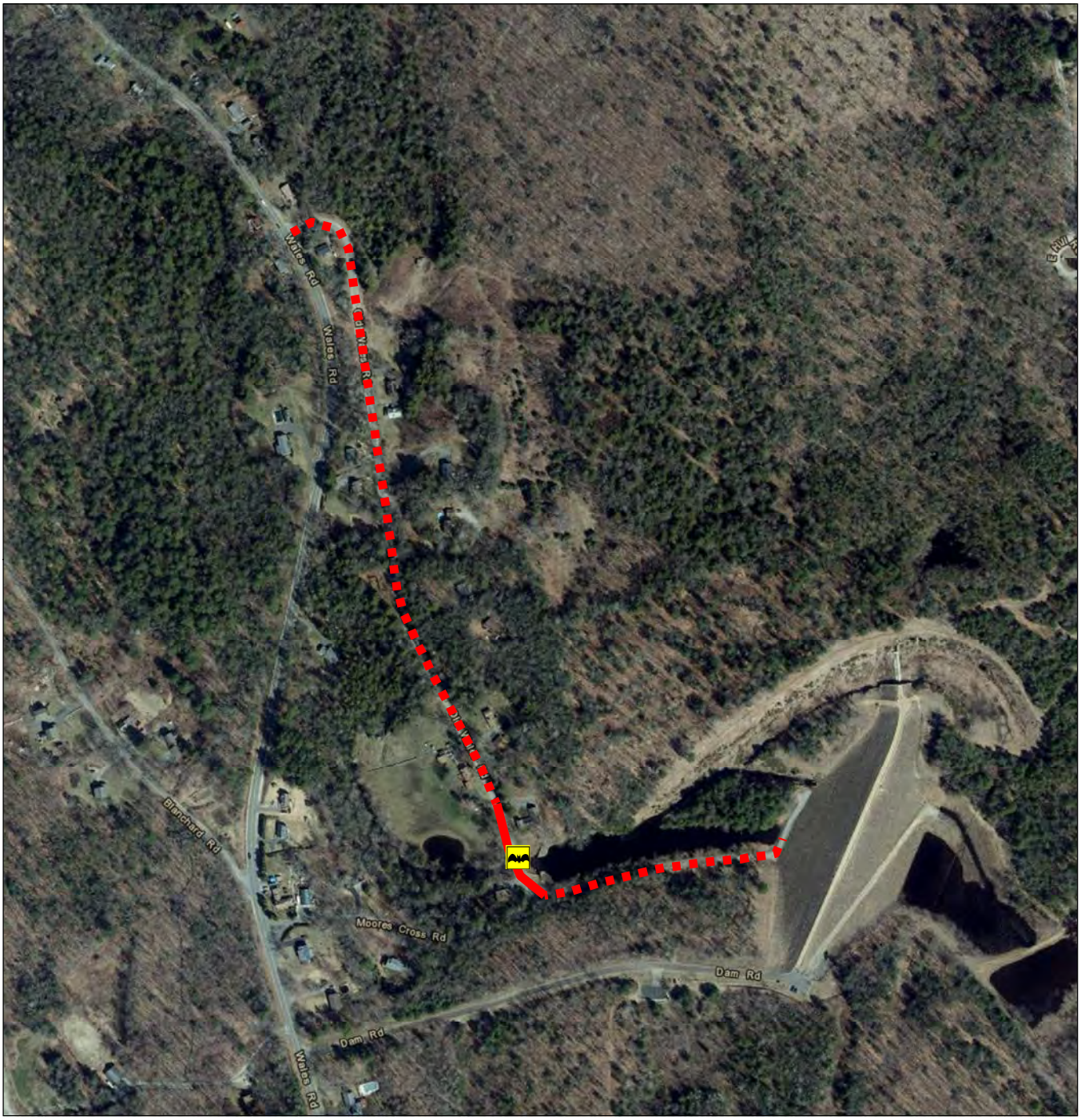
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

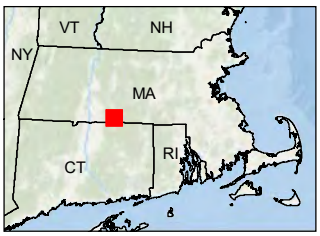
Figure No.
5

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Hampden

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
Monson, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

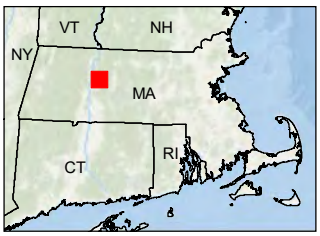
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
6

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Monson

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 300 Feet

(At original document size of 8.5x11)
1:3,600

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
Leverett, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

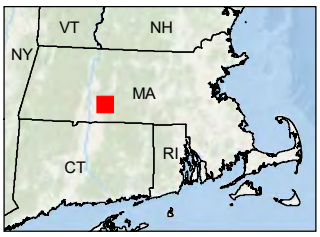
Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
7

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Leverett

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Stantec

Project Location
Ludlow, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

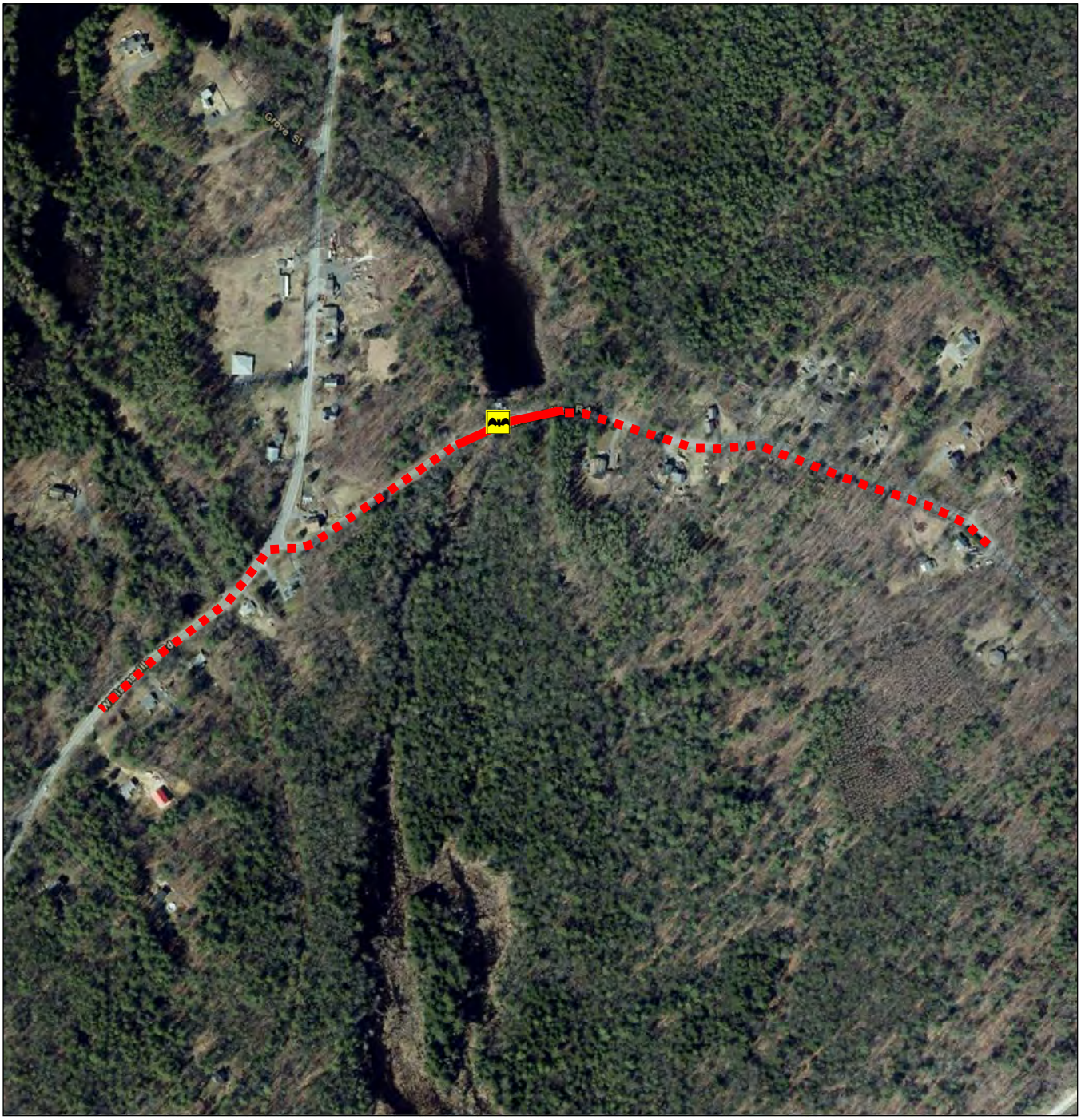
Figure No.
8

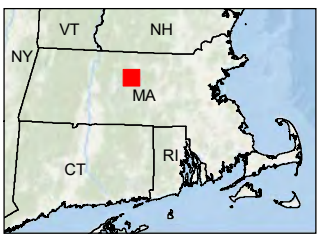
Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Ludlow

Notes
1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Stantec

Project Location
Hubbardston, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

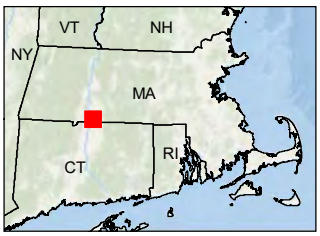
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
9

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Hubbardston

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 300 Feet

(At original document size of 8.5x11)
1:3,600

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Longmeadow, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

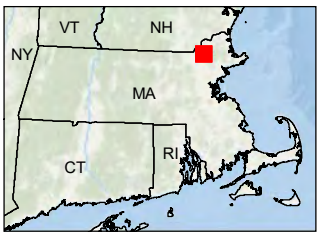
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
10

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Longmeadow

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 800 Feet

(At original document size of 8.5x11)
1:9,600

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Andover, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

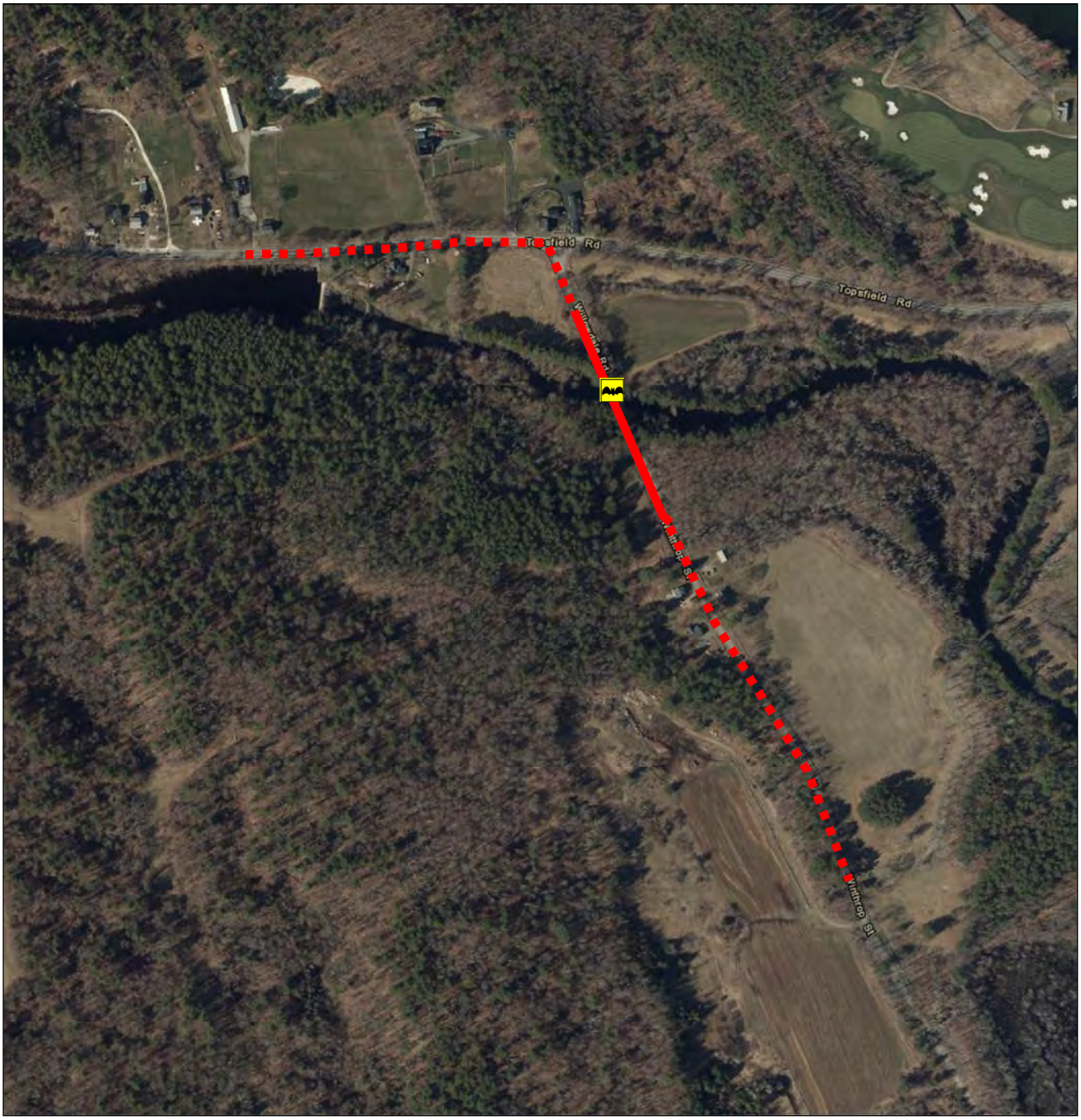
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

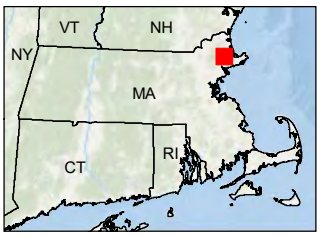
Figure No.
11

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Andover

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Hamilton-Ipswich, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

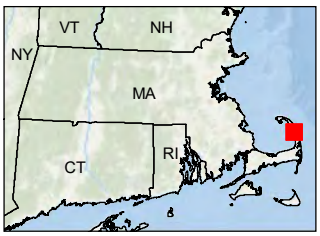
Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
12

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Hamilton-Ipswich

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 500 Feet

(At original document size of 8.5x11)
1:6,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Wellfleet, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

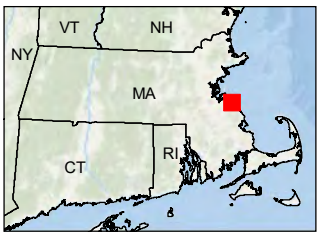
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
13

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Wellfleet

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 600 Feet

(At original document size of 8.5x11)
1:7,200

N

Stantec

Project Location
Cohasset, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

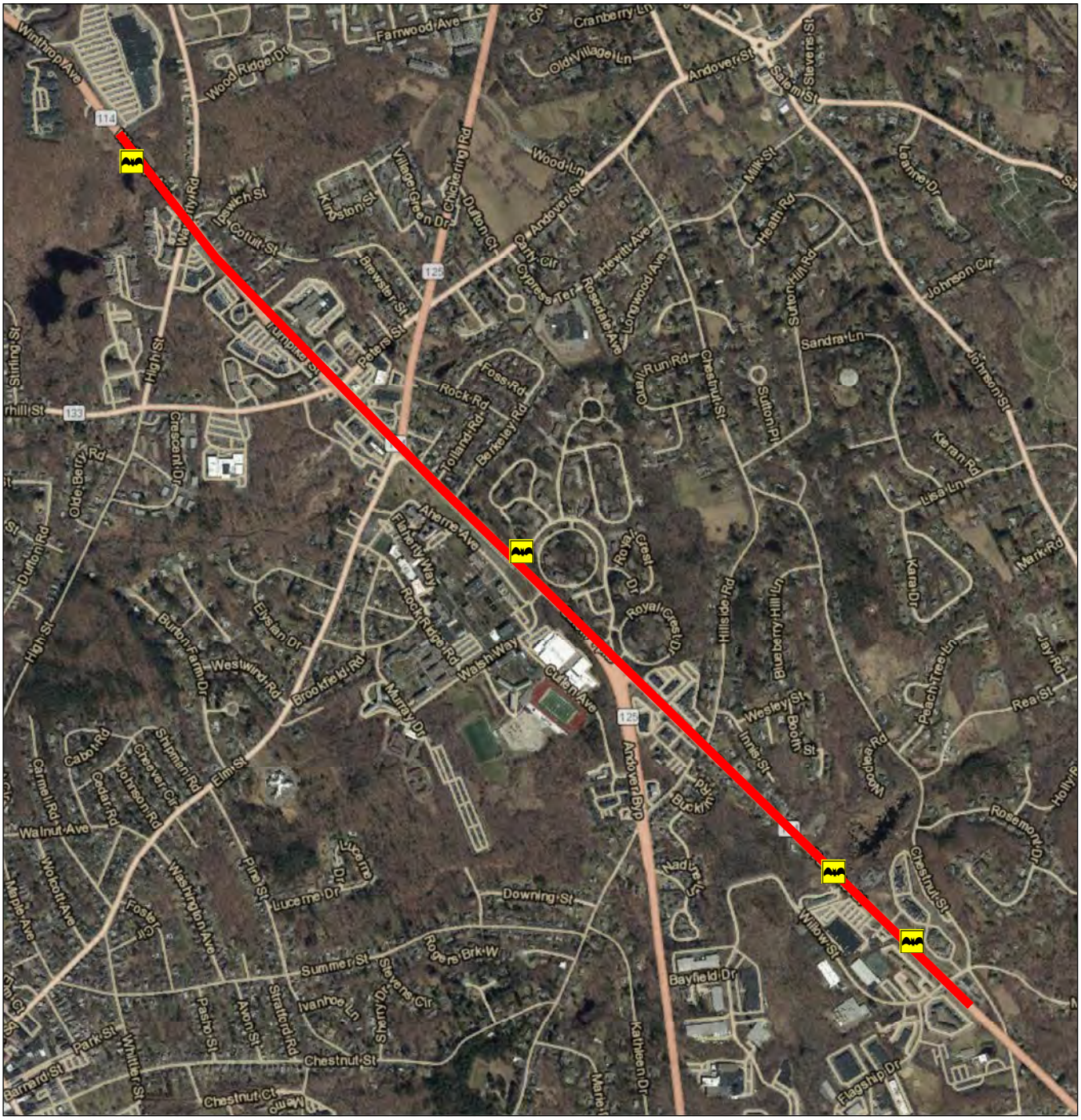
Figure No.
14

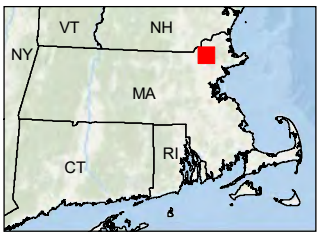
Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Cohasset

Notes
1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Legend

- Proposed Acoustic Survey Location
- Project Area

0 1,500 Feet

(At original document size of 8.5x11)
1:18,000

N

Stantec

Project Location
North Andover, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

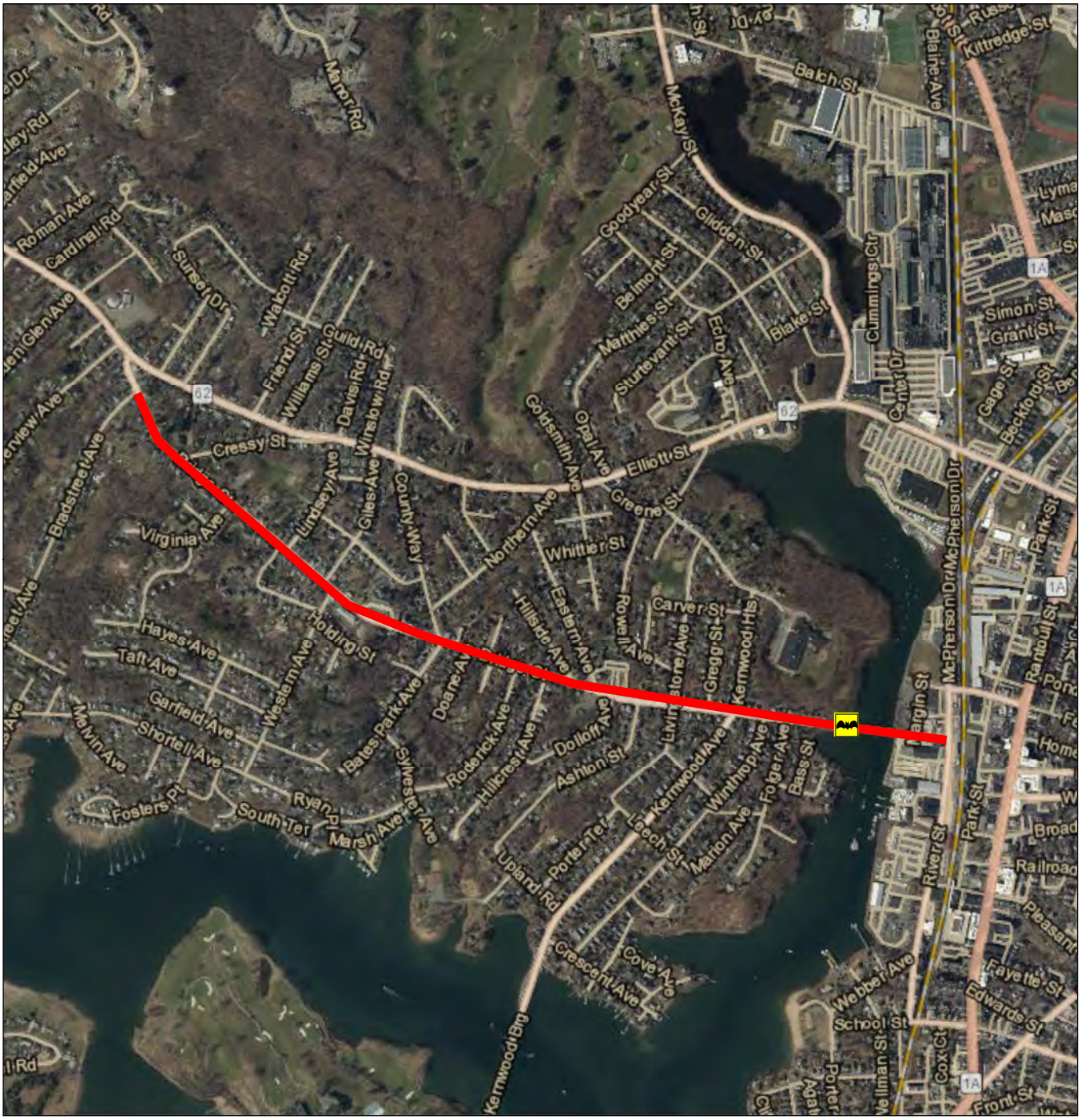
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

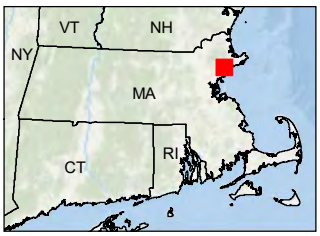
Figure No.
15

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – North Andover

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area

0 1,200 Feet

(At original document size of 8.5x11)
1:14,400

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Beverly, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

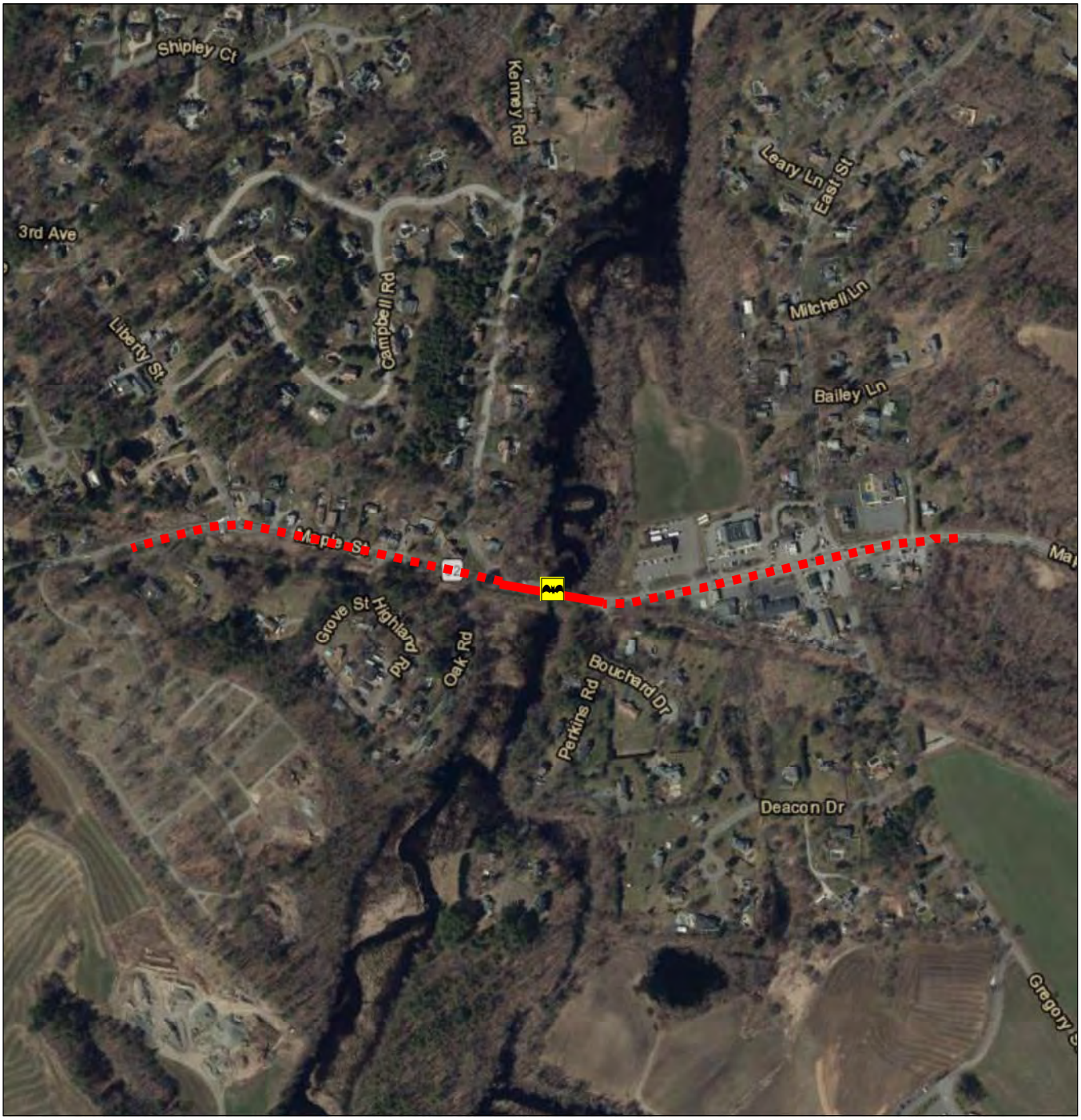
Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

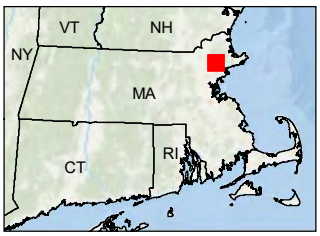
Figure No.
16

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Beverly

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area
- Expanded Project Area

0 600 Feet

(At original document size of 8.5x11)
1:7,200

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Middleton, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

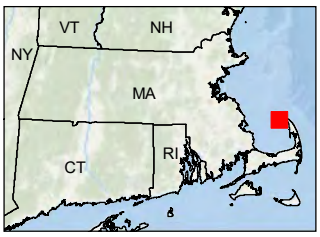
Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
17

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Middleton

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 1,000 Feet

(At original document size of 8.5x11)
1:12,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Provincetown, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

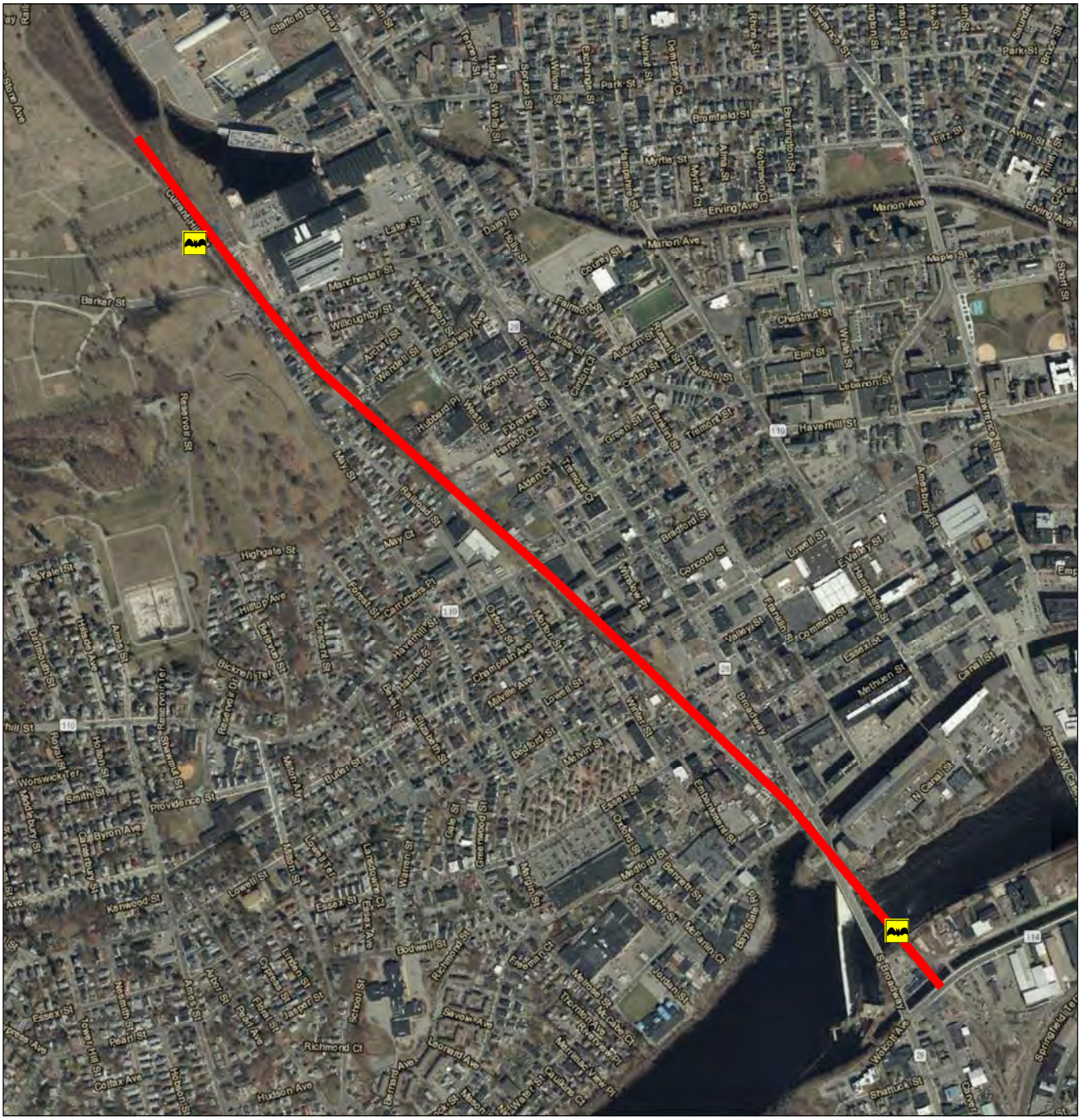
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

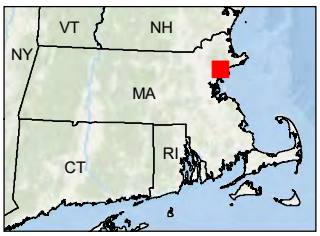
Figure No.
18

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Provincetown

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.


Cumard Hill
Barker St
Reservoir St
Manchester St
Willoughby St
Broadway
Haverhill St
Lowell St
Essex St
Canal St
Merrimack St
Bradford St
Concord St
Elm St
Chestnut St
Marion Ave
Lake St
Dalay St
Hubbard Pl
Highgate St
Yale St
Providence St
Smith St
Kenwood St
Richmond Ct
Hudson Ave
Shattuck St
Bodwell St
Lowell Tpke
Methuen St
Amesbury St
Lawrence St
Park St
Maple St
Myrtle St
Bromfield St
Fitz St
Avon St
Erving Ave
Tremont St
Green St
Franklin St
Auburn St
Cedar St
Chandon St
Lebanon St
Valley St
Common St
Essex St
Oxford St
Middle St
Garnaby St
Chandler St
McFarlin Ct
Jordan St
Freeman Ct
Richmond St
Bodwell St
Lindsay Rd
Cypress St
Linden St
Jasper St
Pearl St
Amos St
Abbot St
Tower Hill St
Collax Ave
Hobson St
Leonard Ave
Barnard Ave
Savoie Ave
Merrimack View Pl
Crowley Ct
Melrose St
Tremblay Ave
McCabe Ct
Watson Ave
Springfield Ter
Carver St
Auburn St
Russell St
Chandon St
Cedar St
Green St
Franklin St
Tremont St
Hamilton Ct
Aiden Ct
Tremont Ct
Bradford St
Concord St
Lowell St
Valley St
Common St
Essex St
Methuen St
Canal St
Broadway
Amesbury St
Lawrence St
Haverhill St
Elm St
Chestnut St
Marion Ave
Maple St
Park St
Bromfield St
Fitz St
Avon St
Erving Ave
Myrtle St
Lebanon St
Hampshire St
Exchange St
Willow St
Spruce St
Water St
Walnut St
Depot Ct
Terrace St
Stafford St
Storm Ave
Manchester St
Willoughby St
Washington St
Broadway
Archer St
Wendell St
Aston St
Hubbard Pl
West St
Florence St
Hanlon Ct
May St
Railroad St
May Ct
Highgate St
Yale St
Hillsop Ave
Forest St
Carruthers Pl
Crescent St
Haverhill St
Orchard St
Hampton Pl
Chaplain Ave
Melvin Ave
Lowell St
Bedford St
Melvin St
Winter St
Butler St
Millvin Ave
Providence St
Smith St
Wentworth Ter
Royal St
Hobart St
Reservoir Ter
Reservoir Dr
Bickness Ter
Crescent St
Dartmouth St
Hilsdale Ave
Amos St
Hillsop Ave
Forest St
Carruthers Pl
Haverhill St
Orchard St
Hampton Pl
Chaplain Ave
Melvin Ave
Lowell St
Broadway
Valley St
Common St
Essex St
Methuen St
Canal St
Oxford St
Middle St
Garnaby St
Chandler St
McFarlin Ct
Jordan St
Freeman Ct
Richmond St
Bodwell St
Lindsay Rd
Cypress St
Linden St
Jasper St
Pearl St
Amos St
Abbot St
Tower Hill St
Collax Ave
Hobson St
Leonard Ave
Barnard Ave
Savoie Ave
Merrimack View Pl
Crowley Ct
Melrose St
Tremblay Ave
McCabe Ct
Watson Ave
Springfield Ter
Carver St
Shattuck St
Hudson Ave
Richmond Ct
Kenwood St
Lowell St
Essex



Legend

- Proposed Acoustic Survey Location
- Project Area

0 600 Feet

(At original document size of 8.5x11)
1:7,200

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Peabody, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

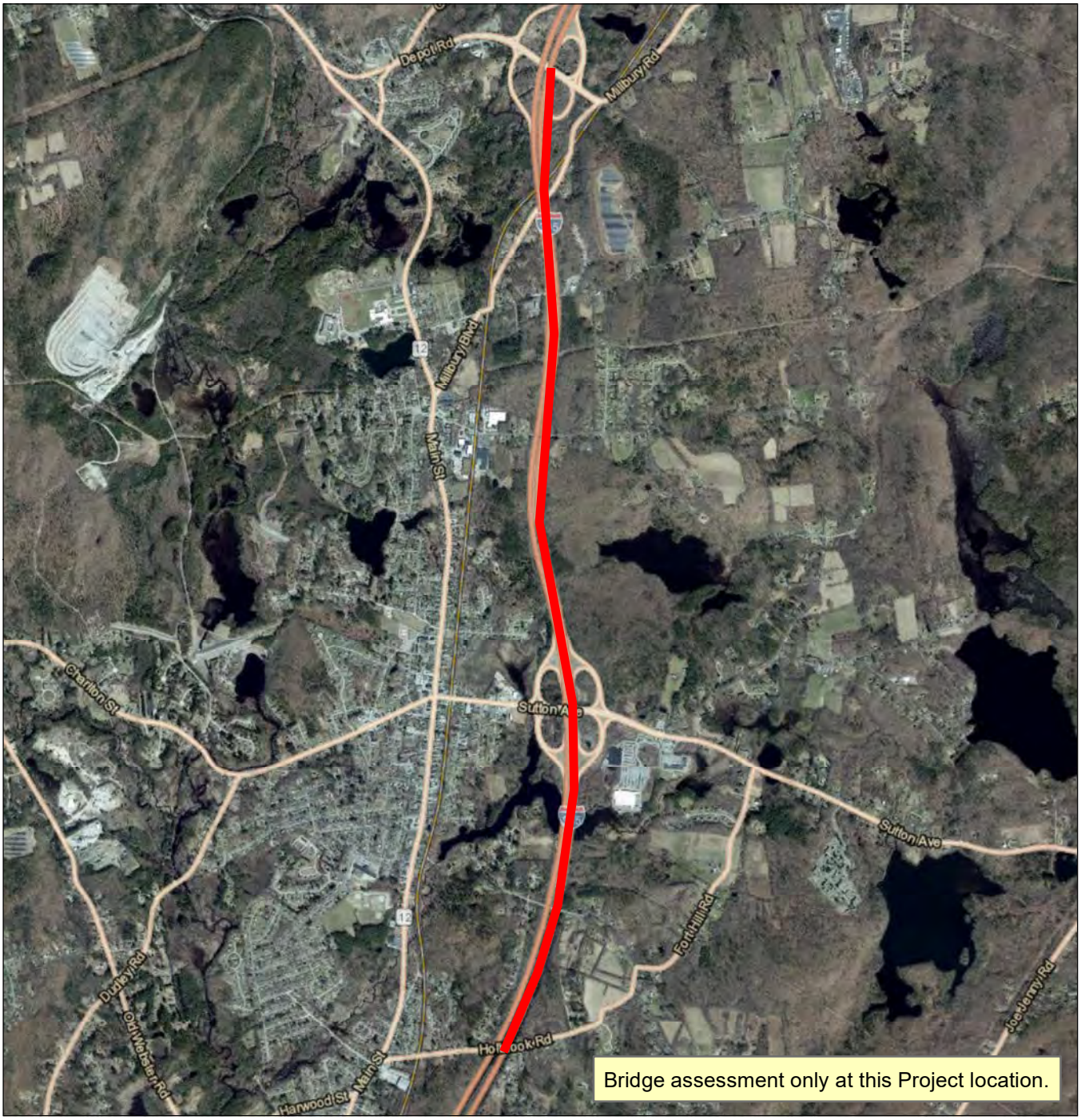
Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

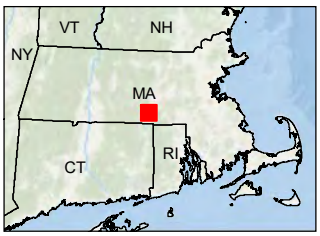
Figure No.
20

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Peabody

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

- Proposed Acoustic Survey Location
- Project Area

0 3,000 Feet

(At original document size of 8.5x11)
1:36,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Oxford, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

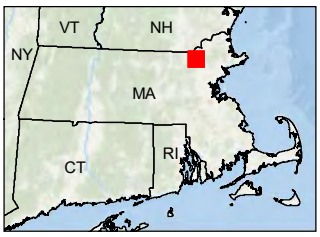
Client/Project 179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
21

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Oxford

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Legend

- Proposed Acoustic Survey Location
- Project Area

0 2,000 Feet

(At original document size of 8.5x11)
1:24,000

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
2. Data Sources: MassDOT, Stantec
3. Background: Massachusetts 2021 MassGIS Color Orthoimagery

Project Location
Tewksbury, Massachusetts

Prepared by MM on 2022-06-14
TR by KWH on 2022-06-20
IR Review by LJ on 2022-06-20

Client/Project
179410726
Massachusetts Department of Transportation
Northern Long-eared Bat Acoustic Survey

Figure No.
22

Title
Northern Long-eared Bat Acoustic Survey
Proposed Location – Tewksbury

Citrix V:\1956\Active_Task Owner and other Non-BC\1956 Jobs\179410726\03_data\gis_cad\gis\mxds\179410726_DetectorsStudyPlan.mxd Revised: 2022-06-20 By: memason

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

APPENDIX B STANTEC NLEB BAT PRESENCE/ABSENCE ACOUSTIC SURVEY DATASHEET AND USFWS PHASE 1 SUMMER HABITAT ASSESSMENTS DATASHEET

Stantec Ground-Based Acoustic Bat Detector Datasheet

Site ID:	**Project Number:**		**Project Name:**				
	State:	**County:**		**Acoustic Survey Type**			
Site Selector:	**Lat:**	**Long:**		Summer Acoustic			
Deployer:	**Notes: NA**						
Date Deployed:							
Deploy Duration:							
Detector #:							

Detector Setup

Detector Make:	**Detector Model:**	**Dist to Obstruct (m):**
Microphone Model:	**Directionality:**	**Mic Height (AGL; m):**
Weatherproofing:	**Mic Angle:**	**Call Data Type:**
Mic Direction (deg):	**In-Field Calibration:**	**Notes:**

HABITAT DESCRIPTION

VEGETATION CHARACTERISTICS

Habitat Type:

Canopy Closure (%):

Habitat Description:

Habitat Use:

Habitat Notes:

STREAM CHARACTERISTICS

Est. Distance to Water Source (m):

Type of Water:

Detector Startup Notes:

Detector Startup:

Card In A:

Card In B:

Memory A:

Memory B:

Battery:

Temperature:

Mic 0:

Cal Ch 0:

Going to Sleep Until:

Additional Site Notes:

USFWS accepted answers:

Mic Angle: 0 = parallel to ground, 45 = angled up, 90 = straight up, 315 = angled down, 270 = pointed down

Habitat Type: creek/riparian, pond, mine portal, field edge, bottomland forest, cave entrance, bridge, open field, upland forest, structure, other

If collecting data on paper, please add site diagram to back.

APPENDIX A: PHASE 1 HABITAT ASSESSMENTS

BAT HABITAT ASSESSMENT DATASHEET

Project Name:_____ Date:_____

Township/Range/Section:_____

Lat Long/UTM/ Zone:_____ Surveyor:_____

Brief Project Description

Project Area				
Project	Total Acres	Forest Acres		Open Acres
Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing	

Vegetation Cover Types	
Pre-Project	**Post-Project**

Landscape within 5 mile radius
Flight corridors to other forested areas?
Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

Proximity to Public Land
What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

APPENDIX A: PHASE 1 HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): _____

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
Pools/Ponds (# and size)		Open and accessible to bats?		
Wetlands (approx. ac.)	Permanent	Seasonal		

Forest Resources at Sample Site				
Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81-100%
Dominant Species of Mature Trees				
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable

IS THE HABITAT SUITABLE FOR INDIANA BATS? _____

IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? _____

Additional Comments:

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations: understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX C BRIDGE/STRUCTURE BAT ASSESSMENT FORM

APPENDIX D: Bridge/Structure Bat Assessment Form

Bridge/Structure Bat Assessment Form Instructions

- This form will be completed to document bat occupancy or bat use of bridges, culverts, and other structures. This form shall be submitted to the appropriate personnel within the DOT and USFWS for recordkeeping (or uploaded into the Information, Planning, and Consultation (IPaC) Determination Key for use of the Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat) prior to conducting: any activities below the deck surface either from the underside or from above the deck surface that bore down to the underside; any activities that could impact expansion joints; any activities involving deck removal on bridges; or any activities involving structure demolition for bridges, culverts, and/or other structures.
- Assessments must be completed within two (2) years of conducting any work (see the above bullet), regardless of whether assessments have been conducted in the past. Assessments must be completed in appropriate weather conditions, suitable for the assessor to observe common signs of bat use.
- Evidence of bat use may include visual observation (live and/or dead), presence of guano, presence of staining, audible observation, and/or odor observation. Presence of one or more indicators is sufficient evidence that bats may be using the bridge, culvert, and/or other structure.
- If bat use of a bridge, culvert, and/or other structure is noted, additional studies may be undertaken during bat active season to identify the specific bat species utilizing the structure, or protected bat species presence can be assumed, in order to comply with threatened and endangered species regulations. Bat active season dates, typically between April and November, vary regionally and by species, so assessors should consult with their local USFWS Field Office for more specific active season dates.
- For use of the Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat – If the bridge/structure is 1,000 feet or more from suitable bat habitat[1] (e.g., an urban or agricultural area without suitable foraging habitat or corridors linking the bridge to suitable foraging habitat), check the appropriate box and fill out the table below. **No further assessment is required.**

Date & Time of Assessment	**DOT Project #**	**Route/Facility Carried**	**County**
Federal Structure ID	**Structure Coordinates** (latitude and longitude)	☐ This bridge/structure is 1,000 feet or more from suitable bat habitat[2] Name:_____ Signature: _____	

- Any questions pertaining to assessments or this form should be directed to the local USFWS Field Office.

[1] Refer to the USFWS's summer survey guidance for the definition of suitable habitat (http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html).

[2] This condition is only for use of the Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat

Bridge/Structure Bat Assessment Form

Date & Time of Assessment	DOT Project Number	Route/Facility Carried	County
Federal Structure ID	Structure Coordinates (latitude and longitude)	Structure Height (approximate)	Structure Length

Structure Type (check one)

Bridge Construction Style

○ Cast-in-place		○ Pre-stressed Girder	
○ Flat Slab/Box		○ Steel I-beam	
○ Truss		○ Covered	
○ Parallel Box Beam		○ Other:	

Culvert Type

○ Box	
○ Pipe/Round	○
○ Other:	

Other Structure

Structure Material (check all that apply)

Deck Material	*Beam Material*	*End/Back Wall Material*
☐ Metal	☐ None	☐ Concrete
☐ Concrete	☐ Concrete	☐ Timber
☐ Timber	☐ Steel	☐ Stone/Masonry
☐ Open grid	☐ Timber	☐ Other:
☐ Other:	☐ Other:	

Culvert Material

☐ Metal
☐ Concrete
☐ Plastic
☐ Stone/Masonry
☐ Other:

Creosote Evidence

○ Yes ○ No ○ Unknown

Notes:

Crossings Traversed (check all that apply)

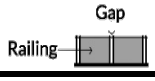
☐ Bare ground	☐ Open vegetation
☐ Rip-rap	☐ Closed vegetation
☐ Flowing water	☐ Railroad
☐ Standing water	☐ Road/trail - Type:
☐ Seasonal water	☐ Other:

Surrounding Habitat (check all that apply)

☐ Agricultural	☐ Grassland
☐ Commercial	☐ Ranching
☐ Residential-urban	☐ Riparian/wetland
☐ Residential-rural	☐ Mixed use
☐ Woodland/forested	☐ Other:

Areas Assessed (check all that apply)

Check all areas that apply. If an area is not present in the structure, check the "not present" box.
Document all bat indicators observed during the assessment. Include the species present, if known, and provide photo documentation as indicated.

Area (check if assessed)	**Assessment Notes**	**Evidence of Bats** (include photos if present)		
☐ All crevices and cracks: **Bridges/culverts:** rough surfaces or imperfections in concrete **Other structures:** soffits, rafters, attic areas	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Concrete surfaces (open roosting on concrete)	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Spaces between concrete end walls and the bridge deck	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Crack between concrete railings on top of the bridge deck 	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Vertical surfaces on concrete I-beams	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Spaces between walls, ceiling joists	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Weep holes, scupper drains, and inlets/pipes	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ All guiderails	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ All expansion joints	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species

Name:	Signature:

APPENDIX D RESUME OF BIOLOGIST TO PERFORM MANUAL VETTING OF RARE SPECIES CALLS

Trevor Peterson PhD

Project Manager, Senior Wildlife Biologist

Dr. Peterson is a senior wildlife biologist and project manager specializing in renewable energy projects, bird and bat migration, and rare species assessments. He focuses on solutions to quantify and manage turbine-related wildlife impacts at terrestrial and offshore commercial wind projects. Since joining the company in 2003, Trevor's project experience has included a wide range of wide range of wildlife surveys at proposed and existing wind projects, rare bat surveys, breeding bird surveys, raptor surveys, nocturnal radar surveys, vernal pool water quality and ecological monitoring, rare turtle telemetry and demographic studies, natural community characterization, and vegetation monitoring. He earned his PhD in Ecology and Environmental Sciences from the University of Maine for his research on the use of long-term acoustic bat data to study bat migration and predict and manage potential impacts from land-based and offshore wind projects. Before working at Stantec, Trevor worked seasonally for the National Park Service at Acadia National Park and Isle Royale National Park and as an island caretaker for the Maine Island Trail Association. Dr. Peterson serves as Stantec's technical lead for acoustic bat surveys, responsible for updating equipment, survey methods, and data analysis/reporting methods.

EDUCATION

PhD Ecology and Environmental Sciences , University of Maine, Orono, ME, 2020

McMillan Offshore Survival Training, Castine, Maine, 2016

AB, Biology/Environmental Studies, Summa cum Laude, Phi Beta Kappa, Bowdoin College, Brunswick, Maine, 2002

Semester Program in Costa Rica, Tropical Field Biology, Environmental Studies, and Spanish, Duke University, Durham, North Carolina, 2000

CERTIFICATIONS & TRAINING

CPR, AED, and Basic First Aid, Americian Safety & Health Institute, Topsham, ME, 2019

Habitat Conservation Plan Training, US Fish and Wildlife Service National Conservation Training Center, Shepherdstown, WV, 2010

MEMBERSHIPS

Member, Northeast Regional Migration Monitoring Network

Member, Northeast Bat Working Group

Member, The Wildlife Society, Maine, May 2011-present

PROJECT EXPERIENCE

RENEWABLE ENERGY, OFFSHORE

Block Island Offshore Wind Farm | Block Island, Rhode Island | 2018-Present | Senior Scientist

Regional Offshore Acoustic Bat Monitoring | Gulf of Maine, mid-Atlantic, Great lakes

Tracking Bats using Nanotag Telemetry in the Gulf of Maine

RENEWABLE ENERGY

Activity-based Informed Curtailment: Using Acoustics to Design and Validate Smart Curtailment at Wind Farms | 2019 - 2022 | Prinicipal Investigator

Avian and Bat Surveys at New Creek Wind Energy Project | Grant County, West Virginia

Avian and Bat Surveys at Laurel Mountain Wind Energy Project | Randolph and Barbour Counties, West Virginia

NATURAL RESOURCE SERVICES

Natural Community Surveys and Resource Inventory | Moosehead Lake Region, Maine

Spotted Turtle and Vernal Pool Monitoring on Greenbush Railroad | Southeastern Massachusetts

Indiana Bat and Rare Bird Surveys at Proposed Wind Energy Project | Jefferson and Oswego Counties, New York

Acoustic Bat Surveys: Proposed Road Corridors | Tennessee

PUBLICATIONS

Peterson, T.. *Predicting and managing risk to bats at commercial wind farms using acoustics. A dissertation submitted in partial fulfillment of the requirements for the degree of doctor of philosophy, University of Maine.*, 2020.

Pelletier, S.K., K.S. Omland, K.S. Watrous and T.S. Peterson, Information synthesis on the potential for bat interactions with offshore wind facilities - final report. *US Department of the Interior, Bureau of Ocean Energy Management, Headquarters. Herndon, Virginia. OCS Study BOEM 2013-01163. 119 pp*, 2013.

Hildt, S. and T. Peterson. Surveying the damage: tools and techniques. *Invited Presentation at the NRDA Short Course, University of Massachusetts*, 2014.

Peterson, T.S., S.K. Pelletier, S.A. Boyden, and K.S. Watrous. Offshore acoustic monitoring of bats in the Gulf of Maine. *Northeastern Naturalist 21(1): 86-107*, 2014.

Johnson, J.S., L.E. Dodd, J.D. Kiser, T.S. Peterson, and K.S. Watrous. Food Habits of Myotis leibii along a Forested Ridgetop in West Virginia. *Northeastern Naturalist 19(4): 665-672*, 2012.

Johnson, J.S., K.S. Watrous, G.J. Giumarro, T.S. Peterson, S.A. Boyden, and M.J. Lacki. Seasonal and geographic trends in acoustic detection of tree-roosting bats. *Acta Chiropterologica, 13(1): 157-168*, 2011.

Peterson, T.S., A. Uesugi, and J. Lichter. Tree recruitment limitation by introduced snowshoe hares, Lepus americanus, on Kent Island, New Brunswick. *Canadian Field Naturalist 119 (4). 569-572*, 2005.

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

APPENDIX B Acoustic Detector Photographs

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

Photo 1. View of the WA1-1 detector set up facing north (left) and east (right).

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

Photo 2. View of the WA1-1 detector set up facing south (left) and west (right).

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

Photo 3. View of the WA1-2 detector set up facing north (left) and east (right).

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

Photo 4. View of the WA1-2 detector set up facing south (left) and west (right).

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

APPENDIX C Resumes of Laura Berube and Caroline Byrne

Laura Berube

Project Scientist

Laura is a Project Scientist for projects involving avian studies for pre- and post-construction projects in the Northeastern United States. Laura is a wildlife biologist with strong bird identification skills and the ability to identify bird species by both sight and sound. She has recently performed diverse avian studies for a number of renewable energy projects in the Northeastern United States, with field work including visual raptor surveys, eagle point count surveys, nocturnal migrant radar surveys, breeding bird surveys, and acoustic bat surveys. Laura is proficient in data management, analysis, summary, and vigorous QAQC for a variety of avian wildlife surveys. Laura is also proficient in acoustic bat analysis including the use of automated analysis programs: Kaleidoscope, BCID, EchoClass, and Sonobat.

Laura is also responsible for conducting vernal pool surveys and natural resource assessments and supporting wetland delineations to assist with the preparation of local, state, and federal permit applications. She has worked on a variety of natural community and rare plant surveys and projects ranging from general reconnaissance observations to quantitative community- and species-specific surveys. These projects have involved natural community mapping and analysis for transportation projects, utility corridors, and development sites.

PROFESSIONAL EXPERIENCE

• Stantec Consulting. 2010-present. Project Scientist.
• University of Maine. 2009. Wildlife Department Field Assistant.

EDUCATION

Bat Conservation and Management - Acoustic Data Management Workshop, Bat Survey Solutions, LLC - Janet Tyburec and John Chenger, Fairfield, Maine, 2015

Bachelor of Science, Wildlife Ecology, University of Maine, Orono, Maine, 2010

Wilderness First Aid Certified, SOLO, Topsham, Maine, 2014

40-Hour HAZWOPER Certification, Topsham, Maine, 2014

OSHA 10-Hour Construction Certification, ClickSafety, Topsham, Maine, 2012

MEMBERSHIPS

Secretary/Treasurer, 2014-2019, The Wildlife Society, Maine

PROJECT EXPERIENCE

NATURAL RESOURCE SERVICES

Record Hill Wind Farm Raptor Surveys, Roxbury, Maine

Conducted raptor surveys to determine species, locations, and behavior in relation to proposed wind turbines. Analyzed data for reporting purposes related to impact assessment and permitting efforts.

Rollins Wind Farm Post-Construction Mortality Monitoring and Raptor Surveys, Maine

Conducted bird and bat mortality ground searches (a requirement of utility-scale wind power developments in Maine). Evaluated as having high searcher efficiency scores for the on-the-ground trials. Responsible for scavenger surveys, which involved the placement and monitoring of carcasses and use of game cameras. Also conducted raptor surveys to determine species, locations, and behavior in relation to proposed wind turbines. Analyzed data for reporting purposes related to impact assessment and permitting efforts.

Eastern Box Turtle Protection Plan and Construction, Brewster, Massachusetts

Conducted regular fence inspection in accordance with and NHESP-approved Eastern Box Turtle Protection Plan designed to protect box turtles in compliance with MESA during construction of a pump station development project. Responsible for documenting the presence of any box turtles in the vicinity of the fencing and reporting deficiencies in the fencing to appropriate personnel.

Stetson I and II Wind Farms Post-Construction Monitoring, Maine

Conducted bird and bat mortality ground searches (a requirement of utility-scale wind power developments in Maine). Evaluated as having high searcher efficiency scores for the on-the-ground trials. Responsible for scavenger surveys, which involved the placement and monitoring of carcasses and use of game cameras.

Oakfield Wind Project Avian Studies | Maine

Conducted raptor surveys to determine species, locations, and behavior in relation to proposed wind turbines. Analyzed data for reporting purposes related to impact assessment and permitting efforts.

Ecological Characterizations | Coos County, New Hampshire

Conducted surveys for rare, threatened, and endangered species of plants and wildlife, assessments of existing

wildlife habitat values, and mapping of wetland and stream resources in a remote area of New Hampshire.

Hand Analysis of Bat Data | Topsham, Maine

Conducted analysis of bat detector data to determine species of bats for multiple project sites. Analysis results were then provided to clients to assist with their project planning and permit applications in compliance with applicable local, state, and federal natural resource regulations.

Wind Project | Eastern Maine

Project scientist responsible for organization, progress, and safety of field staff through the field work phase (wetland delineations, vernal pool surveys, and other natural resource mapping) of large-scale wind power development. Responsible for data management and associated reporting of findings to accompany state and federal permit applications.

Natural Resource Advisory Role in Oil Spill Response | Large Interstate Oil Spill in Gulf of Mexico | Natural Resource Advisor

Natural Resource Advisor (NRA) conducting environmental oversight of oil spill cleanup activities in compliance with an emergency consultation under Section 7 of the Endangered Species Act. NRAs worked directly with operational cleanup crews to implement Best Management Practices (BMPs). These BMPs served as the formal technical guidance issued under the emergency consultation. The objective of this work was to minimize secondary impacts of the cleanup activities on protected resources, including sea turtles, migratory and nesting shorebirds, beach mice, mangrove wetlands, estuaries, coastal wetlands, and dune systems. Implemented BMPs and conducted surveys for piping plover and sea turtles within designated critical habitats. Conducted training and oversight of cleanup crews and prepared daily reports documenting NRA activities. Worked closely with cleanup operations to provide education on BMPs and documenting daily compliance for use in USFWS consultation process and evaluation of secondary impacts to protected resources as part of the Natural Resources Damage Assessment (NRDA).

Proposed Wind Project Bird and Bat Surveys, Coye Hill, Connecticut

Conducted pre-construction wind project development surveys and impact assessments for a proposed wind project in Connecticut. These assessments included raptor surveys, acoustic bat surveys, and breeding bird surveys.

Beech Hill Wind Project | Aroostook County, Maine

Assisted in wetland delineations, vernal pool surveys, and Global Positioning System surveys for a proposed 34-turbine wind project and associated 67-mile transmission line. Identified streams and Wetlands of Special Significance based on the criteria in the Maine Department of Environmental Protection's Natural Resource Protection Act. Characterized wetland and waterbody resources based the U.S. Fish and Wildlife Service Classification of Wetlands and Deep Water Habitats of the United States (Cowardin et. al 1979). Documented the biological and physical characteristics of potential vernal pool habitat based on the criteria of the Maine Department of Inland Fisheries and Wildlife.

Proposed Wind Project | Central Maine

Conducted wetland delineations, vernal pool surveys, and Global Positioning System surveys over an area totaling approximately 6,800 acres for a proposed 55-turbine wind project in Central Maine. Determined wetland boundaries using the technical criteria described in the U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987). Identified streams and Wetlands of Special Significance based on the criteria in the Maine Department of Environmental Protection's Natural Resource Protection Act. Characterized wetland and waterbody resources based the U.S. Fish and Wildlife Service Classification of Wetlands and Deep Water Habitats of the United States (Cowardin et. al 1979). Documented the biological and physical characteristics of potential vernal pool habitat based on the criteria of the Maine Department of Inland Fisheries and Wildlife.

Orangeville, Marsh Hill, and Sheldon Wind Projects, Post-Construction Monitoring | Western New York | Technician Supervisor

Supervised four post-construction monitoring technicians. Responsible for timecard and expense approval, tracking completion of safety trainings, and communicating with staff about needs while in the field.

Proposed Solar and Infrastructure Update Projects | Vermont | Project Manager

Wrote the proposals and was Project Manager for proposed projects requiring northern long-eared bat (Myotis septentrionalis) surveys. Responsible for client and agency communication, managing of field staff and field survey completion, and the completion of final reports and delivery to client to assist with their project planning and permit applications in compliance with applicable state and federal natural resource regulations.

Proposed Wind Project | Maine | Project Manager

Project Manager for proposed wind project requiring pre-construction avian and wildlife surveys. Responsible for client and agency communication, managing of field staff and field survey completion, and the completion of final reports and delivery to client to assist with their project planning and permit applications in compliance with applicable state and federal natural resource regulations.

Proposed Wind Project, Down East Maine

Conducted pre-construction wind project development surveys and impact assessments for a proposed wind project in Maine. These assessments included raptor surveys, eagle point count surveys, acoustic bat surveys, nocturnal radar surveys, and breeding bird surveys. Analyzed and reported on data for reporting purposes related to impact assessment and permitting efforts.

Post-construction Avian Fatality Monitoring at a Developed Wind Project | New Hampshire | Project Manager

Project Manager of the post-construction monitoring survey conducted at a developed wind project in New

Hampshire. Responsible for client and agency communication, managing of field staff and field survey completion, and the completion of final reports and delivery to client and applicable state and federal natural resource agencies to assist with the compliance of the permit.

Automated Program Analysis of Bat Data | Topsham, Maine

Conducted analysis of bat detector data using Kaleidoscope, BCID, and Sonabat software to determine species of bats for multiple project sites. Analysis results were provided to clients to assist with their project planning and permit applications in compliance with applicable state and federal natural resource regulations.

Agency Meeting and Site Visit for Proposed Wind Project, Down East Maine

Attended a pre-application agency consultation meeting for a proposed wind project in Down East Maine. Attended a site visit at proposed project area with client and agency representatives. Provided information on pre-construction wildlife field surveys conducted by Stantec at proposed wind project.

Data Manager | Topsham, Maine

Responsible for managing data related to bird and bat studies conducted by the office. Responsible for the retrieval, and placement of data to assist in effective report writing and limiting of possible liability.

Rollins Wind Project Invasive Species Monitoring | Lincoln, Maine

Conducted invasive species surveys along a recently constructed transmission line right-of-way according to the standards and methods developed in the Invasive Species Management Plan.

Ichthyoplankton Sampling | Field Technician

Assisted in ichtyoplankton field sampling to characterize the marine egg and larvae community present and potentially susceptible to impingement and entrainment at the cooling water intake structure of a facility withdrawing cooling water from Penobscot Bay, in support of the Clean Water Act 316(b) for a confidential client. The results of the sampling will be included in 316b report and would be used to inform the design of the impingement control system to be eventually installed.

Schedule Coordinator | Topsham, Maine

Proposed Wind Project, Western New York

Conducted eagle point count surveys to determine eagle locations and behavior in relation to proposed wind turbines. Assisted in survey design, mapping, and implementation. Preformed quality assurance and control on data to inform potential collision risk of eagles as a result of the project.

Proposed Linear Project | New Brunswick, Canada

Conducted surveys for rare, threatened, and endangered species of plants and wildlife, assessments of existing wildlife habitat values, and mapping of wetland and stream resources.

Groton Wind Farm, Raptor Surveys, Breeding Bird Surveys, Nocturnal Migrant Radar Surveys | Grafton County, New Hampshire | Task Manager

Responsible for the staffing and scheduling of field surveys. Also responsible for task managing the completion of sections of the final report to be delivered to the client. Conducted raptor, breeding bird, and nocturnal migrant radar surveys.. Analyzed data for reporting purposes related to impact assessment and permitting efforts.

Bull Hill Wind Farm Post-Construction Monitoring, Maine

Conducted bird and bat mortality ground searches (a requirement of utility-scale wind power developments in Maine). Responsible for scavenger surveys, which involved the placement and monitoring of carcasses and use of game cameras. Responsible for searcher efficiency trials, which involved the placement and monitoring of carcass retrieval by other surveyors.

Proposed Wind Projects | Maine | Task Manager

Responsible for the staffing and scheduling of field surveys including visual raptor surveys, eagle point count surveys, breeding bird surveys, and acoustic bat surveys. Also responsible for task managing the completion of sections of the final reports to be delivered to clients to assist with their project planning and permit applications in compliance with applicable state and federal natural resource regulations.

Proposed Wind Project | Northern California

Analyzed crepuscular radar data targeting federally threatened and state endangered marbled murrelets (Brachyramphus marmoratus) and reviewed and managed acoustic bat survey data for reporting purposes related to impact assessment and permitting efforts.

Block Island Wind Farm, Offshore | Rhode Island

Conducted analysis of bat detector data using Kaleidoscope software and provided quality review of bat call determinations by the software to determine species of bats. Analysis results were provided to the client to assist with the project’s compliance of applicable state and federal natural resource regulations.

Proposed Wind Project, Offshore | Northeast and Mid-Atlantic US

Conducted analysis of bat detector data using Kaleidoscope software and provided quality review of bat call determinations by the software to determine species of bats. Analysis results were provided to the client to assist with planning and permit applications in compliance with applicable state and federal natural resource regulations.

Caroline Byrne

Wildlife Biologist

Caroline Byrne is a project scientist and bat biologist, specializing in rare species assessments and bioacoustics. She has a wide range of experience with wildlife assessments for birds, bats, turtles, cave fauna, and vegetation. She has conducted extensive mist netting, acoustic, and telemetry surveys and is a federally permitted bat biologist. Caroline has project experience in various sectors including commercial (renewable energy and development), Federal (Department of Defense, Environmental Protection Agency US Fish and Wildlife) and state agencies. Caroline will be working with the emerging EchoPitch program and related research projects funded by the US Department of Energy, National Renewable Energy Laboratory, Renewable Energy and Wildlife Institute, and private clients. Caroline has a BS from Binghamton University and a MS from Indiana State, where she researched Indiana bat social calls and behavior. She has conducted extensive mist netting, acoustic, and telemetry surveys and is a federally permitted bat biologist. Most recently, she has worked as a wildlife research biologist for Biodiversity Research Institute in Portland, Maine.

EDUCATION

Master of Science, Biology, Indiana State University, Terre Haute, Indiana , 2015

Bachelors of Science, Environmental Science: Ecosystems , Binghamton University, Vestal, New York, 2010

CERTIFICATIONS & TRAINING

30-hour Construction Safety and Health , Occupational Safety and Health Administration, San Diego, California, 2022

Wilderness First Aid, Wilderness Medical Associates International, Portland, Maine, 2021

Soundscape Analysis: From Data to Graphs, Wildlife Acoustics, Inc., Maynard, Massachusetts, 2021

Bat Acoustics Training and Analysis Course, Wildlife Acoustics, Maynard, Massachusetts, 2016

Raven Sound Analysis Workshop, Cornell Lab of Ornithology, Ithaca, New York, 2013

Acoustic Techniques Workshop, Bat Conservation Managment, Newburyport, Massachusetts, 2011

Bat Automatic Identification Software Workshop , Western EcoSystems Technology, Inc., Pikeville, Tennessee, 2013

Properties of Sound: How Bat Detectors Work, Wildlife Acoustics, Inc., Maynard, Massachusetts, 2020

MEMBERSHIPS

President-elect, Northeast Bat Working Group, 2009-Present

Past President, The Wildlife Society, Maine, 2015-Present

PROJECT EXPERIENCE

MILITARY

Rare, Threatened, and Endangered Bat Surveys at US Naval Installations | Field Coordinator, Federally Permitted Biologist at Biodiversity Research Institute

While at Biodiversity Research Institute, Caroline performed rare, threatened, and endangered bat surveys throughout the eastern United States, including acoustics: deployment, automated analysis and qualitative review, mist-netting, homing telemetry, foraging telemetry, and hibernacula surveys.

BAT BIOLOGY

Threatened and Endangered Bat Surveys at Ely Mine | Vershire, Vermont | Federally Permitted Biologist, Biodiversity Research Institute

Performed mist-netting surveys, acoustics (deployment, automated analysis, and qualitative analysis), day roost telemetry, automated foraging, and home range telemetry. Compiled results into reports to client and permitting agencies.

Indianapolis International Airport Indiana Bat Project | Indianapolis, Indiana | Graduate Researcher-Indiana State University

Lead a long-term Indiana bat monitoring project. Long-term monitoring of local bat populations included mist netting long-term netting sites with a minimum of 12 per month, radio telemetry and transmitter attachment in order to track foraging bats and locate day roosts, spotlight checks, and emergence count to monitor roost use.
• Vegetation surveys
• Report preparation: Prepared biweekly and annual reports of study results
• Thesis research: Describing the social behavior of Indiana bats (Myotis sodalis) at day roost sites.
• Deployed Pettersson D500X and night vision video to record social behavior at maternity roosts
• Developed ethogram detailing visual and acoustic behaviors
• Coded video for behaviors and analyzed acoustic behaviors in Raven Pro

EMPLOYMENT HISTORY

Biodiversity Research Institute
Mammal Program Field Coordinator

2015 - 2022 · 7 years

Project Management:
• Staffing: Supervise and manage all field staff including other field leads

Permitting: Application, management, and reporting for permits on both the state and federal level

Development: study plans, scopes of work, and standard operating procedures, worked directly with numerous clients including DOD (Navy, Air Force, Army, and Marines), EPA, State Agencies, USFWS, USNPS, Army National Guard, Army Core of Engineers, Air National Guard, and renewable energy companies (i.e., solar and offshore wind)

Logistics: arranged vehicles, lodging, equipment, and staffing schedules

Field Program Work:
• Overseeing all aspects of the capture and radio tracking of Eastern bat species.
• As of 2020, I have identified 13 bat species in North America totaling >1,700 individual bats in hand. In North America, from Maine to South Carolina to Illinois.
• Supervise and participate in the live capture of bats, and monitor and take samples according to the scope of work and approved protocols.
• Daytime radio telemetry to locate roosting sites, nighttime telemetry with up to five teams for simultaneous foraging telemetry for home range analysis.
• Development, siting, production, and execution of nano-telemetry towers for MOTUS network monitoring, captured and tagged bats with MOTUS transmitters during migration
• Hibernacula and anthropogenic structure surveys
• Surveys for Canada lynx with the use of camera traps and scent stations
• Assisted in drafting bat portions of Construction and Operations Plans (COP) for offshore wind development

Acoustics (birds and bats):
• Develop standard operating procedures for acoustic monitoring with various detectors, software, and deployment types
• Deployment and analysis of acoustic monitoring methods for bats
• Deployed Pettersson D500X, 240X, and M500, Anabat SD2, Binary Acoustics AR125, Wildlife Acoustics SM2, SM3, and SM4 to record bat activity
• Post- processing analysis with SonoBat, Kaleidoscope Pro., EchoClass, Sonobat, Raven, and Audacity
• Manual vetting: extensive experience in manual vetting of recordings of eastern bat species
• Offshore wind energy acoustic deployments and acoustic processing and vetting

Indiana State University
Graduate Student

2013 - 2015 · 3 years

Long term monitoring of local bat populations: Mist netting long term netting sites, radio telemetry and transmitter attachment in order to track foraging bats and locate day roosts, spotlight checks and emergence count to monitor roost use. Vegetation surveys. Report preparation. Deployed acoustic monitors and night vision video to record acoustic and visual behavior at maternity roosts, analyzed hundreds of hours of acoustic and video data. Developed ethogram detailing visual, through behavioral coding of video and acoustic behaviors through qualitative and statistically analysis of acoustic behaviors.

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

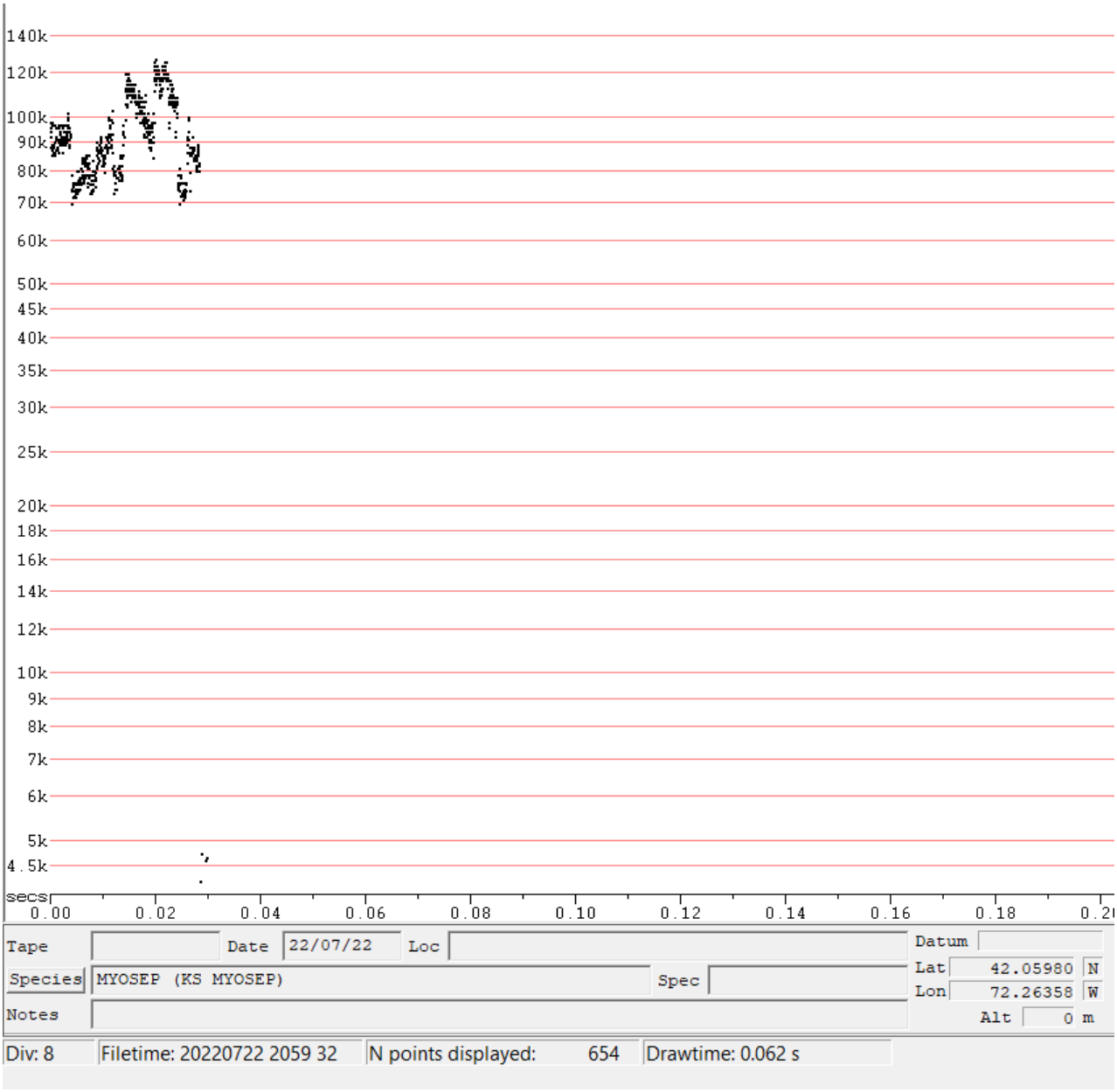
Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

APPENDIX D Screenshots of Bat Passes

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report

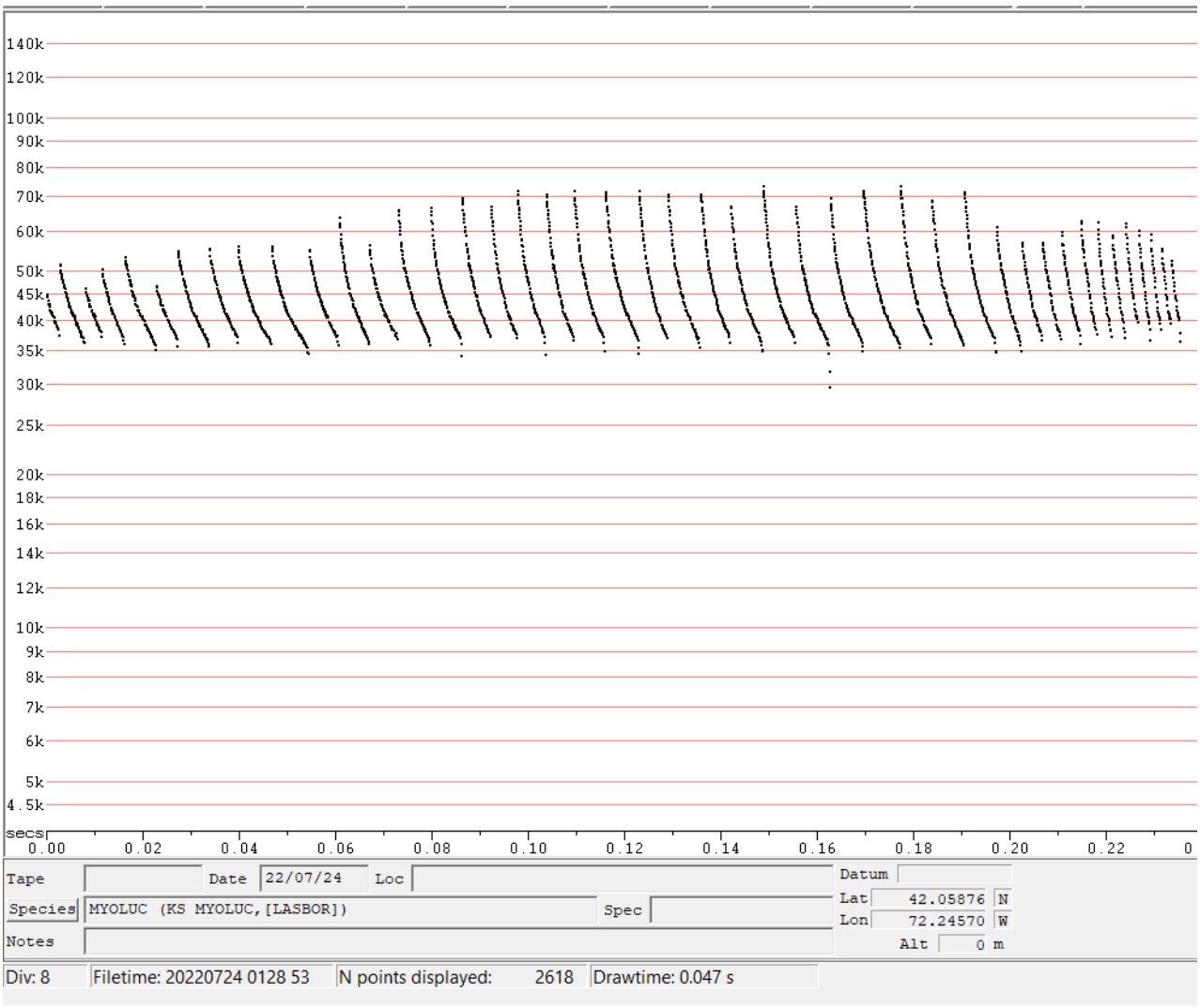


Appendix D. Figure 1. Screenshot of noise recorded on the night of July 22, 2022, and autoclassifed as a northern long-eared bat by KPro for the Reconstruction and Improvements on Monson Road, Wales, Massachusetts, site WA1-1.

October 11, 2022

Tim Dexter, Fish and Wildlife Program Coordinator
Attachments

Reference: Reconstruction and Improvements on Monson Road, Wales, Massachusetts – Northern Long-eared Bat Acoustic Survey Report



Appendix D. Figure 2. Screenshot of a little brown bat pass recorded on the night of July 23, 2022, for the Reconstruction and Improvements on Monson Road, Wales, Massachusetts, site WA1-2.

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00860

MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

NOTICE OF INTENT

THIS PAGE INTENTIONALLY LEEFT BLANK

Notice of Intent

MassDOT Project 608163:
Monson Road Transportation Improvement Project

Town of Wales, MA

June 2024

Weston & Sampson

Weston & Sampson Engineers, Inc.
273 Dividend Road
Rocky Hill, Connecticut06067

www.westonandsampson.com
Tel: 560-513-1473 Fax:860-513-1483

TABLE OF CONTENTS

Permit Transmittal Cover Letter

WPA Form 3 – Notice of Intent Form

APPENDIX A: PROJECT NARRATIVE

APPENDIX B: ALTERNATIVES ANALYSIS

APPENDIX C: SITE MAPS

APPENDIX D: STORMWATER MANAGEMENT

APPENDIX E: ABUTTER NOTIFICATION INFORMATION

APPENDIX F: WETLAND DELINEATION REPORT

APPENDIX G: SITE PHOTOGRAPHS

APPENDIX H: CORRESPONDENCE WITH NHESP

APPENDIX I: PERMIT PLANS

273 Dividend Road, Rocky Hill, CT 06067
Tel: 860.513.1473

June 5, 2024

Wales Conservation Commission
Wales Town Offices
3 Hollow Road
Wales, MA 01081

Re: Notice of Intent
MassDOT Project 608163: Monson Road Transportation Improvement Project

Dear Members of the Commission:

On behalf of the Town of Wales and MassDOT, Weston & Sampson Engineers, Inc. is hereby enclosing one copy of the Notice of Intent and two copies of the project plans to fulfill the requirements of the Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40. This submittal is a formal Notice of Intent for the proposed Monson Road Transportation Improvement Project.

This proposed project is being submitted as a limited project per 310 CMR 10.53(3)(f) for "*Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving drainage systems*." The project includes maintenance and improvements to Monson Road, including new shoulders.

The project proposes several roadway improvements including full depth pavement reconstruction, new four-foot-wide shoulders along 1.5 miles of Monson Road from the Monson town line to Reed Hill Road for pedestrian and bicycle use, minor adjustments to the alignment to improve safety, and roadway drainage improvements. Portions of the project will result in unavoidable impacts to Bordering Vegetated Wetlands (BVW) and Riverfront Area (RFA).

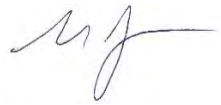
The project additionally will involve upgrades to several of the existing stream crossings along this stretch of Monson Road, as many of the culverts are undersized and do not currently meet the Massachusetts Stream Crossing Standards. It is important to note that the stream crossing work (culvert upgrades and replacements) is considered "bridge exempt." In accordance with the Massachusetts Transportation Bond Bill of 2014, the proposed stream crossing work that is associated with bridge repair and replacement is exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00).

Unavoidable wetland resource area impacts include those to BVW, RFA, and the 100-foot buffer zone associated with the roadway improvements. The project proposes a total of 238 square feet (SF) of permanent alterations to BVW and 134 SF of temporary impacts to BVW as a result of the proposed roadway improvements. The proposed impacts to BVW will be mitigated through the construction of two wetland replication areas, as described in more detail in the enclosed Notice of Intent.

If you have any questions regarding this submittal, please contact me.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.



Michael Joyce
Senior Team Leader - Transportation

cc: DEP-Western Region
Town of Wales, Board of Selectmen

WPA Form 3

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Wales
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Monson Road (a. Street Address) | Wales (b. City/Town) | 01081 (c. Zip Code)

Latitude and Longitude: 42.058656 (d. Latitude) | -72.254086 (e. Longitude)

Roadway (f. Assessors Map/Plat Number) | (g. Parcel /Lot Number)

2. Applicant:

John (a. First Name) | Grasso (b. Last Name)

Town of Wales (c. Organization)

3 Hollow Road (d. Street Address)

Wales (e. City/Town) | MA (f. State) | 01081 (g. Zip Code)

(413) 245-7571 x 100 | (413) 245-3261 (i. Fax Number) | select@townofwales.net (j. Email Address)

3. Property owner (required if different from applicant): ☐ Check if more than one owner

(a. First Name) | (b. Last Name)

Town of Wales (easement) (c. Organization)

3 Hollow Road (d. Street Address)

Wales (e. City/Town) | MA (f. State) | 01081 (g. Zip Code)

(h. Phone Number) | (i. Fax Number) | (j. Email address)

4. Representative (if any):

Mike (a. First Name) | Joyce (b. Last Name)

Weston & Sampson (c. Company)

273 Dividend Road (d. Street Address)

Rocky Hill (e. City/Town) | CT (f. State) | 06067 (g. Zip Code)

860-616-6495 (h. Phone Number) | (i. Fax Number) | joyce.michael@wseinc.com (j. Email address)

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

exempt (a. Total Fee Paid) | exempt (b. State Fee Paid) | exempt (c. City/Town Fee Paid)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Wales
City/Town

A. General Information (continued)

6. General Project Description:

Roadway reconstruction project (See Appendix A for additional project details)

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☒ Transportation
9. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☒ Yes ☐ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

10.53 (3)(f) - maintenance and improvement of existing public roadway
2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Hampden County
a. County

b. Certificate # (if registered land)

N/A - within roadway
c. Book

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Wales
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☒ Bordering Vegetated Wetland	238 SF (permanent), 134 SF (temporary)	1,421 SF (whole project including bridge exempt areas)
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	1. square feet 3. cubic feet of flood storage lost	2. square feet 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☒ Riverfront Area	2 Unnamed and Vinica Brook - Inland 1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☒ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 86,402 square feet

4. Proposed alteration of the Riverfront Area:

a. square feet within 100 ft.	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.
70,987 (perm.); 4,342 (temp.)	45,289 (perm.); 3,528 (temp.)	25,698 (perm.); 814 SF (temp.)

5. Has an alternatives analysis been done and is it attached to this NOI? ☒ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Wales
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

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.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Wales
City/Town

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☒ Yes ☐ No

If yes, include proof of mailing or hand delivery of NOI to:

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

2021
b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

1. ☒ Percentage/acreage of property to be altered:

(a) within wetland Resource Area: 2.4% / 0.22 acres (percentage/acreage)

(b) outside Resource Area: 11.9% / 1.08 acres (percentage/acreage)

2. ☒ Assessor's Map or right-of-way plan of site

2. ☒ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☒ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☒ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Wales
City/Town

C. Other Applicable Standards and Requirements (cont'd)

(c) ☒ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. a. NHESP Tracking # b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

c. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Wales
City/Town

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
      2. ☒ A portion of the site constitutes redevelopment
      3. ☒ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:
      1. ☐ Single-family house
      2. ☐ Emergency road repair
      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Wales
City/Town

D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Monson Road Improvements - Roadway NOI & MEPA Environmental Permit Plan Set
a. Plan Title

Weston & Sampson
b. Prepared By

Scott Bruso, P.E.
c. Signed and Stamped by

June 2024
d. Final Revision Date

Varies
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☒ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Wales
City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant John A. Grasso, Jr., Chairman, Board of Selectmen — 6/3/24

3. Signature of Property Owner (if different)

5. Signature of Representative (if any) Michael J. Joyce, P.E. (Weston & Sampson) — 6/5/24

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Applicant Information

1. Location of Project:

Monson Road	Wales
a. Street Address	b. City/Town
exempt	exempt
c. Check number	d. Fee amount

2. Applicant Mailing Address:

John		Grasso
a. First Name		b. Last Name
Town of Wales		
c. Organization		
3 Hollow Road		
d. Mailing Address		
Wales	MA	01081
e. City/Town	f. State	g. Zip Code
(413) 245-7571 x 100	(413) 245-3261	select@townofwales.net
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

a. First Name		b. Last Name
Town of Wales		
c. Organization		
3 Hollow Road		
d. Mailing Address		
Wales	MA	01081
e. City/Town	f. State	g. Zip Code
h. Phone Number	i. Fax Number	j. Email Address

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee

Step 5/Total Project Fee: _____

Step 6/Fee Payments:

Total Project Fee:	exempt a. Total Fee from Step 5
State share of filing Fee:	exempt b. 1/2 Total Fee **less $**12.50
City/Town share of filling Fee:	exempt c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

Appendix A

Project Narrative

NOI Project Narrative
MassDOT Project 608163 Monson Road Transportation Improvement Project

Introduction

On behalf of the Town of Wales, Weston and Sampson is submitting this Notice of Intent (NOI) application for the proposed Monson Road Transportation Improvements Project in Wales, Massachusetts. This NOI was prepared in accordance with the Massachusetts Wetland Protection Act (MGL c.131 s.40) ("Act") and implementing Regulations (310 CMR 10.00). The Town of Wales does not have a local wetlands bylaw.

The purpose of the project is to make roadway, shoulder, and drainage improvements to a 1.5-mile stretch of Monson Road in Wales. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms. Additionally, Monson Road in this area is experiencing deteriorating roadway conditions.

The project proposes several roadway improvements including full depth pavement reconstruction, new four-foot-wide shoulders along Monson Road for pedestrian and bicycle use, minor adjustments to the alignment to improve safety, and roadway drainage improvements. Portions of the roadway work will result in unavoidable alterations to Bordering Vegetated Wetlands (BVW), the 200-foot Riverfront Area (RFA), and the 100-foot buffer zone to BVW/Bank.

The project additionally will involve upgrades to several of the existing stream crossings along this stretch of Monson Road, as many of the culverts are undersized and do not currently meet the Massachusetts Stream Crossing Standards. It is important to note that the stream crossing work (culvert upgrades and replacements) that is proposed as part of the overall project is subject to Section 24 of the 2014 Transportation Bond Bill (approved 4/18/2014) and is therefore considered "bridge exempt." Accordingly, the proposed stream crossing work is not subject to Section 61 and Sections 62A to 62I, inclusive, of Chapter 30 of General Laws, Chapter 91 (Waterways Act) of the General Laws and Section 40 of Chapter 131 of the General Laws (Wetlands Protection Act).

For this reason, the subject of this NOI application is limited to the roadway improvements and does not include the proposed stream crossing work. Because the stream crossing work is not subject to review under the WPA, that portion of the project is being permitted through a 401 Water Quality Certificate (WQC) application with the Massachusetts Department of Environmental Protection (MassDEP). The culvert replacements will result in impacts to BVW and Land Under Water (LUW) and thus require a 401 WQC application pursuant to 314 CMR 9.04(4). All of the proposed impacts to Waters of the United States will additionally be permitted through a Pre-Construction Notification (PCN) filing with the U.S. Army Corps of Engineers pursuant to Section 404 (33 U.S.C. 1344) of the federal Clean Water Act.

This proposed project is being submitted as a limited project per 310 CMR 10.53(3)(f) for "*Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving drainage systems*."

The project is anticipated to be advertised for construction in August or September of 2024 with the start of construction in Mid-March of 2025. Construction of the project is anticipated to be complete by Fall of 2026.

Additional anticipated permits and regulatory reviews for the project include:

- Massachusetts Environmental Policy Act (MEPA) Environmental Notification Form (ENF)
- Massachusetts Endangered Species Act (MESA) (concurrent review with NOI filing)
- 401 Water Quality Certification (culvert work)
- Section 404 Pre-Construction Notification (PCN) (roadway and culvert work)

Existing Conditions

Monson Road is a two-lane, Rural Major Collector. The Project is approximately 1.5 miles long and is in the western part of Wales, beginning at the Monson Town line and continuing east just beyond the intersection of Monson Road and Reed Hill Road. The land use within the project route includes paved roadway and associated gravel shoulders, adjacent residential properties, wetlands, and undeveloped woodlands. Refer to the locus maps provided in Appendix C for a depiction of the project site.

There are a number of wetland resource areas and stream crossings located adjacent to Monson Road within the project limits, including Bordering Vegetated Wetlands, intermittent streams, and perennial streams. A wetland delineation was conducted by Weston & Sampson in October 2023 and March 2024. A wetland delineation report including mapping depicting the limits of the delineated resource areas, along with wetland determination data forms, is included in Appendix F.

Currently the existing site has an open "country" drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The existing outfalls are in stable condition; however, adjacent to the outfalls in several areas the existing banks experience significant erosion which is contributing to poor water quality within the immediately adjacent resource areas.

Nine culvert crossings convey unnamed streams under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings is located at Sta 15+33, Sta. 24+92, Sta. 34+50 Sta. 43+76, Sta. 46+65, Sta. 50+72, Sta 82+07, and Sta 86+53. These unnamed streams eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road.

The site is not located within the mapped 100-year floodplain, according to the current FEMA FIRM maps (refer to Figures 3.1 through 3.4 in Appendix C).

There is a discrete area of Priority and Estimated Habitat for Rare Species mapped by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) between Peck Road and Maynard Road (see Figure 4 in Appendix C). A copy of this NOI will be submitted to NHESP for review pursuant to the Massachusetts Endangered Species Act (MESA).

Three of the stream crossings, which are perennial watercourses, within the project corridor are designated as cold-water fisheries resources by the Massachusetts Division of Fisheries and Wildlife (MADFW) (refer to Figure 4 in Appendix C). None of the streams are mapped as Outstanding Resource Waters. The project site is not located within an Area of Critical Environmental Concern (ACEC).

Proposed Conditions

The project consists of full depth reconstruction of Monson Road within the project limits and widening of the road from twenty-two feet to twenty-eight feet (10-foot-wide lanes and 4-foot-wide shoulders). The 4-foot-wide shoulders will allow for safer bicycle and pedestrian use. The project includes sections of bituminous curb and new guardrail with up-to-date terminals for increased safety, proper signage, and new pavement markings. To complete the proposed roadway improvements, some tree clearing will be required adjacent to the existing roadway, some of which will occur in RFA. Limited tree and vegetation removal is proposed within the BVW areas, which is being mitigated to the maximum extent practicable with the proposed BVW replication areas, as shown on the plans.

Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. The intersection with Reed Hill Road will be realigned to improve sight lines. Superelevation is also proposed along horizontal curves. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of one foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings.

Six of the existing stream crossings (seven pipes/culverts) are proposed for replacement due to being undersized. In accordance with the Massachusetts Transportation Bond Bill of 2014, the proposed stream crossing work is exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00). This work will be permitted under the 401 Water Quality Certification Regulations pursuant to 314 CMR 9.04(4).

Outlet protection will be provided for all drainage discharge locations within WPA jurisdiction. Additional inlet and outlet improvements are proposed for all the other crossings regulated under the bridge exemption.

The means and methods of construction for this project will involve the use of various heavy equipment to ensure efficient and effective execution of the roadway improvements. Key equipment that will be utilized includes excavators for full-depth road reconstruction and the culvert replacements, bulldozers for grading and earthmoving activities, and graders to achieve precise grading for the roadway base and shoulder construction. Paving machines will be used for the application of new bituminous pavement, and rollers will compact the new pavement and subgrade materials.

Backhoes will be employed for trenching and drainage system installation, while dump trucks will transport materials such as gravel, asphalt, and excavation debris. Chainsaws and wood chippers will be used for tree and vegetation removal, and concrete mixers will be used for constructing the bituminous curb and other concrete elements. A crane or large excavator will be used for installing new guardrails and other heavy precast components, and hydroseeding equipment will be used for applying grass linings in drainage swales. Construction activities will be staged to minimize disruption to traffic and ensure safety. Traffic control measures will be implemented as necessary, including temporary signage, barriers, and flagging operations.

No long-term on-site stockpiling is planned as part of the proposed project. Materials will be brought in and taken from site on a daily basis. Short term stockpiling of materials immediately adjacent to the specific work area will be required at times.

Construction Access and Sequencing

During construction, Monson Road will remain open to traffic at all times since there is no convenient detour route available for traffic. The majority of the roadway and drainage work can be constructed while maintaining two-way traffic. However, at the two larger box culvert crossings, staged construction and alternating one-way traffic through the use of temporary traffic signalization will be required. Detailed staged construction and temporary control of water plans have been provided with the permit documents.

Construction of the project is anticipated to begin in Spring of 2025 and is anticipated to continue through the Fall of 2026.

Stormwater Management

As a redevelopment project, the proposed project has been designed to meet the Massachusetts Stormwater Management Standards to the maximum extent practicable.

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. Approximately 0.88 acres of increase in impervious surface (pavement) is proposed as part of the project. The watershed areas remain consistent with the existing drainage patterns, as only slight modifications to the existing vertical and horizontal alignments are proposed.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of one foot and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. In total, 57 new catch basins are proposed where no catch basins and closed drainage systems currently exist within the project limits.

Seven closed storm sewer systems are proposed along Monson Road. These systems will outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

Of the nine drainage crossings, six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. As this work is being permitted under the bridge exemption, it is not included in this NOI, but will be permitted under the 401 Water Quality Certification Regulations pursuant to 314 CMR 9.04(4).

Please refer to the Stormwater Management Report in Appendix D for additional information on the proposed closed and open drainage systems for the roadway improvement work.

Wetland Resource Area Impacts

Portions of the project will result in impacts to BVW, RFA, and the 100-foot buffer zone to BVW/Bank. Resource area impacts have been avoided and minimized to the extent practicable through the project design including use of steeper slopes, minimizing the roadway width to the extent practicable, and placement of project features where possible to avoid fill or impacts in wetlands. The roadway design includes 10-foot travel lanes and 4-foot shoulders. This required a design criteria exception to provide the 4-foot shoulders instead of 5-foot bikes lanes/shoulders or 5-foot buffered bike lanes / shoulders, which most MassDOT projects must provide in accordance with MassDOT's complete streets requirements. This limited the widening of the road to twenty-eight feet wide instead of thirty feet or thirty-four feet.

Additionally, structural best management practices (BMPs) including deep sump catch basins have been incorporated into the stormwater design to reduce roadway erosion while improving stormwater quality.

Unavoidable wetland resource area impacts include those to BVW, RFA, and the 100-foot buffer zone associated with the roadway improvements. The project proposes a total of 238 SF of permanent alterations to BVW as a result of the proposed roadway improvements. Specifically, approximately 21 SF of BVW impacts are proposed near Station 82 as a result of roadway widening, and approximately 217 SF of impacts are proposed near Station 57 as a result of relocating a stone wall to accommodate the roadway improvements.

The project also proposes a total of 134 SF of temporary impacts to BVW as a result of sediment control installation at the limits of work. The proposed impacts to BVW are summarized in Table 1 below.

Table 1. Summary of Impact to Bordering Vegetated Wetlands Within Limit of Work

Location (Approximate Station)	Permanent Impact (SF)	Temporary Impact (SF)	Total Impact (SF)
57+00	217	74	291
58+00	0	6	6
82+00	21	54	75
CUMULATIVE	238	134	372

The proposed permanent impacts to BVW will be mitigated through the construction of two wetland replication areas, as described in the Mitigation section below. Temporary impacts to BVW will be restored in kind following construction. Grades will be returned to pre-existing contours, and the wetlands will be seeded with a native seed mix as needed following sediment control removal.

The project proposes a total of 75,329 SF of impact within the Riverfront Area (70,987 SF permanent and 4,342 SF temporary). Of that, approximately 31,206 SF of those impacts will occur in previously degraded RFA that consists of existing roadway. The following table provides a breakdown of where work is occurring within RFA as part of the proposed project. Please note, the below table includes only those RFA impacts associated with the roadway work and does not include the RFA impacts associated with the bridge exempt activities (the culvert replacements), as that work is not subject to review under the Wetlands Protection Act. Work proposed in RFA includes the construction of roadside grass and modified rock swales, the relocation of stone walls, and construction of vegetated and modified rock fill slopes. The temporary impacts proposed in RFA are associated with the installation of sediment controls along the limits of work.

Table 2. Summary of Impact to Riverfront Area Within Limit of Work*

Location	Permanent Impact (SF)	Temporary Impact (SF)	Total Impact (SF)
24+91	19,508	848	20,356
43+70	29,485	2,418	31,903
50+72	21,994	1,076	23,070
CUMULATIVE	70,987	4,342	75,329

*These proposed impacts to Riverfront Area do not include impacts associated with the Bridge Exemption work. In accordance with the Massachusetts Transportation Bond Bill of 2014, the proposed work described herein that is associated with bridge repair and replacement is exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00).

Lastly, the project proposes approximately 45,289 SF of impacts within the 100-foot buffer zone to BVW/Bank associated with the reconstruction of Monson Road, the roadway widening activities and proposed drainage improvements. Of the 45,289 SF of impacts to the 100-foot buffer zone, approximately 10,700 linear feet of temporary sediment control barriers are proposed for the project, some of which will be located within the 100-foot buffer zone.

Mitigation

Wetland resource area impacts have been avoided and minimized to the extent practicable through the project design including use of steeper slopes, minimizing the roadway width to the extent practicable, and placement of project features where possible to avoid fill or impacts in wetlands. The roadway design of 10-foot travel lanes and 4-foot shoulders was selected as it meets the design criteria and project goals, while limiting the increase in impervious area. Additionally, structural best management practices (BMPs) including deep sump catch basins have been incorporated into the stormwater design to reduce roadway erosion while improving stormwater quality.

Permanent wetland impacts will be mitigated through the construction of two wetland replication areas. The proposed 217 SF wetland replication area is depicted on Sheet 16 in the permit drawings. The overall project also will include construction of an additional 1,204 SF wetland replication area to mitigate for unavoidable BVW impacts associated with the culvert replacement work (to be permitted under the 401 WQC, as described above). The proposed wetland replication areas have been designed to provide greater than 1:1 mitigation for the total BVW impacts for the overall project, which includes those impacts proposed as part of the stream crossing work under the 401 WQC application.

A planting schedule for the 1,204 SF wetland replication area is provided on Sheet 180 of the plans in Appendix I. Proposed plantings include highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and a native wetland seed mix. The smaller wetland replication area will be seeded with a native wetland seed mix.

Proposed temporary impacts areas within BVW will be restored in situ after construction from the removal of sediment controls and restoration of these areas to pre-existing grades.

Due to space constraints on the site (limited to the roadway corridor), and the need to reconstruct and widen the roadway in order to meet the project purpose and need, there is limited space available for RFA mitigation on site. However, where space allows, shade tree plantings are proposed along the roadway corridor. In total, fifty-three trees are proposed to be planted along the roadway. Of this, eighteen trees will be planted within RFA, and thirteen trees will be planted within the 100-foot buffer zone to BVW. A summary of the proposed species is provided in Table 3 below. Please refer to the project plans in Appendix I for specific planting locations.

Table 3. Summary of Proposed Shade Tree Plantings along the Project Corridor

Scientific Name	Common Name	Caliper	Container	Remarks
Cercis canadensis	Eastern Redbud	2-2.5”	B&B	Single stem
Amelanchier x grandiflora	Serviceberry	2-2.5”	B&B	Single stem
Ulmus americana	American Elm	2-2.5”	B&B	

Additional mitigation proposed seeks to address roadside erosion. The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling has led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway.

Under existing conditions many areas within the limit of work are experiencing significant roadside erosion which is entering adjacent wetland resource areas. The proposed project has been designed for anticipated flows with alterations to the overall grade of the roadway and the addition of closed drainage throughout the corridor. This drainage includes sixty new sump catch basins and approximately 3,500 linear feet (LF) of new pipe to support the closed drainage. All discharges adjacent to wetland resources include preformed scour holes to reduce unwanted erosion.

Sediment controls (compost filter tubes or similar) will be installed between the limits of work and adjacent wetlands to protect them during construction. Sediment controls are depicted on the project plans provided in Appendix I.

Compliance with Performance Standards

This proposed project is being submitted for review as a limited project per 310 CMR 10.53(3)(f) "*Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving drainage systems*."

As a limited project, the project must meet the performance standards for wetland resource areas to the maximum extent practicable. The project has been designed to minimize and avoid impacts to the extent practicable and proposes mitigation for those impacts which are unavoidable.

Compliance with the performance standards for BVW and RFA are discussed below.

Bordering Vegetated Wetland

The proposed project will result in approximately 238 SF of permanent BVW impacts as a result of the roadway widening work and approximately 134 SF of temporary BVW impacts as a result of sediment control installation. This work will be mitigated through the construction of a 217 SF wetland replication area, as depicted on Sheet 16 in the permit drawings. The overall project will include construction of an additional 1,204 SF wetland replication area to mitigate for BVW impacts associated with the culvert replacement work (to be permitted under the 401 WQC, as described above). Overall, the two wetland replication areas, totaling 1,421 SF, will provide mitigation for all of the project's proposed permanent BVW impacts (both associated with the roadway work and the bridge exempt work) at well over a 1:1 ratio.

Any proposed work within BVW must meet the performance standards set forth by the WPA. Each performance standard for work in BVW (per 310 CMR 10.55(5)) is provided below, followed by an explanation on how the project complies with each standard.

(a) Where the presumption set forth in 310 CMR 10.55(3) is not overcome, any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.

Impacts to BVW have been avoided and minimized to the maximum extent practicable; however, as described above, approximately 238 SF of permanent alterations are proposed within BVW in order to conduct the roadway improvements. Please refer to the roadway alternatives analysis in Appendix B for additional detail regarding how this alternative was selected to balance meeting the project purpose while minimizing impacts to BVW.

(b) Notwithstanding the provisions of 310 CMR 10.55(4)(a), the issuing authority may issue an Order of Conditions permitting work which results in the loss of up to 5000 square feet of Bordering Vegetated Wetland when said area is replaced in accordance with the following general conditions and any additional, specific conditions the issuing authority

deems necessary to ensure that the replacement area will function in a manner similar to the area that will be lost:

1. The surface of the replacement area to be created ("the replacement area") shall be equal to that of the area that will be lost ("the lost area").

The proposed roadway improvements will result in the permanent alteration of 238 SF of BVW. The two proposed wetland replication areas have been designed to provide greater than 1:1 mitigation for the total BVW impacts for the overall project, which includes those impacts proposed as part of the stream crossing work under the 401 WQC application.

2. The ground water and surface elevation of the replacement area shall be equal to that of the lost area.

The proposed replacement areas are contiguous with existing BVWs on site and have been designed to be equivalent with regard to the existing ground water and surface elevation.

3. The overall horizontal configuration and location of the replacement area with respect to the bank shall be similar to that of the lost area.

The 217 SF replication area is proposed adjacent to the BVW impact area associated with the relocation of the stone wall at STA 57. The proposed 1,204 SF replication area is located contiguous to an existing BVW immediately adjacent to the limits of the roadway grading. The areas of BVW impact are spread throughout the site but are all located immediately adjacent to a stream and the existing roadway grading. The proposed wetland replacement areas are in the same general configuration with relation to the landscape as the proposed impact areas.

4. The replacement area shall have an unrestricted hydraulic connection to the same water body or waterway associated with the lost area.

The 217 SF replication area will have an unrestricted hydraulic connection to the same waterway as the lost area in that location. The second proposed replacement area is located immediately adjacent to a stream. The areas of BVW impact are spread throughout the site but are all located immediately adjacent to a stream and the existing roadway grading. The proposed location for the 1,204 SF replication area was the only location on site that was suitable for the appropriately sized wetland replication area.

5. The replacement area shall be located within the same general area of the water body or reach of the waterway as the lost area.

The 217 SF replication area will be located within the same general reach of the wetland as the lost area. As stated above, the proposed 1,204 SF replacement area is located immediately adjacent to a stream. The areas of BVW impact are spread throughout the site but are all located immediately adjacent to a stream and the existing roadway grading. The

proposed location for the larger replacement area was the only location on site that was suitable for a replication area of this size.

6. At least 75% of the surface of the replacement area shall be reestablished with indigenous wetland plant species within two growing seasons, and prior to said vegetative reestablishment any exposed soil in the replacement area shall be temporarily stabilized to prevent erosion in accordance with standard U.S. Soil Conservation Service methods.

The two wetland replication areas will be monitored by a qualified wetland scientist for a minimum of two growing seasons after construction to ensure that at least 75% of the surface of each replication area is established with native wetland vegetation following two growing seasons.

7. the replacement area shall be provided in a manner which is consistent with all other General Performance Standards for each resource area in Part III of 310 CMR 10.00. In the exercise of this discretion, the issuing authority shall consider the magnitude of the alteration and the significance of the project site to the interests identified in M.G.L. c. 131, § 40, the extent to which adverse impacts can be avoided, the extent to which adverse impacts are minimized, and the extent to which mitigation measures, including replication or restoration, are provided to contribute to the protection of the interests identified in M.G.L. c. 131, § 40.

All appropriate performance standards for resource areas on site have been addressed in this narrative. The impacts to adjacent BVW resources have been minimized to the maximum extent possible as part of this proposed project. Measures to avoid and minimize impacts to BVW resources include the use of steeper slopes and minimizing the roadway width to the extent practicable. Please refer to the Alternatives Analysis in Appendix B for additional detail.

(c) Notwithstanding the provisions of 310 CMR 10.55(4)(a), the issuing authority may issue an Order of Conditions permitting work which results in the loss of a portion of Bordering Vegetated Wetland when.

1. said portion has a surface area less than five hundred square feet.

The proposed project will result in approximately 238 SF of permanent BVW impacts as a result of the roadway widening work.

2. said portion extends in a distinct linear configuration ("finger-like") into adjacent uplands; and

The proposed impact areas extend into a linear configuration into adjacent uplands.

3. in the judgment of the issuing authority it is not reasonable to scale down, redesign or otherwise change the proposed work so that it could be completed without loss of said wetland.

The proposed stone wall relocation that will result in 217 SF of permanent wetland impacts is unavoidable and is necessary to accommodate the roadway widening work in this location. These impacts have been avoided and minimized to the maximum extent possible, and appropriate mitigation will be provided. The additional 21 SF of BVW proposed to be permanently impacted at the eastern end of the project will be mitigated through construction of the 1,204 SF replication area.

(d) Notwithstanding the provisions of 310 CMR 10.55(4)(a),(b) and (c), no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.59.

A portion of the proposed roadway work is located within NHESP-mapped Estimated Habitats of Rare Wildlife and Priority Habitats of Rare Species. As part of this proposed project, a Massachusetts Endangered Species Act (MESA) determination was previously sought and a determination was issued on February 9, 2018, which indicated that the project would not result in a prohibited Take of state-listed rare species. Since the previous submission, plans have changed, and the previous determination has expired (See Appendix H for a copy of the previous determination – NHESP File No. 18-37517). As a result, this NOI is being submitted to NHESP for streamlined MESA review in conjunction with this NOI application.

(e) Any proposed work shall not destroy or otherwise impair any portion of a Bordering Vegetated Wetland that is within an Area of Critical Environmental Concern designated by the Secretary of Energy and Environmental Affairs under M.G.L. c. 21A, § 2(7) and 301 CMR 12.00: Areas of Critical Environmental Concern. 310 CMR 10.55(4)(e):

No portion of the proposed project area is located within an Area of Critical Environmental Concern.

Riverfront Area

The project proposes a total of 75,329 SF of impact within the Riverfront Area (70,987 SF permanent and 4,342 SF temporary). Of that, approximately 31,206 SF of those impacts will occur in previously degraded RFA that consists of existing roadway. Work proposed in RFA includes the construction of roadside grass and modified rock swales, the relocation of stone walls, and the construction of vegetated and modified rock fill slopes. The temporary impacts proposed in RFA are associated with the installation of sediment controls along the limits of work.

Due to the layout of the roadway and the need to widen the existing roadway in order to meet the project need, impacts to RFA were unavoidable. Please refer to the Alternatives Analysis in Appendix B, and the information below regarding compliance with the performance standards for RFA.

The project is considered a redevelopment project as defined under the WPA (310 CMR 10.04), which states, in part:

Redevelopment means replacement, rehabilitation, or expansion of existing structures, improvement of existing roads or reuse of degraded or previously developed areas for purposes of 310 CMR 10.58, governing work in the riverfront area. For purposes of the Stormwater Management Standards as provided in 310 CMR 10.05(6)(k) through (q), redevelopment is defined to include the following projects:

(a) Maintenance and improvement of existing roadways including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

Each performance standard for work in RFA for redevelopment projects area (per 310 CMR 10.58 (5)) is provided below, followed by an explanation on how the project complies with each standard.

(a) At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.

The proposed work will be located within the limits of the roadway right of way and associated roadway easements. Roadway widening is proposed in order to meet the project purpose and need; however, roadway widening, and the extent of impervious surface being added has been minimized to the extent practicable while still meeting the project purpose and need. Please refer to the alternatives analysis in Appendix B for additional information.

The proposed project will result in an improvement over existing conditions, as subsurface drainage systems consisting of catch basins and manholes are proposed to improve the existing drainage conditions along the roadway. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms. Additionally, Monson Road in this area is experiencing deteriorating roadway conditions. The proposed project will improve conditions through reconstruction and widening of the roadway, and through the proposed culvert replacements and new subsurface drainage improvements to improve stormwater management.

(b) Stormwater management is provided according to standards established by the Department.

As a redevelopment project, the proposed project has been designed to meet the Massachusetts Stormwater Management Standards to the maximum extent

practicable. Please refer to the Stormwater Management Report in Appendix D for additional information.

(c) Within 200-foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or one hundred feet, whichever is less, or not closer than existing conditions within 25-foot riverfront areas, except in accordance with 310 CMR 10.58(5)(f) or (g).

The proposed work adjacent to perennial streams will occur within previously developed and degraded areas consisting of existing roadway. Work proposed within the RFA includes grading and roadway widening, as well as stormwater improvements which are necessary in order to improve drainage conditions along Monson Road.

(d) Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).

Proposed work must occur within the Riverfront Area due to the need to improve the existing perennial stream crossings along the project corridor and improve drainage conditions along the roadway. Additionally, the project must occur within the RFA since the existing roadway currently encroaches into the area.

(e) The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).

As a limited project, the project is seeking flexibility with meeting this performance standard. This project is a roadway project with three perennial stream crossings. Due to the work needing to occur within the existing roadway corridor and right-of-way, impacts to RFA were unavoidable. However, the project proposes to limit impervious area to the maximum extent practicable, as described in the Alternatives Analysis in Appendix B.

Due to space constraints on the site (limited to the roadway corridor), and the need to reconstruct and widen the roadway in order to meet the project purpose and need, there is limited space available for RFA mitigation on site. However, where space allows, shade tree plantings are proposed within RFA along the roadway corridor. In total, eighteen trees are proposed to be planted along the roadway corridor within RFA. Proposed species are included in the table below. Please refer to the project plans in Appendix I for specific planting locations.

Proposed plantings will include the following:

Scientific Name	Common Name	Caliper	Container	Remarks
Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single stem
Amelanchier x grandiflora	Serviceberry	2-2.5"	B&B	Single stem
Ulmus americana	American Elm	2-2.5"	B&B	

(f) When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Restoration shall include:
1. removal of all debris, but retaining any trees or other mature vegetation.
trees or other mature vegetation.
2. grading to a topography which reduces runoff and increases infiltration.
3. coverage by topsoil at a depth consistent with natural conditions at the site; and
4. seeding and planting with an erosion control seed mixture, followed by plantings of herbaceous and woody species appropriate to the site.

As a limited project, the project is seeking flexibility with meeting this performance standard. The applicant proposes to meet this performance standard to the maximum extent practicable given the space constraints on site. Where space allows, shade tree plantings are proposed along the roadway corridor. Please refer to the project plans in Appendix I for specific planting locations.

(g) When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 through 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Energy and Environmental Affairs.

As a limited project, the project is seeking flexibility with meeting this performance standard. The applicant proposes to meet this performance standard to the maximum extent practicable given the space constraints on site. Where space allows, shade tree plantings are proposed along the roadway corridor. Please refer to the project plans in Appendix I for specific planting locations.

(h) The issuing authority shall include a continuing condition in the Certificate of Compliance for projects under 310 CMR 10.58(5)(f) or (g) prohibiting further alteration within the restoration or mitigation area, except as may be required to maintain the area in its restored or mitigated condition. Prior to requesting the issuance of the Certificate of Compliance, the applicant shall demonstrate the restoration or mitigation has been successfully completed for at least two growing seasons.

As a roadway project, maintenance will be required within the roadway right-of-way. The applicant proposes to install shade tree plantings along the roadway where space allows, as discussed above and shown on the plans in Appendix I. Those plantings will be monitored to ensure their viability and success for at least two growing seasons, as required.

Conclusion

Weston and Sampson are submitting this Notice of Intent (NOI) application for the Monson Road Transportation Improvements Project on behalf of the Town of Wales. The purpose of the project is to make roadway, shoulder, and drainage improvements to a 1.5-mile stretch of Monson Road. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms. Additionally, Monson Road in this area is experiencing deteriorating roadway conditions.

The proposed project will improve drainage conditions and provide for a safer roadway while also minimizing wetland resource area impacts to the maximum extent practicable. Mitigation has been provided for unavoidable impacts. The project is eligible for review as a limited project under the WPA, as described in the NOI. Therefore, the Applicant respectfully requests that the Commission issue an Order of Conditions approving the Project to protect the interests identified in the Wetlands Protection Act.

Appendix B

Alternatives Analysis

Alternatives Analysis – Notice of Intent

Weston & Sampson completed an alternatives analysis for Monson Road Transportation Improvements project in the Town of Wales, Massachusetts. The following information is presented below:

- Summary of Proposed Improvements
- Summary of Alternatives Considered for the Project

These proposed alternatives cover the roadway work only and not the culvert replacements, which fall under the bridge exemption. In accordance with the Massachusetts Transportation Bond Bill of 2014, the culvert replacements are exempt from review under the Massachusetts Wetlands Protection Act (M.G.L. c.131 §40) and its implementing regulations (310 CMR 10.00).

SUMMARY OF PROPOSED IMPROVEMENTS

The proposed project is a full depth reconstruction of Monson Road, which includes widening the roadway, intersection improvements, and drainage improvements. The proposed project will include addition of curbing and piped drainage systems to alleviate flooding and improve water quality within the project site.

The proposed plan includes the following elements:

- Reconstruct roadway (2 lanes; 10-foot wide lanes with 4-foot wide shoulders).
- Improve site lines with minor horizontal and vertical alignment changes.
- Add superelevation to curves.
- Install deep sump catch basins.
- Replace six (6) stream crossings (seven pipe/culvert replacements).
- Maintain erosion and sedimentation control measures throughout the project.

Drawings of the proposed project are included with the Notice of Intent Application. The proposed activities are improvements over existing conditions. Curbing sections of the proposed roadway and providing deep sump catch basins will reduce the amount of suspended solids in the stormwater discharge.

SUMMARY OF ALTERNATIVES CONSIDERED FOR THE PROJECT

The development of the proposed plan took into account the following alternatives:

- No action alternative.
- Road reconstruction with open drainage system.
- Road reconstruction with 32’ wide roadway with closed drainage system.
- Road reconstruction with 28’ wide roadway with open and closed drainage systems.

No Action Alternative

The no action alternative was reviewed during the initial stages of the project development. This alternative would leave the roadways and culverts in poor condition with aging infrastructure and drainage problems. Stormwater collection would not meet current development standards. This proposed alternative would have no direct impact on wetland resource areas however, there would

also be no improvement upon existing conditions. This proposed alternative does not meet the purpose or need for the project which is why it was not considered further.

Road Reconstruction (Open Drainage System)

The existing conditions of Monson Road include stormwater that sheets off the road into undefined swales and wetlands. Maintaining the open drainage system was considered to reduce the cost of installation of a piped system. The channels by themselves do not provide water quality treatment. Sediment forebays or equivalent Best Management Practices (BMPs) are required to be constructed with drainage channels to count toward stormwater treatment. Constructing these BMPs would require a sizeable amount of space, and potential property takes. Excavating defined channels would have increased wetland impacts comparable to the 28' wide roadway reconstruction alternative due to the property takes which would be necessary. This lateral expansion would move impacts further into adjacent wetland resources. This proposed alternative would also not result in an improvement over existing conditions which does not meet the Riverfront Area redevelopment performance standards.

Road Reconstruction (32' wide)

A roadway with 11' travel lanes and 5' wide shoulders (32' wide) was considered to meet the design criteria and improve pedestrian and bicycle accommodations. A closed drainage system with curbing was considered in this alternative along with replacing culverts and end walls. Widening the road from 22' to 32' would increase impervious cover, which would increase stormwater flow. Removing open drainage swales would reduce sedimentation into wetlands however this alternative would have increased wetland impacts comparable to the 28' wide roadway reconstruction alternative due to the property takes which would be necessary. This lateral expansion would move impacts further into adjacent wetland resources.

Road Reconstruction (28' wide)

This roadway design includes 10-foot travel lanes and 4-foot shoulders. This required a design criteria exception to provide the 4-foot shoulders instead of 5-foot bikes lanes/shoulders or 5-foot buffered bike lanes/shoulders, which most MassDOT projects must provide in accordance with MassDOT's complete streets requirements. This limits the widening of the road to 28 feet wide instead of 30 feet or more. Additionally, structural best management practices (BMPs) including deep sump catch basins have been incorporated into the stormwater design to reduce roadway erosion while improving stormwater quality. This alternative would also include replacing culverts and replacing end walls. Wetland impacts are the smallest with this proposed alternative as the lateral expansion is conservative. This alternative also reduces sedimentation from existing erosion into wetland resources resulting in an overall improvement over existing conditions.

The 28' wide roadway alternative was chosen because this alternative meets the design standards with the smallest increase in impervious area. This alternative also includes structural BMPs including deep sump catch basins. This alternative will reduce erosion of the road while improving stormwater quality.

Redevelopment Project

Per 310 CMR 10.04 Redevelopment means replacement, rehabilitation, or expansion of existing structures, improvement of existing roads or reuse of degraded or previously developed areas for purposes of 310 CMR 10.58, governing work in the Riverfront Area. For purpose of the Stormwater Management Standards as provided in 310 CMR 10.05(6)(k) through (q), redevelopment is defined to include the following projects:

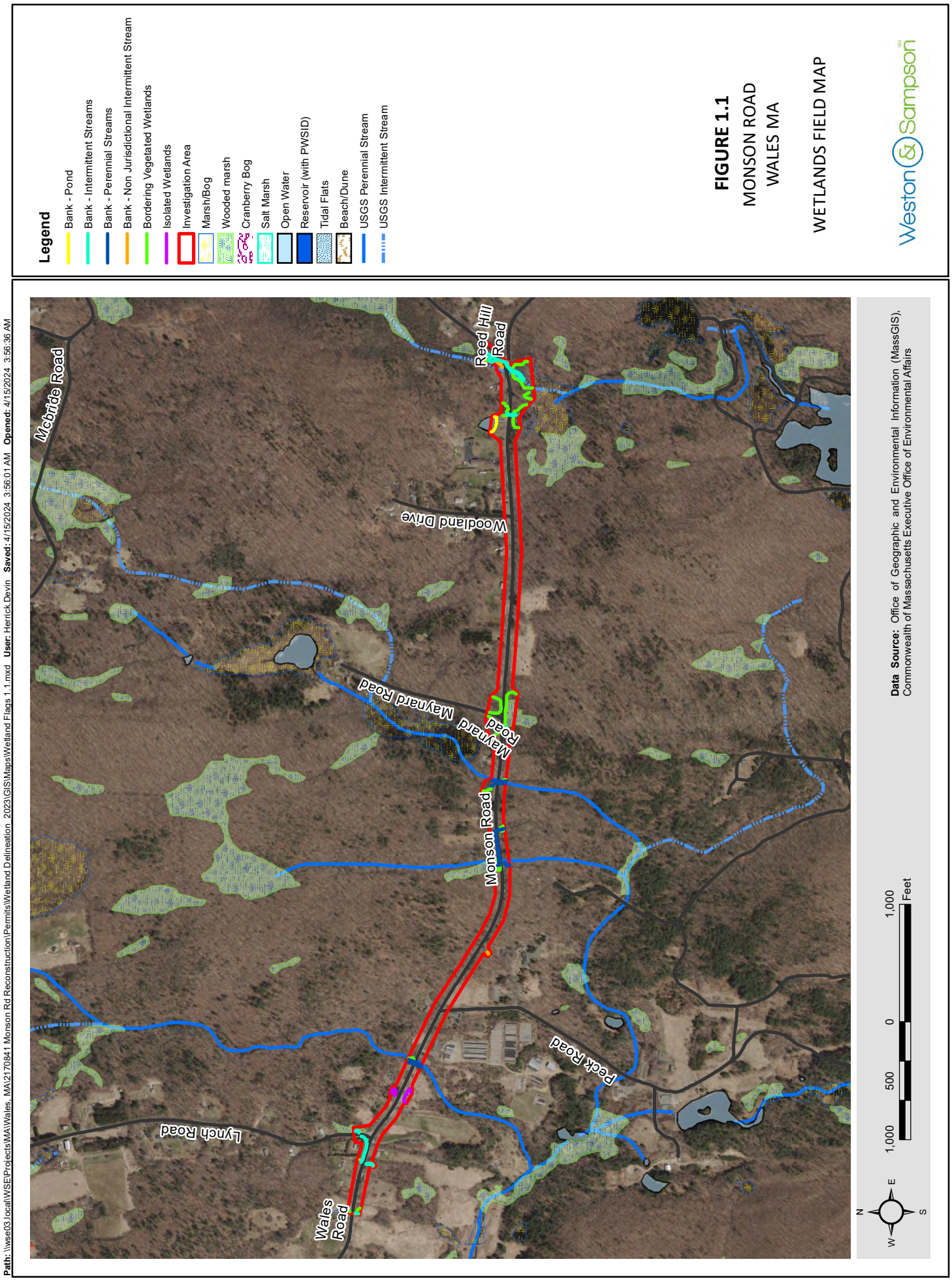
> (a) maintenance and improvement of existing roadways including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems and repaving;

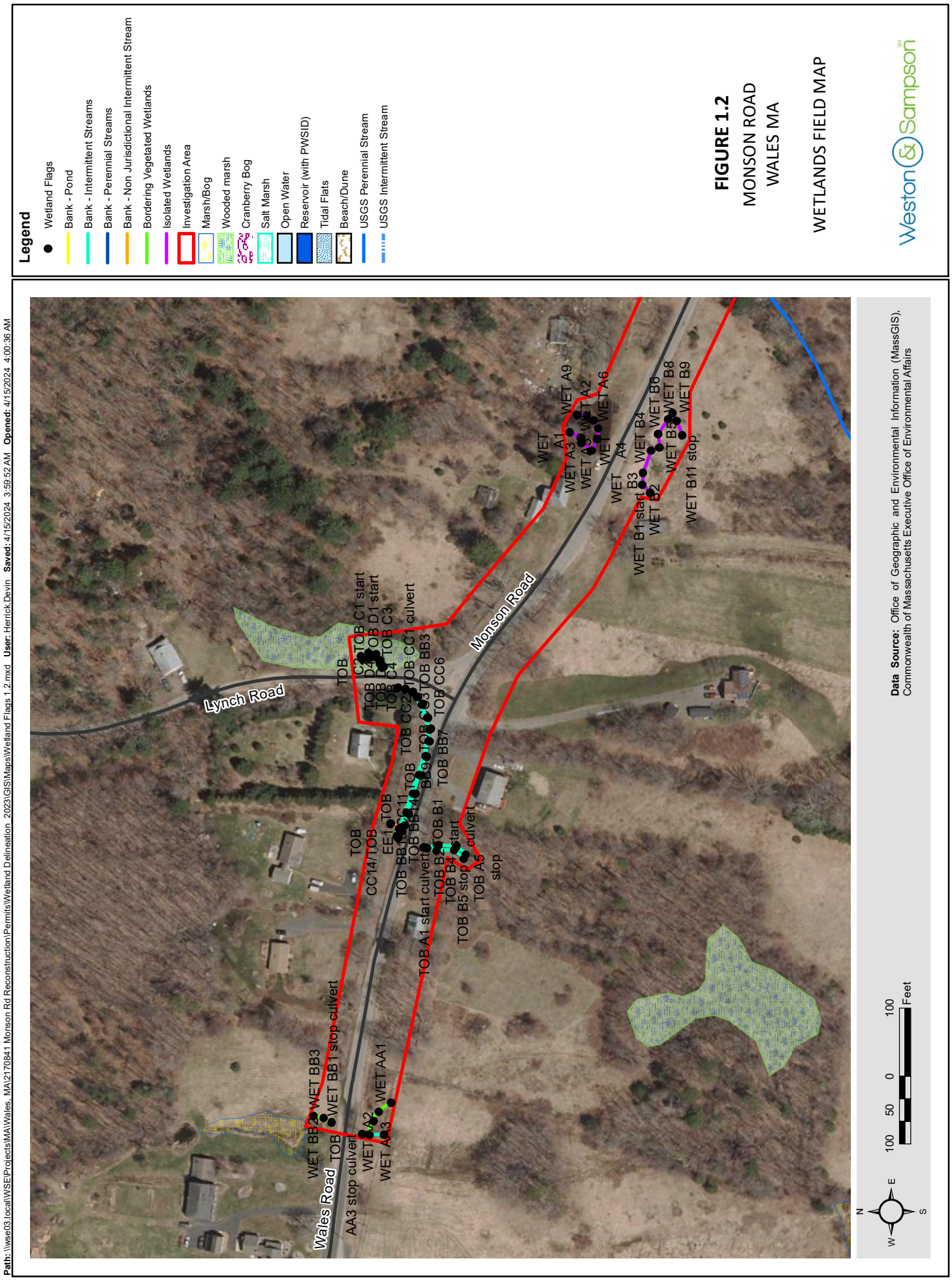
The proposed work within the Riverfront Area is for the maintenance and improvement of an existing road, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems and repaving. As such, work at this site is considered re-development work in Riverfront Area.

Upon completion of construction the resulting conditions will include improved stormwater handling utilizing subsurface drainage which will result in an improvement over existing conditions to the interests identified in M.G.L. c. 131 § 40.

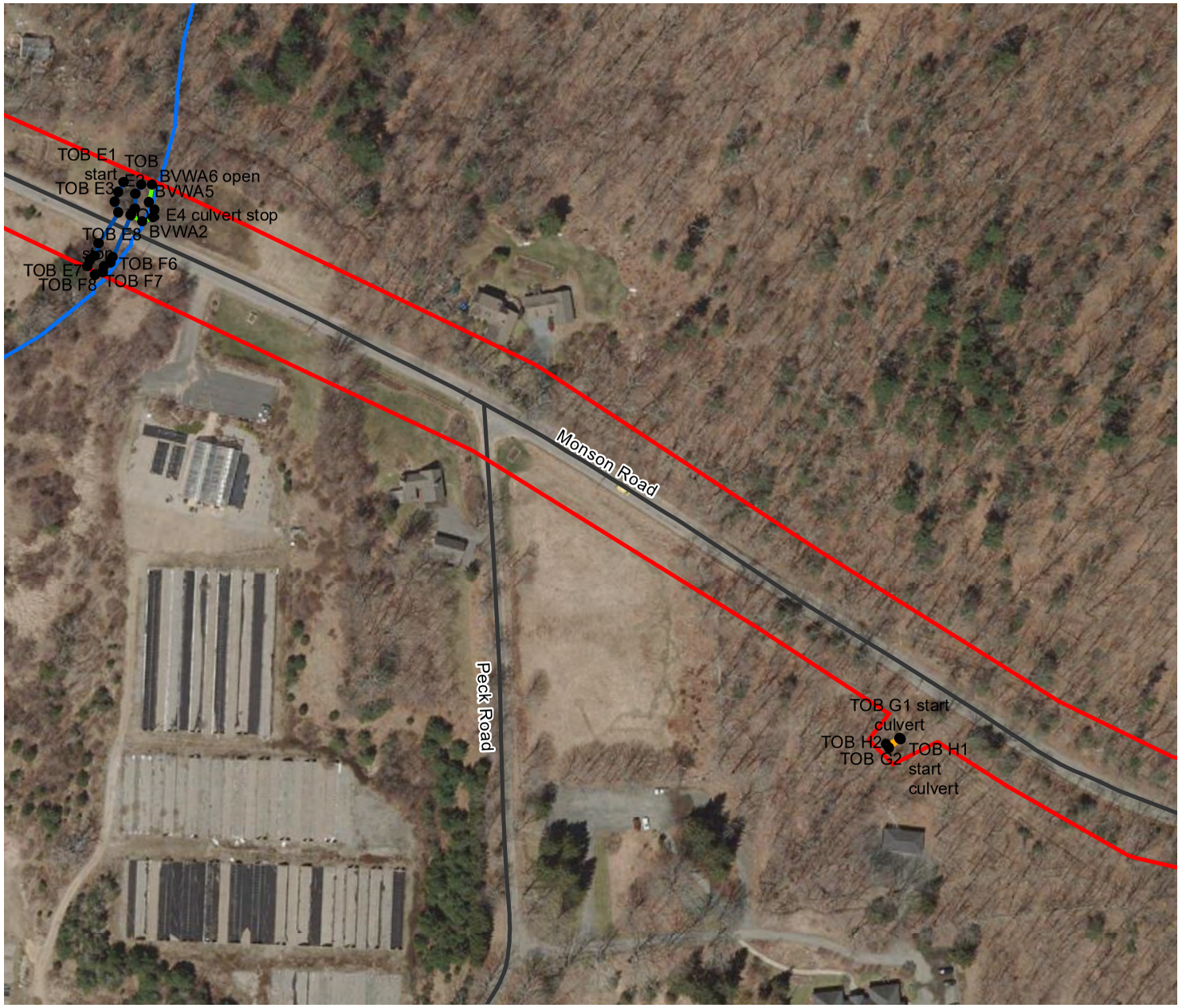
Appendix C

Site Maps


Legend
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.1
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.1.mxd User: Herrick.Devin Saved: 4/15/2024 3:56:01 AM Opened: 4/15/2024 3:56:36 AM
Mcbride Road
Reed Hill Road
Woodland Drive
Maynard Road
Maynard Road
Monson Road
Peck Road
Lynch Road
Wales Road
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
1,000 500 0 1,000 Feet
N
W
E
S


Legend
Wetland Flags
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.2
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Lynch Road
Monson Road
Wales Road
WET BB3
WET BB2
WET BB1 stop culvert
TOB
AA3 stop culvert
WET A2
WET A3
WET AA1
TOB CC14/TOB EE1
TOB CC11
TOB BB10
TOB BB9
TOB BB8
TOB BB7
TOB A1 start culvert
TOB B1
TOB B4
TOB B5 stop
TOB A5 culvert
stop
TOB CC6
TOB BB3
TOB CC1 culvert
TOB CC2
TOB C3
TOB C4
TOB C2
TOB C1 start
TOB D2
TOB D1 start
TOB C3
WET A1
WET A9
WET A3
WET A2
WET A5
WET A6
WET A4
WET B3
WET B4
WET B1 start
WET B2
WET B6
WET B5
WET B8
WET B9
WET B11 stop
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
N
S
E
W
100
50
0
100
Feet
Path: \\wse03.local\WSEProjects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.2.mxd User: Herrick.Devin Saved: 4/15/2024 3:59:52 AM Opened: 4/15/2024 4:00:36 AM

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.3.mxd User: Herrick.Devin Saved: 4/15/2024 4:01:11 AM Opened: 4/15/2024 4:01:40 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

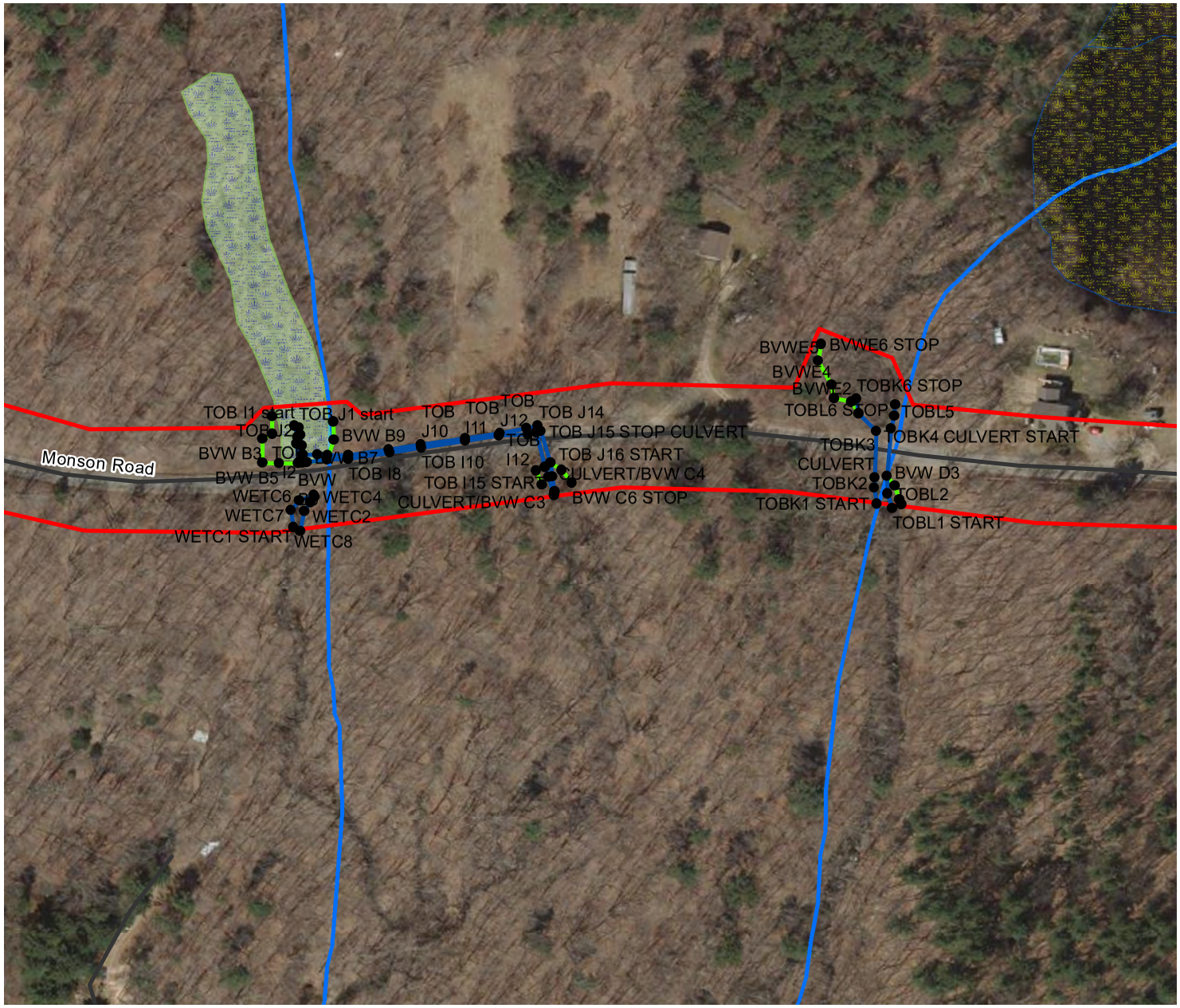
- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.3

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

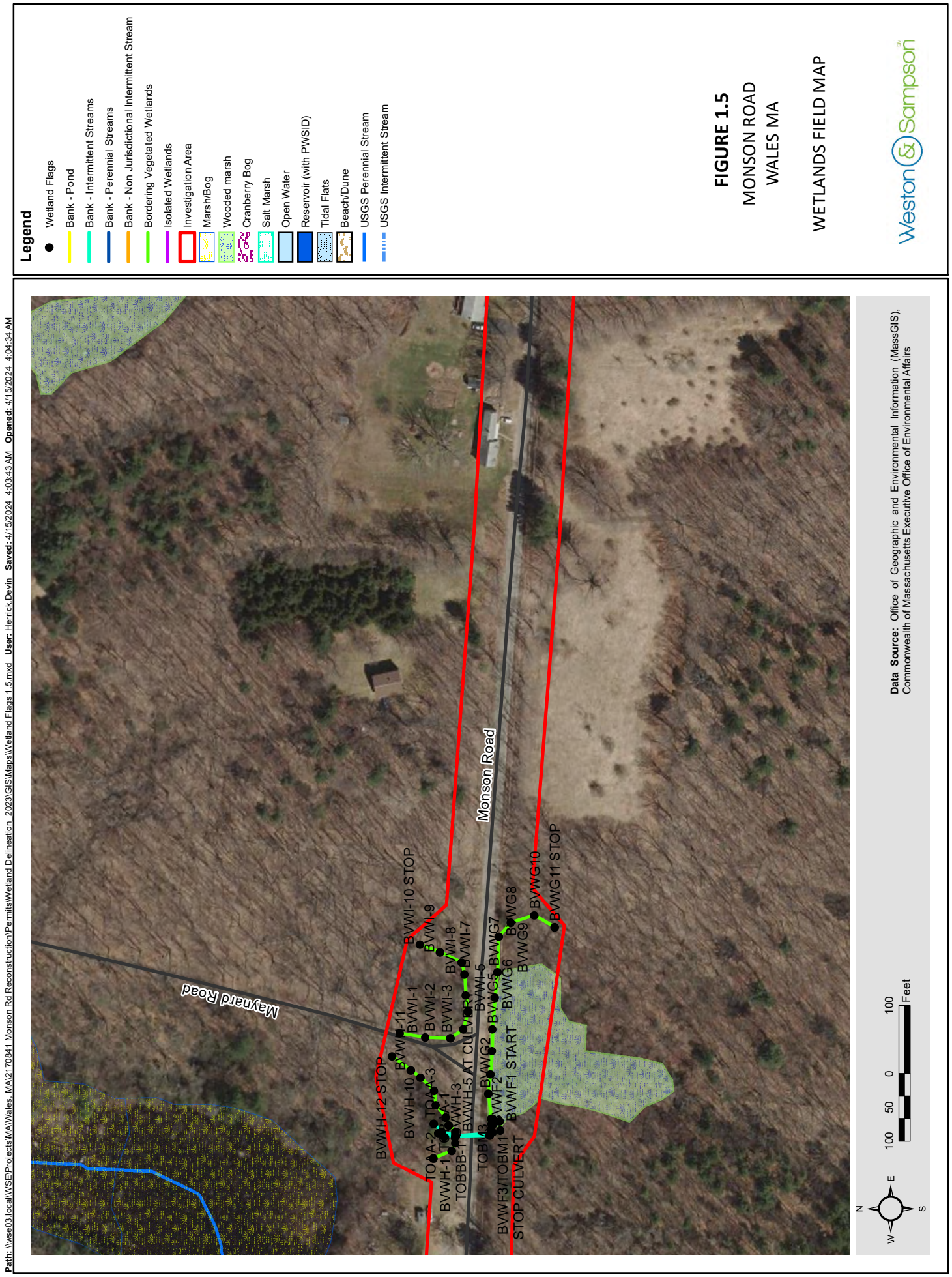
- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

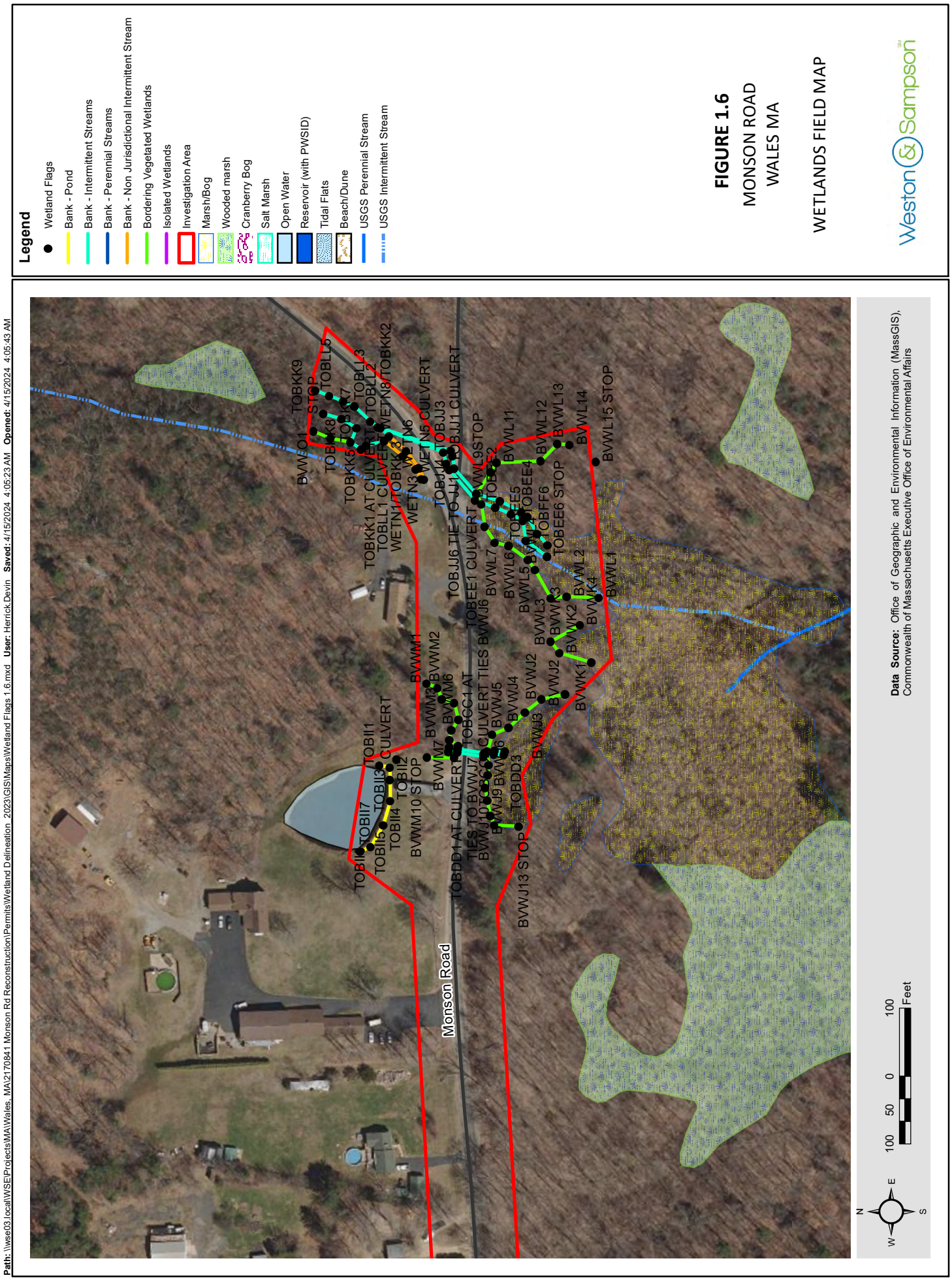
FIGURE 1.4

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson


Legend
Wetland Flags
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.5
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Maynard Road
Monson Road
BVWH-12 STOP
BVWH-11
BVWH-10
BVWH-9
BVWH-8
BVWH-7
BVWH-6
BVWH-5
BVWH-4
BVWH-3
BVWH-2
BVWH-1
TOBBB-1
TOBM3
BVWF3/TOBM1
STOP CULVERT
BVWF2
BVWF1 START
BVWI-1
BVWI-2
BVWI-3
BVWI-5 AT CULVERT
BVWI-7
BVWI-8
BVWI-9
BVWI-10 STOP
BVWG2
BVWG3
BVWG5
BVWG6
BVWG7
BVWG8
BVWG9
BVWG10
BVWG11 STOP
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
N
E
S
W
100
50
0
100
Feet
Path: \\wse03.local\WSEProjects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.5.mxd User: Herrick.Devin Saved: 4/15/2024 4:03:43 AM Opened: 4/15/2024 4:04:34 AM


Legend
Wetland Flags
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.6
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Monson Road
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
100 50 0 100 Feet
N
W
E
S
Path: \\wse03.local\WSEProjects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.6.mxd User: Herrick.Devin Saved: 4/15/2024 4:05:23 AM Opened: 4/15/2024 4:05:43 AM

N
W E
S

1,000 500 0 1,000
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

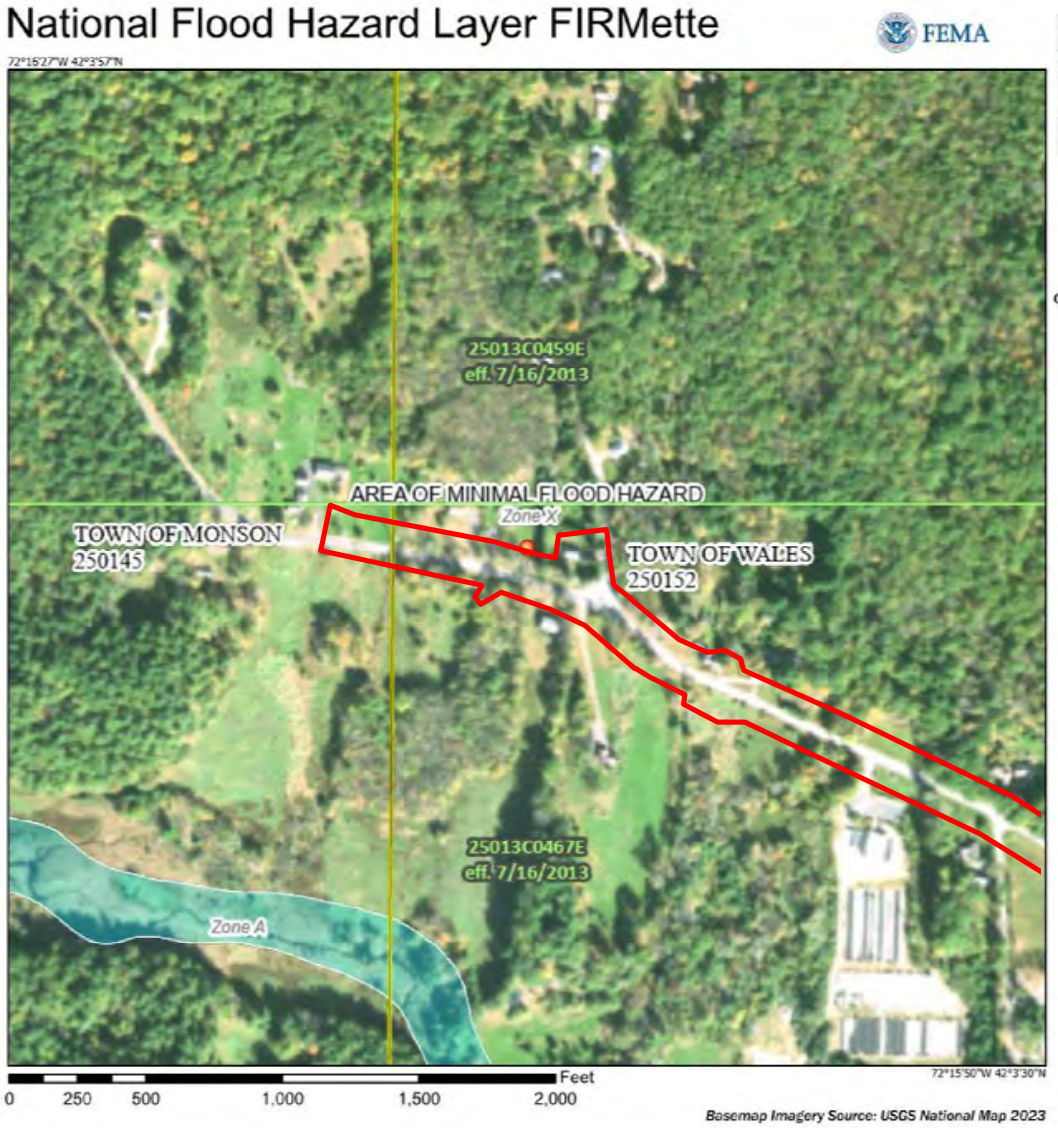
Investigation Area

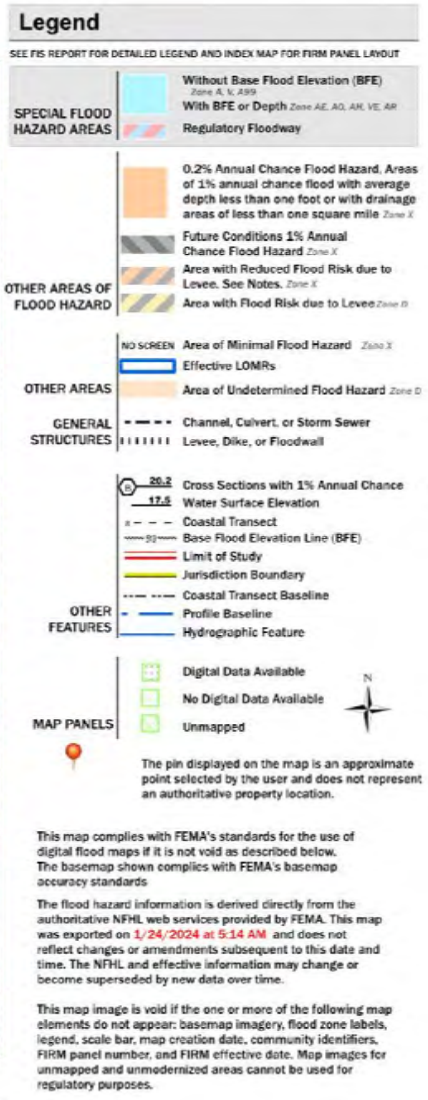
FIGURE 2

MONSON ROAD
WALES MA

USGS TOPOGRAPHIC MAP

Weston & Sampson





Legend

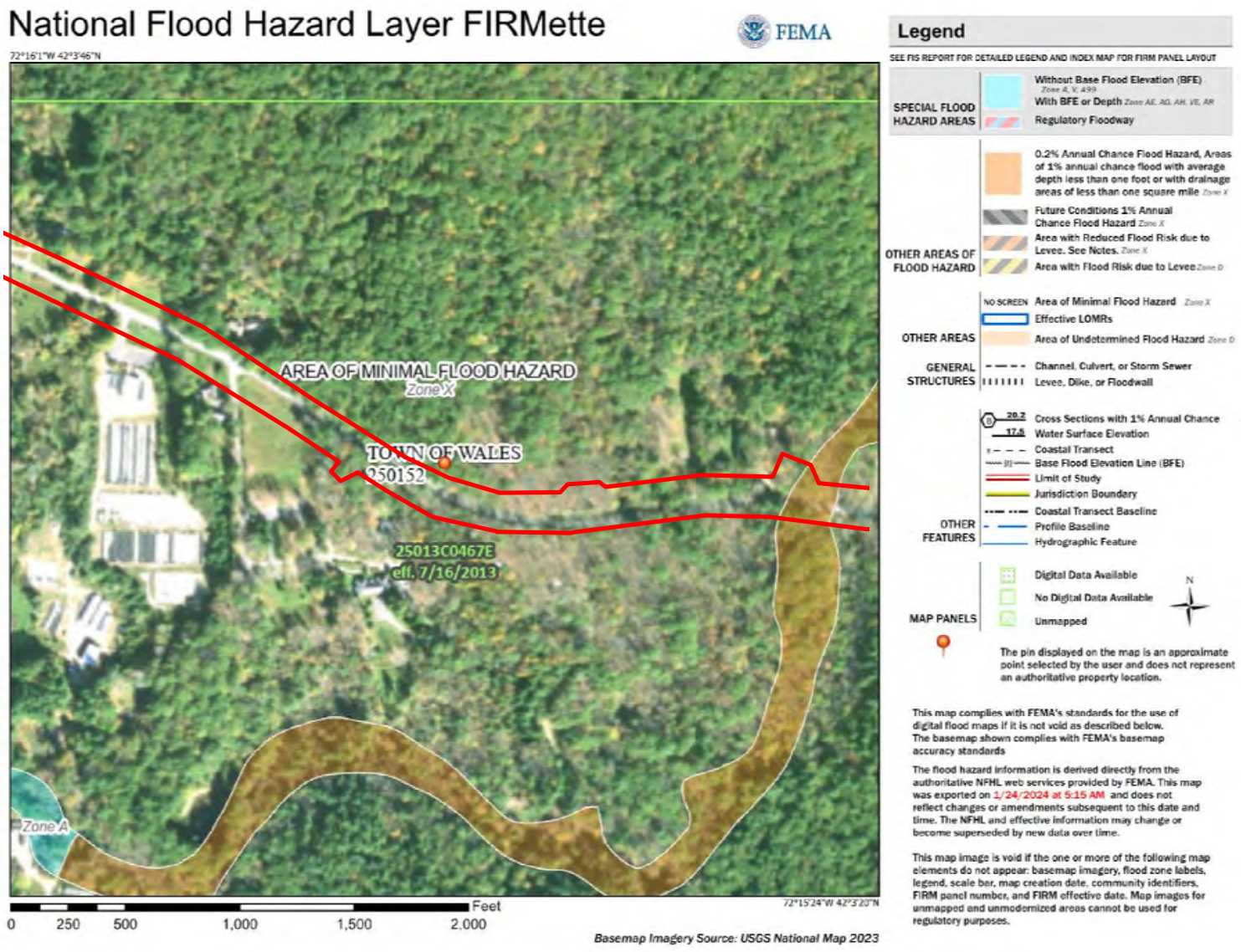
Investigation Area

FIGURE 3.1

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

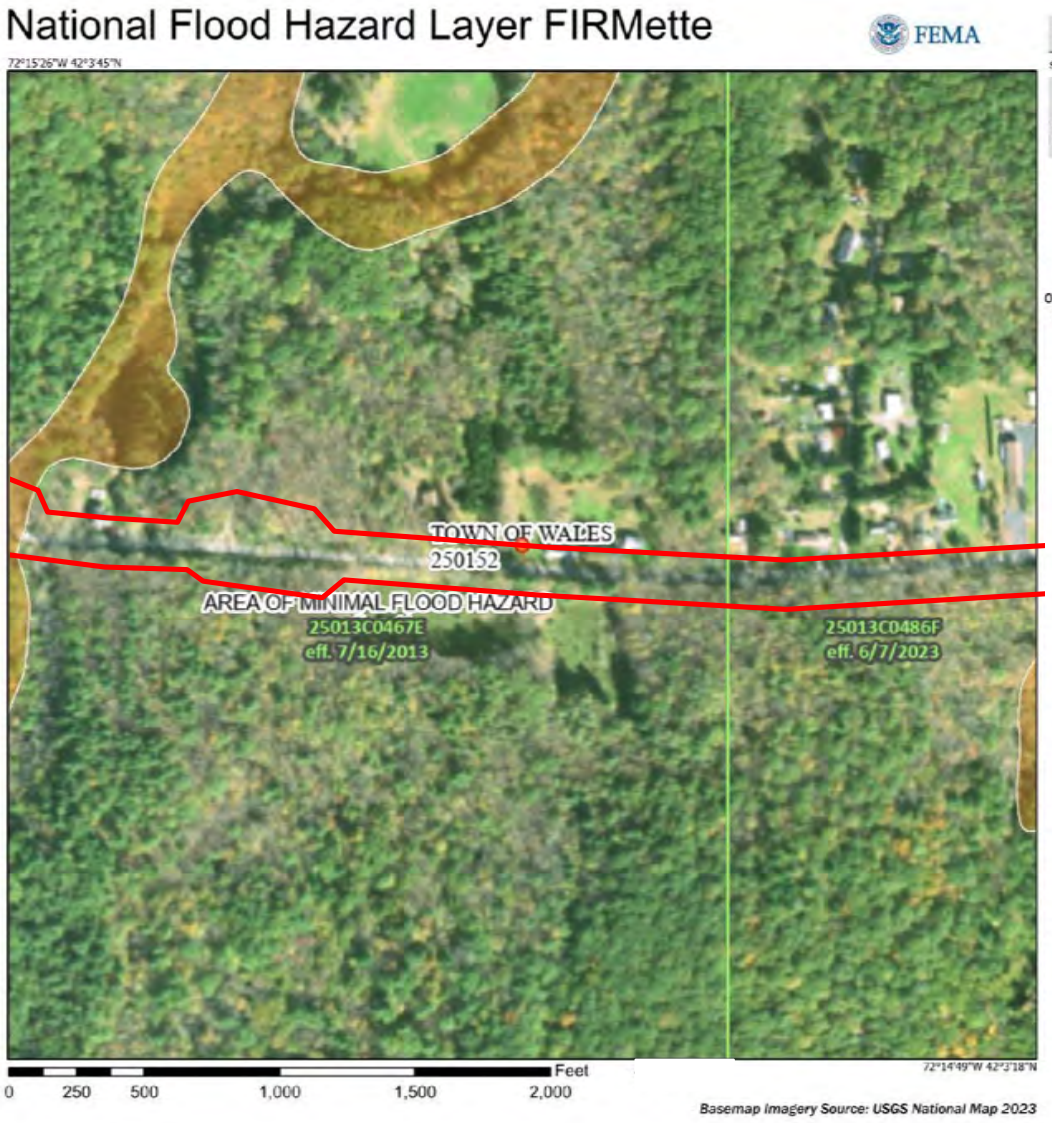
Investigation Area

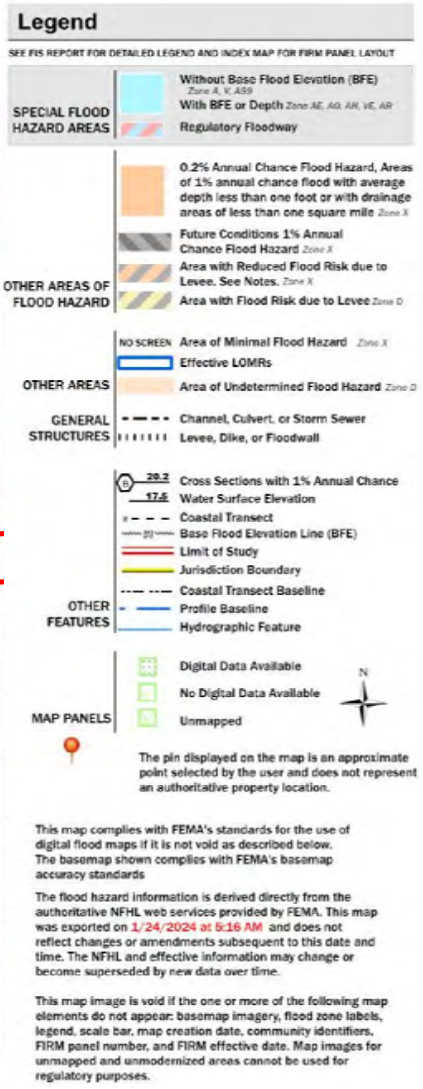
FIGURE 3.2

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson





Legend

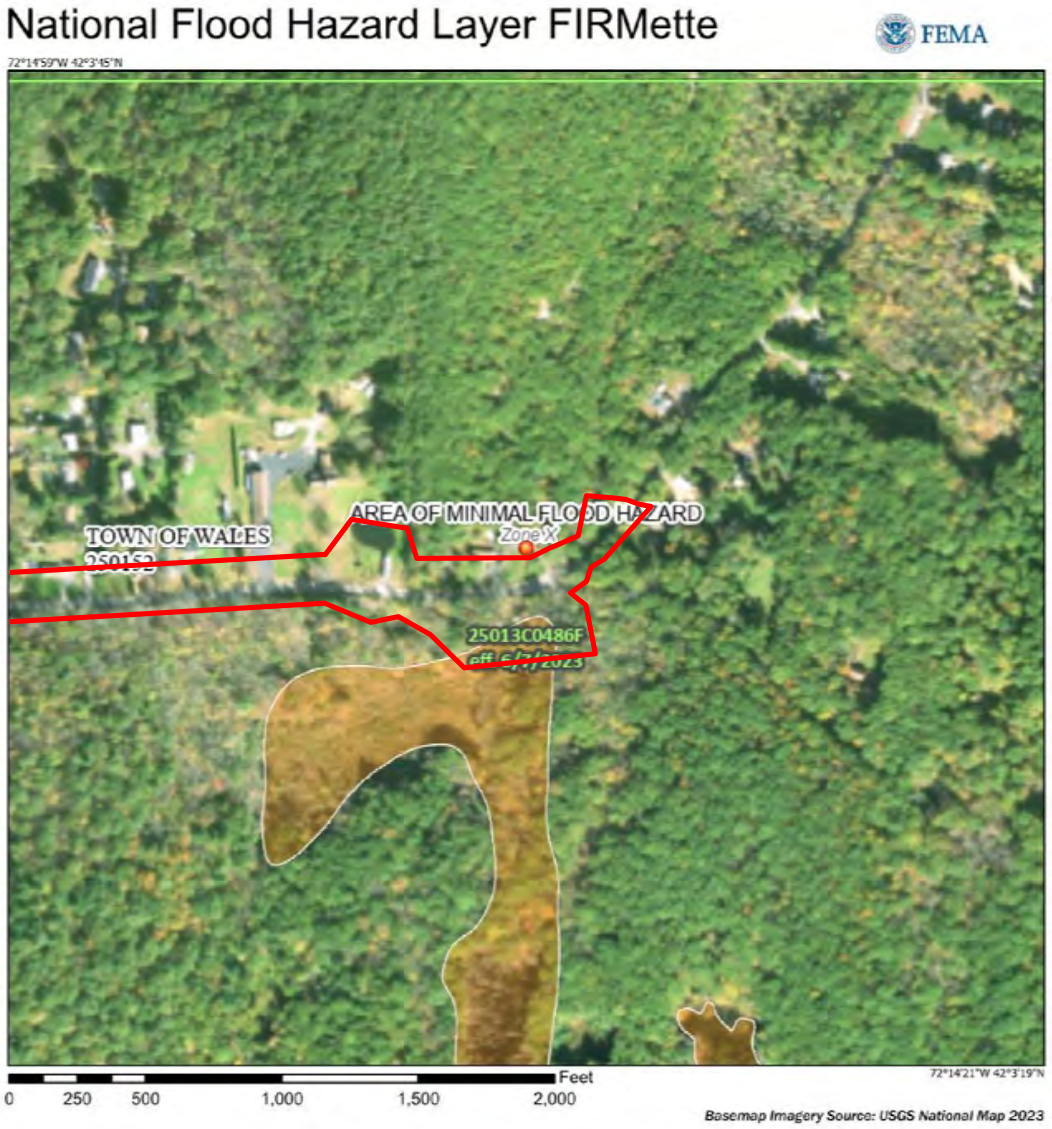
Investigation Area

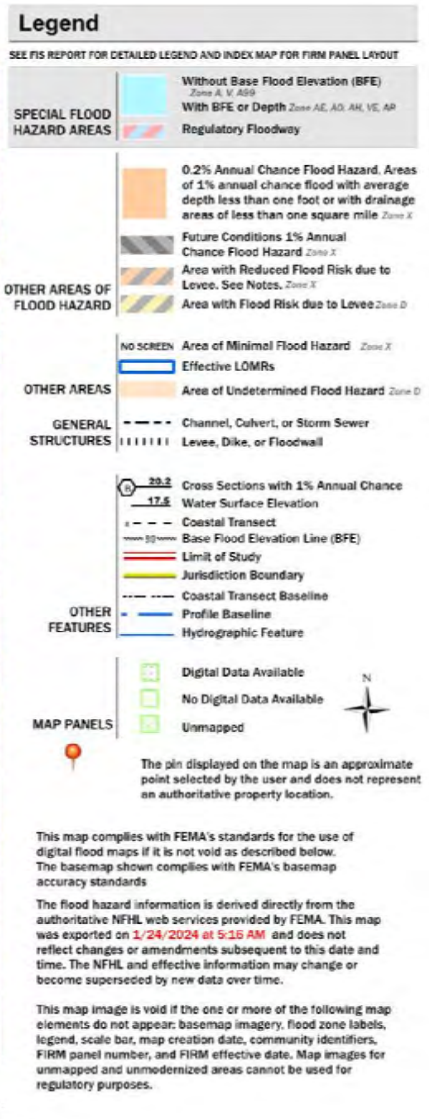
FIGURE 3.3

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson





Legend

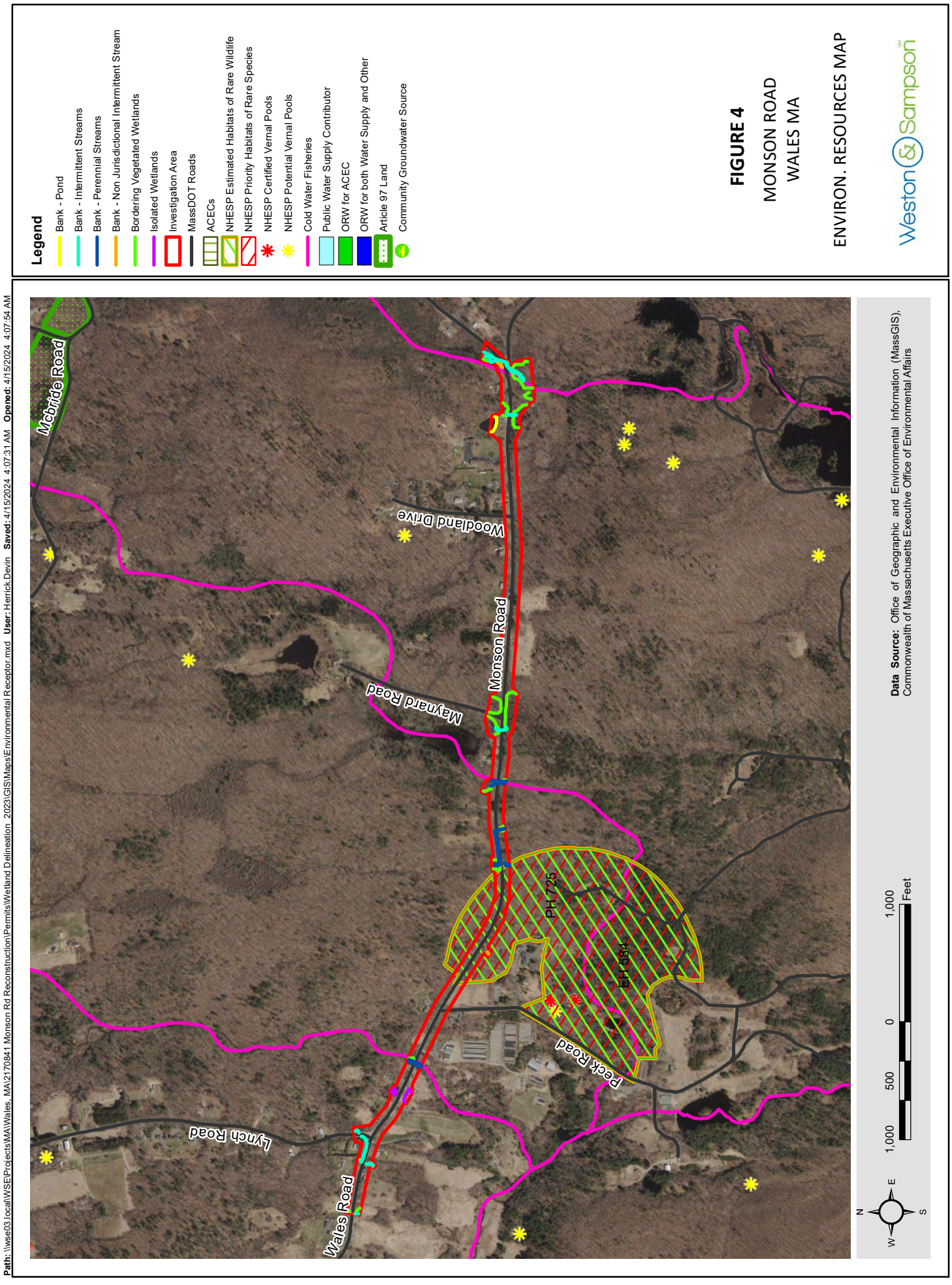
Investigation Area

FIGURE 3.4

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson


Legend
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
MassDOT Roads
ACECs
NHESP Estimated Habitats of Rare Wildlife
NHESP Priority Habitats of Rare Species
NHESP Certified Vernal Pools
NHESP Potential Vernal Pools
Cold Water Fisheries
Public Water Supply Contributor
ORW for ACEC
ORW for both Water Supply and Other
Article 97 Land
Community Groundwater Source
FIGURE 4
MONSON ROAD
WALES MA
ENVIRON. RESOURCES MAP
Weston & Sampson
Mcbride Road
Woodland Drive
Maynard Road
Monson Road
Lynch Road
Wales Road
Beck Road
PH 725
EH 584
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
1,000
500
0
1,000
Feet
N
E
S
W
Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Environmental Receptor.mxd User: Herrick.Devin Saved: 4/15/2024 4:07:31 AM Opened: 4/15/2024 4:07:54 AM

Appendix D

Stormwater Management Report

WESTON & SAMPSON ENGINEERS, INC.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

April, 2024

TOWN OF
Wales
MASSACHUSETTS

STORMWATER MANAGEMENT REPORT
Monson Road Reconstruction
Project File No.608163

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF ATTACHMENTS ii

1.0 INTRODUCTION 1

2.0 DESIGN METHODOLOGIES 1

3.0 EXISTING DRAINAGE CONDITIONS 2

4.0 PROPOSED DRAINAGE CONDITIONS 2

5.0 THE STORMWATER MANAGEMENT STANDARDS 3

6.0 EROSION & SEDIMENTATION CONTROL MEASURES 7

7.0 SUMMARY 7

REGISTERED PROFESSIONAL ENGINEER'S CERTIFICATION 7

LIST OF ATTACHMENTS

Attachment A ..... Figures

Attachment B ..... Stormwater Checklist

Attachment C ..... Drainage Report

Attachment D ..... Operation and Maintenance Plan

Attachment E ..... Erosion and Sedimentation Control Plan and Pollution Prevention Plan

1.0 INTRODUCTION

This Stormwater Management Report has been developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. See Attachment A for a Locus Map of the Project Location. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has an open "country" drainage system consisting of stormwater runoff that sheets off the road into undefined swales and wetlands. Cross culverts convey a mix of stormwater runoff from the road and streamflow from overland areas. Roadside sediment deposits block some of the water from sheeting off the road, which causes water to flood the road and damage the road structure. There are also minimal water quality measures. There are nine culvert crossings that convey streams and roadside ditch water under Monson Road. These water courses eventually discharge into Vinica Brook. The existing culverts are undersized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 4.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project site is considered to be categorized as a redevelopment project according to the definition within volume 2, chapter 3 of the Massachusetts Stormwater Handbook. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

The drainage requirements are summarized in the Stormwater Checklist found in Attachment B.

2.0 DESIGN METHODOLOGIES

The survey performed for this project has been used in conjunction with the Mass GIS LIDAR Data to delineate drainage area limits for this project. The watershed area for each structure (both existing and proposed) was finalized based on a detailed field investigation.

The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design. Rational Method is used for determining runoff peak flows and design spreads of the road drainage system for a 10-year frequency design storm. The storm drainage systems were evaluated and designed using *Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2023*. An IDF curve for the project site was derived to depict the current precipitation intensities as summarized in the NOAA Atlas 14 Precipitation Data.

A proposed drainage area spreadsheet was composed to compute total areas and C-values for each catch basin. The runoff coefficients used are 0.9 for paved areas, 0.3 for grassy areas and 0.2 for unimproved areas (woods). A minimum time of concentration of 5 minutes was used for paved areas.

The hydraulic flow capacity of each drainage system was determined through gutter flow, storm sewer design, and hydraulic grade line analyses. The results of these calculations are presented using the Hydraflow Storm Sewers Program (see Attachment C for Drainage Report).

The culverts that cross Monson Road are designed for a 25-year frequency design storm because Monson Road is a Rural Major Collector. The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. The HY-8 Reports are included in the Drainage Report in Attachment C.

3.0 EXISTING DRAINAGE CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.2 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.5 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Eight culvert crossings convey unnamed brooks under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+33, Sta. 24+92, Sta. 34+50 Sta. 43+76, Sta. 46+65, Sta. 50+72, Sta 82+07, and Sta 86+53. These unnamed brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Attachment C for Drainage Report and HY-8 output.

4.0 PROPOSED DRAINAGE CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and improve the existing drainage conditions. The proposed impervious area within the project limits is 5.3 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 3.8 acres. 0.70 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. Based on site investigations, historical records, and GIS data, the proposed drainage areas were determined which can be found in the Drainage Report in Attachment C.

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. See Attachment C for the Drainage Report that describes each swale and contains swale design calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

Seven closed storm sewer systems are proposed along Monson Road. See Attachment C for the Drainage Report that describes each system and contains Hydraflow Storm Sewer Reports. These

systems shall outfall near the existing cross culverts or proposed drainage swales. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts.

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Attachment C for the Drainage Report which contains the proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 2 Design Methodologies. The 12" CPP culvert at STA 15+33 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9.5 ft and rise 6.5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+76 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+65 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain and the 12" CMP crossing at STA 55+20 will also remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, the 24" stone box culvert which crossed diagonally under Monson Road near STA 86+53 will be replaced by a well-defined box culvert of span 8 ft and rise 4.5 ft. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+33, STA 43+76, STA 46+65, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in the Drainage Report in Attachment C.

Water Quality:

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis.

At the existing outfalls, there is no evidence of erosion. All banks are stable with heavy vegetation and scour holes containing large rocks. A long-term Pollution Prevention Plan/ Operation and Maintenance Plan is included in Attachment D. This plan clearly identifies that the Town Highway maintenance will be responsible for inspections and periodic maintenance, which includes street sweeping and sediment removal.

5.0 THE STORMWATER MANAGEMENT STANDARDS

The Massachusetts Department of Environmental Protection (MassDEP) developed the Stormwater Policy that includes the ten Stormwater Management Standards. These standards address water quality and water quantity. It should be noted that the upstream watershed areas are unchanged. Minor increases in flows will have negligible effect on the discharges in Vinica Brook. This roadway

redevelopment project was designed to comply with the standards up to the maximum extent practicable. See Attachment B for the Stormwater Checklist.

Standard 1: *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The proposed project will create seven new closed drainage systems, but none of these systems will include new untreated discharges. The redevelopment project includes widening Monson Road and adding a shoulder for the safety of pedestrians and bikes. The total increase in impervious area is 0.88 acres, and the total increase in flow for a 10-yr storm event is 3.83%. The new pipe discharges will be treated by standard water quality measures to the maximum extent practicable as indicated in the Standard 4 explanation. Outfall protection is proposed for each new outfall and is summarized with backup calculations in the Drainage Report in Attachment C.

Standard 2: *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

The proposed project will include roadway widening with the addition of 4-ft shoulders to improve safety conditions and meet the requirements of MassDOT. Retention or detention is not practicable within the roadway right of way. The total increase in flows is 1.7 cfs for the 10 Year storm, which is a 3.83% increase over the pre-development peak discharge rate. The total increase in flows for the 2 Year storm is 1.2 cfs. The increase in flow is distributed across multiple outfalls and culvert crossings as shown in Tables 1 and 2 below. The increase in flow was calculated with the Rational Method based on the increase in impervious area per drainage area. This flow will be treated with catch basins with deep sumps as well as natural grass and lined swales. The flow will discharge to areas with outlet protection (level spreaders, modified rockfill aprons, or scour holes), which will reduce the velocity of the flow allowing sediment to deposit and decrease potential erosion.

Table 1. Increase in Flows for 10-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	4.47	4.56	0.09
Sta 15+30 Crossing	8.21	8.42	0.21
Sta 24+93 Crossing	8.15	8.41	0.26
Sta 31+62 Outlet/ Runoff	5.39	5.61	0.22
Sta 43+76 Crossing	1.42	1.52	0.10
Sta. 46+65 Crossing	1.82	1.76	-0.05
Sta 50+72 Crossing	5.34	5.65	0.31
Sta 73+23 Outlet/ Runoff	3.36	3.50	0.13
Sta 82+00 Outlet/ Runoff	4.57	4.85	0.28
Sta 85+72 Outlet/ Crossing	2.20	2.36	0.16
Total	**44.9**	**46.6**	**1.7**

The largest increase in flow is 0.31 cfs at the 50+72 crossing. The flow will be dissipated by an existing scour hole before traveling downstream to an unnamed brook. At all the crossings with proposed improvements, there will be a reduction in velocity due to increased openness ratios in the box culverts and larger proposed pipe diameters.

Table 2. Increase in Flows for 2-year Design Frequency Storm

Drainage Area	Existing Flow (cfs)	Proposed Flow (cfs)	Increase in Flow (cfs)
Sta 11+50 to 14+10	3.05	3.11	0.06
Sta 15+30 Crossing	5.60	5.75	0.15
Sta 24+93 Crossing	5.55	5.73	0.18
Sta 31+62 Outlet/ Runoff	3.67	3.82	0.15
Sta 43+76 Crossing	0.96	1.03	0.07
Sta. 46+65 Crossing	1.24	1.20	-0.04
Sta 50+72 Crossing	3.64	3.85	0.21
Sta 73+23 Outlet/ Runoff	2.29	2.38	0.09
Sta 82+00 Outlet/ Runoff	3.11	3.30	0.19
Sta 85+72 Outlet/ Crossing	1.50	1.61	0.11
Total	30.6	31.8	1.2

This roadway project requires road widening, which causes an increase in flow. The site does not contain areas to detain or retain stormwater runoff due to lack of available space within the public layout. The stormwater is treated before discharge, and the outlets contain outlet protection to reduce potential erosion. This roadway redevelopment project will comply with this standard up to the maximum extent practicable.

Standard 3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration to the maximum extent possible. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type*

Due to the limitations of right-of-way and existing utilities, there is insufficient space for the installation of recharge BMPs. Efforts were made to reduce the amount of curbing to allow roadway runoff into pervious areas. Roadside swales, including natural grass swales as well as modified rockfill lined swales are proposed along the corridor to help promote infiltration and provide disconnection. Additionally, the creation of approximately 75 linear feet of re-routed and daylighted stream channel increases the land under water area and promotes further recharge. Due to this project being a redevelopment, this standard complies to the maximum extent practicable.

Standard 4: *For new development, stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS)*

This project is a limited project that does not include modifications to the upstream watersheds, but only improvements to the existing roadway and storm drainage systems. All proposed drainage structures will have 4' deep sumps. Natural grass and lined swales are proposed to the maximum extent practicable to keep stormwater off of the roadway, promote infiltration, and contribute to TSS removal.

Standard 5: *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs. The use of infiltration practices without pretreatment is prohibited*

This standard is not applicable because roadways are not among the areas classified as having higher potential pollutant loads.

Standard 6: *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas*

Three of the brooks crossing Monson Road within the project are designated as Cold-Water Fisheries. These crossings are Vinica Brook at the Reed Hill Road intersection, Schoolhouse Brook (STA 50 +72) and the unnamed brook at STA 24+92. Stormwater discharges have been proposed near existing outfall locations in order to maintain the existing drainage patterns. All new outfalls are proposed outside of wetlands and streams and outfall protection is proposed in advance of the critical areas in order to reduce erosion and excess sediment. Insufficient space within the public layout restricts the installation of additional water quality measures. Linear stormwater infiltration practices were considered for the project, however, due to the relocation of the existing stone walls within the remaining town layout limits to reduce the total length of removal of stone walls below the MEPA threshold, many of the stone walls occupy locations where excavated infiltration swales could be installed without more significant right-of-way impacts. Additionally, in many areas long, linear and parallel wetlands and watercourses run along the roadway and occupy portions of the roadway town layout which also normally be considered for linear practices. Lastly, in order to qualify as a linear stormwater practice, the design would need to provide a certain depth and width in order to provide the minimum quality volume characteristics which significantly increase the easements needed on the abutting private properties which include single family developed and undeveloped residential and large parcels of undeveloped wildlife sanctuary property all of which are densely vegetated with mature shade and other tree species.

Standard 7: *Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.*

This project qualifies as a redevelopment project according to the definition within volume 2, chapter 3 of the *Massachusetts Stormwater Handbook.* The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

Piped stormwater systems and roadside swales are proposed to improve the conveyance and quality of stormwater. Stormwater water quality measures including deep sump catch basins are included to increase the removal of total suspended solids. Provision of structural SCMs beyond deep sump catch basins such as linear infiltration was investigated for this project however provision of such measures is not feasible due to lack of available space within the project right of way.

Standard 8: *Erosion and Sedimentation Controls must be implemented to prevent impacts during construction or land disturbance activities*

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment E. The location of proposed erosion control measures and installation details are shown on the plans. These measures include inlet protection on all catch basins and sediment barriers down gradient of all disturbances within the wetland buffer zones. Because the project will disturb more than an acre of land the contractor will request coverage under the NPDES Construction General Permit and will provide a Stormwater Pollution Prevention Plan (SWPPP).

Standard 9: *All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed*

An Operation and Maintenance Plan is provided in Attachment D.

Standard 10: *All illicit discharges to the system are prohibited*

Illicit discharges are not permitted in the Town of Wales. The project's stormwater management system, as shown on the plans submitted with this report, have been designed in full compliance with Standard 10. The project area does not have any known illicit connections. Any illicit connections to the stormwater management system found in the project limit of work during construction will be removed and/or resolved through MassDOT's Illicit Discharge Detention and Elimination (IDDE) Program. The Long-Term Pollution Prevention Plan, provided in Appendix E, includes measures to prevent illicit discharges.

6.0 EROSION & SEDIMENTATION CONTROL MEASURES

To protect the adjacent properties from construction related activities, a Soil Erosion and Sediment Control Plan has been developed in accordance with the latest Massachusetts Department of Environmental Protection (MassDEP) Erosion and Sediment Control Guidelines. This plan will be implemented prior to the start of any site disturbance and will involve the combined use of compost filter tubes, silt fencing, silt sacks, and vegetative stabilization. Refer to Design Plans for soil erosion and sediment control notes and details.

Once a construction schedule has been established, a responsible person shall be named who will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials, installation, and maintenance of erosion and sediment structures, and the communication and detailed explanation of the requirements and objectives of the erosion and sediment control measures to all people involved in the site work.

Weston & Sampson shall be notified at 1-860-616-6495 of any proposed alteration to the erosion and sediment control plan prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

7.0 SUMMARY

The proposed project will improve the roadway, traffic and drainage conditions at the project site. The proposed roadway redevelopment will comply with the standards to the maximum extent practicable. The proposed project shall satisfy the stormwater requirements of the Massachusetts Stormwater Handbook.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Management Report, including the soils information, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, and the plans showing the stormwater management system, and have assessed that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also assessed that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

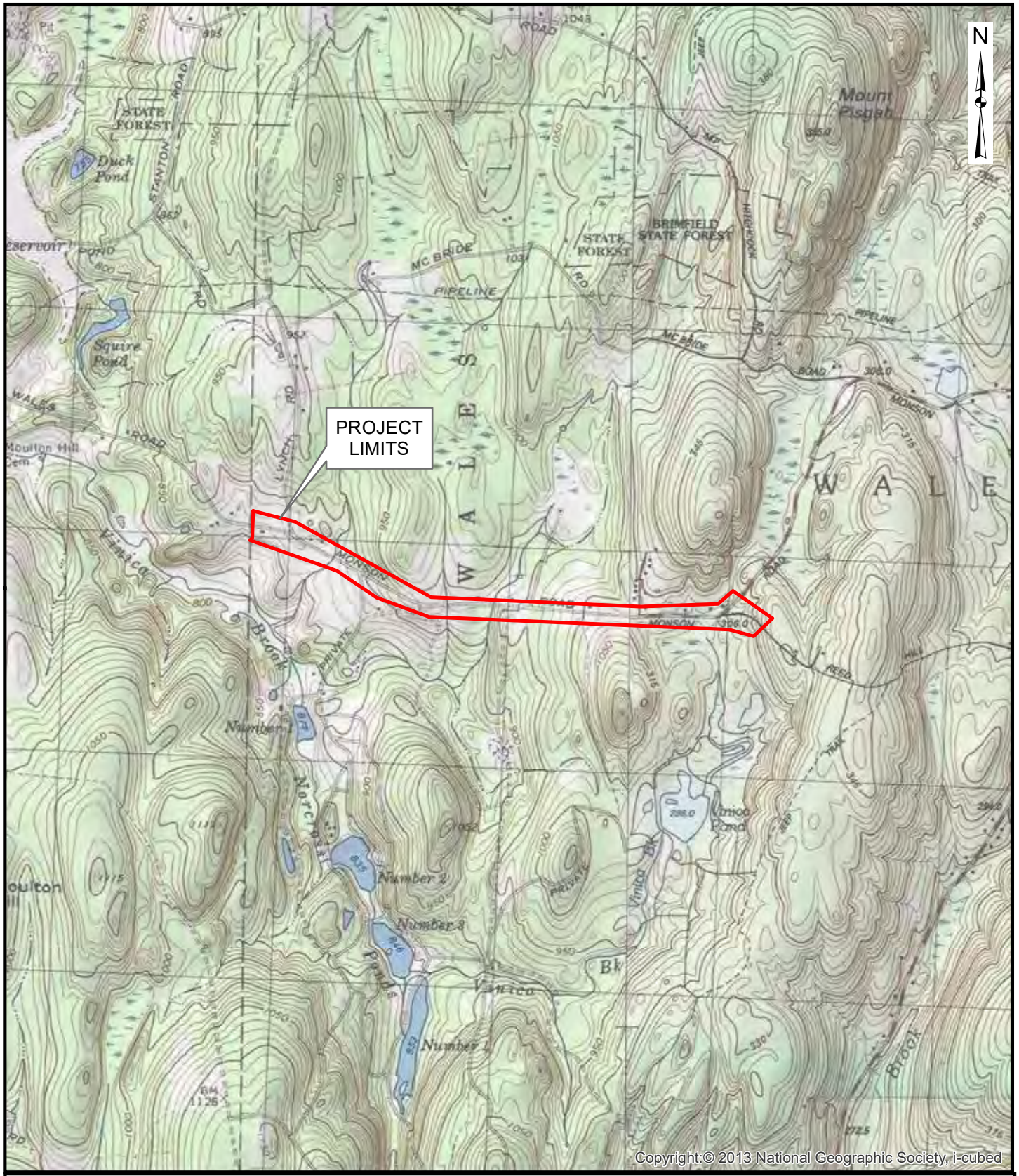
Registered Professional Engineer Block and Signature

Conrad C. Nuthmann 6/4/2024

Signature and Date

ATTACHMENT A

Figures



Project Limits

FIGURE 1
MONSON ROAD IMPROVEMENTS
Wales, MA

LOCUS MAP

1 inch = 2,000 feet

1,000 0 1,000

Scale In Feet

Weston & Sampson

Path: P:\MA\Wales, MA\2170841 Monson Rd Reconstruction\CAD\GIS\LocusMap.mxd User: ColesL Saved: 1/31/2018 2:49:29 PM Opened: 1/31/2018 2:49:49 PM

ATTACHMENT B

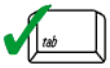
Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

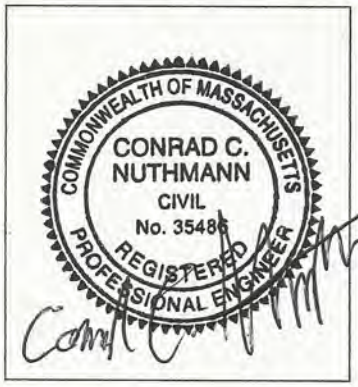
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date 6/5/2024

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☒ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

☒ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

ATTACHMENT C

Drainage Report

Weston & Sampson

westonandsampson.com

712 Brook Street, Suite 103
Rocky Hill, CT 06067
tel: 860.513.1473

REPORT

April 2024

TOWN OF
Wales
MASSACHUSETTS

DRAINAGE REPORT
Monson Road Reconstruction
Project File No.608163

DRAINAGE REPORT

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i

LIST OF APPENDICES ii

1.0 INTRODUCTION 1

2.0 METHODOLIGIES 1

3.0 DESIGN SUMMARY 2
3.1 Drainage Regulations 2
3.2 Rational Method Factors 2

4.0 EXISTING CONDITIONS 3

5.0 PROPOSED CONDITIONS 3
5.1 Drainage Swales 3
5.2 Storm Sewer Systems 4
5.3 Cross Culverts 5
5.4 HY-8 6
5.5 HEC-RAS 6
5.6 Temporary Water Handling 7

6.0 WATER QUALITY MEASURES 7

7.0 CONCLUSION 7

LIST OF APPENDICES

Appendix A .....Watershed Maps

Appendix B ..... Rational Method Data

Appendix C ..... Hydraflow Reports

Appendix D .....HY-8 Reports

Appendix E .....HEC-RAS

Appendix F..... Drainage Swales

Appendix G..... Outlet Protection

1.0 INTRODUCTION

This Drainage Report was developed on behalf of the Town of Wales, MA for the Monson Road Transportation Improvement Project (TIP). Monson Road is a two-lane, Rural Major Collector. The project is located along Monson Road beginning at the Wales/Monson town line and traveling east about 1.5 miles to Reed Hill Road. This project consists of full depth reconstruction of Monson Road within the project limits and widening the road from 22' to 28' (10' wide lanes and 4' wide shoulders). Minor horizontal and vertical alignment changes are proposed to meet the current design standards and improve sight lines. Superelevation is also proposed along horizontal curves.

Currently the existing site has stormwater sheet off the road into undefined swales and wetlands. Drainage issues include roadside sediment deposits that cause water to flood the road, which damages the road structure. Pavement unraveling causes erosion at the edge of the pavement. There are also minimal water quality measures. There are nine culvert crossings that convey unnamed streams under Monson Road. The culverts also convey stormwater runoff that travels via roadside swales. These streams eventually discharge into Vinica Brook, which closest point is located approximately 1,000-ft to the south of the Monson Road intersection with Lynch Road. The existing culverts are inadequately sized, and overtopping of the roadway occurs during large storms.

The proposed project includes grass and modified rockfill lined swales in addition to closed drainage systems and curbing. Six of the existing culverts will be modified as described in Section 5.0. These drainage improvements will alleviate flooding and improve water quality within the project site. The project involves maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.

This report summarizes the existing drainage conditions and issues, the methodology used to perform the drainage analysis, and the proposed improvements to the storm drainage system.

2.0 METHODOLIGIES

Watershed areas were established through the use of project topographic survey, Mass GIS LIDAR Data, and site visits to verify watershed area limits. Site investigation of the entire project area included review of the condition of existing roads, utilities, culverts, and general surroundings. Field observations provided a better understanding of drainage patterns, watershed areas, and structures not included on mapping. Following site investigations, the layout of each drainage system was finalized and mapped. See Appendix A for Drainage Area Maps.

The Rational Method was used to determine the peak surface runoff rate of this watershed. The Rational Method involves three factors: the drainage area, the runoff coefficients based on surface features, and rainfall intensity based on the time of concentration of the drainage area. Individual peak surface runoff rates were determined for each catch basin where storm water is collected. The individual runoff rates were then combined into an overall system to represent the existing conditions. This was done for each of the systems studied, and the findings are discussed in the following sections.

Hydraflow Storm Sewers Extensions for AutoCAD Civil 3D 2023 was used to model the proposed piped drainage systems. The computer program used the Rational Method to determine peak flow rates based

on specific parameters input by the user. The capacity of each pipe was analyzed and compared to the flow in cubic feet per second (cfs) through the system. The software also computed gutter spreads and hydraulic grade lines. The Rational Method input is attached in Appendix B. Hydraflow results are included in Appendix C. The proposed systems were finalized to improve drainage conditions in a cost-effective manner, improve water quality, minimize property impacts, and maintain roadway conditions in the future.

The existing and proposed culverts were analyzed and designed using HY-8 Culvert Hydraulic Analysis Program version 7.50. HY-8 is a computerized implementation of Federal Highway Administration (FHWA) culvert hydraulic design. The program calculates the capacity of the culvert with headwater and tail water influences. The program also calculates energy dissipation. The HY-8 Reports are included in Appendix D.

3.0 DESIGN SUMMARY

The closed drainage systems and cross culverts were designed to meet MassDOT Standards.

3.1 Drainage Regulations

- The Massachusetts Highway Department Project Development & Design Guide - Chapter 8 (Drainage and Erosion Control) has been used as a guideline for the roadway drainage design.
- The roadway storm drain system is designed for a 10-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide. A 25-year design storm frequency was checked for systems with low points.
- The cross culverts are designed for a 25-year design storm frequency based on the recommendations for a Rural Major Collector in the Design Guide.

3.2 Rational Method Factors

- Drainage Area - The properties within the watershed limits of the storm drainage systems consist of woods and residential and commercial lots.
- Runoff coefficients were based on land cover obtained from aerial photography, survey, and field observations. The following runoff coefficients were used:
  - Impervious Areas (Asphalt, Concrete, Roofs, Etc.) = 0.90
  - Grass (open space) = 0.3
  - Woods = 0.2
- Precipitation data is based on the most current information taken from NOAA Atlas 14, Volume 10, Version 2, Precipitation Frequency Data Server for Wales, MA.
- Time of concentrations were based on the TR-55 method. A 5-minute minimum time of concentration was used for paved areas. The time of concentrations range from five minutes to twenty-four minutes.

4.0 EXISTING CONDITIONS

The existing drainage at Monson Road includes stormwater sheeting into undefined drainage swales and streamflow to culvert crossings. There are no existing closed drainage systems within the project area. The total impervious area of the existing roadway within the project limits is 4.6 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 4.5 acres. Sediment deposits cause the stormwater to flood the road, which causes the pavement to unravel. Eight culvert crossings convey unnamed brooks under Monson Road from north to south, and there is one culvert crossing at Sta. 55+20 which conveys a perched wet area from south to north. The eight north to south crossings are located at Sta 15+33, Sta. 24+92, Sta. 34+50 Sta. 43+76, Sta. 46+65, Sta. 50+72, Sta 82+07, and Sta 86+53. These unnamed brooks eventually discharge into Vinica Brook. The culverts also convey stormwater discharge from the northern drainage swales to the southern side of Monson Road. The existing culverts were modeled with HY-8. The models show that stormwater overtops the road for most of the culverts during a 25-year design storm. See Appendix D for existing culvert reports.

5.0 PROPOSED CONDITIONS

The proposed roadway improvements include roadway widening, roadway curbing, and super elevating sections of the roadway, which results in significant drainage revisions. Piped roadway drainage systems consisting of catch basins and manholes are proposed to meet the MassDOT drainage design standards and also improve the existing drainage conditions. The proposed impervious area within the project limits is 5.3 acres and the total pervious area consisting mainly of lawn, brush and lightly wooded areas is 3.8 acres. 0.70 acres of the proposed pavement is new impervious area. The watershed areas remain consistent with the existing drainage patterns as only slight modifications to the existing vertical and horizontal alignments is proposed. See utility plans under separate cover.

5.1 Drainage Swales

Drainage swales are proposed in sections where there is no curbing. The swales will have a bottom width of 1 FT and side slopes of 2:1. Three swales will have grass linings, and three swales will have modified rockfill linings. See Appendix E for Swale Calculations. The swales were designed to withstand the shear stress from a 10-year design frequency storm.

The modified rockfill swale from STA 14+50 to 17+00 has two sections: the first part conveys water from Sta. 17+00 into the culvert crossing at STA 15+25 and the second part continues west of the culvert crossing to outlet into the 15" RCP under the two residential driveways. This 15" RCP outlets into the grass swale which runs from STA 13+50 to STA 11+50. The existing grade from STA 11+00 to 11+50 carries the water from the swale into the existing wetlands. Curbing is provided from STA 13+50 to 15+00 on the south side of the road to protect runoff from getting in the yard of the house at 170 Monson Road. From STA 15+25 to STA 17+25, due to the superelevation of the roadway and the existing drainage patterns, the flow all sheets off to the southwest into the outlet area of the 18" RCP cross culvert at STA 15+25.

A modified rockfill drainage swale is proposed from STA 31+75 to 39+50 (flowing to the west) to catch the large amount of runoff traveling from the north side of Monson Road down into the project site. There will be no curbing on the northern side of the road to allow the runoff from the road to enter the swale. In addition, there will be no curbing on the south side of the road to allow any water on the high side of

the superelevation to naturally sheet off and follow the existing drainage patterns. At the high point of the roadway, STA 40+30, the modified rockfill swale will tie into a proposed grass swale which will flow to the east to outlet into the twin 12" RCP cross culverts.

After the initiation of the design project, the Town of Wales dug a roadside ditch from Sta. 44+00 to Sta. 46+65 to divert flow away from the existing plugged culvert at Sta. 43+76. The Town then installed a 12" CPP crossing at Sta. 46+65 to convey the diverted flow across Monson Road. This diversion created new wetlands along the side of the road as well as on the south side of the road where the 12" CPP outlets. The proposed conditions will replace the culvert at Sta. 43+76 with twin 12" RCPs and maintain the roadside ditch to divert a portion of the flow away from Sta. 43+76 during large storm events, so stormwater can travel east to the existing low point off the roadway at Sta. 46+65 and enter a proposed 12" RCP culvert to cross Monson Road to the south side. These proposed conditions will maintain the newly created wetlands as well as the existing drainage patterns.

A modified rockfill swale is proposed on the south side of the road from STA 70+50 to the outfall location at STA 73+25. This area of the project site, based on the natural topography, has water travelling onto the roadway from the south. This proposed swale will catch a large area of runoff before it can reach the roadway.

5.2 Storm Sewer Systems

Seven closed storm sewer systems are proposed along Monson Road. See Appendix B for drainage area information and see Appendix C for the Hydraflow Storm Sewer Reports. These systems shall outfall into streams or wooded areas. Modified rockfill aprons are proposed at outlets that do not directly discharge into the outlet protection for the culverts. See Appendix F for outlet protection calculations.

System Sta. 22+25

This system contains six catch basins and 12" or 15" reinforced concrete pipes (RCP). The system captures approximately 650 feet of roadway drainage along Monson Road between Lynch Road and the culvert at STA 24+93.This system also captures off-road drainage which is currently settling in the front yard of property 155 Monson Rd. This system discharges into the modified rockfill outlet protection at Sta. 22+25 directly before the flagged B-series wetlands.

System Sta. 25+50

This system contains two catch basins, and pipes are 12" RCP. The system captures approximately 700 feet of roadway drainage along the southern lane of Monson Road between the culvert at STA 24+93 and Sta. 30+00 (Peck Road). This system discharges into the outlet protection area of the two cross culverts near STA 25+00.

System Sta. 50+50

This system contains six catch basins, and pipes are 12" RCP. The system captures approximately 400 feet of roadway drainage along Monson Road between STA 48+00 and STA 52+00. The low point is located at STA 50+38 where this system outfalls into the proposed outlet protection near the existing 36" PVC cross culvert.

System Sta. 51+24

This system contains fourteen catch basins, and pipes are 12" RCP. The system captures approximately 1835 feet of roadway drainage along of Monson Road between STA 52+00 and STA

70+35. This system flows to the west and outlets into the proposed outlet protection for the existing 36" PVC cross culvert at STA 51+24.

System Sta. 73+30

This system contains five catch basins, and pipes are 12" RCP. The system captures approximately 500 feet of roadway drainage along Monson Road between STA 70+35 and STA 75+33. This system outfalls near the low point of the roadway at STA 73+25 with a proposed modified rockfill apron as outlet protection. The proposed swale on the south side of the road also outlets at the same location.

System Sta. 81+97

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 590 feet of roadway drainage along Monson Road between STA 75+35 and STA 81+25. There is no curb on the south side of the roadway from STA 76+50 to STA 79+20 so that water can sheet of naturally and eventually flow into the wetlands. At the low point at STA 82+75, there is no curb on either side of the road to allow water to sheet off into the adjacent wetlands. The water from the closed system discharges onto a modified rockfill apron which is part of the outlet protection for the 18" RCP culvert crossing at STA 82+05.

System Sta. 85+72

This system contains four catch basins, and pipes are 12" RCP. The system captures approximately 315 feet of roadway drainage along Monson Road between Sta 83+85 and Sta. 87+00. This system is located at a low point (STA 85+85) and outfalls into the graded rockfill channel which is in the place of the existing Reed Hill Rd. intersection. The adjacent wetland replication area adjoins the existing wetlands to accept the water from this closed system in addition to the box culvert coming from the north side of Monson Road and the proposed 18" culvert which crosses the relocated Reed Hill Road intersection. A proposed grass swale also helps convey water on the south side of Monson Road from STA 84+50 into the wetland replication area.

5.3 Cross Culverts

The nine drainage crossing locations will remain the same, but six of the culverts will be replaced with upgraded sizes and/or improved materials, one culvert will be removed, and two culverts will be retained. See Appendix D for proposed culvert reports. The culvert crossings are sized to convey a 25-year storm as described in Section 3 Design Summary. The 12" CPP culvert at STA 15+33 will be replaced by an 18" RCP culvert. The two twin pipe culverts at STA 24+92 will be replaced by an R.C.C box culvert of span 9.5 ft and rise 6.5 ft. The 15" culvert of unknown material at STA 34+50, which does not convey any streams or connect any wetland areas, will be removed and the flow will be conveyed by the proposed roadside swale and overland flow to the crossing at 24+92. The 12" CMP culvert at STA 43+76 will be replaced with twin 12" RCP culverts with flared ends on both the inlet and outlet. The 12" CPP culvert at STA 46+65 will be replaced by a 12" RCP culvert with a flared end at both the inlet and outlet. The 36" PVC pipe culvert at STA 50+72 will remain. The 12" CMP crossing at STA 55+20 was modeled using Hydraflow, which shows that a 12" pipe has enough capacity to convey the small contributing drainage area during a 25-year storm event, therefore the existing pipe will remain. The 12" CMP crossing at STA 82+07 will be replaced by an 18" RCP culvert. Finally, the 24" stone box culvert which crossed diagonally under Monson Road near STA 86+53 will be replaced by a well-defined box culvert of span 8 ft and rise 4.5 ft. A newly proposed 18" RCP cross culvert will be installed under the re-aligned Reed Hill Road at Sta. 1+50.

Outlet protection will be provided for all culvert crossings. The existing scour hole at STA 24+92 will be preserved and enhanced with native streambed material. The existing scour hole at STA 50+72 will be preserved and not modified. The outfalls at STA 15+33, STA 43+76, STA 46+65, STA 73+25, and STA 82+07 will have proposed modified rockfill aprons for outlet protection. Outlet Protection Calculations are in Appendix F.

5.4 HY-8

The primary software used for hydraulic analysis of culvert is HY-8. The crossings at STA 1+50, 15+33, 43+76, 46+65 and 82+07 were analyzed for existing and proposed conditions. The FHWA Culvert Hydraulic Analysis Program (HY-8) enables to analyze culvert performance for a crossing that has multiple culvert barrels that share the same tailwater and roadway overtopping.
Refer Appendix D for detailed results.

5.5 HEC-RAS

Culvert crossings at St. 24+92, 50+72 and 86+53 were evaluated using HEC-RAS program. Water surface profiles for the brook's 2, 10, 25, 50, and 100-year return frequency flood events were developed in a manner consistent with the standards used to develop water surface profiles under the NFIP. Survey information acquired for the project base plans was input using the HEC-RAS computer application and used as a basis for assembling a flood elevation profile hydraulic model of the project site. In the completed model, the channel and overbanks were assigned roughness coefficients (Manning's "n"). These values were selected based on aerial maps and field visit. All flood simulations performed with the project HEC-RAS model were done in a mixed flow mode and employed the upstream and downstream stream slope as the upstream and downstream boundary condition respectively.

A detailed hydraulic analysis was performed for the culvert crossings (both existing and proposed) in order to evaluate for 2, 5, 10, 25-year storm design. This investigation was conducted in a manner consistent with American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Department of Transport (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

The HEC-RAS model was performed for both existing as well as proposed conditions for the crossing 24+92, the existing crossing at 50+72 and the proposed crossing at 83+56. The geometry data, manning's constant and culvert data were input. Refer Appendix D for output data.

At Station (24+92): A four-sided precast concrete box culvert is proposed at this crossing. The span of culvert is 9.5 ft and rise of 6.5 ft. Two feet of the box culvert will be filled with natural stream bottom material. The results show this crossing will handle up to a 100-year event.

At Station (50+72): A 36" PVC pipe culvert exists for this crossing with the invert elevations of 922.04 on the upstream side and 920.04 on the downstream side. Existing structure was modeled using HEC-RAS. The results show this crossing will not overtop during a 25-year design period.

At Station (86+53): A 24" Stone box culvert exists over the entire crossing. A tributary of Vinica Brook crosses Monson Road at this station. The small woodland channel flows under Monson Road into a small depression near the intersection of Reed Hill Road. A precast concrete box culvert of span 8 ft

and rise 4.5 ft is proposed for this crossing. 2-feet of natural material will be filled at the bottom. Results indicate the crossing will adequately handle up to a 100-yr storm event.

6.0 TEMPORARY WATER HANDLING

Temporary water handling will be provided using temporary bypass pipes and sandbag systems as shown on the plans. (see design plans for sizes and invert elevations) will be installed. Sandbags in form of cofferdams will. The size of temporary pipes and flow through sandbags was based on HEC-RAS modeling information. A steady flow analysis was performed with approximate inverts and 2-year return period. The 2-year return period is a common design standard for temporary water handling structures and is considered a reasonable balance between the risk of failure and the cost of construction.

7.0 WATER QUALITY MEASURES

The existing roadway has significant sediment deposits and ponded areas. Pavement unraveling led to erosion at the edge of the pavement. Curbing the proposed roadway will significantly reduce the erosion potential at the edge of the pavement and from adjacent properties. Sediment from the roadway runoff will be trapped in the 4-foot sumps of the proposed catch basins. Natural turf will be established within the graded areas adjacent to the roadway. Street sweeping will be conducted on a regular basis. Due to limitations in the amount of public right-of-way, there will be no proposed water quality BMP's in an effort to reduce impacts on private property.

8.0 CONCLUSION

The proposed storm drainage systems are designed in accordance with the guidelines set in Chapter 8 (Drainage and Erosion Control) of the Mass Highway manual. The Hydraflow results show that the proposed systems are designed to convey a 10-year storm. The culverts are designed to convey a 25-year storm. The piped systems will assist in capturing roadway runoff to alleviate any potential flooding. The proposed drainage systems adequately address water quality to the maximum extent practicable.

APPENDIX A

Watershed Maps

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:53 AM

WALES
MONSON ROAD
DRAINAGE AREA MAPS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	8
	PROJECT FILE NO.	608163	

© 2024 Vexcel Corporation

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)

WATERSHED BOUNDARY (TYP.)

TC PATH (TYP.)

CATCHMENT AREA (TYP.)

OUTFALL STA 11+50
DESIGN POINT

OUTFALL STA 15+33
DESIGN POINT

N

MONSON ROAD
DRAINAGE AREA MAP–1

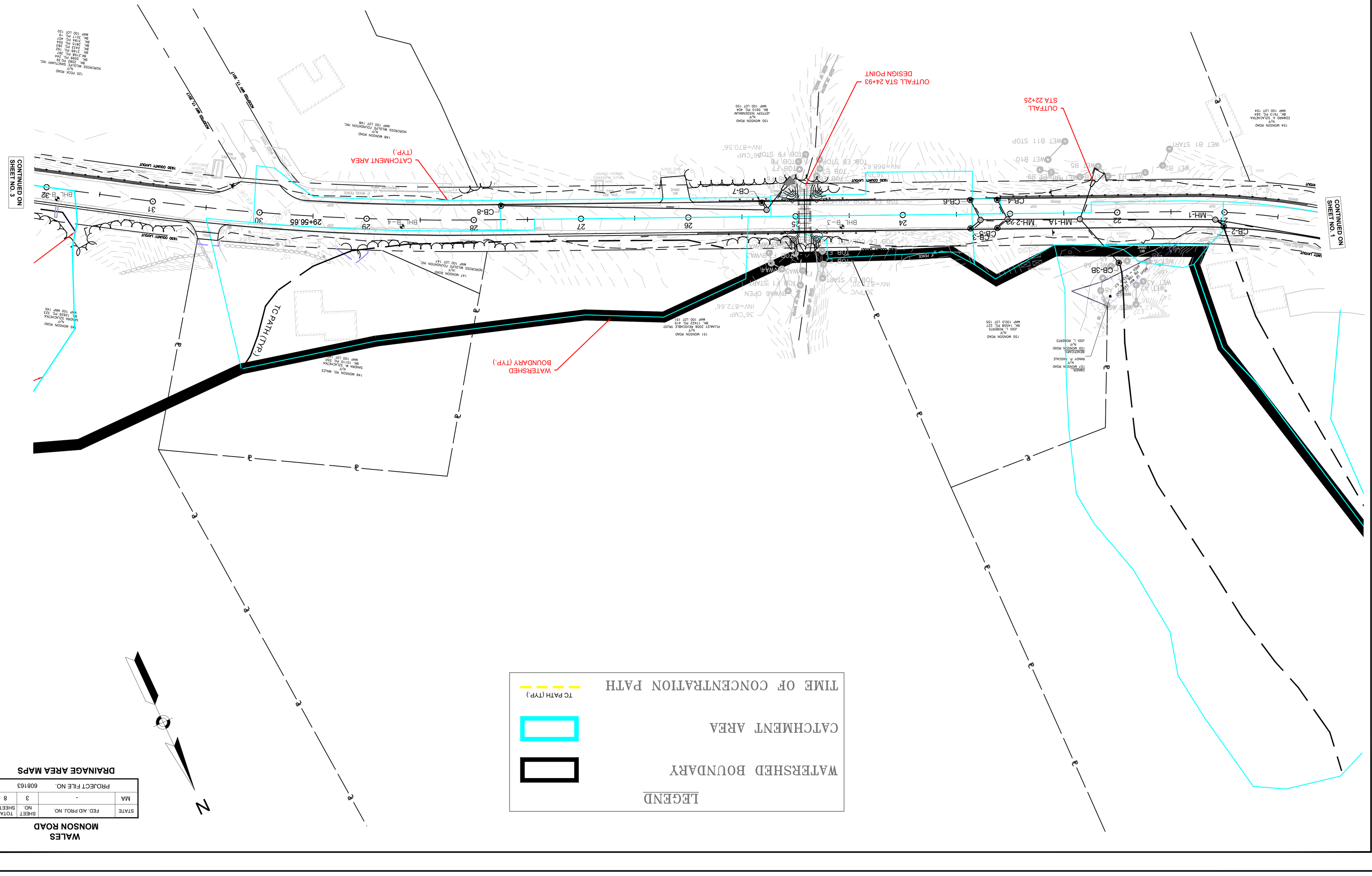
SCALE: 1"=40'

CONTINUED ON SHEET NO. 2

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-128112
A008080 - 89

MONSON ROAD
DRAINAGE AREA MAP-2

SCALE: 1"=40'



LEGEND

- WATERSHED BOUNDARY
- CATCHMENT AREA
- TIME OF CONCENTRATION PATH
  - TC PATH (TYP.)

DRAINAGE AREA MAPS

PROJECT FILE NO.		608163	
STATE	FED. AID PROJ. NO.	-	SHEET NO. 3	TOTAL SHEETS 8
MA			

WALES
MONSON ROAD

Proposal No. 608163-128112

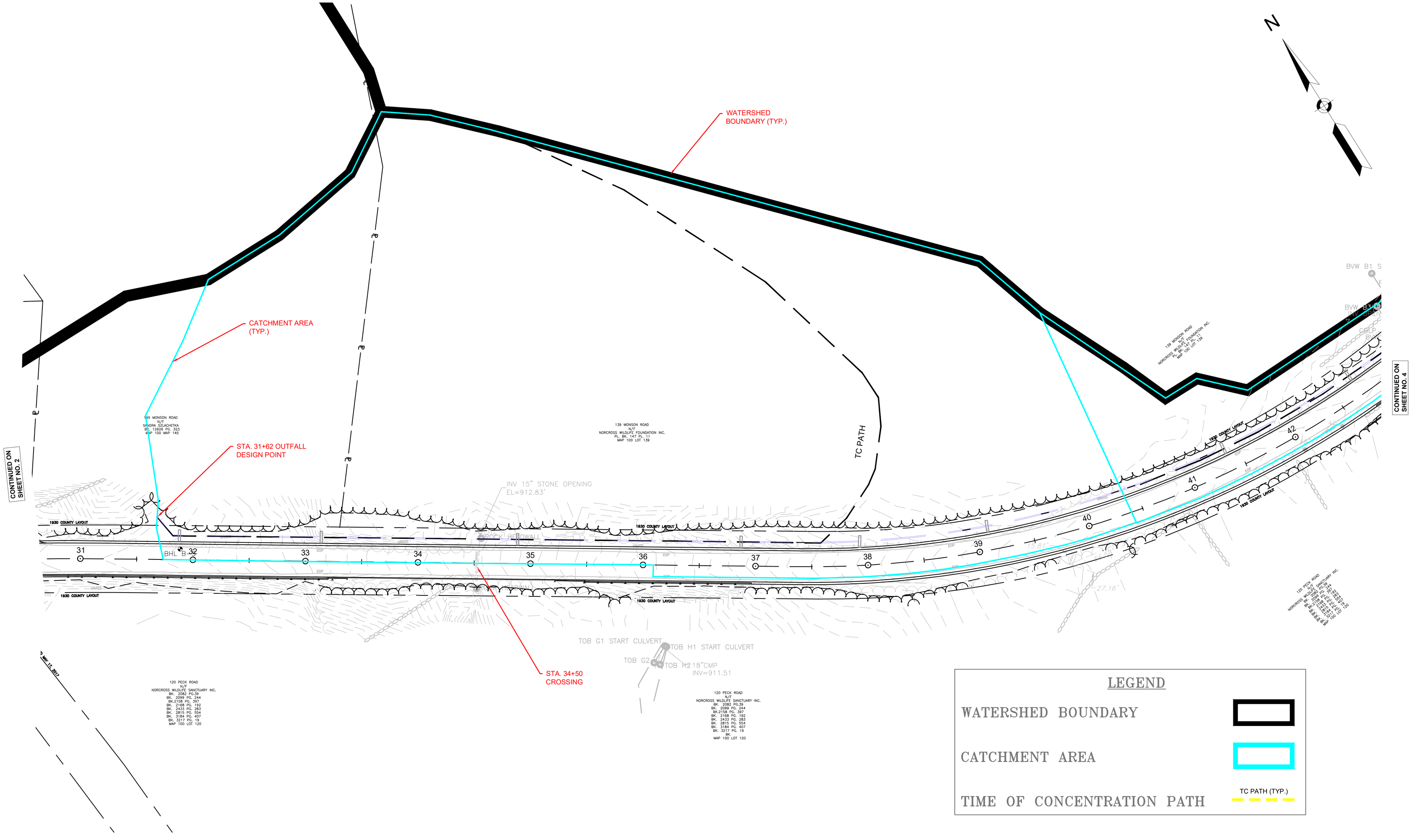
MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM

A00860 - 90

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



LEGEND

WATERSHED BOUNDARY	
CATCHMENT AREA	
TIME OF CONCENTRATION PATH	TC PATH (TYP.)

MONSON ROAD
DRAINAGE AREA MAP–3

SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:49 AM
Proposal No. 608163-128112
A608060 - 91
16 - 060

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)

N

WATERSHED BOUNDARY (TYP.)

TC PATH (TYP.)

135 MONSON ROAD
N/F
NORCROSS WILDLIFE FOUNDATION INC.
BK. 9662 PG. 213
MAP 100 MAP 135

131 MONSON ROAD
N/F
BARBARA KUSTRA
BK. 5611 PG. 359
MAP 100 LOT 131

127 MONSON ROAD
N/F
HERBERT J. PERRY
BK. 17252 PG. 31
MAP 100 LOT 127

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2099 PG.30
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 12
MAP 100 LOT 120

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2099 PG.30
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 12
MAP 100 LOT 120

1931 COUNTY LAYOUT

1930 COUNTY LAYOUT

BVW B1 START
TOB I1 START
BVW B10 STOP
TOB J1 STA
BVW B5
TOB I2
TOB J2
BVW B9
TOB J5
CBLP
INV 12" CPP
EL=928.25'
TOB J15 STOP
BVW C6 STOP
TOB J17
TOB J18 STOP
TOB I17 STOP
BVW C1
WETC6
WETC5
WETC4
WETC3
WETC2
WETC START
12"CMP
INV=931.27
EL=933.14
42
43
44
45
46
47
48
49
50
51
52
53
CB-14
MH-8
CB-15
CB-16
CB-17
MH-9 (10' DIA.)
CB-18
CB-19
BVWE6 STOP
BVWE5
BVWE4
BVWE3
BVWE2
TOBK3 (CB-16)
TOBK2
TOBK1 START
TOBL6 STOB6"PVC
INV=922.04'
TOBL5
TOBL4
TOBL3
TOBL2
TOBL1 START
BVWD2
BVWD1 START
TOB I1 START
36"PVC
INV=920.04'
CBLP

OUTFALL STA 43+76
DESIGN POINT

OUTFALL STA 46+65
DESIGN POINT

CATCHMENT
AREA (TYP.)

OUTFALL STA 50+73
DESIGN POINT

CONTINUED ON SHEET NO. 3

CONTINUED ON SHEET NO. 5

MONSON ROAD
DRAINAGE AREA MAP–4

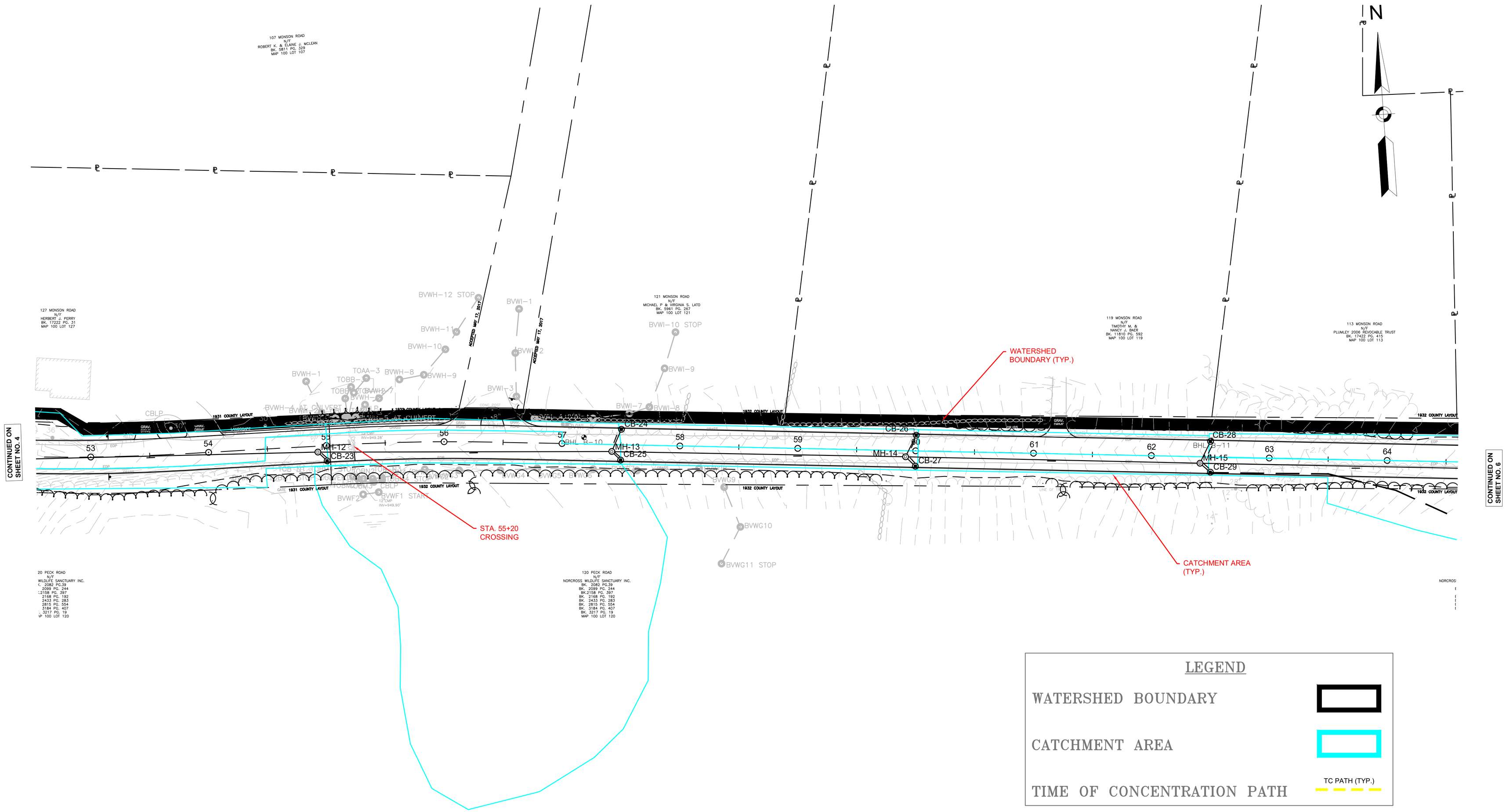
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM
Proposal No. 608163-128112
A00860 - 26

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



LEGEND

WATERSHED BOUNDARY	
CATCHMENT AREA	
TIME OF CONCENTRATION PATH	TC PATH (TYP.)

MONSON ROAD
DRAINAGE AREA MAP-5

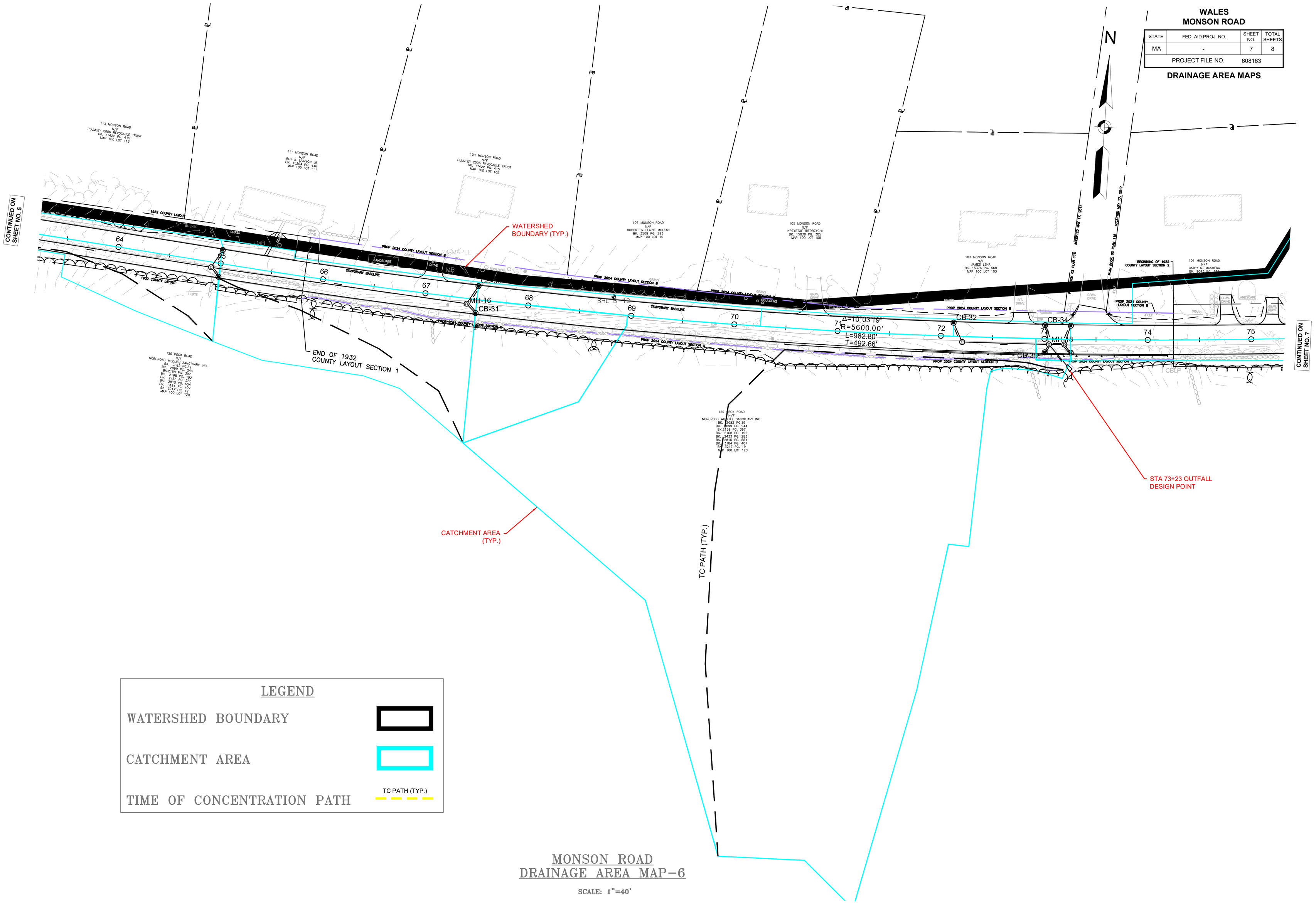
SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM
Proposal No. 608163-128112
A00800 - 93

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS



LEGEND

WATERSHED BOUNDARY	
CATCHMENT AREA	
TIME OF CONCENTRATION PATH	TC PATH (TYP.)

MONSON ROAD
DRAINAGE AREA MAP–6

SCALE: 1"=40'

MONSON ROAD -DRAINAGE MAPS.DWG Plotted on 8-Apr-2024 11:50 AM

Proposal No. 608163-128112

A008860 - 94

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	8
PROJECT FILE NO.	608163		

DRAINAGE AREA MAPS

LEGEND

WATERSHED BOUNDARY

CATCHMENT AREA

TIME OF CONCENTRATION PATH — TC PATH (TYP.)

N

WATERSHED BOUNDARY (TYP.)

CATCHMENT AREA (TYP.)

TC PATH (TYP.)

CONTINUED ON SHEET NO. 17

99 MONSON ROAD N/F RICHARD K. JENKINS BK. 10698 PG. 339 MAP 100 LOT 99

97 MONSON ROAD N/F ALLAN M. COOLONG BK. 10927 PG. 428 MAP 100 LOT 97

93 MONSON ROAD N/F WAYNE T. PECK BK. 5878 PG. 362 MAP 100 LOT 93

100 MONSON RD N/F DIANE L. MONET BK. 31808 PG. MAP 100 LOT 1

120 PECK ROAD N/F NORCROSS WILDLIFE SANCTUARY INC. BK. 2082 PG.39 BK. 2099 PG. 244 BK.2158 PG. 397 BK. 2168 PG. 192 BK. 3433 PG. 283 BK. 2815 PG. 554 BK. 3184 PG. 407 BK. 3217 PG. 19 MAP 100 LOT 120

1932 COUNTY LAYOUT

1933 COUNTY LAYOUT

END OF 1932 COUNTY LAYOUT SECTION 2 BEGINNING OF 1933 COUNTY LAYOUT

PROP 2024 COUNTY LAYOUT SECTION D

OUTFALL STA 82+07 DESIGN POINT

STA 85+72 OUTFALL DESIGN POINT

CROSSING STA 86+50

12"CMP INV=996.68

12"CMP INV=996.08

12"DIP INV=999.99 12.0% INV=1000.27

INV 24" STONE BOX CULVERT EL=996.84'

INV 24" STONE BOX CULVERT EL=995.79'

24" STONE BOX CULVERT INV=996.68

24" STONE BOX CULVERT INV=996.16

CBLP LEANING

ACCEPTED MAY 17, 2017

PLAN BOOK 280

LAYOUT PER MGL CHAPTER 8B SECTION 3 ACCEPTED MAY 17, 2017

MONSON ROAD
DRAINAGE AREA MAP–7

SCALE: 1"=40'

APPENDIX B

Rational Method Data

Monson Road Reconstruction
Wales, MA

Date: 4/8/2024
By: NSD
Checked By: RSV

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

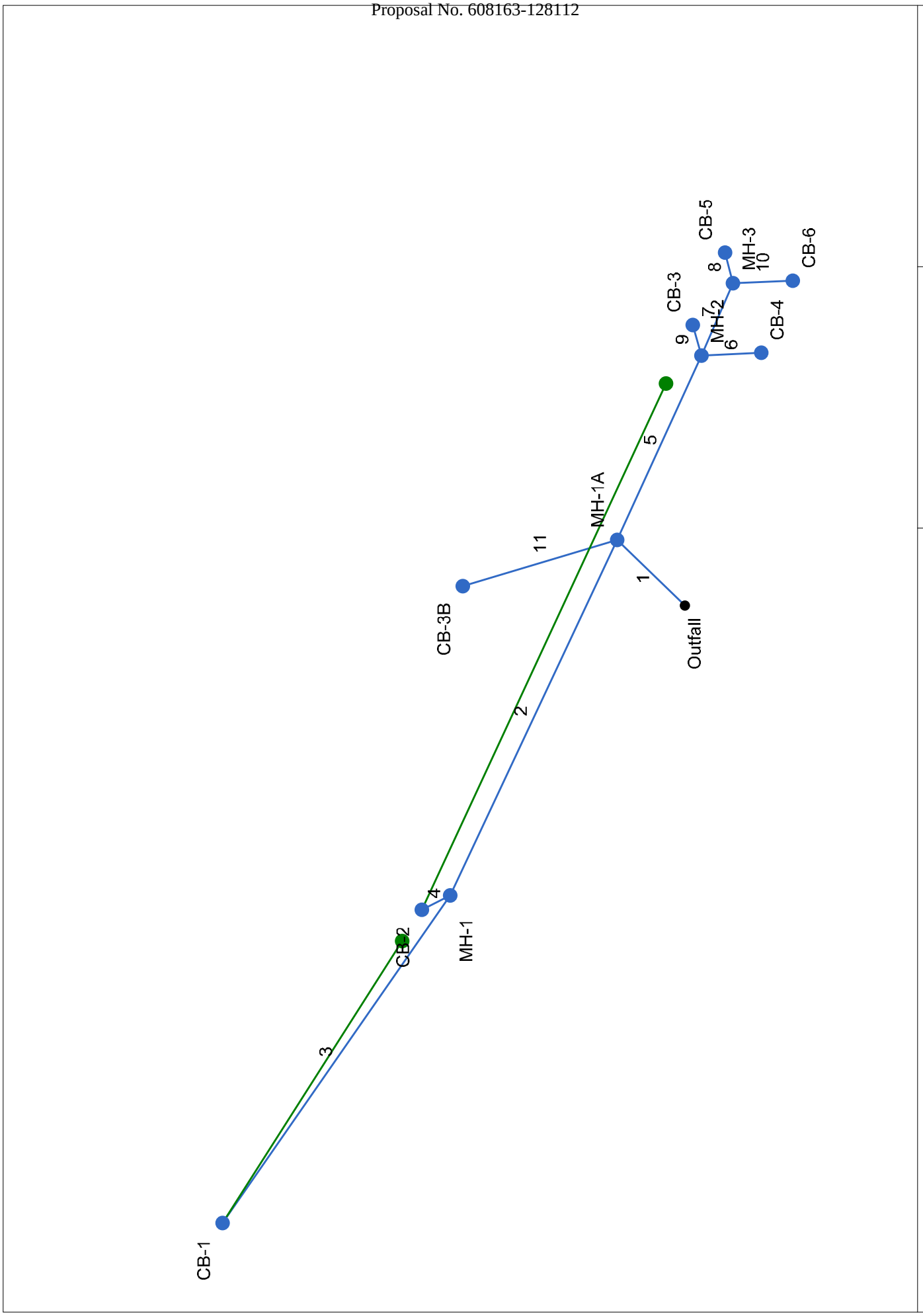
Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)
Proposed Drainage System								
	STA 24+84							
CB1		48,140	**1.105**	2,722	7,922	37,496	0.26	11
CB2		24,150	**0.554**	5,996	16,154	2,000	0.44	5
CB3		9,479	**0.218**	5,061	4,418		0.62	5
CB3B		92,066	**2.114**	2,150	5,730	84,186	0.22	15
CB4		372	**0.009**	372			0.90	5
CB5		5,665	**0.130**	2,370	3,295		0.55	5
CB6		5,703	**0.131**	2,720	948	2,035	0.55	5
	STA 25+00							
CB7		4,854	**0.111**	4,050	804		0.80	5
CB8		7,359	**0.169**	6,261	1,098		0.81	5
	STA 50+61							
CB14		2,813	**0.065**	769	2,044		0.46	5
CB15		3,181	**0.073**	2,086		1,095	0.66	5
CB16		3,387	**0.078**	762	417	2,208	0.37	5
CB17		4,558	**0.105**	2,885	158	1,515	0.65	5
CB18		7,714	**0.177**	3,404	1,284	3,026	0.53	5
CB19		4,866	**0.112**	2,185	758	1,923	0.53	5
	STA 51+24							
CB20		9,120	**0.209**	6,483	1,406	1,231	0.71	5
CB21		6,026	**0.138**	2,414	1,437	2,175	0.50	5
CB22		2,673	**0.061**	1,854	819		0.72	5
CB23		6,334	**0.145**	5,584		750	0.82	5
CB24		5,414	**0.124**	4,364		1,050	0.76	5
CB25		4,912	**0.113**	4,350		562	0.82	5
CB26		4,444	**0.102**	3,664	780		0.79	5
CB27		3,941	**0.090**	3,578	363		0.84	5
CB28		5,465	**0.125**	3,756	1,709		0.71	5
CB29		10,177	**0.234**	3,549		6,628	0.44	5
CB28B		4,735	**0.109**	3,765	970		0.78	5
CB29B		23,495	**0.539**	3,627		19,868	0.31	7.3
CB30		4,950	**0.114**	3,994	956		0.78	5
CB31		14,123	**0.324**	2,122	12,001		0.39	5
	STA 73+30							
CB32		3,093	**0.071**	2,762	331		0.84	5
CB34		1,830	**0.042**	1,649	181		0.84	5
CB35		700	**0.016**	470	230		0.70	5
CB34B		11,104	**0.255**	4,501	6,603		0.54	5
CB35B		4,454	**0.102**	3,140	1,314		0.72	5
	STA 81+97							
CB36		6,857	**0.157**	1,065	5,792		0.39	5.0
CB36B		36,290	**0.833**	6,103	30,187		0.40	10.0
CB36C		31,245	**0.717**	5,437	25,808		0.40	10.0
CB37		5,183	**0.119**	4,845		338	0.85	5
	STA 85+72							
CB38		11,348	**0.261**	6,499	4,849		0.64	5
CB39		1,038	**0.024**	758		280	0.71	5
CB40		5,335	**0.122**	3,556	1,187	592	0.69	5
CB41		359	**0.008**	273	86		0.76	5

NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover		C
Impervious		0.9
Grass		0.3
Unimproved (Woods)		0.2

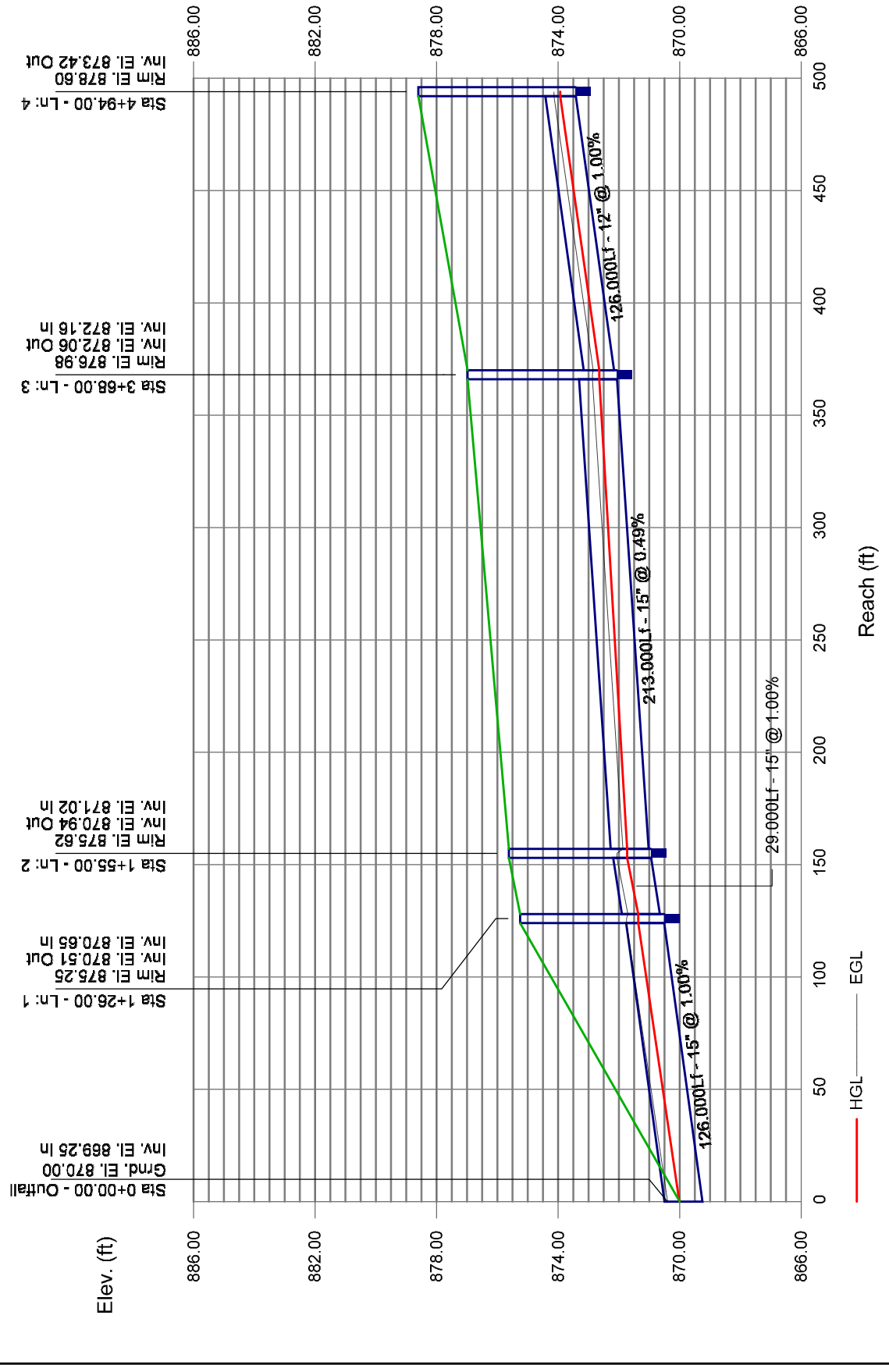
APPENDIX C

Hydraflow Reports


Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan
CB-1
CB-2
MH-1
CB-3B
MH-1A
Outfall
CB-3
MH-2
CB-4
CB-5
MH-3
CB-6
1
2
3
4
5
6
7
8
9
10
11
Project File: Sta.24+84-REV2.stm
Number of lines: 11
Date: 3/15/2024
Storm Sewers v2023.00

Proj. file: Sta.24+84.stm

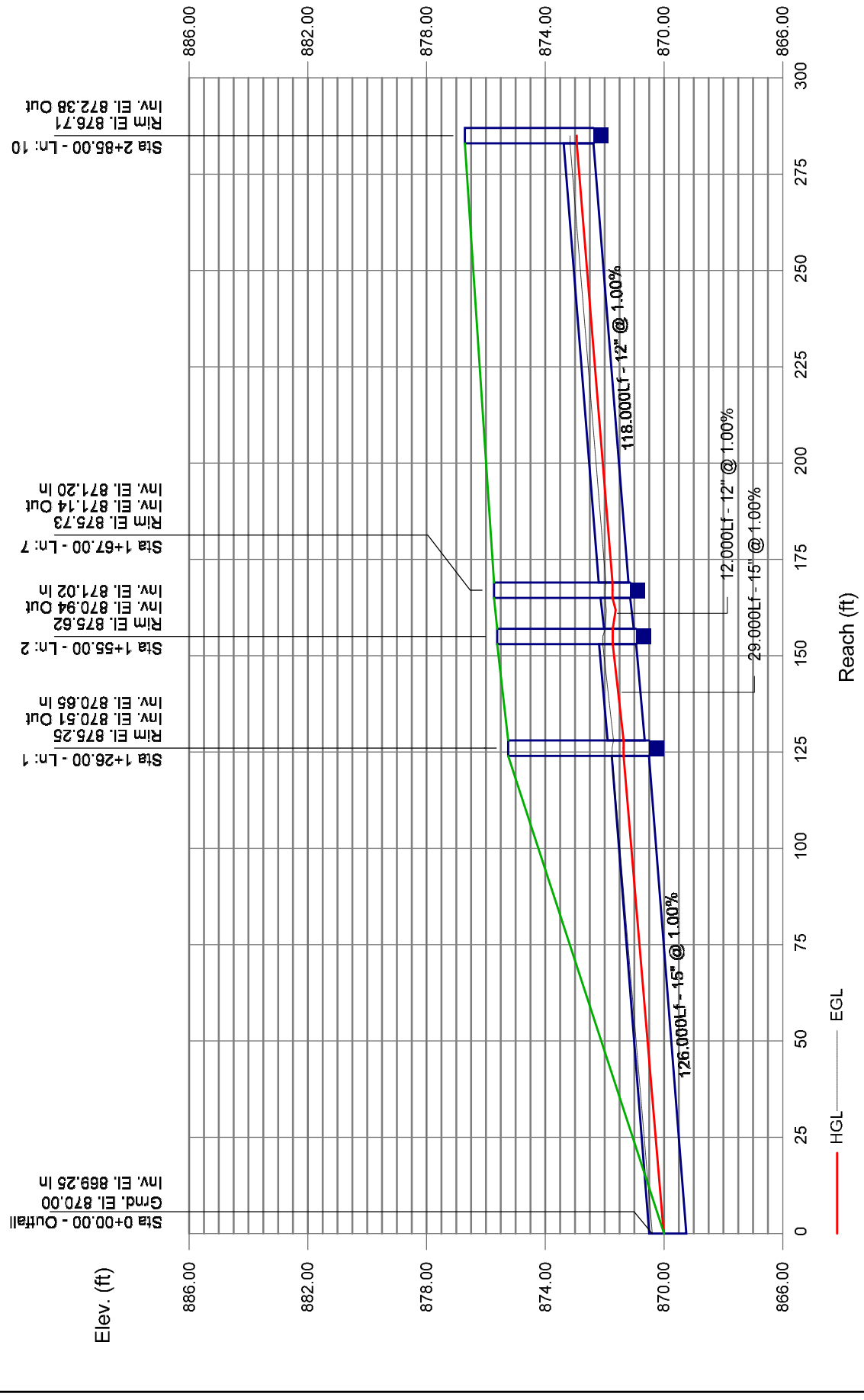
Storm Sewer Profile



Storm Sewers

Proj. file: Sta.24+84.stm

Storm Sewer Profile



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-1A	Manhole	875.51	Cir	4.00	4.00	15	Cir	869.82	12 12 12	Cir Cir Cir	870.00 870.00 870.00
2	MH-1	Manhole	876.90	Cir	4.00	4.00	12	Cir	872.06	12 12	Cir Cir	872.16 872.16
3	CB-1	Combination	878.65	Cir	4.00	4.00	12	Cir	873.42			
4	CB-2	Combination	876.63	Cir	4.00	4.00	12	Cir	872.26			
5	MH-2	Manhole	875.15	Cir	4.00	4.00	12	Cir	870.68	12 12 12	Cir Cir Cir	871.02 870.75 871.02
6	CB-4	Combination	874.99	Cir	4.00	4.00	12	Cir	871.22			
7	MH-3	Manhole	875.16	Cir	4.00	4.00	12	Cir	870.88	12 12	Cir Cir	871.00 871.00
8	CB-5	Combination	875.45	Cir	4.00	4.00	12	Cir	871.12			
9	CB-3	Combination	874.99	Cir	4.00	4.00	12	Cir	871.14			
10	CB-6	Combination	875.54	Cir	4.00	4.00	12	Cir	871.21			
11	CB-3B	Combination	874.88	Cir	4.00	4.00	12	Cir	870.55			

Project File: Sta.24+84-REV2.stm | Number of Structures: 11 | Run Date: 3/15/2024

A00860 - 102

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	15.9	3.7	4.51	5.78	5.11	15	1.07	869.50	869.82	870.33	870.68	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	4.3	2.14	3.98	3.96	12	1.66	870.00	872.06	870.68	872.69	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	4.4	1.47	3.56	3.56	12	1.00	872.16	873.42	872.69	873.93	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	5.9	0.97	3.56	2.75	12	1.00	872.16	872.26	872.69	872.67	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.4	5.8	1.46	3.67	3.09	12	1.06	870.00	870.68	870.68	871.19	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	5.9	0.03	3.65	0.78	12	1.05	871.02	871.22	871.19	871.29	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	5.9	1.07	2.57	3.12	12	0.52	870.75	870.88	871.20	871.33	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.90	2.08	12	1.20	871.00	871.12	871.47	871.42	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	5.9	0.39	3.38	2.65	12	1.20	871.02	871.14	871.25	871.40	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	5.9	0.54	3.74	2.08	12	1.11	871.00	871.21	871.47	871.51	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	3.7	1.74	3.70	3.44	12	1.08	870.00	870.55	870.68	871.11	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 103

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.47	0.00	1.07	0.40	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.20	4.86	0.29	2.69	2.0	4
4	CB-2	0.97	0.40	1.13	0.24	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.21	3.69	0.28	1.92	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.03	0.00	0.03	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.12	0.76	0.05	0.76	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
9	CB-3	0.39	0.12	0.51	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.00	0.19	3.00	2.0	Off
10	CB-6	0.54	0.00	0.54	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.12	0.19	3.12	2.0	Off
11	CB-3B	1.74	0.00	1.74	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.17	8.35	0.33	8.35	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 104

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.000	0.00	4.26	0.00	0.00	1.22	0.0	16.0	4.6	5.55	5.78	5.36	15	1.07	869.50	869.82	870.48	870.80	870.75	875.51	MH1A-OUTLET
2	1	124.000	0.00	1.66	0.00	0.00	0.50	0.0	11.6	5.3	2.64	3.98	3.94	12	1.66	870.00	872.06	871.25	872.76	875.51	876.90	MH1-MH1A
3	2	126.000	1.11	1.11	0.30	0.33	0.33	11.1	11.1	5.4	1.80	3.56	3.79	12	1.00	872.16	873.42	872.76	873.99	876.90	878.65	CB1-MH1
4	2	10.000	0.55	0.55	0.30	0.17	0.17	5.0	5.0	7.2	1.19	3.56	2.91	12	1.00	872.16	872.26	872.76	872.72	876.90	876.63	CB2-MH1
5	1	64.000	0.00	0.49	0.00	0.00	0.25	0.0	5.5	7.0	1.78	3.67	2.64	12	1.06	870.00	870.68	871.25	871.38	875.51	875.15	MH2-MH1A
6	5	19.000	0.01	0.01	0.50	0.01	0.01	5.0	5.0	7.2	0.04	3.65	0.69	12	1.05	871.02	871.22	871.51	871.30	875.15	874.99	CB4-MH2
7	5	25.000	0.00	0.26	0.00	0.00	0.18	0.0	5.2	7.1	1.30	2.57	2.21	12	0.52	870.75	870.88	871.51	871.53	875.15	875.16	MH3-MH2
8	7	10.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.90	2.06	12	1.20	871.00	871.12	871.62	871.46	875.16	875.45	CB5-MH3
9	5	10.000	0.22	0.22	0.30	0.07	0.07	5.0	5.0	7.2	0.48	3.38	1.91	12	1.20	871.02	871.14	871.51	871.43	875.15	874.99	CB3-MH2
10	7	19.000	0.13	0.13	0.70	0.09	0.09	5.0	5.0	7.2	0.66	3.74	2.06	12	1.11	871.00	871.21	871.62	871.55	875.16	875.54	CB6-MH3
11	1	51.000	2.11	2.11	0.22	0.46	0.46	15.7	15.7	4.6	2.14	3.70	2.86	12	1.08	870.00	870.55	871.25	871.40	875.51	874.88	CB3B-MH1A

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00860 - 105

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-1A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-1	1.80	0.00	1.25	0.55	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.045	0.020	0.013	0.21	5.63	0.30	3.04	2.0	4
4	CB-2	1.19	0.55	1.36	0.38	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.057	0.057	0.013	0.23	4.03	0.30	2.27	2.0	9
5	MH-2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	CB-4	0.04	0.00	0.04	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.85	0.05	0.85	2.0	Off
7	MH-3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	CB-5	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
9	CB-3	0.48	0.38	0.85	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.38	0.25	4.38	2.0	Off
10	CB-6	0.66	0.00	0.66	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.05	3.57	0.22	3.57	2.0	Off
11	CB-3B	2.14	0.00	2.14	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.20	9.92	0.37	9.92	2.0	Off

Project File: Sta.24+84-REV2.stm | Number of lines: 11 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 106

Proposal No. 608163-128112

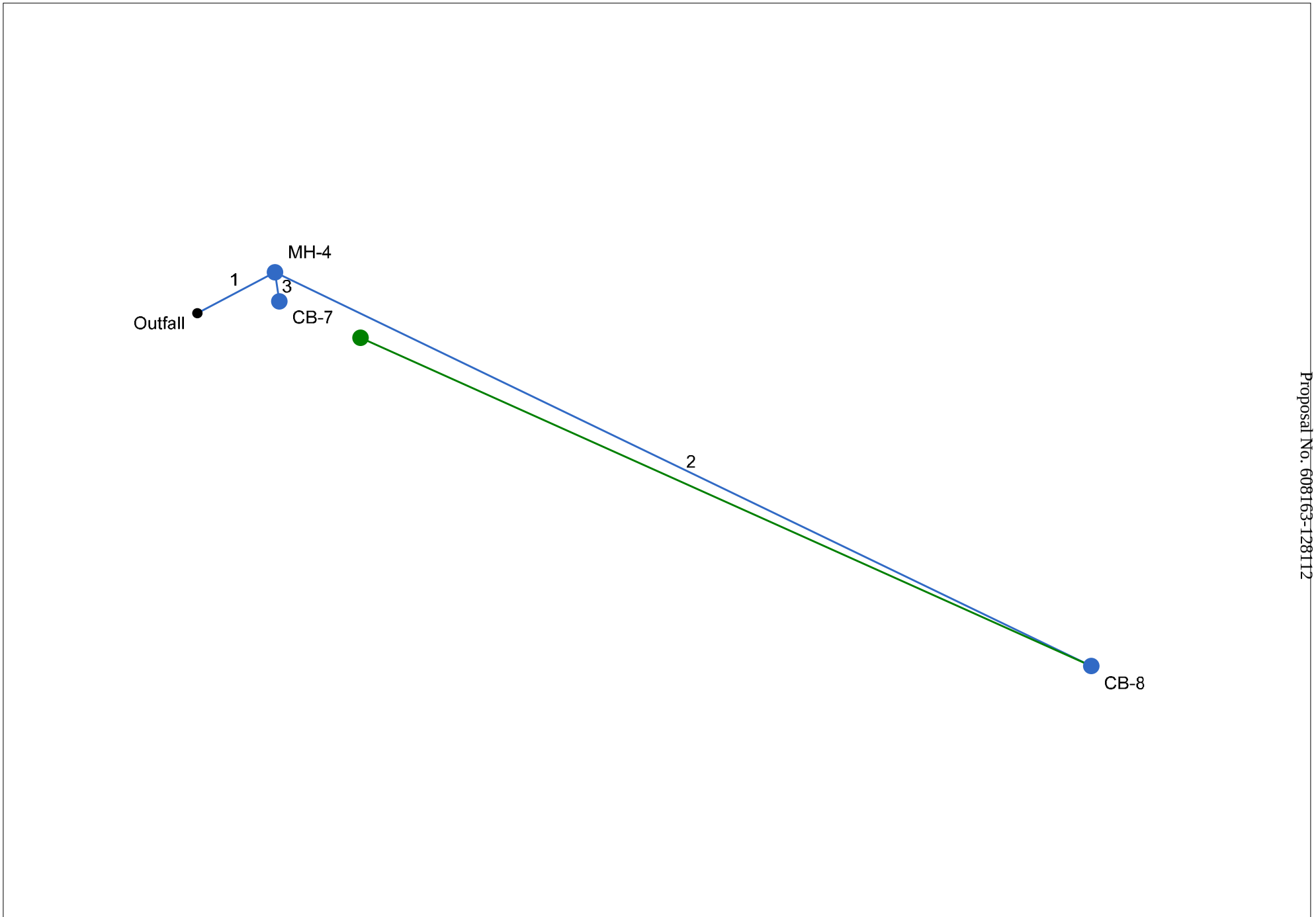
Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH1A-OUTLET	User																		0.00
2	MH1-MH1A	User																		0.00
3	CB1-MH1	TR55	0.800	30.00	3.10	5.00	10.05	270.00	7.70	UnPaved	4.48	1.01								11.05
4	CB2-MH1	TR55	0.240	33.00	3.10	5.80	3.90	300.00	8.00	UnPaved	4.56	1.10								5.00
5	MH2-MH1A	User																		0.00
6	CB4-MH2	User																		5.00
7	MH3-MH2	User																		0.00
8	CB5-MH3	User																		5.00
9	CB3-MH2	User																		5.00
10	CB6-MH3	User																		5.00
11	CB3B-MH1A	TR55	0.400	50.00	3.10	1.76	13.19	480.00	4.00	UnPaved	3.23	2.48								15.67

Project File: Sta.24+84-REV2.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 11 | Date: 3/15/2024

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



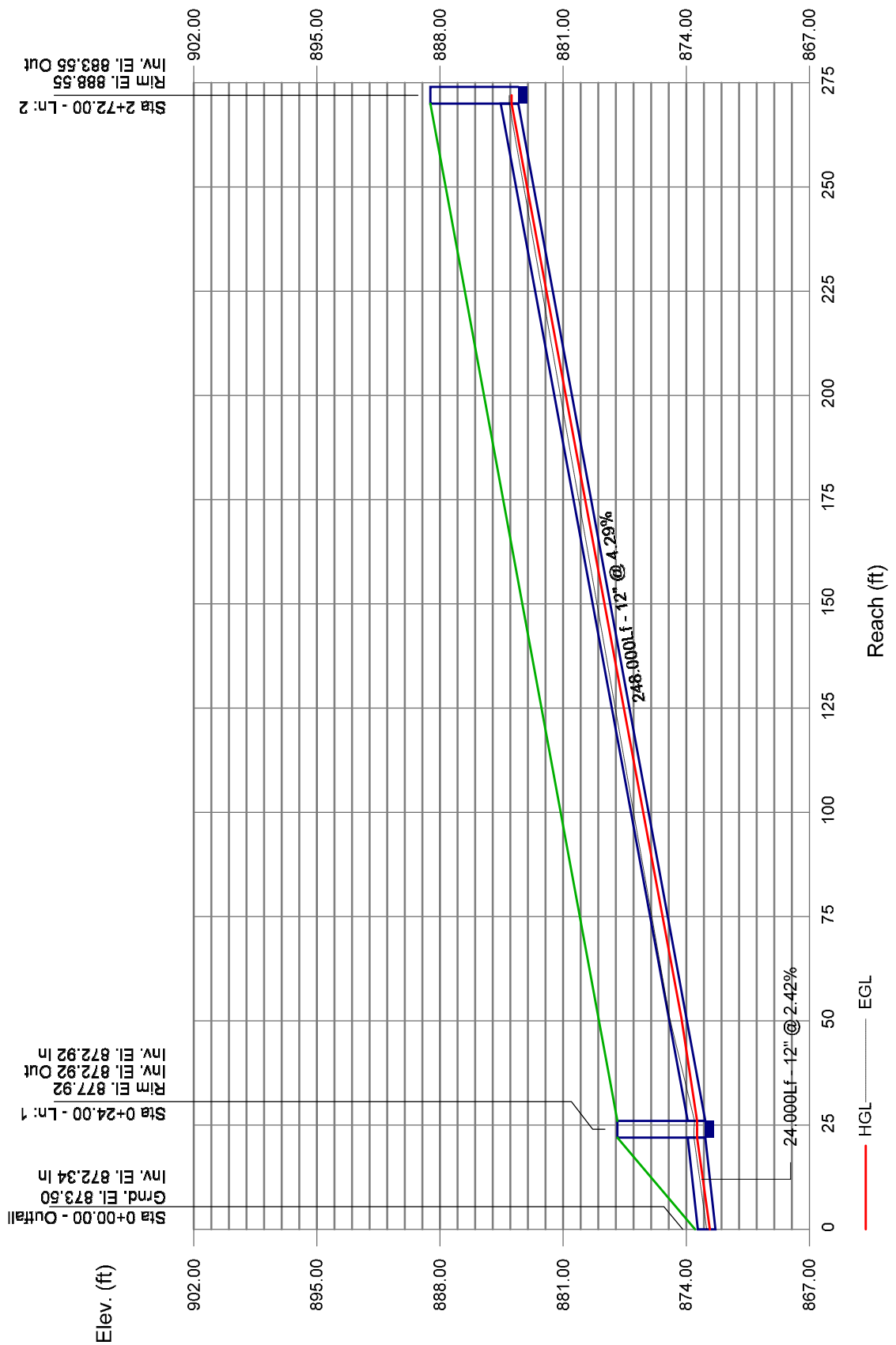
A00860 - 108

Proposal No. 608163-128112

Project File: Sta.25+00.stm	Number of lines: 3	Date: 12/5/2023

Proj. file: Sta.25+00.stm

Storm Sewer Profile



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-4	Manhole	877.92	Cir	4.00	4.00	12	Cir	872.92	12 12	Cir Cir	872.92 872.92
2	CB-8	Combination	888.55	Cir	4.00	4.00	12	Cir	883.55			
3	CB-7	Combination	877.89	Cir	4.00	4.00	12	Cir	873.06			

Project File: Sta.25+00.stm | Number of Structures: 3 | Run Date: 12/5/2023

A00860 - 110

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	24.000	0.00	0.28	0.00	0.00	0.23	0.0	6.6	5.4	1.22	5.54	4.53	12	2.42	872.34	872.92	872.66	873.39	873.50	877.92	MH4-OUTLET
2	1	248.000	0.17	0.17	0.81	0.14	0.14	5.0	5.0	5.9	0.81	7.37	2.64	12	4.29	872.92	883.55	873.39	883.93	877.92	888.55	CB8-MH4
3	1	8.000	0.11	0.11	0.80	0.09	0.09	5.0	5.0	5.9	0.52	4.71	2.04	12	1.75	872.92	873.06	873.39	873.36	877.92	877.89	CB7-MH4

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 111

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-8	0.81	0.00	0.59	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.060	4.00	0.020	0.020	0.013	0.09	4.42	0.22	2.74	2.0	3
3	CB-7	0.52	0.23	0.51	0.23	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.020	0.020	0.013	0.10	5.04	0.23	3.27	2.0	Off

Project File: Sta.25+00.stm | Number of lines: 3 | Run Date: 12/5/2023

NOTES: Inlet N-Values = 0.015; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

A00860 - 112

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

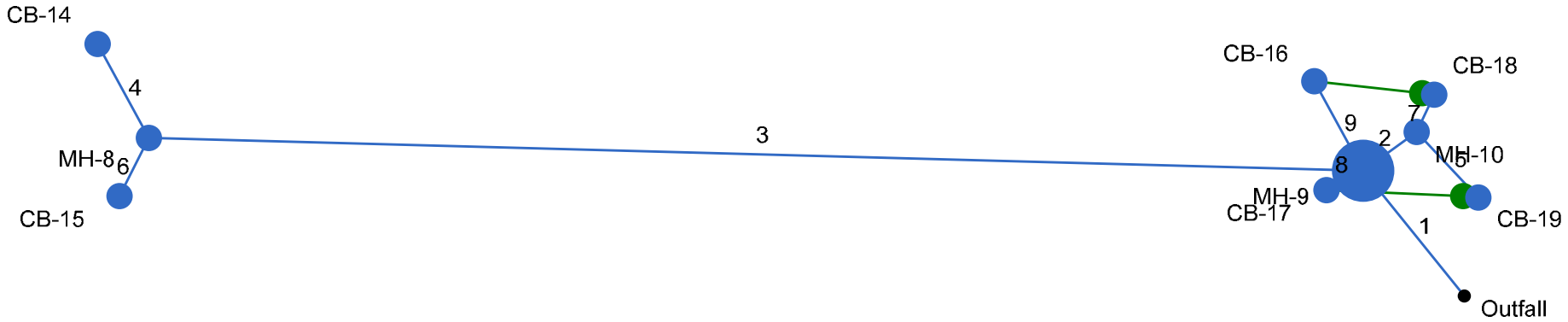
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH4-OUTLET	User																		0.00
2	CB8-MH4	User																		5.00
3	CB7-MH4	User																		5.00

Project File: Sta.25+00.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 3 | Date: 12/5/2023

A00860 - 113

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



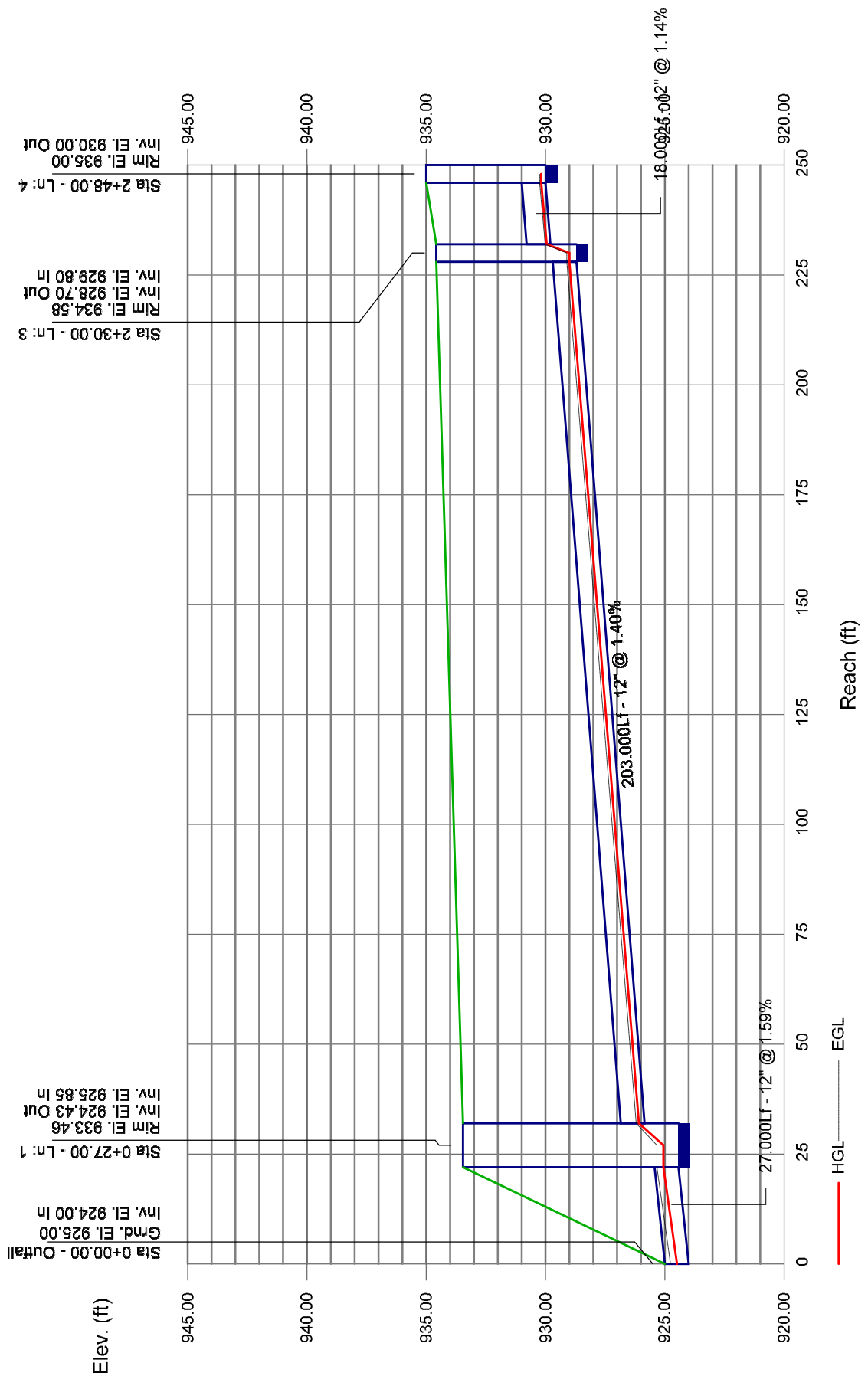
A00860 - 114

Proposal No. 608163-128112

Project File: Sta.50+70.stm	Number of lines: 9	Date: 3/15/2024

Proj. file: Sta.50+70.stm

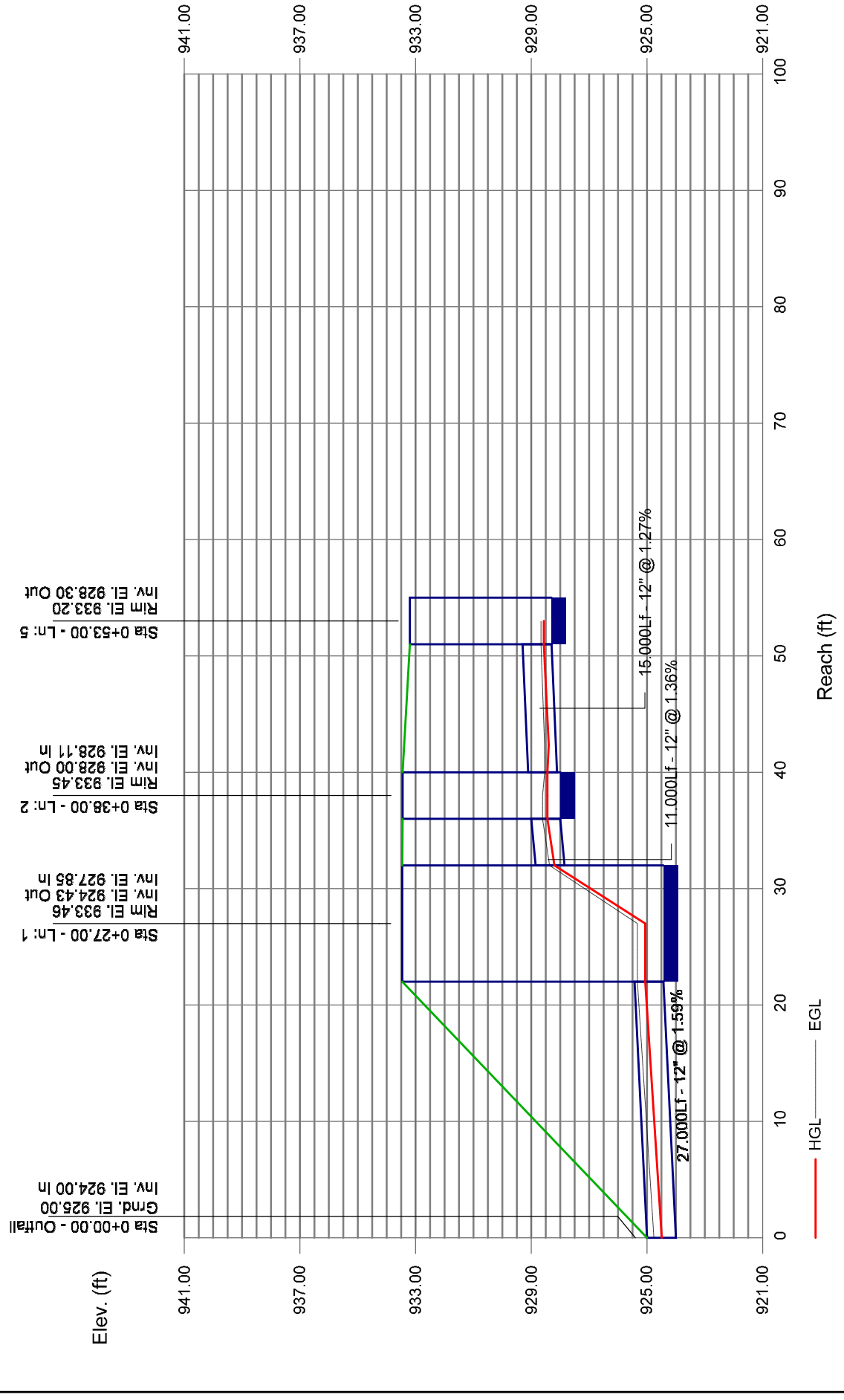
Storm Sewer Profile



Storm Sewers

Storm Sewer Profile

Proj. file: Sta.50+70.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-9	Manhole	933.46	Cir	10.00	10.00	12	Cir	924.43	12 12 12 12	Cir Cir Cir Cir	927.85 925.85 928.26 928.44
2	MH-10	Manhole	933.45	Cir	4.00	4.00	12	Cir	928.00	12 12	Cir Cir	928.11 928.20
3	MH-8	Manhole	934.58	Cir	4.00	4.00	12	Cir	928.70	12 12	Cir Cir	929.80 928.84
4	CB-14	Combination	935.00	Cir	4.00	4.00	12	Cir	930.00			
5	CB-19	Combination	933.20	Cir	4.00	4.00	12	Cir	928.30			
6	CB-15	Combination	934.02	Cir	4.00	4.00	12	Cir	928.97			
7	CB-18	Combination	933.32	Cir	4.00	4.00	12	Cir	928.31			
8	CB-17	Combination	933.36	Cir	4.00	4.00	12	Cir	928.37			
9	CB-16	Combination	933.61	Cir	4.00	4.00	12	Cir	928.63			

Project File: Sta.50+70.stm | Number of Structures: 9 | Run Date: 3/15/2024

A00860 - 117

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.3	5.5	1.77	4.49	4.62	12	1.59	924.00	924.43	924.44	925.00	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	5.9	0.90	4.16	3.66	12	1.36	927.85	928.00	928.17	928.40	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	5.9	0.43	4.22	2.98	12	1.40	925.85	928.70	926.07	928.97	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	5.9	0.16	3.80	2.16	12	1.14	929.80	930.00	929.94	930.17	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	5.9	0.34	4.01	2.10	12	1.27	928.11	928.30	928.40	928.54	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	5.9	0.27	3.87	2.52	12	1.18	928.84	928.97	929.02	929.18	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	5.9	0.56	4.46	3.29	12	1.57	928.20	928.31	928.44	928.62	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	5.9	0.38	4.46	2.95	12	1.57	928.26	928.37	928.46	928.63	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	5.9	0.17	3.76	2.20	12	1.12	928.44	928.63	928.59	928.80	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 118

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.16	0.00	0.15	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.06	3.02	0.19	1.22	2.0	Off
5	CB-19	0.34	0.09	0.44	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.73	0.17	2.73	2.0	Off
6	CB-15	0.27	0.00	0.27	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.10	2.12	0.17	0.13	2.0	Off
7	CB-18	0.56	0.02	0.58	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.04	3.30	0.20	3.30	2.0	Off
8	CB-17	0.38	0.00	0.29	0.09	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.09	4.44	0.22	2.63	2.0	5
9	CB-16	0.17	0.00	0.15	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.31	0.20	1.49	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 119

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.60	0.00	0.00	0.32	0.0	6.2	6.7	2.17	4.49	4.92	12	1.59	924.00	924.43	924.49	925.06	925.00	933.46	MH9-OUTLET
2	1	11.000	0.00	0.29	0.00	0.00	0.15	0.0	5.1	7.2	1.10	4.16	3.88	12	1.36	927.85	928.00	928.20	928.44	933.46	933.45	MH10-MH9
3	1	203.000	0.00	0.13	0.00	0.00	0.07	0.0	5.1	7.2	0.53	4.22	3.16	12	1.40	925.85	928.70	926.09	929.00	933.46	934.58	MH8-MH9
4	3	18.000	0.06	0.06	0.46	0.03	0.03	5.0	5.0	7.2	0.20	3.80	2.29	12	1.14	929.80	930.00	929.95	930.18	934.58	935.00	CB14-MH8
5	2	15.000	0.11	0.11	0.53	0.06	0.06	5.0	5.0	7.2	0.42	4.01	2.17	12	1.27	928.11	928.30	928.44	928.57	933.45	933.20	CB19-MH10
6	3	11.000	0.07	0.07	0.66	0.05	0.05	5.0	5.0	7.2	0.33	3.87	2.67	12	1.18	928.84	928.97	929.04	929.21	934.58	934.02	CB15-MH8
7	2	7.000	0.18	0.18	0.53	0.10	0.10	5.0	5.0	7.2	0.69	4.46	3.49	12	1.57	928.20	928.31	928.47	928.66	933.45	933.32	CB18-MH10
8	1	7.000	0.10	0.10	0.65	0.07	0.07	5.0	5.0	7.2	0.47	4.46	3.12	12	1.57	928.26	928.37	928.48	928.65	933.46	933.36	CB17-MH9
9	1	17.000	0.08	0.08	0.37	0.03	0.03	5.0	5.0	7.2	0.21	3.76	2.33	12	1.12	928.44	928.63	928.60	928.82	933.46	933.61	CB16-MH9

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00860 - 120

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-9	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	MH-8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	CB-14	0.20	0.00	0.17	0.02	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.020	0.020	0.013	0.07	3.25	0.20	1.48	2.0	Off
5	CB-19	0.42	0.13	0.55	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.03	3.17	0.20	3.17	2.0	Off
6	CB-15	0.33	0.00	0.33	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.018	4.00	0.048	0.048	0.013	0.11	2.28	0.19	0.43	2.0	Off
7	CB-18	0.69	0.03	0.72	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.07	3.79	0.23	3.79	2.0	Off
8	CB-17	0.47	0.00	0.34	0.13	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.10	4.78	0.23	2.95	2.0	5
9	CB-16	0.21	0.00	0.18	0.03	Comb	2.0	2.00	0.00	2.00	2.00	0.013	4.00	0.020	0.020	0.013	0.07	3.56	0.20	1.76	2.0	7

Project File: Sta.50+70.stm | Number of lines: 9 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs.; * Indicates Known Q added. All curb inlets are throat.

A00860 - 121

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

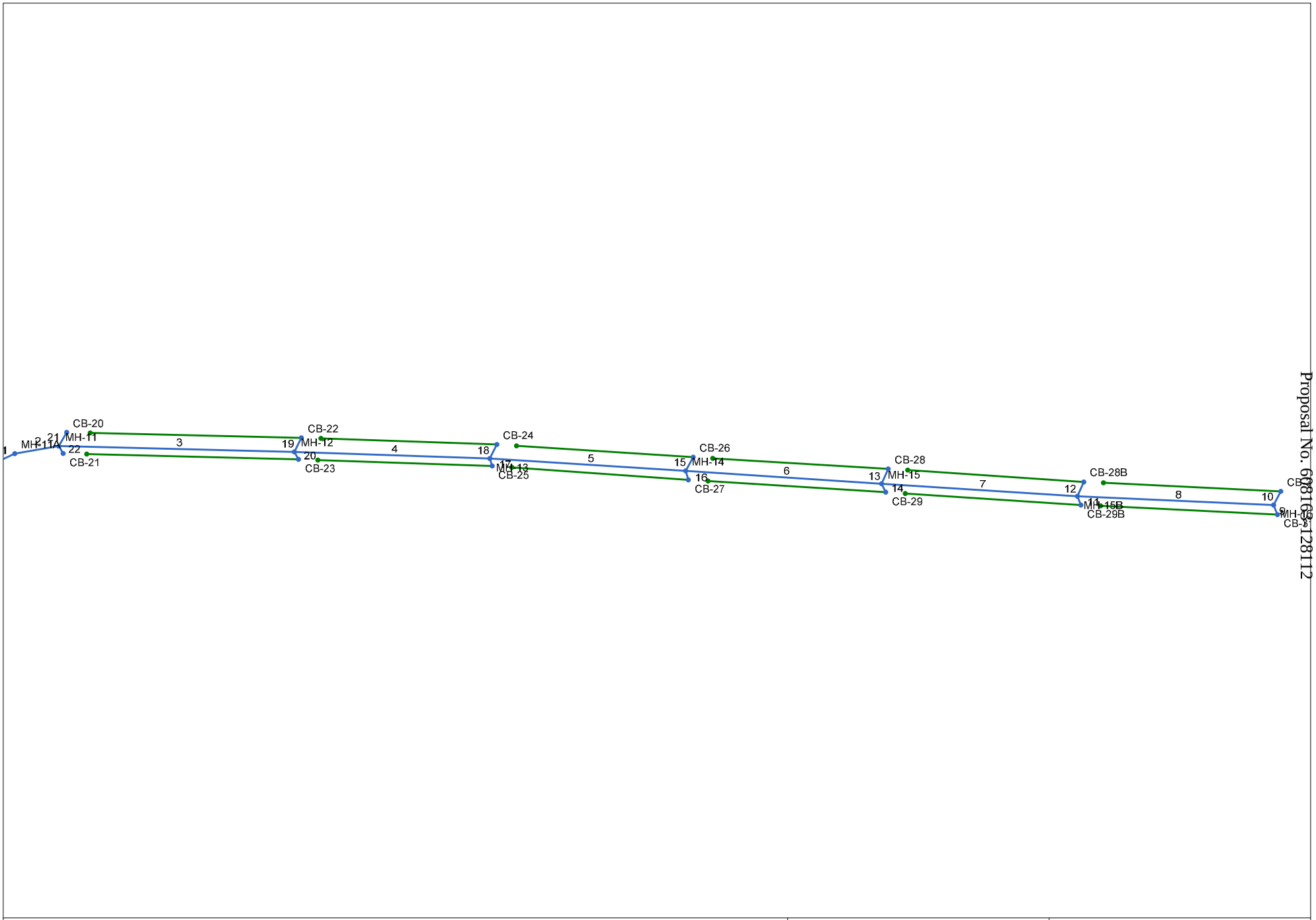
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH9-OUTLET	User																		0.00
2	MH10-MH9	User																		0.00
3	MH8-MH9	User																		0.00
4	CB14-MH8	User																		5.00
5	CB19-MH10	User																		5.00
6	CB15-MH8	User																		5.00
7	CB18-MH10	User																		5.00
8	CB17-MH9	User																		5.00
9	CB16-MH9	User																		5.00

Project File: Sta.50+70.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 9 | Date: 3/15/2024

A00860 - 122

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



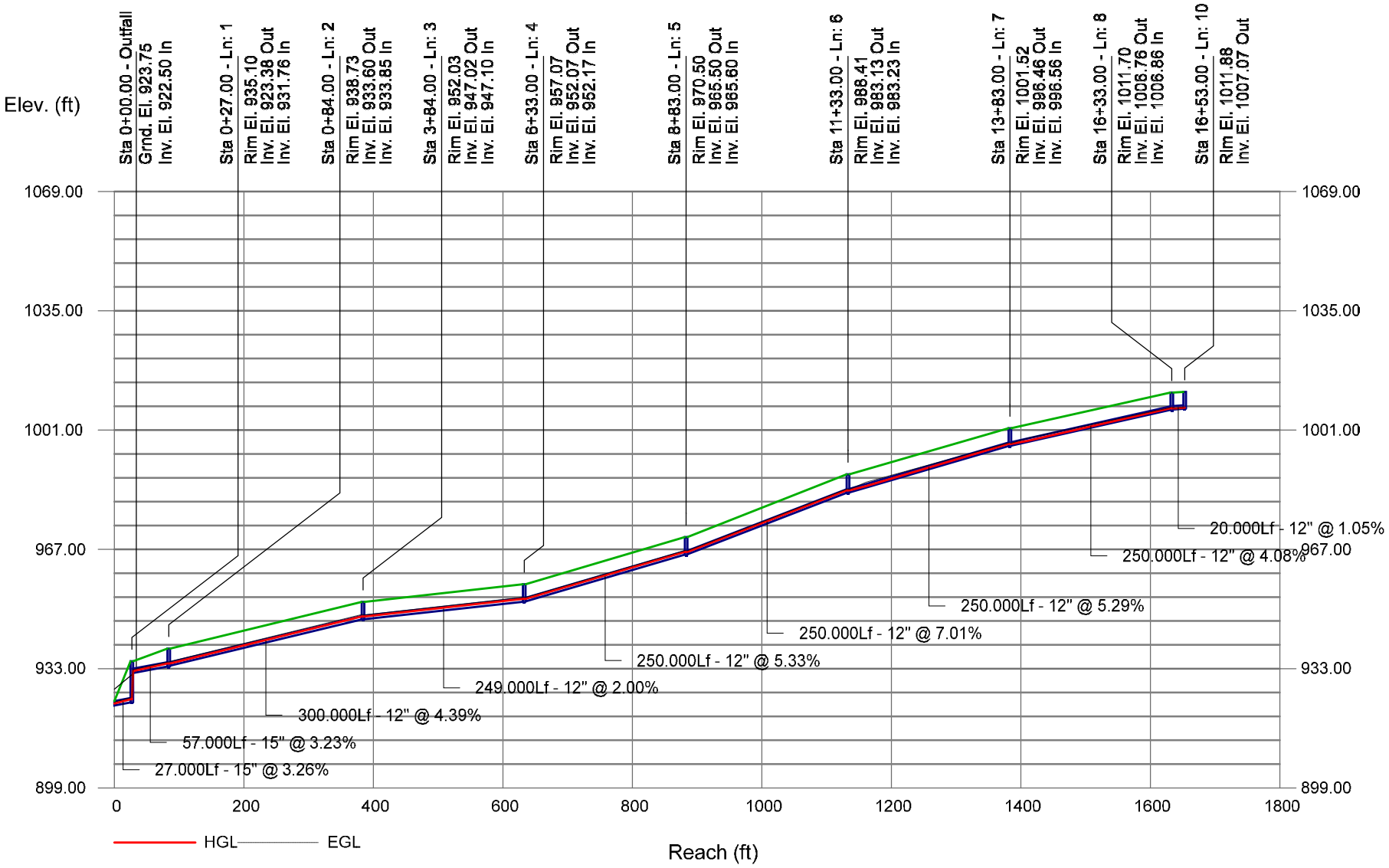
A00860 - 123

Proposal No. 6001691128112

Project File: Sta.51+24.stm	Number of lines: 22	Date: 3/15/2024

Storm Sewer Profile

Proj. file: Sta.51+24.stm



Proposal No: 6008163-128112

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-11A	Manhole	935.10	Cir	4.00	4.00	15	Cir	923.38	15	Cir	931.76
2	MH-11	Manhole	938.73	Rect	4.00	4.00	15	Cir	933.60	12	Cir	933.85
										12	Cir	933.64
										12	Cir	934.36
3	MH-12	Manhole	952.03	Cir	4.00	4.00	12	Cir	947.02	12	Cir	947.10
										12	Cir	947.21
										12	Cir	947.12
4	MH-13	Manhole	957.07	Cir	4.00	4.00	12	Cir	952.07	12	Cir	952.17
										12	Cir	952.17
										12	Cir	952.17
5	MH-14	Manhole	970.50	Cir	4.00	4.00	12	Cir	965.50	12	Cir	965.60
										12	Cir	965.75
										12	Cir	965.82
6	MH-15	Manhole	988.41	Cir	4.00	4.00	12	Cir	983.13	12	Cir	983.23
										12	Cir	983.34
										12	Cir	983.45
7	MH-15B	Manhole	1001.52	Cir	4.00	4.00	12	Cir	996.46	12	Cir	996.56
										12	Cir	996.67
										12	Cir	996.56
8	MH-16	Manhole	1011.70	Cir	4.00	4.00	12	Cir	1006.76	12	Cir	1007.06
										12	Cir	1006.86
9	CB-31	Combination	1011.79	Cir	4.00	2.00	12	Cir	1007.19			
10	CB-30	Combination	1011.88	Cir	4.00	4.00	12	Cir	1007.07			
11	CB-29B	Combination	1001.78	Cir	4.00	4.00	12	Cir	996.78			
12	CB-28B	Combination	1001.70	Cir	4.00	4.00	12	Cir	996.76			
13	CB-28	Combination	988.60	Cir	4.00	4.00	12	Cir	983.54			
14	CB-29	Combination	988.57	Cir	4.00	4.00	12	Cir	983.57			
15	CB-26	Combination	970.98	Cir	4.00	4.00	12	Cir	965.95			
16	CB-27	Combination	970.94	Cir	4.00	4.00	12	Cir	965.94			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00860 - 125

Proposal No. 608163-128112

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
17	CB-25	Combination	957.22	Cir	4.00	4.00	12	Cir	952.27			
18	CB-24	Combination	957.26	Cir	4.00	4.00	12	Cir	952.37			
19	CB-22	Combination	952.45	Cir	4.00	4.00	12	Cir	947.41			
20	CB-23	Combination	951.93	Cir	4.00	4.00	12	Cir	947.23			
21	CB-20	Combination	938.84	Cir	4.00	4.00	12	Cir	933.84			
22	CB-21	Combination	939.47	Cir	4.00	4.00	12	Cir	934.47			

Project File: Sta.51+24.stm | Number of Structures: 22 | Run Date: 3/15/2024

A00860 - 126

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	2.38	0.00	0.00	1.35	0.0	16.4	3.6	4.91	11.66	7.15	15	3.26	922.50	923.38	923.07	924.28	923.75	935.10	MH11A-OUTLET
2	1	57.000	0.00	2.38	0.00	0.00	1.35	0.0	16.3	3.7	4.94	11.60	7.14	15	3.23	931.76	933.60	932.33	934.50	935.10	938.73	MH11-MH11A
3	2	300.000	0.00	2.03	0.00	0.00	1.13	0.0	15.6	3.7	4.23	7.46	6.84	12	4.39	933.85	947.02	934.50	947.89	938.73	952.03	MH12-MH11
4	3	249.000	0.00	1.82	0.00	0.00	0.96	0.0	14.8	3.8	3.70	5.03	5.48	12	2.00	947.10	952.07	947.89	952.89	952.03	957.07	MH13-MH12
5	4	250.000	0.00	1.63	0.00	0.00	0.81	0.0	14.0	3.9	3.21	8.22	5.14	12	5.33	952.17	965.50	952.89	966.27	957.07	970.50	MH14-MH13
6	5	250.000	0.00	1.44	0.00	0.00	0.66	0.0	13.1	4.1	2.68	9.43	4.69	12	7.01	965.60	983.13	966.27	983.83	970.50	988.41	MH15-MH14
7	6	250.000	0.00	1.08	0.00	0.00	0.46	0.0	12.1	4.2	1.96	8.19	4.00	12	5.29	983.23	996.46	983.83	997.06	988.41	1001.52	MH15B-MH15
8	7	250.000	0.00	0.43	0.00	0.00	0.21	0.0	5.1	5.9	1.23	7.19	3.29	12	4.08	996.56	1006.76	997.06	1007.23	1001.52	1011.70	MH16-MH15B
9	8	13.000	0.32	0.32	0.39	0.12	0.12	5.0	5.0	5.9	0.74	3.56	3.25	12	1.00	1007.06	1007.19	1007.37	1007.55	1011.70	1011.79	CB31-MH16
10	8	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.65	2.27	12	1.05	1006.86	1007.07	1007.23	1007.37	1011.70	1011.88	CB30-MH16
11	7	12.000	0.54	0.54	0.31	0.17	0.17	12.0	12.0	4.2	0.71	3.41	2.71	12	0.92	996.67	996.78	997.06	997.13	1001.52	1001.78	CB29B-MH15B
12	7	20.000	0.11	0.11	0.78	0.09	0.09	5.0	5.0	5.9	0.51	3.56	1.96	12	1.00	996.56	996.76	997.06	997.06	1001.52	1001.70	CB28B-MH15B
13	6	21.000	0.13	0.13	0.71	0.09	0.09	5.0	5.0	5.9	0.55	3.48	2.05	12	0.95	983.34	983.54	983.83	983.85	988.41	988.60	CB28-MH15
14	6	12.000	0.23	0.23	0.44	0.10	0.10	5.0	5.0	5.9	0.60	3.56	2.46	12	1.00	983.45	983.57	983.83	983.89	988.41	988.57	CB29-MH15
15	5	20.000	0.10	0.10	0.79	0.08	0.08	5.0	5.0	5.9	0.47	3.56	1.85	12	1.00	965.75	965.95	966.27	966.23	970.50	970.98	CB26-MH14
16	5	12.000	0.09	0.09	0.84	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.92	12	1.00	965.82	965.94	966.27	966.22	970.50	970.94	CB27-MH14
17	4	10.000	0.09	0.09	0.82	0.07	0.07	5.0	5.0	5.9	0.44	3.56	1.62	12	1.00	952.17	952.27	952.89	952.54	957.07	957.22	CB25-MH13
18	4	20.000	0.10	0.10	0.76	0.08	0.08	5.0	5.0	5.9	0.45	3.56	1.64	12	1.00	952.17	952.37	952.89	952.65	957.07	957.26	CB24-MH13
19	3	20.000	0.06	0.06	0.72	0.04	0.04	5.0	5.0	5.9	0.26	3.56	1.31	12	1.00	947.21	947.41	947.89	947.62	952.03	952.45	CB22-MH12
20	3	11.000	0.15	0.15	0.82	0.12	0.12	5.0	5.0	5.9	0.73	3.56	2.01	12	1.00	947.12	947.23	947.89	947.59	952.03	951.93	CB23-MH12
21	2	20.000	0.21	0.21	0.71	0.15	0.15	5.0	5.0	5.9	0.88	3.56	2.15	12	1.00	933.64	933.84	934.50	934.23	938.73	938.84	CB20-MH11
22	2	11.000	0.14	0.14	0.50	0.07	0.07	5.0	5.0	5.9	0.41	3.56	2.75	12	1.00	934.36	934.47	934.59	934.74	938.73	939.47	CB21-MH11

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-11A	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-11	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	1
3	MH-12	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	MH-13	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	MH-14	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	MH-15	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	MH-15B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	MH-16	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	CB-31	0.74	0.00	0.53	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.57	0.22	2.86	2.0	11
10	CB-30	0.51	0.00	0.39	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.08	3.97	0.21	2.28	2.0	12
11	CB-29B	0.71	0.21	0.63	0.29	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.10	4.97	0.23	3.24	2.0	14
12	CB-28B	0.51	0.11	0.46	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.041	4.00	0.020	0.020	0.013	0.09	4.29	0.22	2.59	2.0	13
13	CB-28	0.55	0.16	0.53	0.18	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.12	0.22	2.45	2.0	15
14	CB-29	0.60	0.29	0.64	0.26	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.82	2.0	16
15	CB-26	0.47	0.18	0.50	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	3.92	0.21	2.25	2.0	18
16	CB-27	0.45	0.26	0.53	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.071	4.00	0.020	0.020	0.013	0.08	4.05	0.21	2.38	2.0	17
17	CB-25	0.44	0.17	0.45	0.16	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.31	0.22	2.61	2.0	20
18	CB-24	0.45	0.15	0.44	0.15	Comb	2.0	2.00	0.00	2.00	2.00	0.038	4.00	0.020	0.020	0.013	0.09	4.28	0.22	2.58	2.0	19
19	CB-22	0.26	0.15	0.31	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.020	0.020	0.013	0.09	4.49	0.22	2.68	2.0	21
20	CB-23	0.73	0.16	0.60	0.28	Comb	2.0	2.00	0.00	2.00	2.00	0.014	4.00	0.024	0.024	0.013	0.13	5.34	0.25	3.49	2.0	22
21	CB-20	0.88	0.10	0.78	0.21	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.028	0.028	0.013	0.11	3.77	0.23	2.10	2.0	Off
22	CB-21	0.41	0.28	0.52	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.066	4.00	0.020	0.020	0.013	0.08	4.09	0.22	2.43	2.0	Off

Project File: Sta.51+24.stm | Number of lines: 22 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Storm Sewer Inlet Time Tabulation

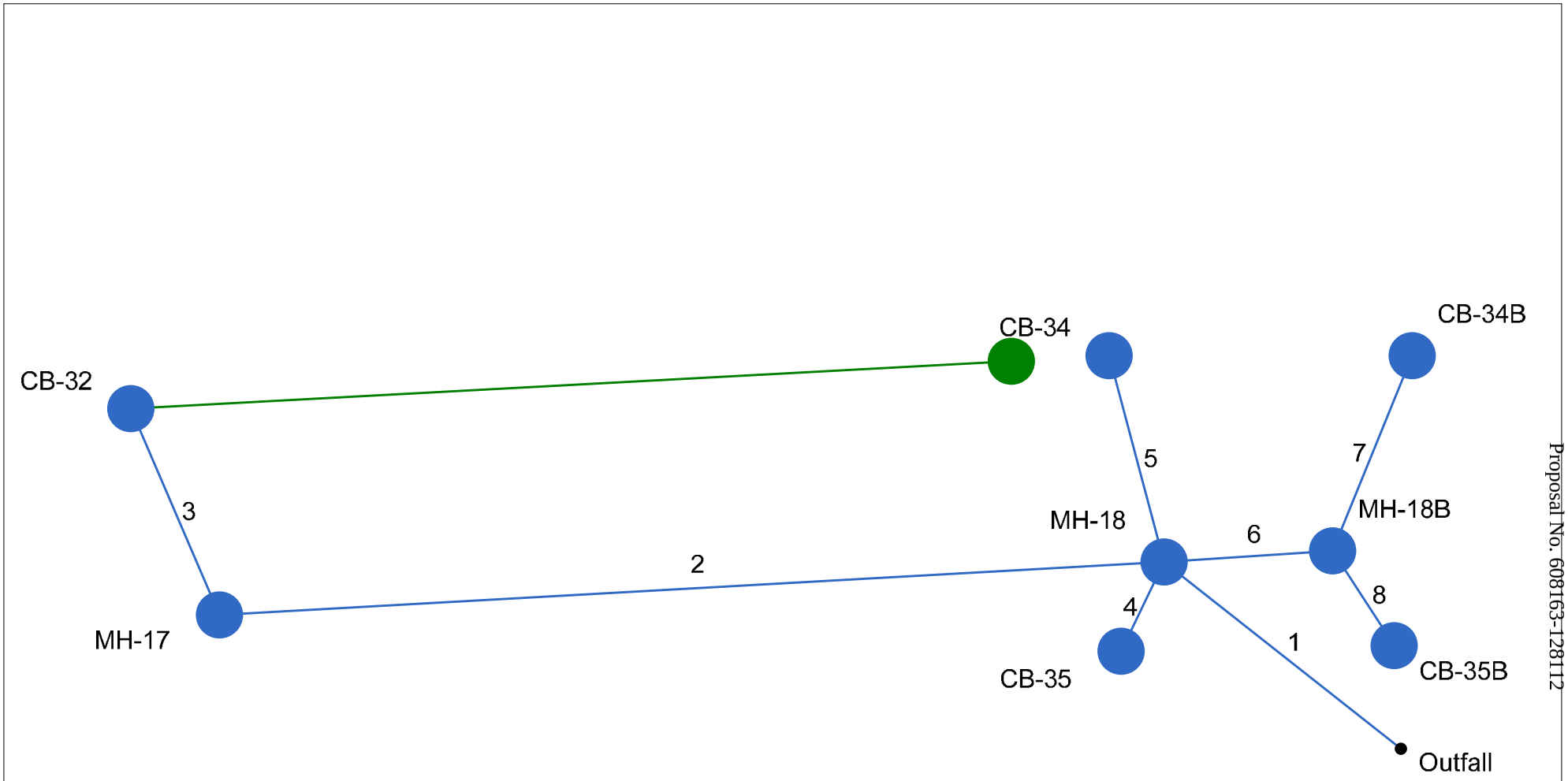
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH11A-OUTLET	User																		0.00
2	MH11-MH11A	User																		0.00
3	MH12-MH11	User																		0.00
4	MH13-MH12	User																		0.00
5	MH14-MH13	User																		0.00
6	MH15-MH14	User																		0.00
7	MH15B-MH15	User																		0.00
8	MH16-MH15B	User																		0.00
9	CB31-MH16	User																		5.00
10	CB30-MH16	User																		5.00
11	CB29B-MH15B	TR55	0.800	30.00	3.10	4.00	10.99	170.00 100.00	13.00 4.00	UnPaved UnPaved	5.82 3.23	0.49 0.52								12.00
12	CB28B-MH15B	User																		5.00
13	CB28-MH15	User																		5.00
14	CB29-MH15	User																		5.00
15	CB26-MH14	User																		5.00
16	CB27-MH14	User																		5.00
17	CB25-MH13	User																		5.00
18	CB24-MH13	User																		5.00
19	CB22-MH12	User																		5.00
20	CB23-MH12	User																		5.00
21	CB20-MH11	User																		5.00
22	CB21-MH11	User																		5.00

Project File: Sta.51+24.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 22 | Date: 3/15/2024

A00860 - 129

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



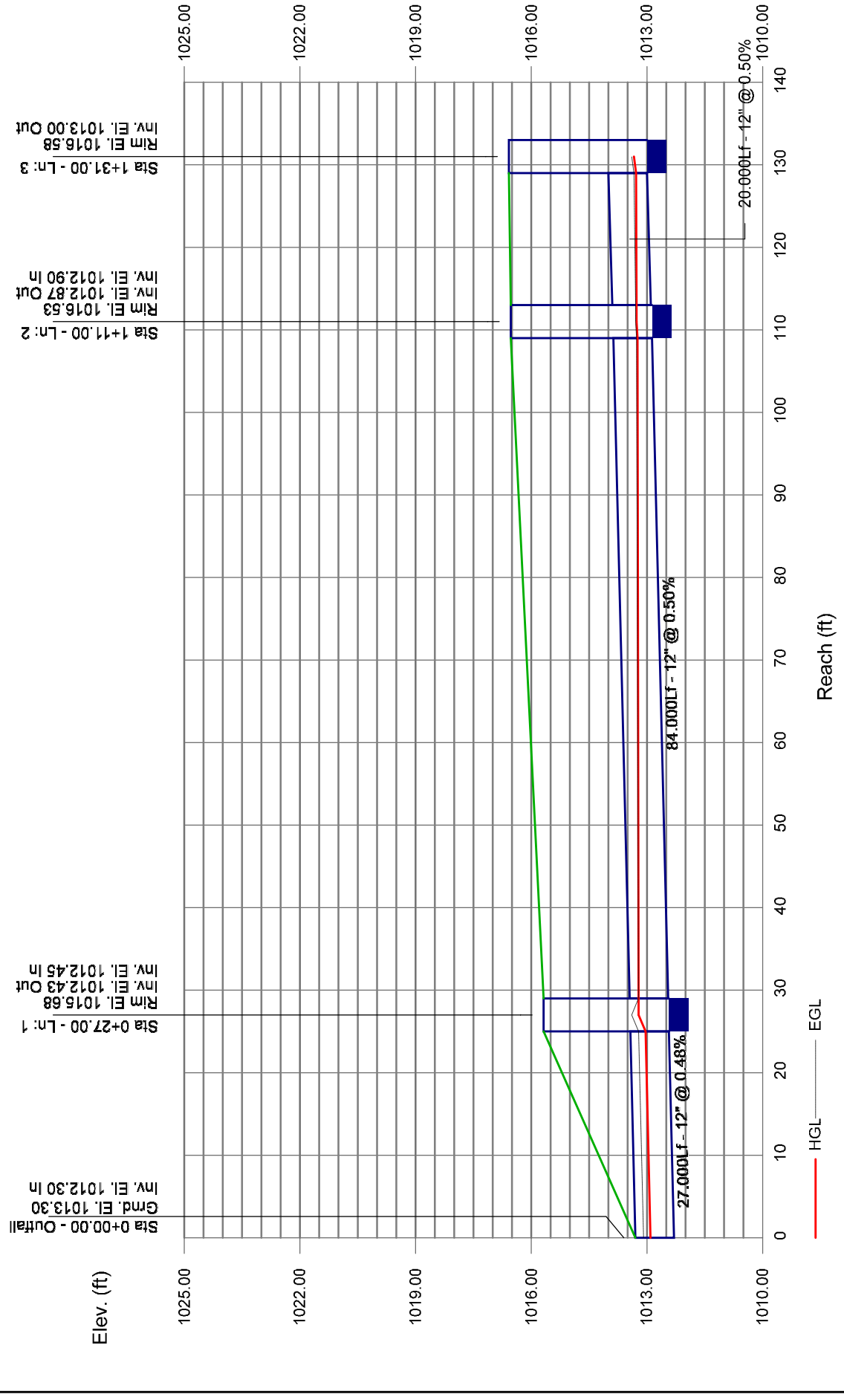
A00860 - 130

Proposal No. 608163-128112

Project File: Sta.73+25.stm	Number of lines: 8	Date: 3/15/2024

Proj. file: Sta.73+25.stm

Storm Sewer Profile



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-18	Manhole	1015.68	Cir	4.00	4.00	12	Cir	1012.43	12 12 12 12	Cir Cir Cir Cir	1012.45 1012.45 1012.44 1012.45
2	MH-17	Manhole	1016.53	Cir	4.00	4.00	12	Cir	1012.87	12	Cir	1012.90
3	CB-32	Combination	1016.58	Cir	4.00	2.00	12	Cir	1013.00			
4	CB-35	Combination	1015.93	Cir	4.00	4.00	12	Cir	1012.49			
5	CB-34	Combination	1015.52	Cir	4.00	2.00	12	Cir	1012.53			
6	MH-18B	Manhole	1015.73	Cir	4.00	4.00	12	Cir	1012.52	12 12	Cir Cir	1012.53 1012.55
7	CB-34B	Combination	1015.61	Cir	4.00	4.00	12	Cir	1012.63			
8	CB-35B	Combination	1016.00	Cir	4.00	4.00	12	Cir	1012.60			

Project File: Sta.73+25.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00860 - 132

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.7	5.4	1.69	2.47	3.39	12	0.48	1012.30	1012.43	1012.91	1013.04	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	5.8	0.34	2.52	0.90	12	0.50	1012.45	1012.87	1013.22	1013.25	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	5.9	0.35	2.52	1.61	12	0.50	1012.90	1013.00	1013.27	1013.28	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	5.9	0.07	2.37	0.11	12	0.44	1012.45	1012.49	1013.22	1013.22	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	5.9	0.20	2.45	0.32	12	0.47	1012.44	1012.53	1013.22	1013.22	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	5.8	1.24	2.43	2.00	12	0.47	1012.45	1012.52	1013.22	1013.23	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	5.9	0.83	2.58	1.39	12	0.53	1012.53	1012.63	1013.29	1013.30	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	5.9	0.43	2.52	0.71	12	0.50	1012.55	1012.60	1013.29	1013.29	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 133

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.35	0.00	0.28	0.07	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	3.81	0.21	2.07	2.0	5
4	CB-35	0.07	0.00	0.07	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.18	0.07	1.18	2.0	Off
5	CB-34	0.20	0.07	0.27	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.04	2.00	0.12	2.00	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	0.83	0.00	0.83	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.09	4.26	0.25	4.26	2.0	Off
8	CB-35B	0.43	0.00	0.43	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.00	2.67	0.16	2.67	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 134

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	27.000	0.00	0.49	0.00	0.00	0.32	0.0	6.9	6.5	2.06	2.47	3.76	12	0.48	1012.30	1012.43	1012.91	1013.14	1013.30	1015.68	MH18-OUTLET
2	1	84.000	0.00	0.07	0.00	0.00	0.06	0.0	5.2	7.1	0.42	2.52	0.85	12	0.50	1012.45	1012.87	1013.33	1013.35	1015.68	1016.53	MH17-MH18
3	2	20.000	0.07	0.07	0.84	0.06	0.06	5.0	5.0	7.2	0.42	2.52	1.40	12	0.50	1012.90	1013.00	1013.36	1013.37	1016.53	1016.58	CB32-MH17
4	1	9.000	0.02	0.02	0.70	0.01	0.01	5.0	5.0	7.2	0.08	2.37	0.11	12	0.44	1012.45	1012.49	1013.33	1013.33	1015.68	1015.93	CB35-MH18
5	1	19.000	0.04	0.04	0.84	0.03	0.03	5.0	5.0	7.2	0.24	2.45	0.34	12	0.47	1012.44	1012.53	1013.33	1013.33	1015.68	1015.52	CB34-MH18
6	1	15.000	0.00	0.36	0.00	0.00	0.21	0.0	5.2	7.1	1.51	2.43	2.13	12	0.47	1012.45	1012.52	1013.33	1013.35	1015.68	1015.73	MH18B-MH18
7	6	19.000	0.26	0.26	0.54	0.14	0.14	5.0	5.0	7.2	1.01	2.58	1.45	12	0.53	1012.53	1012.63	1013.41	1013.42	1015.73	1015.61	CB34B-MH18B
8	6	10.000	0.10	0.10	0.72	0.07	0.07	5.0	5.0	7.2	0.52	2.52	0.74	12	0.50	1012.55	1012.60	1013.41	1013.42	1015.73	1016.00	CB35B-MH18B

Project File: Sta.73+25.stm

Number of lines: 8

Run Date: 3/15/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00860 - 135

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-18	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-17	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-32	0.42	0.00	0.33	0.10	Comb	2.0	2.00	0.00	2.00	2.00	0.024	4.00	0.020	0.020	0.013	0.08	4.11	0.21	2.38	2.0	5
4	CB-35	0.08	0.00	0.08	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.09	1.31	0.08	1.31	2.0	Off
5	CB-34	0.24	0.10	0.34	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.02	2.30	0.14	2.30	2.0	Off
6	MH-18B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	1
7	CB-34B	1.01	0.00	1.01	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.10	5.17	0.27	5.17	2.0	Off
8	CB-35B	0.52	0.00	0.52	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	0.02	3.05	0.19	3.05	2.0	Off

Project File: Sta.73+25.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 136

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

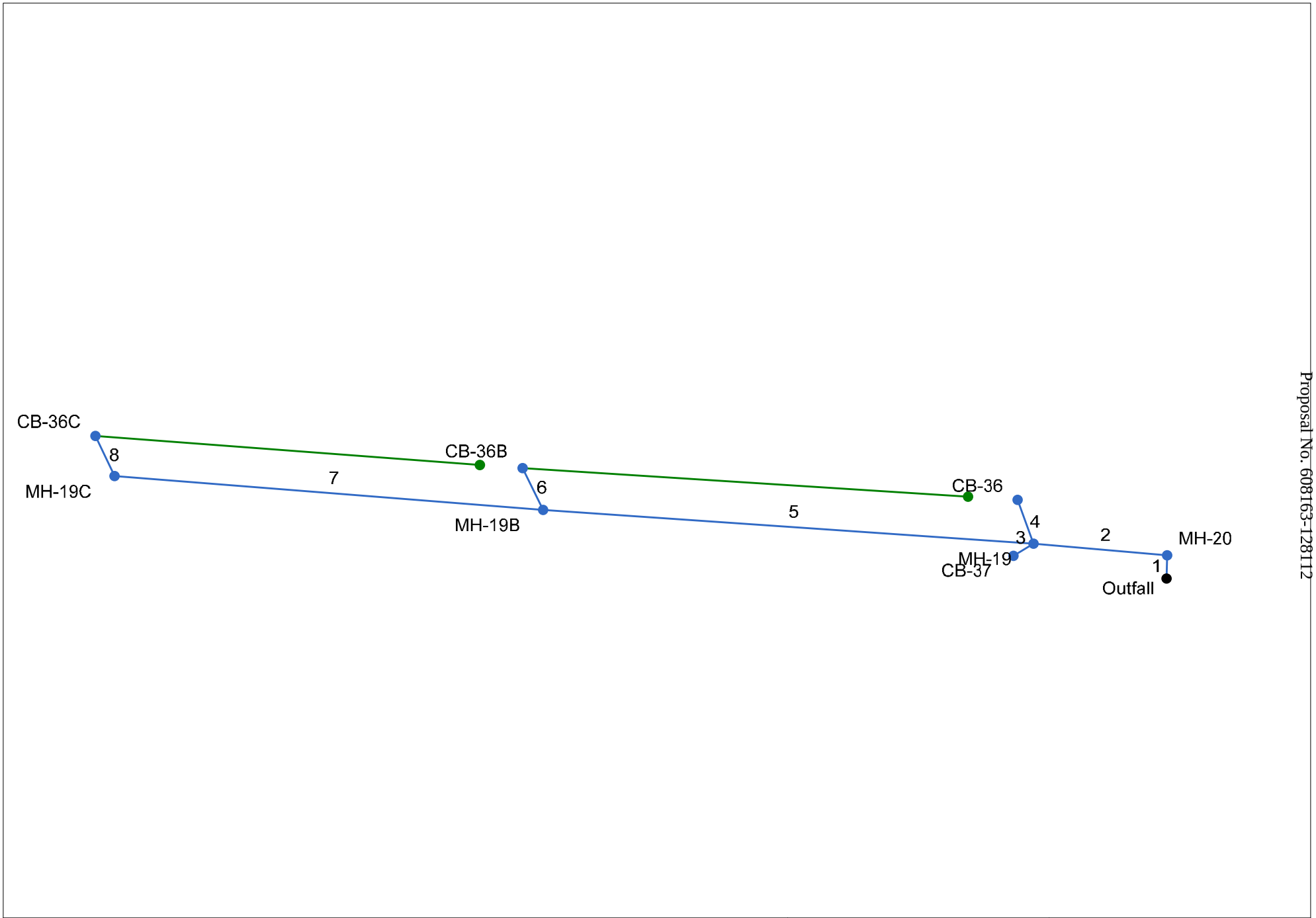
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH18-OUTLET	User																		0.00
2	MH17-MH18	User																		0.00
3	CB32-MH17	User																		5.00
4	CB35-MH18	User																		5.00
5	CB34-MH18	User																		5.00
6	MH18B-MH18	User																		0.00
7	CB34B-MH18B	User																		5.00
8	CB35B-MH18B	User																		5.00

Project File: Sta.73+25.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00860 - 137

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



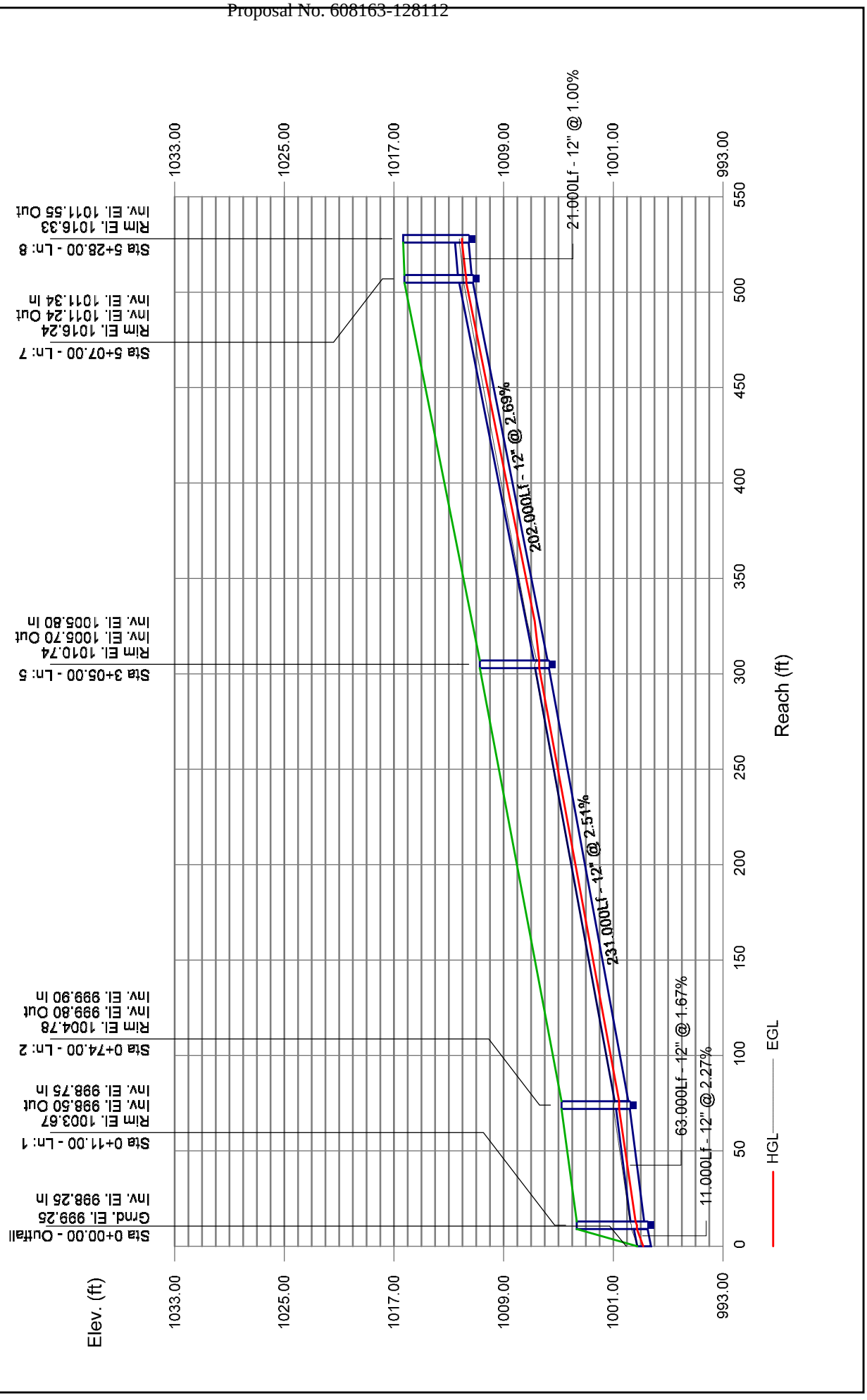
A00860 - 138

Proposal No. 608163-128112

Project File: Sta.81+97.stm	Number of lines: 8	Date: 3/15/2024

Storm Sewer Profile

Proj. file: Sta.81+97.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-20	Manhole	1003.67	Cir	4.00	4.00	12	Cir	998.50	12	Cir	998.75
2	MH-19	Manhole	1004.78	Cir	4.00	4.00	12	Cir	999.80	12 12 12	Cir Cir Cir	999.90 1000.00 999.90
3	CB-37	Combination	1004.87	Cir	4.00	2.00	12	Cir	1000.01			
4	CB-36	Combination	1005.13	Cir	4.00	2.00	12	Cir	1000.22			
5	MH-19B	Manhole	1010.74	Cir	4.00	4.00	12	Cir	1005.70	12 12	Cir Cir	1006.45 1005.80
6	CB-36B	Combination	1011.71	Cir	4.00	4.00	12	Cir	1006.67			
7	MH-19C	Manhole	1016.24	Cir	4.00	4.00	12	Cir	1011.24	12	Cir	1011.34
8	CB-36C	Combination	1016.33	Cir	4.00	2.00	12	Cir	1011.55			

Project File: Sta.81+97.stm | Number of Structures: 8 | Run Date: 3/15/2024

A00860 - 140

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	11.000	0.00	1.83	0.00	0.00	0.78	0.0	12.2	4.2	3.31	5.37	6.12	12	2.27	998.25	998.50	998.82	999.28	999.25	1003.67	MH20-OUTLET
2	1	63.000	0.00	1.83	0.00	0.00	0.78	0.0	12.0	4.2	3.33	4.60	5.72	12	1.67	998.75	999.80	999.38	1000.58	1003.67	1004.78	MH19-MH20
3	2	11.000	0.12	0.12	0.85	0.10	0.10	5.0	5.0	5.9	0.60	3.56	1.90	12	1.00	999.90	1000.01	1000.58	1000.33	1004.78	1004.87	CB37-MH19
4	2	22.000	0.16	0.16	0.39	0.06	0.06	5.0	5.0	5.9	0.37	3.56	1.59	12	1.00	1000.00	1000.22	1000.58	1000.47	1004.78	1005.13	CB36-MH19
5	2	231.000	0.00	1.55	0.00	0.00	0.62	0.0	11.2	4.4	2.72	5.64	4.68	12	2.51	999.90	1005.70	1000.58	1006.41	1004.78	1010.74	MH19B-MH19
6	5	22.000	0.83	0.83	0.40	0.33	0.33	10.0	10.0	4.6	1.53	3.56	4.01	12	1.00	1006.45	1006.67	1006.91	1007.19	1010.74	1011.71	CB36B-MH19B
7	5	202.000	0.00	0.72	0.00	0.00	0.29	0.0	10.1	4.6	1.32	5.84	3.07	12	2.69	1005.80	1011.24	1006.41	1011.73	1010.74	1016.24	MH19C-MH19B
8	7	21.000	0.72	0.72	0.40	0.29	0.29	10.0	10.0	4.6	1.33	3.56	3.85	12	1.00	1011.34	1011.55	1011.76	1012.04	1016.24	1016.33	CB36C-MH19C

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 141

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-20	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	MH-19	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	CB-37	0.60	0.00	0.55	0.06	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.042	0.020	0.013	0.12	2.92	0.22	1.20	2.0	Off
4	CB-36	0.37	0.92	0.90	0.39	Comb	2.0	2.00	0.00	2.00	2.00	0.025	4.00	0.031	0.020	0.013	0.15	5.07	0.26	3.00	2.0	Off
5	MH-19B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	2
6	CB-36B	1.53	0.52	1.13	0.92	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.15	7.27	0.27	5.39	2.0	4
7	MH-19C	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	4.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	5
8	CB-36C	1.33	0.00	0.81	0.52	Comb	2.0	2.00	0.00	2.00	2.00	0.027	4.00	0.020	0.020	0.013	0.12	6.18	0.25	4.34	2.0	6

Project File: Sta.81+97.stm | Number of lines: 8 | Run Date: 3/15/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 142

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

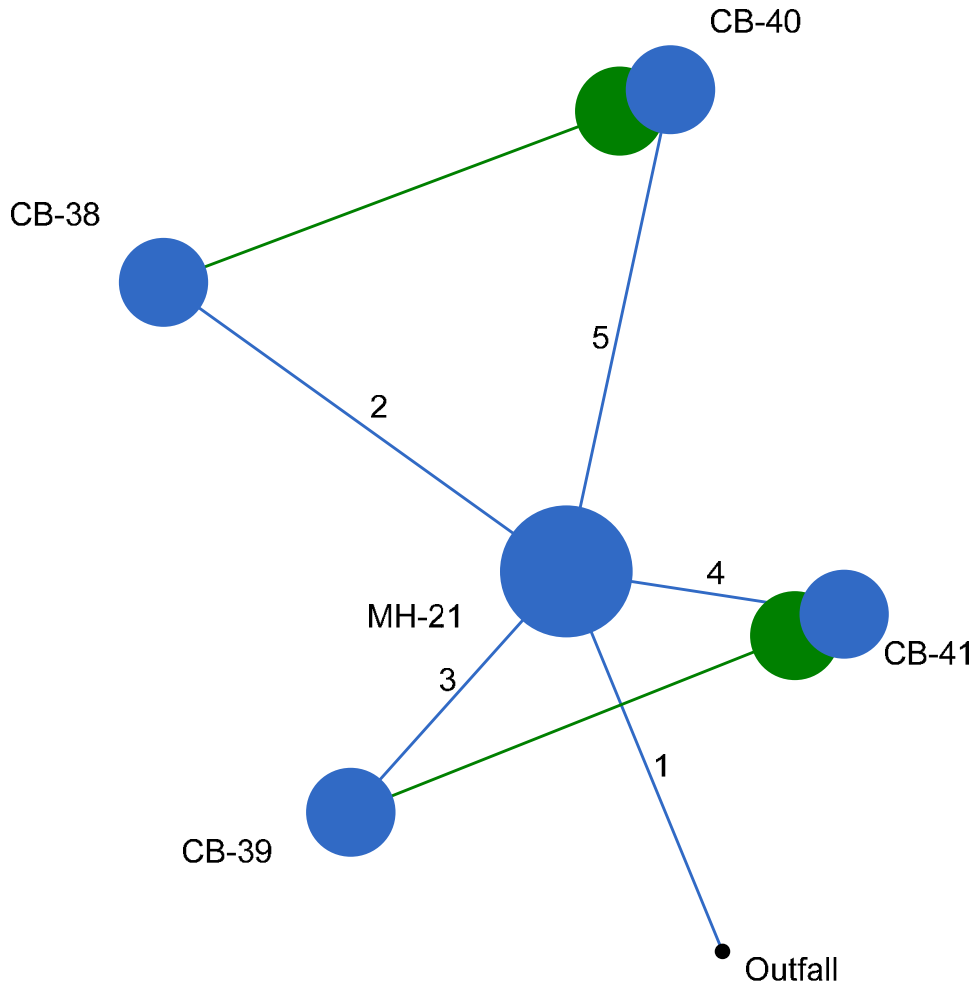
Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH20-OUTLET	User																		0.00
2	MH19-MH20	User																		0.00
3	CB37-MH19	User																		5.00
4	CB36-MH19	User																		5.00
5	MH19B-MH19	User																		0.00
6	CB36B-MH19B	User																		10.00
7	MH19C-MH19B	User																		0.00
8	CB36C-MH19C	User																		10.00

Project File: Sta.81+97.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 8 | Date: 3/15/2024

A00860 - 143

Proposal No. 608163-128112

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Sta.85+72.stm	Number of lines: 5	Date: 4/8/2024

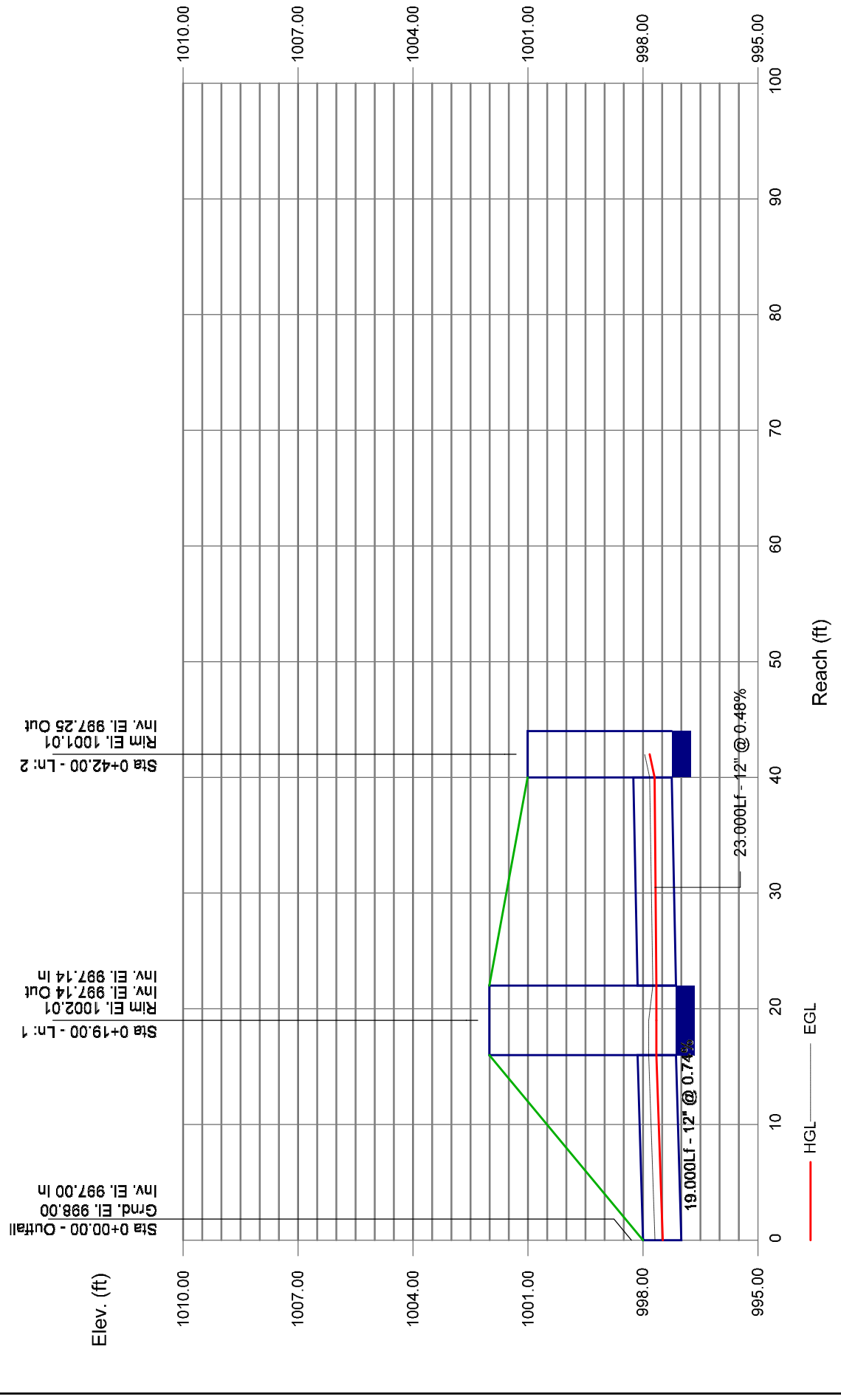
Storm Sewers v2023.00

A00860 - 144

Proposal No. 608163-128112

Storm Sewer Profile

Proj. file: Sta.85+72.stm



Storm Sewers

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-21	Manhole	1002.01	Cir	6.00	6.00	12	Cir	997.14	12 12 12 12	Cir Cir Cir Cir	997.14 997.14 997.14 997.14
2	CB-38	Combination	1001.01	Cir	4.00	4.00	12	Cir	997.25			
3	CB-39	Combination	1002.33	Cir	4.00	4.00	12	Cir	997.21			
4	CB-41	Combination	1002.17	Cir	4.00	4.00	12	Cir	997.21			
5	CB-40	Combination	1000.85	Cir	4.00	4.00	12	Cir	997.25			

Project File: Sta.85+72.stm | Number of Structures: 5 | Run Date: 4/8/2024

A00860 - 146

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	5.4	1.45	3.06	3.72	12	0.74	997.00	997.14	997.49	997.65	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	5.9	0.98	2.46	2.66	12	0.48	997.14	997.25	997.65	997.70	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	5.9	0.08	2.43	0.23	12	0.47	997.14	997.21	997.65	997.65	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	5.9	0.04	2.61	0.12	12	0.54	997.14	997.21	997.65	997.65	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	5.9	0.49	2.46	1.42	12	0.48	997.14	997.25	997.65	997.66	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES:Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

A00860 - 147

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	0.98	0.00	0.87	0.11	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.19	3.22	0.25	1.43	2.0	5
3	CB-39	0.08	0.00	0.08	0.00	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.55	0.18	0.70	2.0	4
4	CB-41	0.04	0.00	0.05	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.11	0.99	0.06	0.99	2.0	Off
5	CB-40	0.49	0.11	0.60	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.04	2.04	0.21	2.04	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 37.17 / (Inlet time + 7.30) ^ 0.73; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 148

Proposal No. 608163-128112

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.41	0.00	0.00	0.27	0.0	6.7	6.6	1.78	3.06	3.96	12	0.74	997.00	997.14	997.55	997.71	998.00	1002.01	MH21-OUTLET
2	1	23.000	0.26	0.26	0.64	0.17	0.17	5.0	5.0	7.2	1.20	2.46	2.80	12	0.48	997.14	997.25	997.71	997.76	1002.01	1001.01	CB38-MH21
3	1	15.000	0.02	0.02	0.71	0.01	0.01	5.0	5.0	7.2	0.10	2.43	0.24	12	0.47	997.14	997.21	997.71	997.71	1002.01	1002.33	CB39-MH21
4	1	13.000	0.01	0.01	0.76	0.01	0.01	5.0	5.0	7.2	0.05	2.61	0.13	12	0.54	997.14	997.21	997.71	997.71	1002.01	1002.17	CB41-MH21
5	1	23.000	0.12	0.12	0.69	0.08	0.08	5.0	5.0	7.2	0.60	2.46	1.48	12	0.48	997.14	997.25	997.71	997.72	1002.01	1000.85	CB40-MH21

Project File: Sta.85+72.stm

Number of lines: 5

Run Date: 4/8/2024

NOTES:Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

A00860 - 149

Proposal No. 608163-128112

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH-21	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CB-38	1.20	0.00	1.02	0.17	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.060	0.060	0.013	0.21	3.47	0.27	1.69	2.0	5
3	CB-39	0.10	0.00	0.10	0.01	Comb	2.0	2.00	0.00	2.00	2.00	0.012	4.00	0.020	0.020	0.013	0.05	2.75	0.18	0.90	2.0	4
4	CB-41	0.05	0.01	0.06	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.020	0.020	0.013	-0.10	1.12	0.07	1.12	2.0	Off
5	CB-40	0.60	0.17	0.77	0.00	Comb	2.0	2.00	4.00	2.00	2.00	Sag	4.00	0.060	0.060	0.013	0.08	2.41	0.25	2.41	2.0	Off

Project File: Sta.85+72.stm | Number of lines: 5 | Run Date: 4/8/2024

NOTES: Inlet N-Values = 0.016; Intensity = 42.77 / (Inlet time + 7.20) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

A00860 - 150

Proposal No. 608163-128112

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH21-OUTLET	User																		0.00
2	CB38-MH21	User																		5.00
3	CB39-MH21	User																		5.00
4	CB41-MH21	User																		5.00
5	CB40-MH21	User																		5.00

Project File: Sta.85+72.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 5 | Date: 4/8/2024

A00860 - 151

Proposal No. 608163-128112

APPENDIX D

HY-8 Reports

Existing

HY-8 Reports

STA 15+33 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

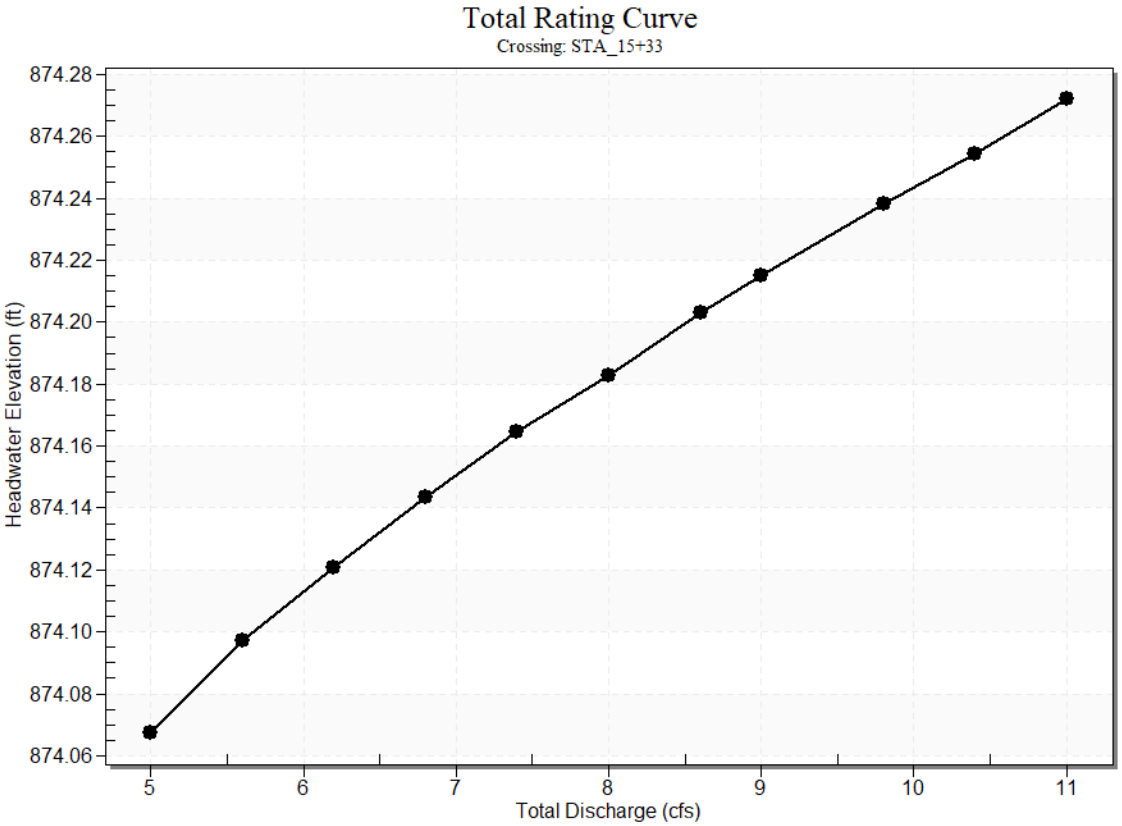
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA_15+33

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
874.07	5.00	4.15	0.84	16
874.10	5.60	4.17	1.40	4
874.12	6.20	4.18	2.00	4
874.14	6.80	4.19	2.59	4
874.16	7.40	4.21	3.16	3
874.18	8.00	4.22	3.75	3
874.20	8.60	4.23	4.35	3
874.21	9.00	4.23	4.75	3
874.24	9.80	4.25	5.54	3
874.25	10.40	4.26	6.14	3
874.27	11.00	4.26	6.73	3
874.00	4.11	4.11	0.00	Overtopping

Rating Curve Plot for Crossing: STA_15+33



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	4.15 cfs	874.07	1.75	3.818	7-M2c	1.00	0.86	0.86	0.13	5.78	2.08
5.60 cfs	4.17 cfs	874.10	1.75	3.847	7-M2c	1.00	0.86	0.86	0.14	5.79	2.18
6.20 cfs	4.18 cfs	874.12	1.76	3.871	7-M2c	1.00	0.86	0.86	0.15	5.80	2.27
6.80 cfs	4.19 cfs	874.14	1.77	3.894	7-M2c	1.00	0.86	0.86	0.16	5.82	2.35

7.40 cfs	4.21 cfs	874.16	1.77	3.915	7-M2c	1.00	0.86	0.86	0.16	5.83	2.42
8.00 cfs	4.22 cfs	874.18	1.78	3.933	7-M2c	1.00	0.87	0.87	0.17	5.84	2.50
8.60 cfs	4.23 cfs	874.20	1.79	3.953	7-M2c	1.00	0.87	0.87	0.18	5.85	2.57
9.00 cfs	4.23 cfs	874.21	1.79	3.965	7-M2c	1.00	0.87	0.87	0.18	5.85	2.61
9.80 cfs	4.25 cfs	874.24	1.80	3.988	7-M2c	1.00	0.87	0.87	0.19	5.87	2.70
10.40 cfs	4.26 cfs	874.25	1.80	4.004	7-M2c	1.00	0.87	0.87	0.20	5.88	2.76
11.00 cfs	4.26 cfs	874.27	1.81	4.022	7-M2c	1.00	0.87	0.87	0.21	5.88	2.82

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

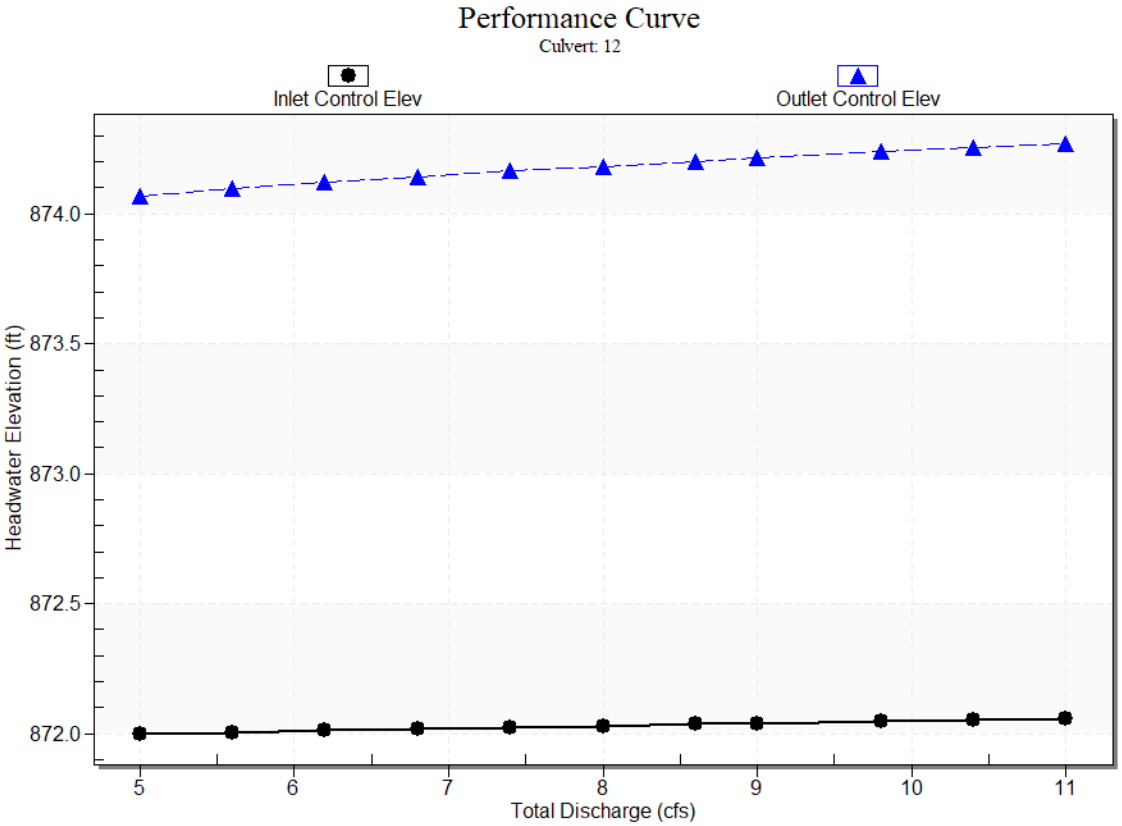
Inlet Elevation (invert): 870.25 ft,

Outlet Elevation (invert): 869.63 ft

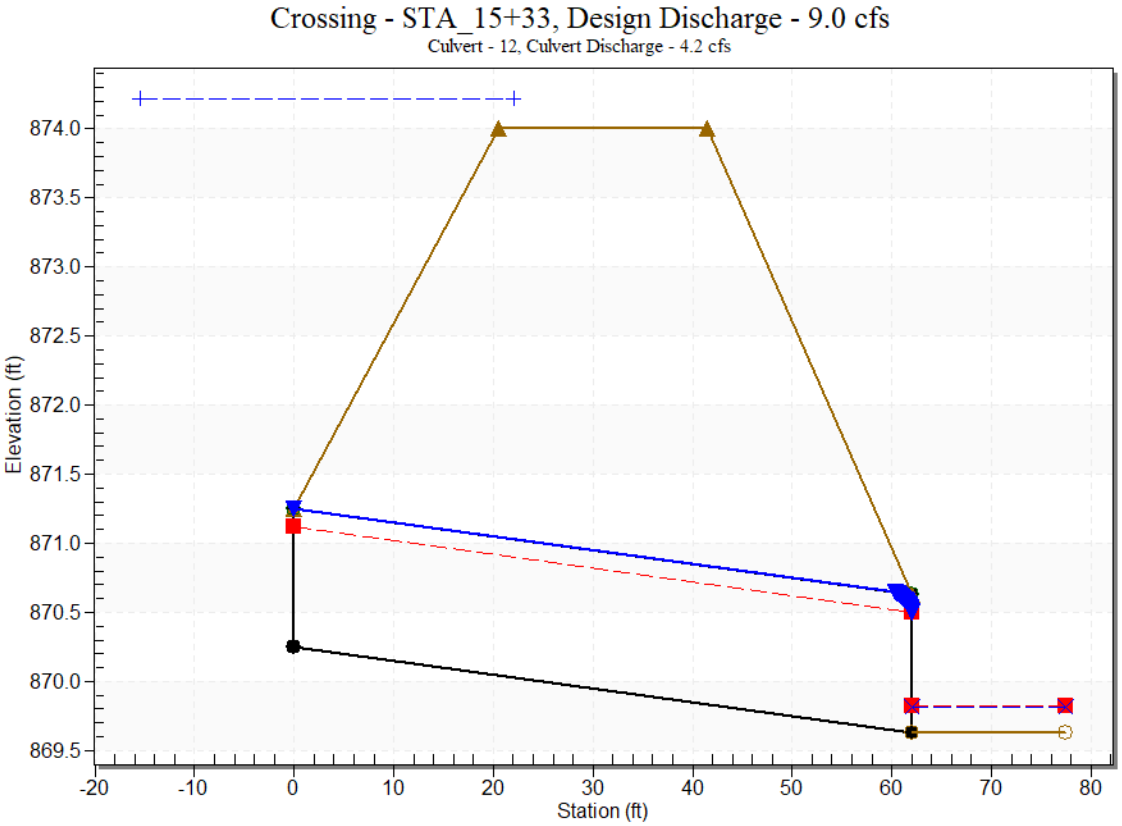
Culvert Length: 62.00 ft,

Culvert Slope: 0.0100

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.25 ft

Outlet Station: 62.00 ft

Outlet Elevation: 869.63 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA_15+33

Table 3 - Downstream Channel Rating Curve (Crossing: STA_15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.76	0.13	2.08	0.40	1.03
5.60	869.77	0.14	2.18	0.43	1.05
6.20	869.78	0.15	2.27	0.46	1.06
6.80	869.79	0.16	2.35	0.49	1.07
7.40	869.79	0.16	2.42	0.51	1.07
8.00	869.80	0.17	2.50	0.53	1.08
8.60	869.81	0.18	2.57	0.56	1.09
9.00	869.81	0.18	2.61	0.57	1.09
9.80	869.82	0.19	2.70	0.60	1.10
10.40	869.83	0.20	2.76	0.63	1.11
11.00	869.84	0.21	2.82	0.65	1.12

Tailwater Channel Data - STA_15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 18.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.63 ft

Roadway Data for Crossing: STA_15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 874.00 ft

Roadway Surface: Paved

Roadway Top Width: 21.00 ft

STA 25+92 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 22.00 cfs

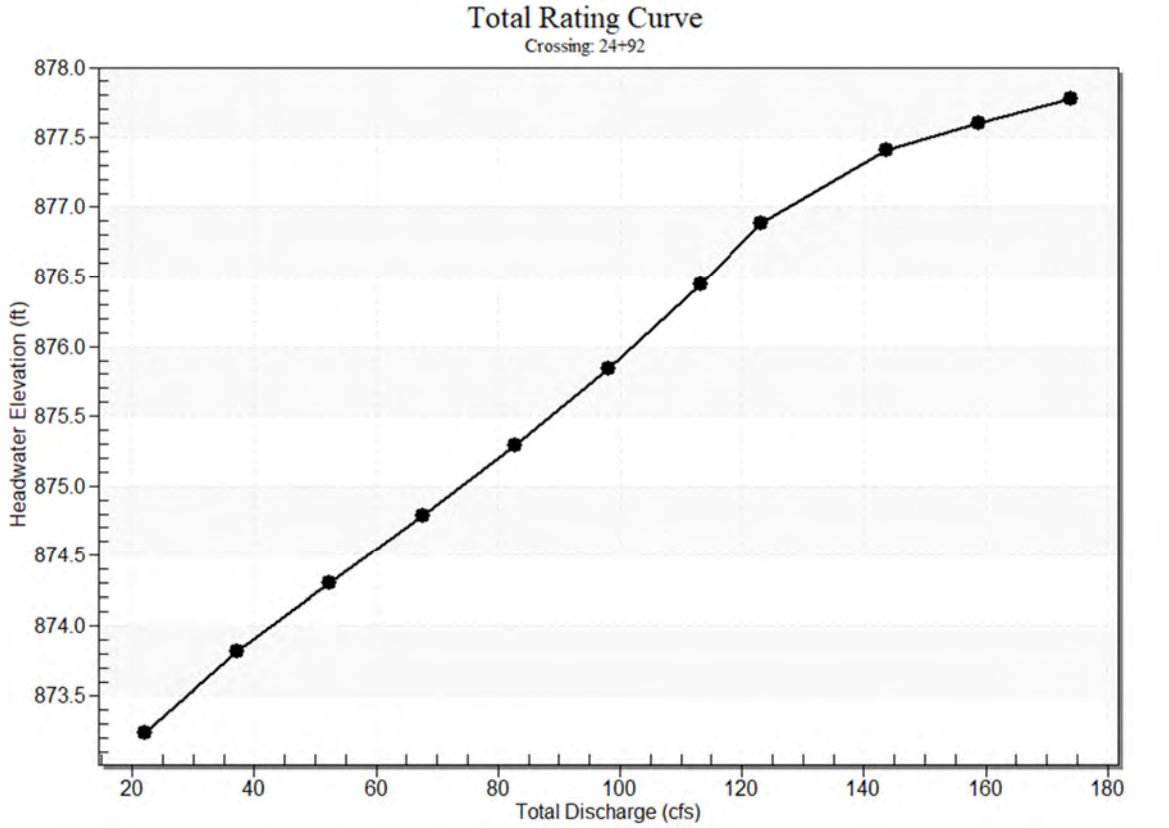
Design Flow: 123.00 cfs

Maximum Flow: 174.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 24+92

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
873.24	22.00	19.92	2.07	0.00	6
873.81	37.20	29.45	7.75	0.00	4
874.30	52.40	37.68	14.74	0.00	2
874.79	67.60	45.15	22.45	0.00	3
875.29	82.80	51.89	30.92	0.00	3
875.84	98.00	58.27	39.73	0.00	4
876.45	113.20	64.64	48.57	0.00	4
876.89	123.00	68.78	54.18	0.00	8
877.40	143.60	73.35	60.17	10.07	6
877.60	158.80	75.00	62.29	21.48	5
877.77	174.00	76.41	64.07	33.43	4
877.10	127.41	70.70	56.72	0.00	Overtopping

Rating Curve Plot for Crossing: 24+92



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	19.92 cfs	873.24	2.04	0.0*	1-S2n	0.73	1.43	0.84	0.24	12.27	4.39
37.20 cfs	29.45 cfs	873.81	2.61	0.321	1-S2n	0.89	1.76	1.06	0.33	13.16	5.34
52.40 cfs	37.68 cfs	874.30	3.10	0.863	5-S2n	1.01	2.00	1.23	0.40	13.74	6.06
67.60 cfs	45.15 cfs	874.79	3.59	1.392	5-S2n	1.11	2.19	1.38	0.46	14.23	6.66

82.80 cfs	51.89 cfs	875.29	4.09	2.232	5-S2n	1.20	2.34	1.50	0.52	14.65	7.16
98.00 cfs	58.27 cfs	875.84	4.64	2.680	5-S2n	1.28	2.47	1.61	0.58	15.03	7.60
113.20 cfs	64.64 cfs	876.45	5.25	3.162	5-S2n	1.35	2.58	1.72	0.63	15.41	8.00
123.00 cfs	68.78 cfs	876.89	5.69	3.495	5-S2n	1.40	2.64	1.79	0.66	15.66	8.24
143.60 cfs	73.35 cfs	877.40	6.20	3.878	5-S2n	1.46	2.70	1.86	0.72	15.94	8.69
158.80 cfs	75.00 cfs	877.60	6.40	4.022	5-S2n	1.47	2.72	1.88	0.77	16.04	9.00
174.00 cfs	76.41 cfs	877.77	6.57	4.146	5-S2n	1.49	2.73	1.91	0.81	16.13	9.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

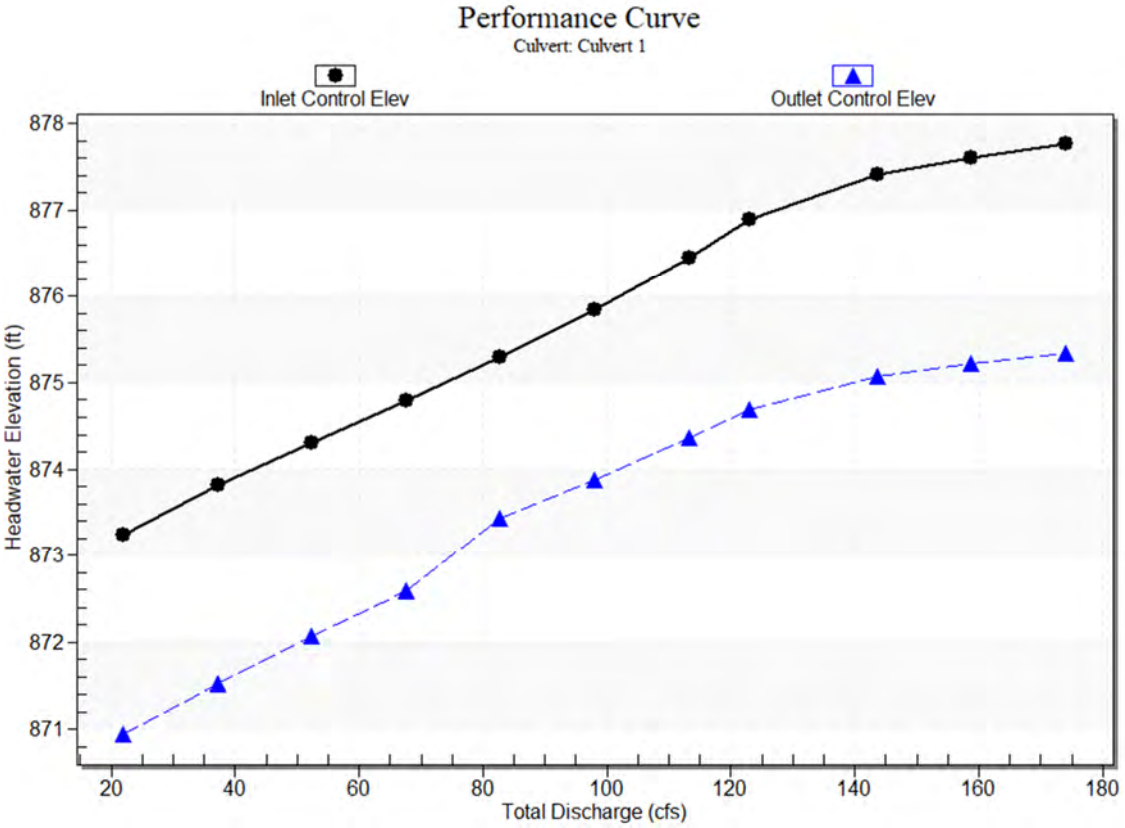
Inlet Elevation (invert): 871.20 ft,

Outlet Elevation (invert): 869.29 ft

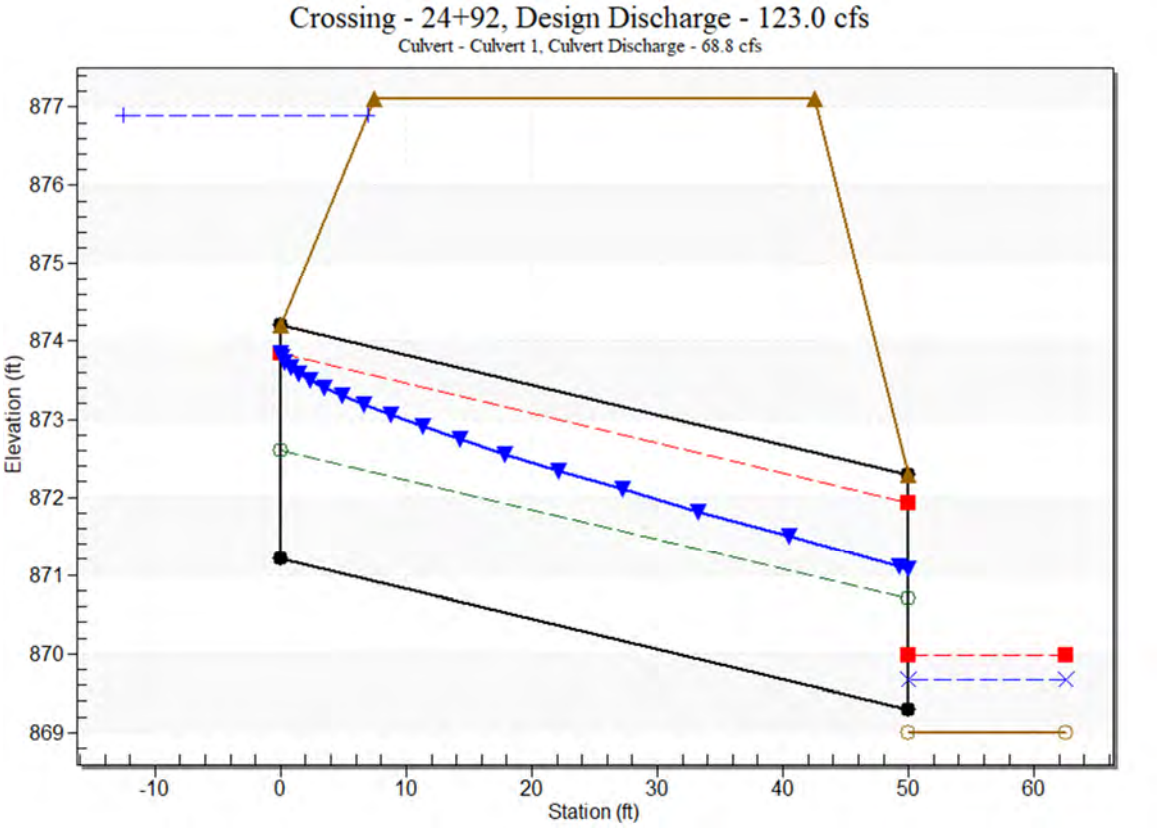
Culvert Length: 50.04 ft,

Culvert Slope: 0.0382

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.20 ft

Outlet Station: 50.00 ft

Outlet Elevation: 869.29 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0110

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Culvert Data: Culvert 2

Table 3 - Culvert Summary Table: Culvert 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
22.00 cfs	2.07 cfs	873.24	0.58	0.0*	1-S2n	0.32	0.45	0.32	0.24	5.01	4.39
37.20 cfs	7.75 cfs	873.81	1.15	0.0*	1-S2n	0.62	0.88	0.62	0.33	7.39	5.34
52.40 cfs	14.74 cfs	874.30	1.64	0.0*	1-S2n	0.85	1.22	0.85	0.40	8.90	6.06
67.60 cfs	22.45 cfs	874.79	2.13	0.0*	1-S2n	1.06	1.52	1.06	0.46	10.02	6.66
82.80 cfs	30.92 cfs	875.29	2.63	0.0*	1-S2n	1.26	1.80	1.29	0.52	10.62	7.16
98.00 cfs	39.73 cfs	875.84	3.18	0.730	5-S2n	1.46	2.05	1.49	0.58	11.34	7.60
113.20 cfs	48.57 cfs	876.45	3.79	1.974	5-S2n	1.64	2.27	1.67	0.63	12.00	8.00
123.00 cfs	54.18 cfs	876.89	4.23	2.523	5-S2n	1.76	2.39	1.79	0.66	12.29	8.24
143.60 cfs	60.17 cfs	877.40	4.74	3.161	5-S2n	1.89	2.50	1.93	0.72	12.53	8.69
158.80 cfs	62.29 cfs	877.60	4.94	3.399	5-S2n	1.93	2.54	1.98	0.77	12.61	9.00
174.00 cfs	64.07 cfs	877.77	5.11	3.604	5-S2	1.97	2.57	2.01	0.81	12.70	9.29

n

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

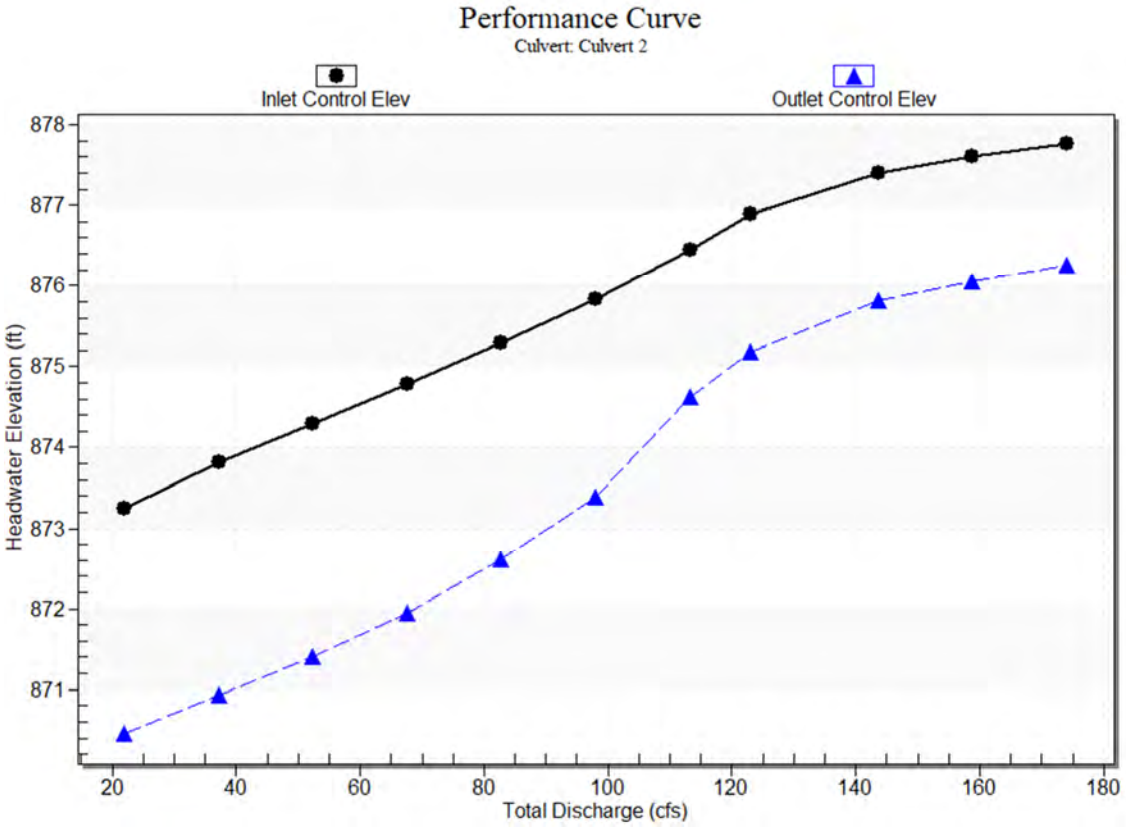
Inlet Elevation (invert): 872.66 ft,

Outlet Elevation (invert): 870.00 ft

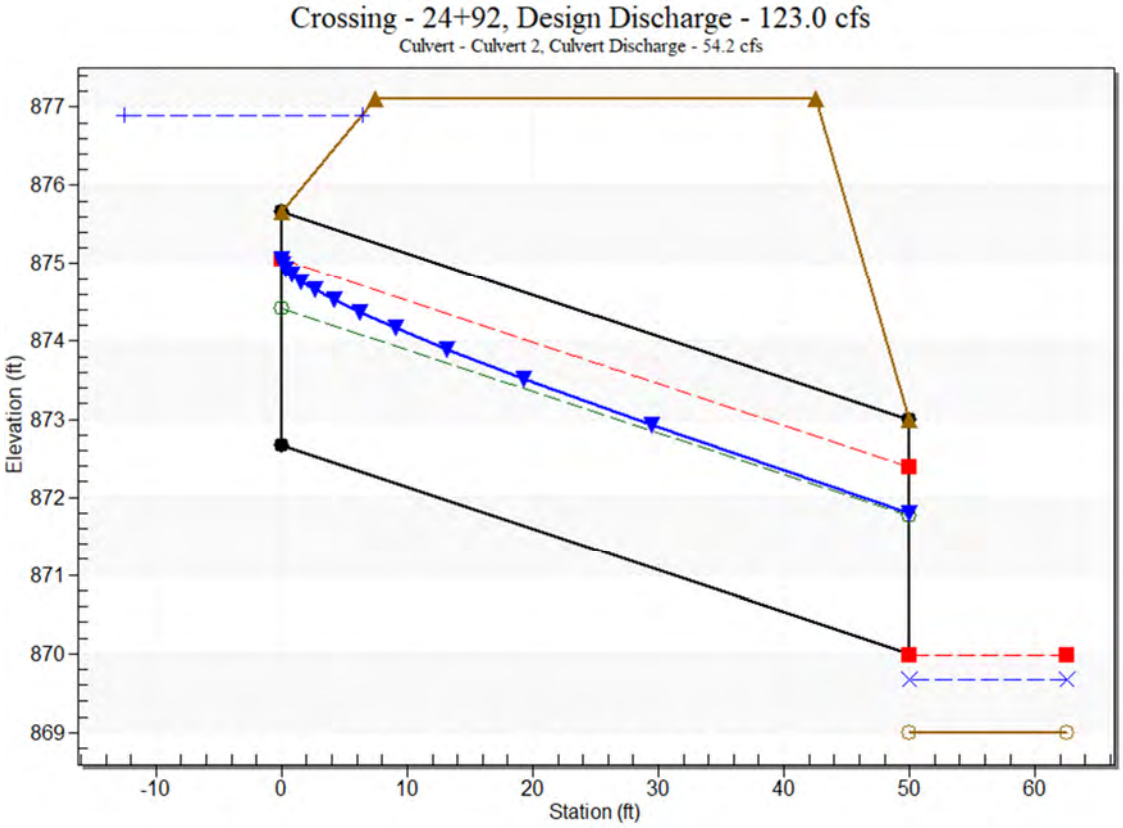
Culvert Length: 50.07 ft,

Culvert Slope: 0.0532

Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 872.66 ft

Outlet Station: 50.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 24+92

Table 4 - Downstream Channel Rating Curve (Crossing: 24+92)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
22.00	869.24	0.24	4.39	1.49	1.62
37.20	869.33	0.33	5.34	2.04	1.70
52.40	869.40	0.40	6.06	2.50	1.75
67.60	869.46	0.46	6.66	2.90	1.79
82.80	869.52	0.52	7.16	3.27	1.82
98.00	869.58	0.58	7.60	3.61	1.85
113.20	869.63	0.63	8.00	3.92	1.87
123.00	869.66	0.66	8.24	4.12	1.89
143.60	869.72	0.72	8.69	4.50	1.91
158.80	869.77	0.77	9.00	4.77	1.93
174.00	869.81	0.81	9.29	5.03	1.94

Tailwater Channel Data - 24+92

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.00 ft

Roadway Data for Crossing: 24+92

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 877.10 ft

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

STA 43+76 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

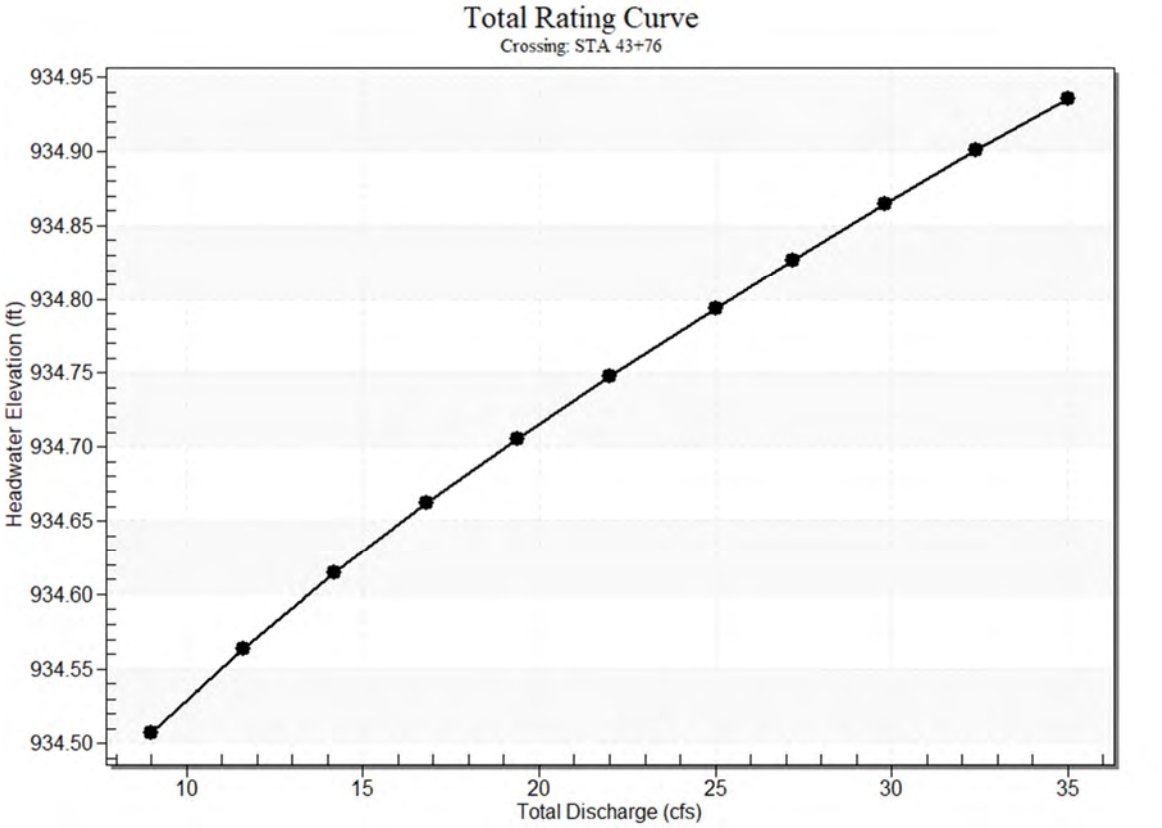
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.51	9.00	3.33	5.63	8
934.56	11.60	3.46	8.09	4
934.61	14.20	3.58	10.60	4
934.66	16.80	3.68	13.11	4
934.71	19.40	3.77	15.58	3
934.75	22.00	3.86	18.11	3
934.79	25.00	3.95	21.02	3
934.83	27.20	4.02	23.17	3
934.86	29.80	4.09	25.70	3
934.90	32.40	4.16	28.24	3
934.94	35.00	4.22	30.72	2
934.30	2.78	2.78	0.00	Overtopping

Rating Curve Plot for Crossing: STA 43+76



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	3.33 cfs	934.51	1.37	0.0*	5-S2n	0.50	0.78	0.50	0.27	8.41	1.44
11.60 cfs	3.46 cfs	934.56	1.42	0.0*	5-S2n	0.51	0.79	0.52	0.31	8.45	1.58
14.20 cfs	3.58 cfs	934.61	1.47	0.040	5-S2n	0.52	0.81	0.53	0.35	8.51	1.69
16.80 cfs	3.68 cfs	934.66	1.52	0.105	5-S2n	0.53	0.82	0.54	0.38	8.56	1.79

19.40 cfs	3.77 cfs	934.71	1.57	0.164	5-S2n	0.53	0.83	0.55	0.42	8.62	1.88
22.00 cfs	3.86 cfs	934.75	1.61	0.220	5-S2n	0.54	0.83	0.55	0.45	8.66	1.96
25.00 cfs	3.95 cfs	934.79	1.65	0.282	5-S2n	0.55	0.84	0.56	0.48	8.71	2.05
27.20 cfs	4.02 cfs	934.83	1.69	0.325	5-S2n	0.56	0.85	0.57	0.50	8.74	2.11
29.80 cfs	4.09 cfs	934.86	1.72	0.375	5-S2n	0.56	0.86	0.57	0.53	8.78	2.17
32.40 cfs	4.16 cfs	934.90	1.76	0.423	5-S2n	0.57	0.86	0.58	0.56	8.81	2.23
35.00 cfs	4.22 cfs	934.94	1.80	0.468	5-S2n	0.57	0.87	0.59	0.58	8.84	2.29

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

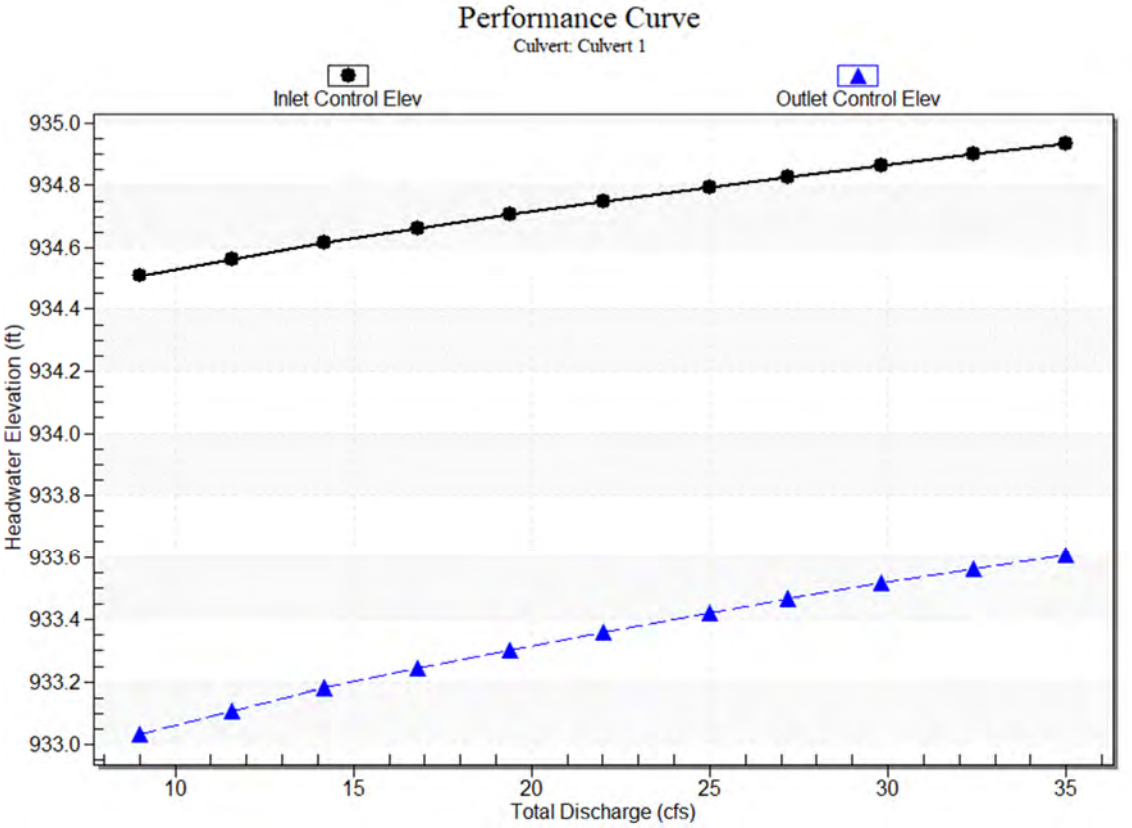
Inlet Elevation (invert): 933.14 ft,

Outlet Elevation (invert): 931.27 ft

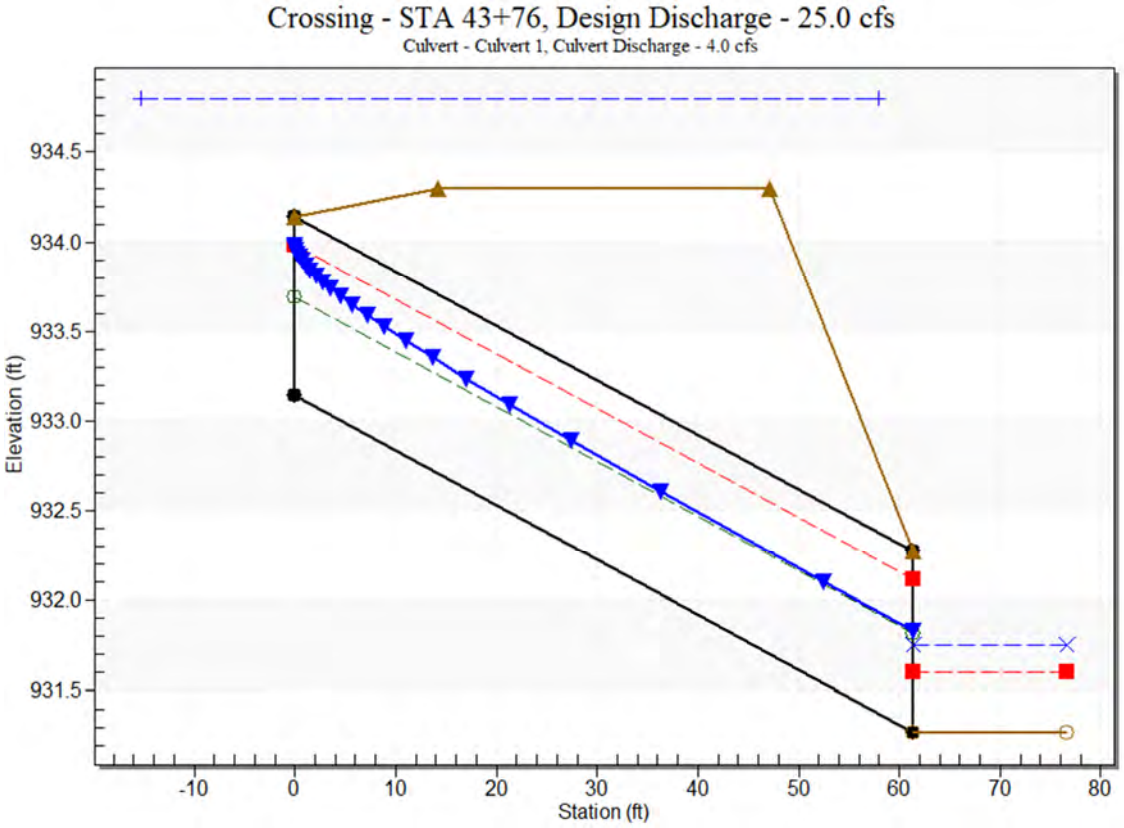
Culvert Length: 61.37 ft,

Culvert Slope: 0.0305

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 933.14 ft

Outlet Station: 61.34 ft

Outlet Elevation: 931.27 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: STA 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.54	0.27	1.44	0.17	0.52
11.60	931.58	0.31	1.58	0.19	0.53
14.20	931.62	0.35	1.69	0.22	0.54
16.80	931.65	0.38	1.79	0.24	0.55
19.40	931.69	0.42	1.88	0.26	0.55
22.00	931.72	0.45	1.96	0.28	0.56
25.00	931.75	0.48	2.05	0.30	0.56
27.20	931.77	0.50	2.11	0.32	0.57
29.80	931.80	0.53	2.17	0.33	0.57
32.40	931.83	0.56	2.23	0.35	0.58
35.00	931.85	0.58	2.29	0.36	0.58

Tailwater Channel Data - STA 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 931.27 ft

Roadway Data for Crossing: STA 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 934.30 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 50+72 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 40.00 cfs

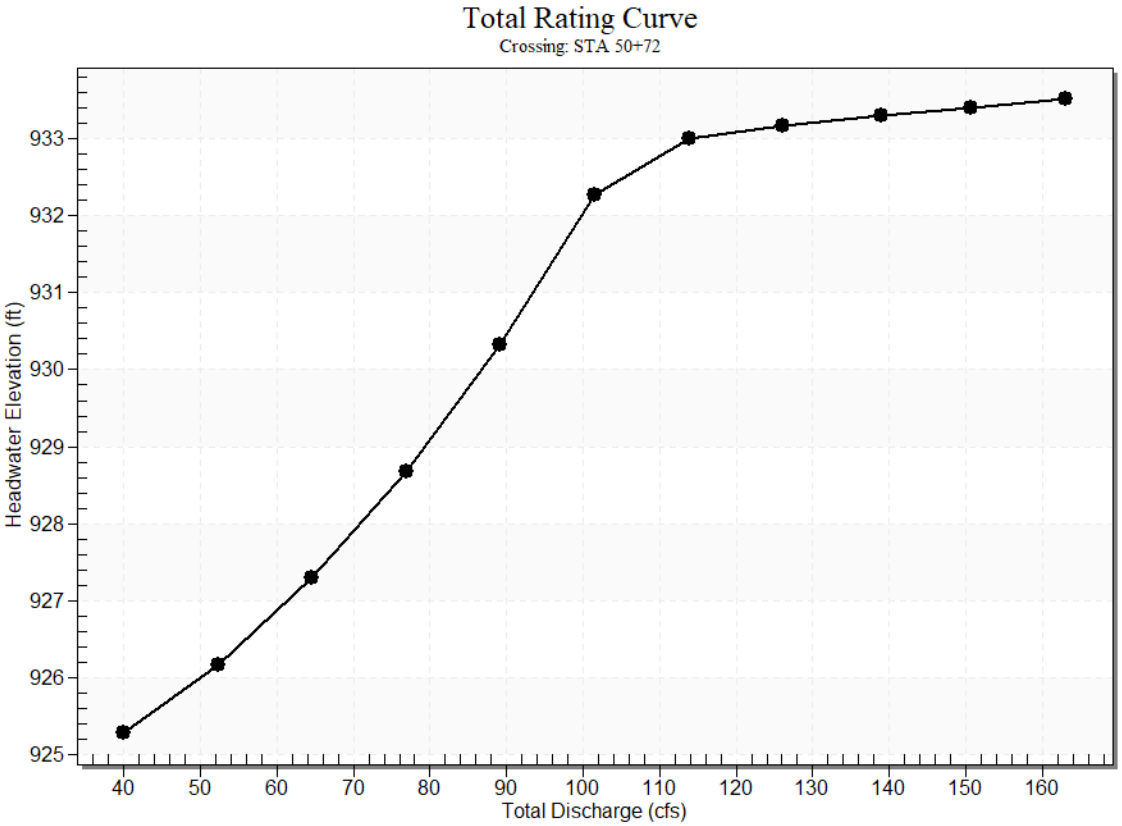
Design Flow: 139.00 cfs

Maximum Flow: 163.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 50+72

Headwater Elevation (ft)	Total Discharge (cfs)	36 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
925.29	40.00	40.00	0.00	1
926.17	52.30	52.30	0.00	1
927.29	64.60	64.60	0.00	1
928.68	76.90	76.90	0.00	1
930.32	89.20	89.20	0.00	1
932.27	101.50	101.50	0.00	1
933.00	113.80	105.69	8.07	7
933.16	126.10	106.57	19.49	6
933.29	139.00	107.32	31.62	5
933.40	150.70	107.91	42.65	4
933.51	163.00	108.49	54.42	4
932.80	104.55	104.55	0.00	Overtopping

Rating Curve Plot for Crossing: STA 50+72



Culvert Data: 36

Table 2 - Culvert Summary Table: 36

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00 cfs	40.00 cfs	925.29	3.25	0.908	5-S2n	0.97	2.06	1.25	0.66	14.38	4.32
52.30 cfs	52.30 cfs	926.17	4.13	2.126	5-S2n	1.12	2.35	1.47	0.77	15.13	4.68
64.60 cfs	64.60 cfs	927.29	5.25	3.003	5-S2n	1.26	2.58	1.68	0.86	15.88	4.98
76.90 cfs	76.90 cfs	928.68	6.64	4.007	5-S2n	1.39	2.74	1.87	0.94	16.64	5.24

89.20 cfs	89.20 cfs	930.32	8.28	5.141	5-S2n	1.51	2.84	2.03	1.01	17.49	5.47
101.50 cfs	101.50 cfs	932.27	10.23	6.363	5-S2n	1.63	2.80	2.18	1.08	18.46	5.68
113.80 cfs	105.69 cfs	933.00	10.96	6.926	5-S2n	1.67	3.00	2.26	1.15	18.48	5.86
126.10 cfs	106.57 cfs	933.16	11.12	7.025	5-S2n	1.68	3.00	2.27	1.21	18.56	6.03
139.00 cfs	107.32 cfs	933.29	11.25	7.109	5-S2n	1.69	3.00	2.28	1.27	18.62	6.20
150.70 cfs	107.91 cfs	933.40	11.36	7.177	5-S2n	1.70	3.00	2.29	1.32	18.68	6.34
163.00 cfs	108.49 cfs	933.51	11.47	7.244	5-S2n	1.70	3.00	2.29	1.38	18.73	6.48

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

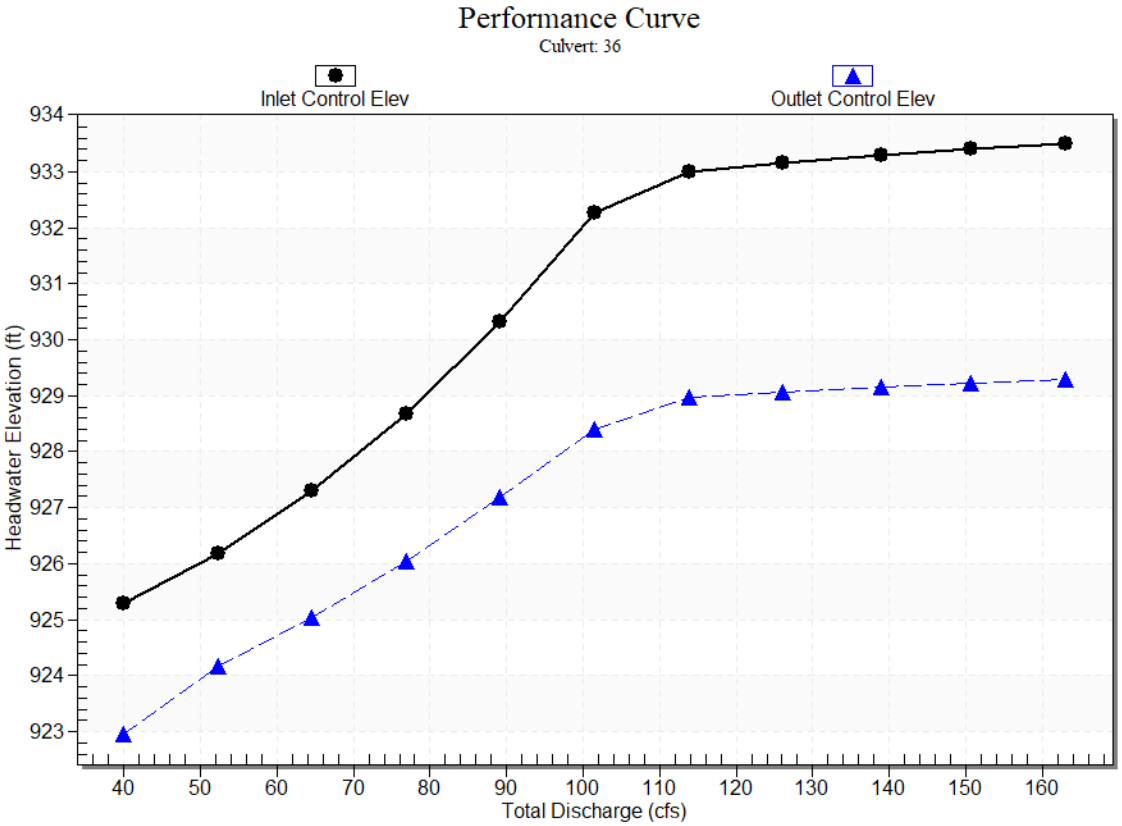
Inlet Elevation (invert): 922.04 ft,

Outlet Elevation (invert): 920.04 ft

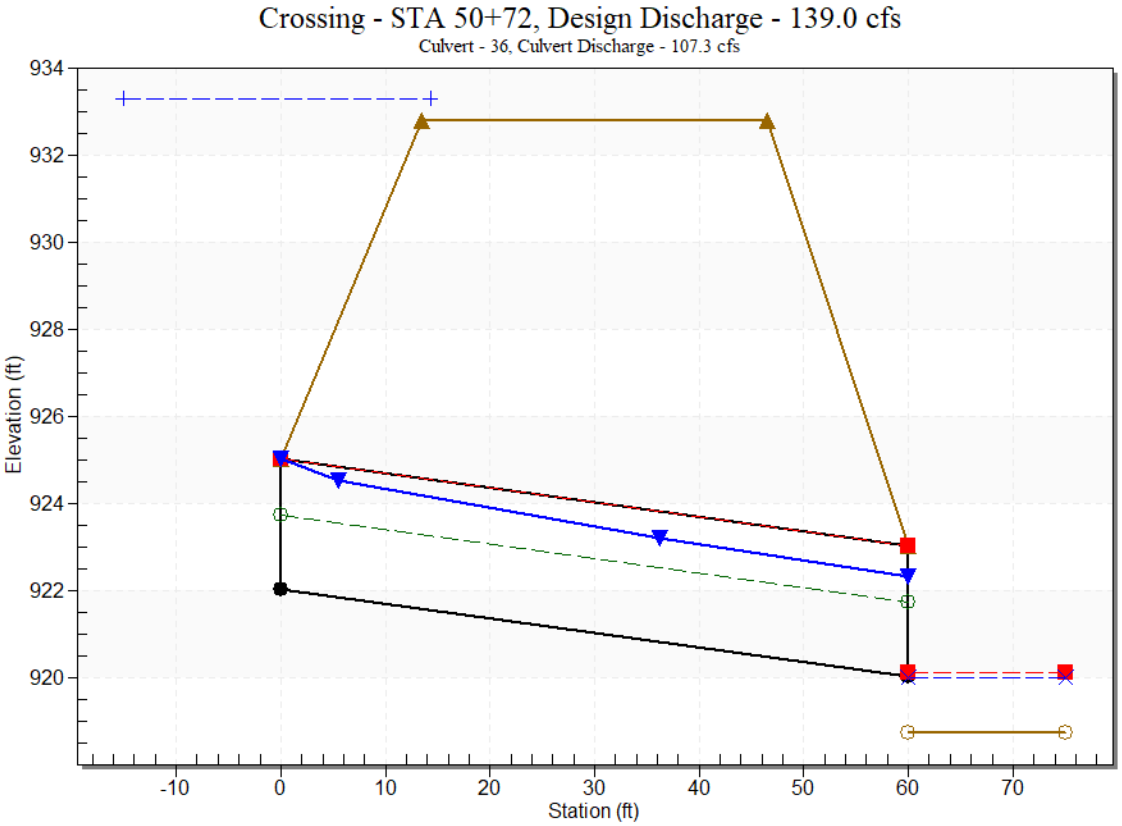
Culvert Length: 60.03 ft,

Culvert Slope: 0.0333

Culvert Performance Curve Plot: 36



Water Surface Profile Plot for Culvert: 36



Site Data - 36

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 922.04 ft

Outlet Station: 60.00 ft

Outlet Elevation: 920.04 ft

Number of Barrels: 1

Culvert Data Summary - 36

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: PVC

Embedment: 0.00 in

Barrel Manning's n: 0.0090

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 50+72

Table 3 - Downstream Channel Rating Curve (Crossing: STA 50+72)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
40.00	919.41	0.66	4.32	1.36	1.06
52.30	919.52	0.77	4.68	1.58	1.08
64.60	919.61	0.86	4.98	1.76	1.10
76.90	919.69	0.94	5.24	1.93	1.11
89.20	919.76	1.01	5.47	2.09	1.12
101.50	919.83	1.08	5.68	2.23	1.13
113.80	919.90	1.15	5.86	2.37	1.14
126.10	919.96	1.21	6.03	2.49	1.15
139.00	920.02	1.27	6.20	2.62	1.16
150.70	920.07	1.32	6.34	2.73	1.17
163.00	920.13	1.38	6.48	2.84	1.17

Tailwater Channel Data - STA 50+72

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0330

Channel Manning's n: 0.0400

Channel Invert Elevation: 918.75 ft

Roadway Data for Crossing: STA 50+72

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 932.80 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

STA 82+07 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

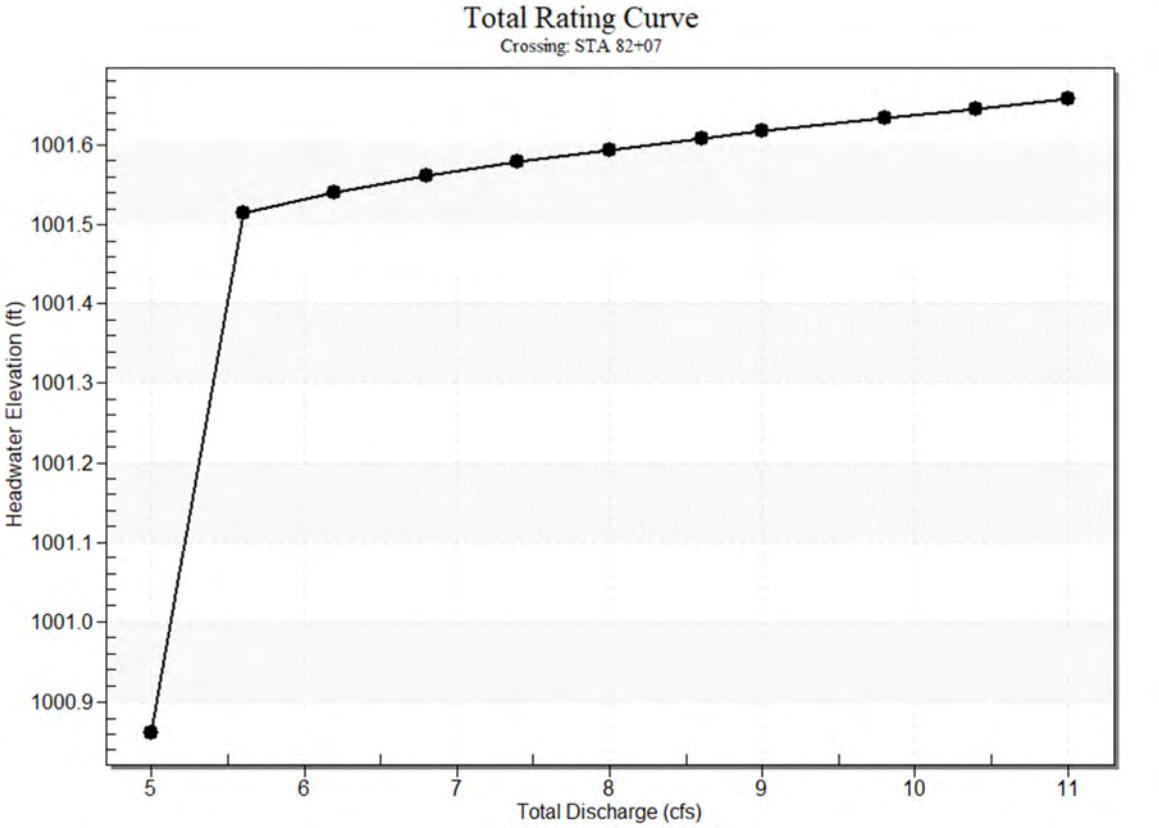
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: STA 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1000.86	5.00	5.00	0.00	1
1001.51	5.60	5.41	0.15	49
1001.54	6.20	5.42	0.73	5
1001.56	6.80	5.43	1.32	4
1001.58	7.40	5.44	1.93	4
1001.59	8.00	5.45	2.50	3
1001.61	8.60	5.46	3.10	3
1001.62	9.00	5.47	3.51	3
1001.63	9.80	5.48	4.30	3
1001.65	10.40	5.48	4.90	3
1001.66	11.00	5.49	5.50	3
1001.50	5.40	5.40	0.00	Overtopping

Rating Curve Plot for Crossing: STA 82+07



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	1000.86	2.23	4.182	7-M2c	1.00	0.92	0.92	0.10	6.63	2.00
5.60 cfs	5.41 cfs	1001.51	2.49	4.834	7-M2c	1.00	0.94	0.94	0.11	7.08	2.09
6.20 cfs	5.42 cfs	1001.54	2.50	4.861	7-M2c	1.00	0.94	0.94	0.11	7.09	2.18
6.80 cfs	5.43 cfs	1001.56	2.51	4.881	7-M2c	1.00	0.94	0.94	0.12	7.11	2.26

7.40 cfs	5.44 cfs	1001.58	2.52	4.898	7-M2c	1.00	0.94	0.94	0.13	7.12	2.34
8.00 cfs	5.45 cfs	1001.59	2.52	4.913	7-M2c	1.00	0.94	0.94	0.13	7.13	2.41
8.60 cfs	5.46 cfs	1001.61	2.53	4.928	7-M2c	1.00	0.94	0.94	0.14	7.14	2.48
9.00 cfs	5.47 cfs	1001.62	2.53	4.937	7-M2c	1.00	0.94	0.94	0.14	7.15	2.52
9.80 cfs	5.48 cfs	1001.63	2.54	4.953	7-M2c	1.00	0.94	0.94	0.15	7.16	2.61
10.40 cfs	5.48 cfs	1001.65	2.54	4.965	7-M2c	1.00	0.94	0.94	0.15	7.16	2.67
11.00 cfs	5.49 cfs	1001.66	2.55	4.977	7-M2c	1.00	0.94	0.94	0.16	7.17	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

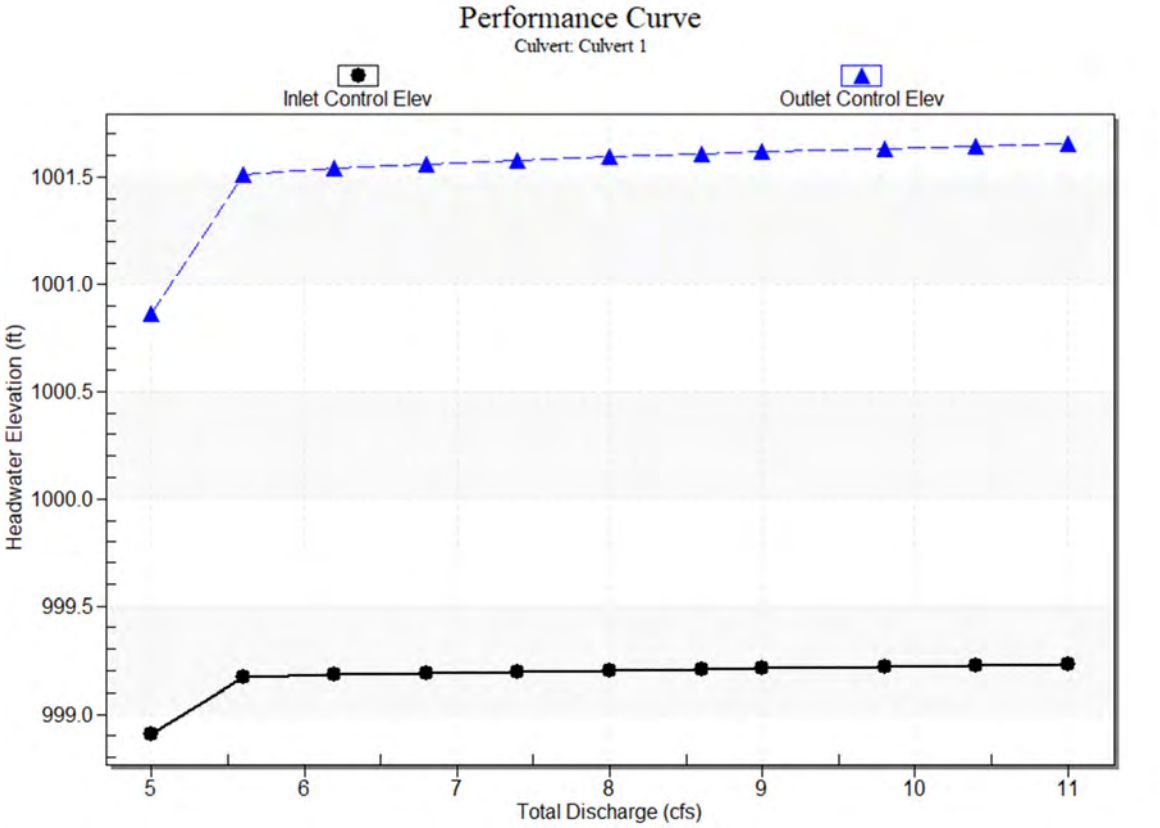
Inlet Elevation (invert): 996.68 ft,

Outlet Elevation (invert): 996.08 ft

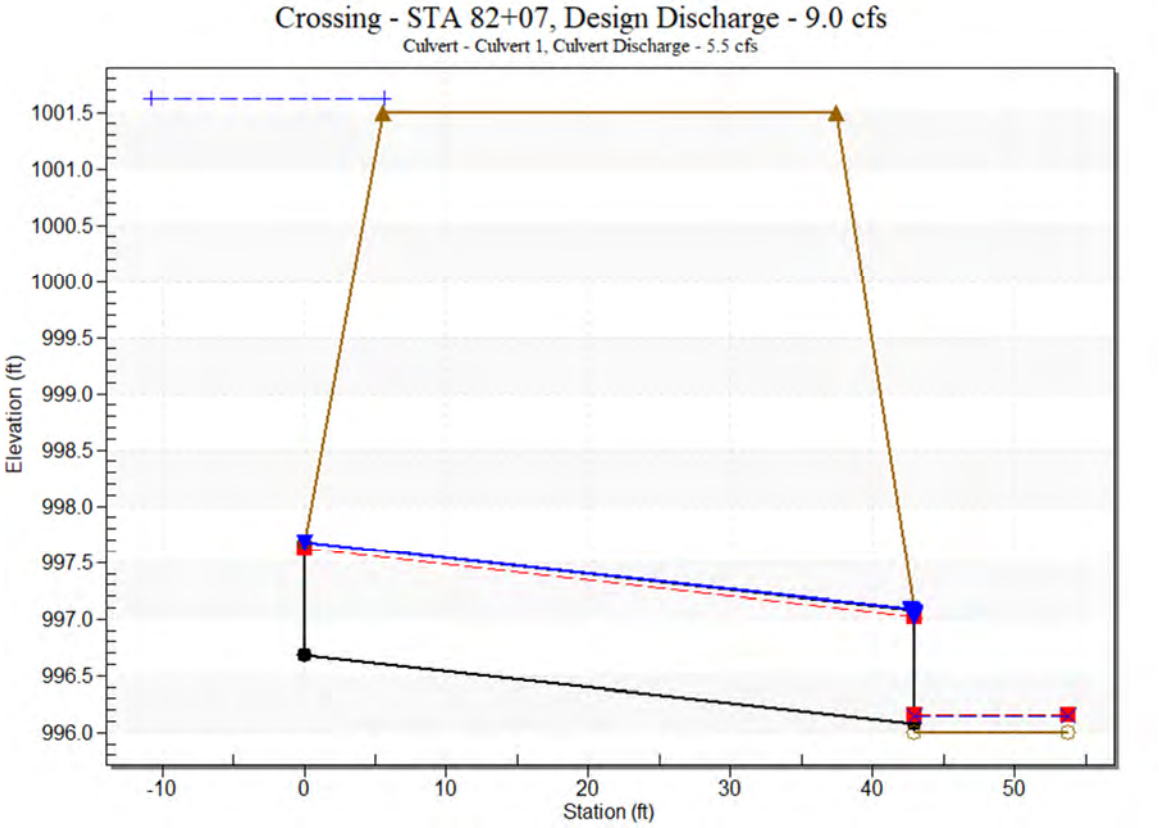
Culvert Length: 43.00 ft,

Culvert Slope: 0.0140

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.68 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.08 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: STA 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: STA 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - STA 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: STA 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 1001.50 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

STA 85+60 Existing
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 26.00 cfs

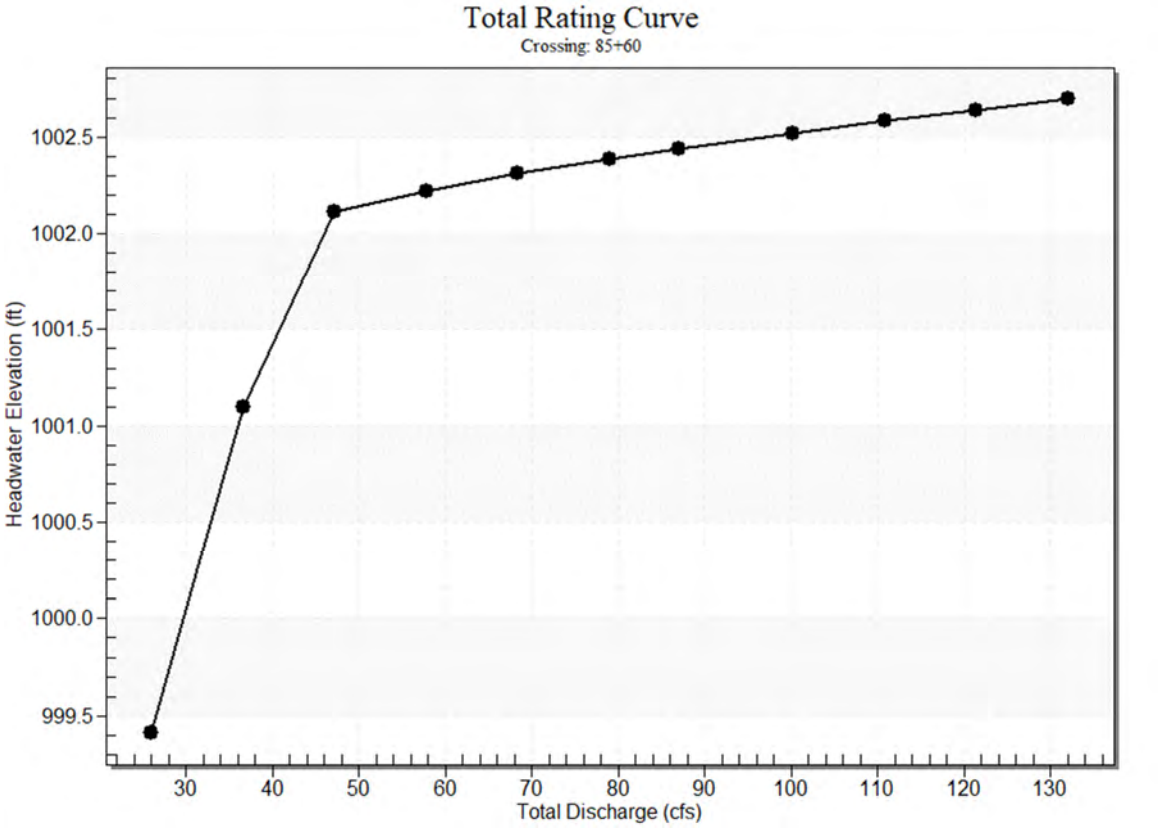
Design Flow: 87.00 cfs

Maximum Flow: 132.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 85+60

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.41	26.00	26.00	0.00	1
1001.10	36.60	36.60	0.00	1
1002.11	47.20	41.63	5.48	6
1002.22	57.80	42.11	15.60	6
1002.31	68.40	42.47	25.85	5
1002.39	79.00	42.79	36.09	4
1002.44	87.00	43.00	43.95	4
1002.52	100.20	43.33	56.83	4
1002.58	110.80	43.58	67.08	3
1002.64	121.40	43.81	77.50	3
1002.70	132.00	44.03	87.91	3
1002.00	41.10	41.10	0.00	Overtopping

Rating Curve Plot for Crossing: 85+60



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
26.00 cfs	26.00 cfs	999.41	3.25	2.849	5-S2n	1.71	1.74	1.71	0.57	7.62	4.30
36.60 cfs	36.60 cfs	1001.10	4.94	4.305	6-FFc	2.00	2.00	2.00	0.70	9.15	4.87
47.20 cfs	41.63 cfs	1002.11	5.95	5.090	6-FFc	2.00	2.00	2.00	0.82	10.41	5.33
57.80 cfs	42.11 cfs	1002.22	6.06	5.171	6-FFc	2.00	2.00	2.00	0.92	10.53	5.73

68.40 cfs	42.47 cfs	1002.31	6.15	5.233	6-FFc	2.00	2.00	2.00	1.02	10.62	6.07
79.00 cfs	42.79 cfs	1002.39	6.23	5.286	6-FFc	2.00	2.00	2.00	1.11	10.70	6.38
87.00 cfs	43.00 cfs	1002.44	6.28	5.323	6-FFc	2.00	2.00	2.00	1.18	10.75	6.60
100.20 cfs	43.33 cfs	1002.52	6.36	5.380	6-FFc	2.00	2.00	2.00	1.28	10.83	6.92
110.80 cfs	43.58 cfs	1002.58	6.42	5.422	6-FFc	2.00	2.00	2.00	1.36	10.89	7.16
121.40 cfs	43.81 cfs	1002.64	6.48	5.463	6-FFc	2.00	2.00	2.00	1.44	10.95	7.38
132.00 cfs	44.03 cfs	1002.70	6.54	5.502	6-FFc	2.00	2.00	2.00	1.51	11.01	7.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

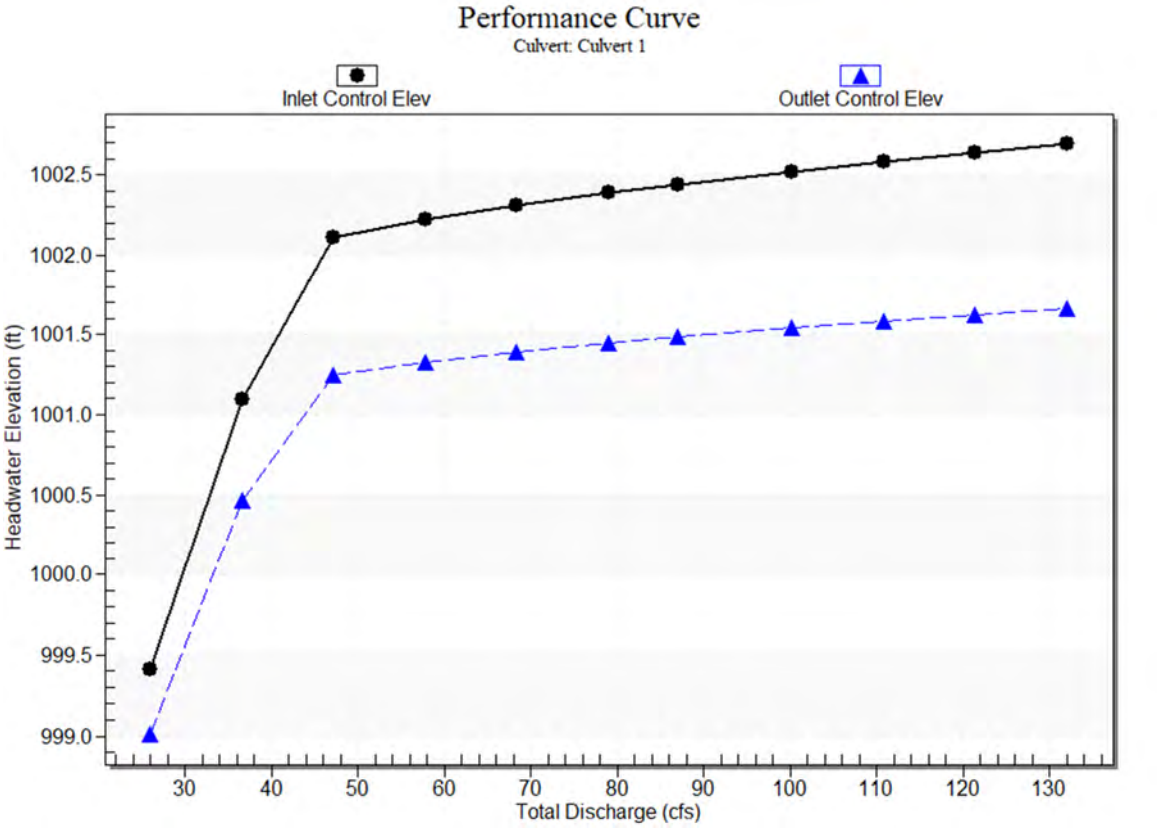
Inlet Elevation (invert): 996.16 ft,

Outlet Elevation (invert): 995.79 ft

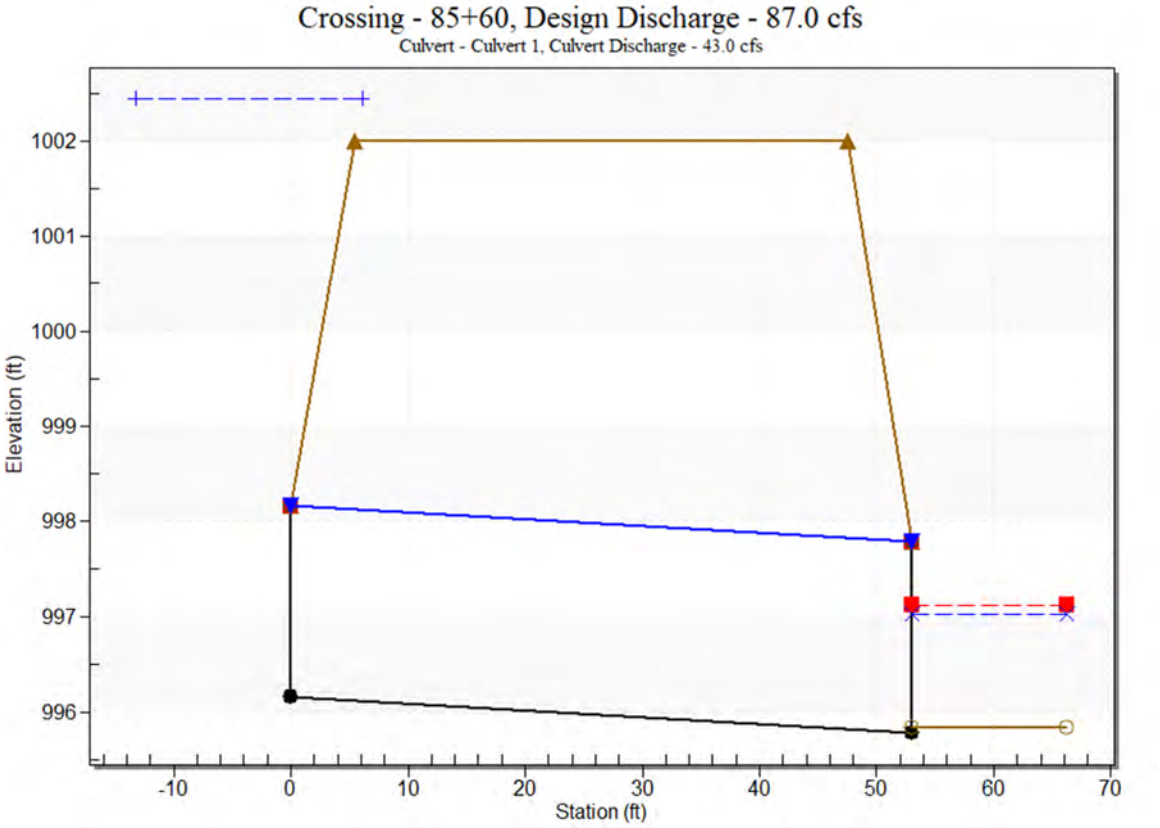
Culvert Length: 53.00 ft,

Culvert Slope: 0.0070

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 996.16 ft

Outlet Station: 53.00 ft

Outlet Elevation: 995.79 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 2.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: 85+60

Table 3 - Downstream Channel Rating Curve (Crossing: 85+60)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
26.00	996.41	0.57	4.30	1.78	1.03
36.60	996.54	0.70	4.87	2.19	1.06
47.20	996.66	0.82	5.33	2.55	1.08
57.80	996.76	0.92	5.73	2.88	1.09
68.40	996.86	1.02	6.07	3.19	1.11
79.00	996.95	1.11	6.38	3.47	1.12
87.00	997.02	1.18	6.60	3.68	1.13
100.20	997.12	1.28	6.92	4.00	1.14
110.80	997.20	1.36	7.16	4.25	1.14
121.40	997.28	1.44	7.38	4.49	1.15
132.00	997.35	1.51	7.58	4.72	1.16

Tailwater Channel Data - 85+60

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0500

Channel Invert Elevation: 995.84 ft

Roadway Data for Crossing: 85+60

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1002.00 ft

Roadway Surface: Paved

Roadway Top Width: 42.00 ft

DRAINAGE REPORT

Proposed

HY-8 Reports

Proposed STA 1+50
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.50 cfs

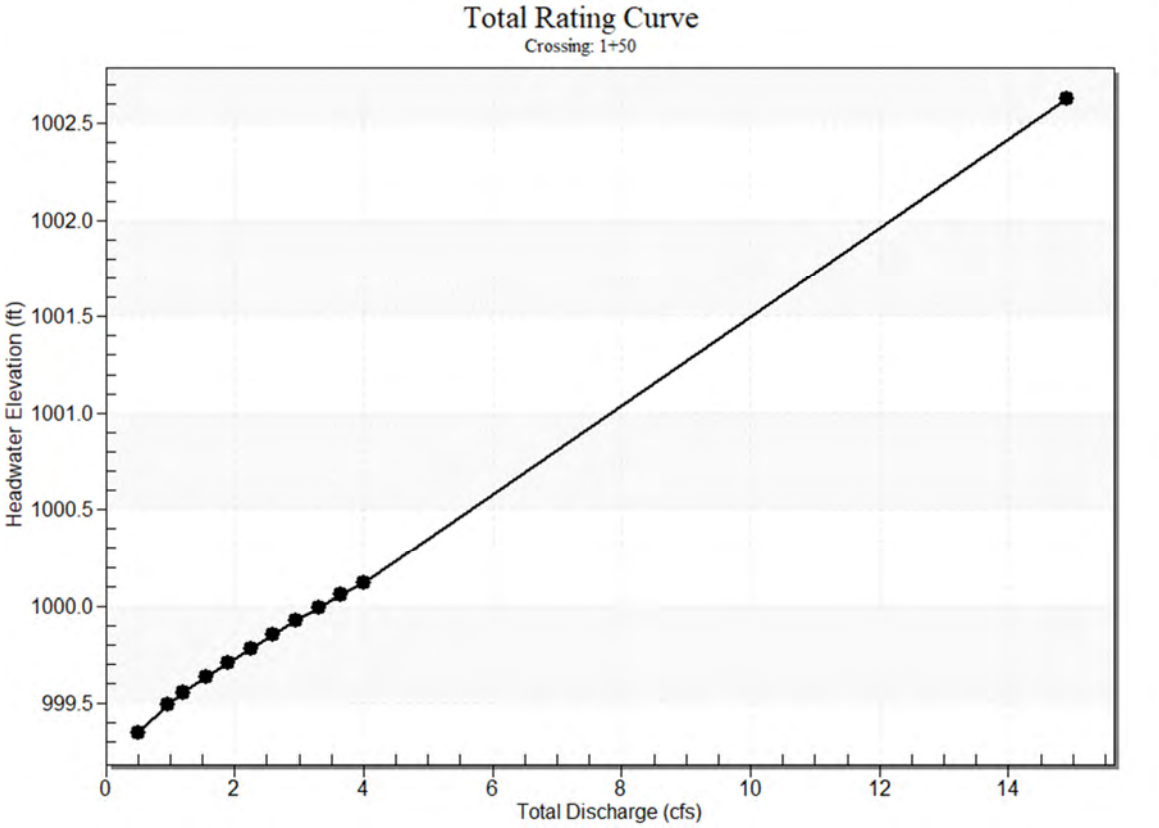
Design Flow: 0.97 cfs

Maximum Flow: 4.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 1+50

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
999.35	0.50	0.50	0.00	1
999.50	0.97	0.97	0.00	1
999.55	1.20	1.20	0.00	1
999.63	1.55	1.55	0.00	1
999.71	1.90	1.90	0.00	1
999.78	2.25	2.25	0.00	1
999.86	2.60	2.60	0.00	1
999.93	2.95	2.95	0.00	1
999.99	3.30	3.30	0.00	1
1000.06	3.65	3.65	0.00	1
1000.12	4.00	4.00	0.00	1
1002.60	14.34	14.34	0.00	Overtopping

Rating Curve Plot for Crossing: 1+50



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.50 cfs	0.50 cfs	999.35	0.35	0.0*	1-S2n	0.18	0.26	0.18	0.10	4.08	0.79
0.97 cfs	0.97 cfs	999.50	0.50	0.0*	1-S2n	0.25	0.37	0.25	0.15	4.96	1.02
1.20 cfs	1.20 cfs	999.55	0.55	0.0*	1-S2n	0.28	0.41	0.28	0.17	5.28	1.10
1.55 cfs	1.55 cfs	999.63	0.63	0.0*	1-S2n	0.32	0.47	0.32	0.20	5.69	1.21

1.90 cfs	1.90 cfs	999.71	0.71	0.0*	1-S2n	0.35	0.52	0.35	0.23	6.03	1.30
2.25 cfs	2.25 cfs	999.78	0.78	0.0*	1-S2n	0.38	0.57	0.38	0.25	6.32	1.39
2.60 cfs	2.60 cfs	999.86	0.86	0.0*	1-S2n	0.41	0.61	0.41	0.27	6.60	1.46
2.95 cfs	2.95 cfs	999.93	0.93	0.0*	1-S2n	0.44	0.65	0.44	0.29	6.85	1.53
3.30 cfs	3.30 cfs	999.99	0.99	0.0*	1-S2n	0.47	0.69	0.47	0.31	7.06	1.59
3.65 cfs	3.65 cfs	1000.06	1.06	0.0*	1-S2n	0.49	0.73	0.49	0.33	7.20	1.65
4.00 cfs	4.00 cfs	1000.12	1.12	0.0*	1-S2n	0.51	0.77	0.51	0.35	7.46	1.70

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

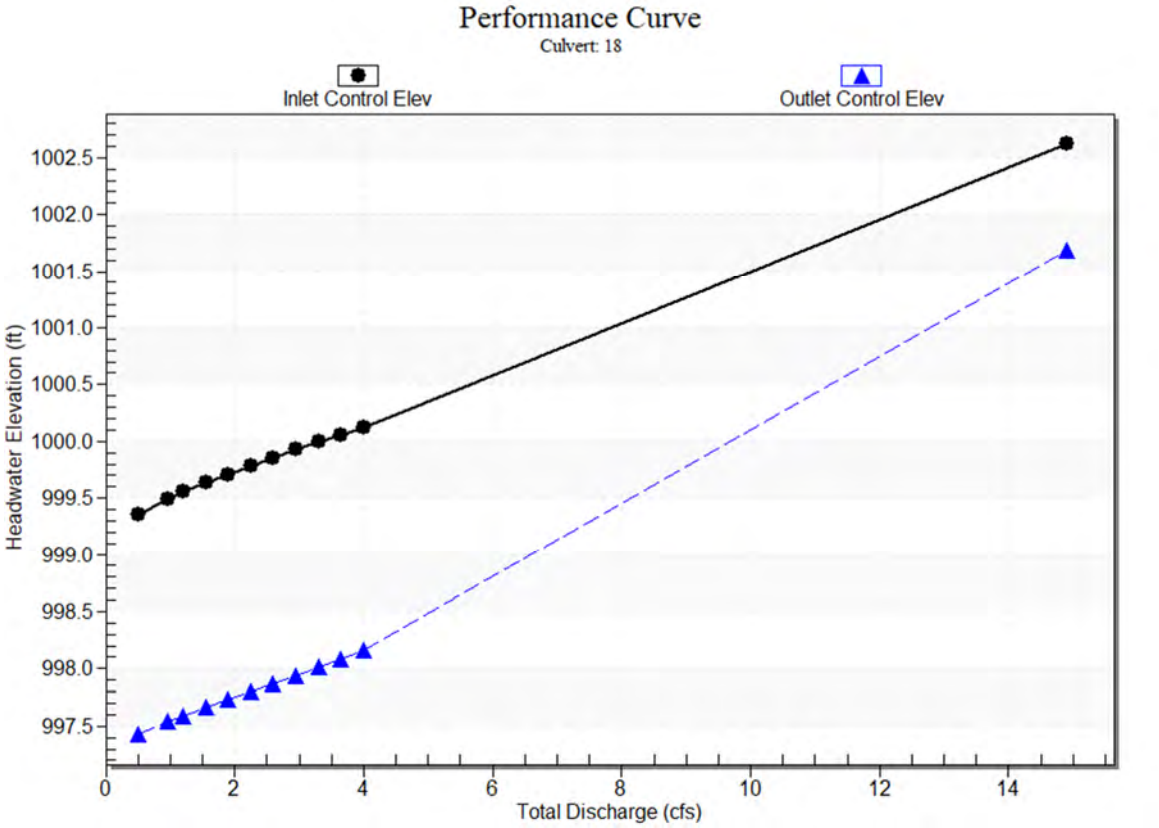
Inlet Elevation (invert): 999.00 ft,

Outlet Elevation (invert): 997.16 ft

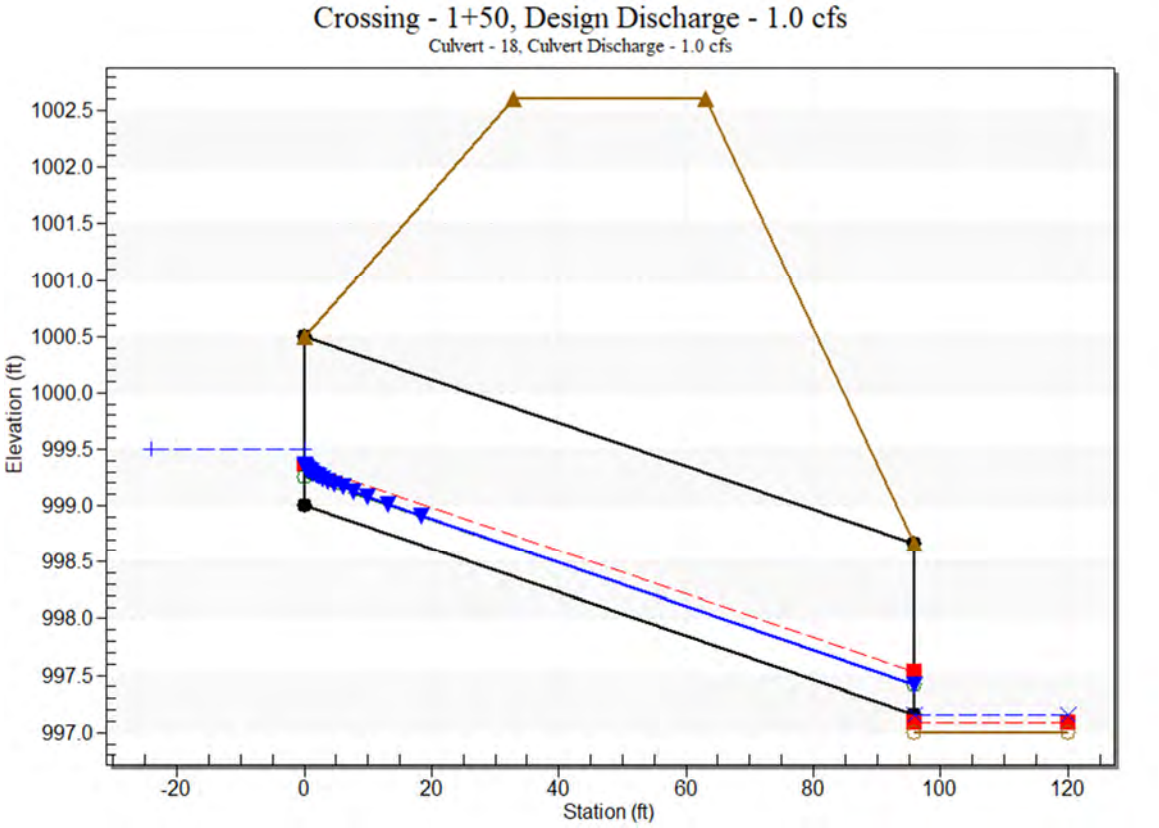
Culvert Length: 96.02 ft,

Culvert Slope: 0.0192

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 999.00 ft

Outlet Station: 96.00 ft

Outlet Elevation: 997.16 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 1+50

Table 3 - Downstream Channel Rating Curve (Crossing: 1+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.50	997.10	0.10	0.79	0.06	0.44
0.97	997.15	0.15	1.02	0.09	0.47
1.20	997.17	0.17	1.10	0.11	0.48
1.55	997.20	0.20	1.21	0.12	0.49
1.90	997.23	0.23	1.30	0.14	0.50
2.25	997.25	0.25	1.39	0.16	0.51
2.60	997.27	0.27	1.46	0.17	0.51
2.95	997.29	0.29	1.53	0.18	0.52
3.30	997.31	0.31	1.59	0.20	0.52
3.65	997.33	0.33	1.65	0.21	0.53
4.00	997.35	0.35	1.70	0.22	0.53

Tailwater Channel Data - 1+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 997.00 ft

Roadway Data for Crossing: 1+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 ft

Crest Elevation: 1002.60 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

STA 15+33
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

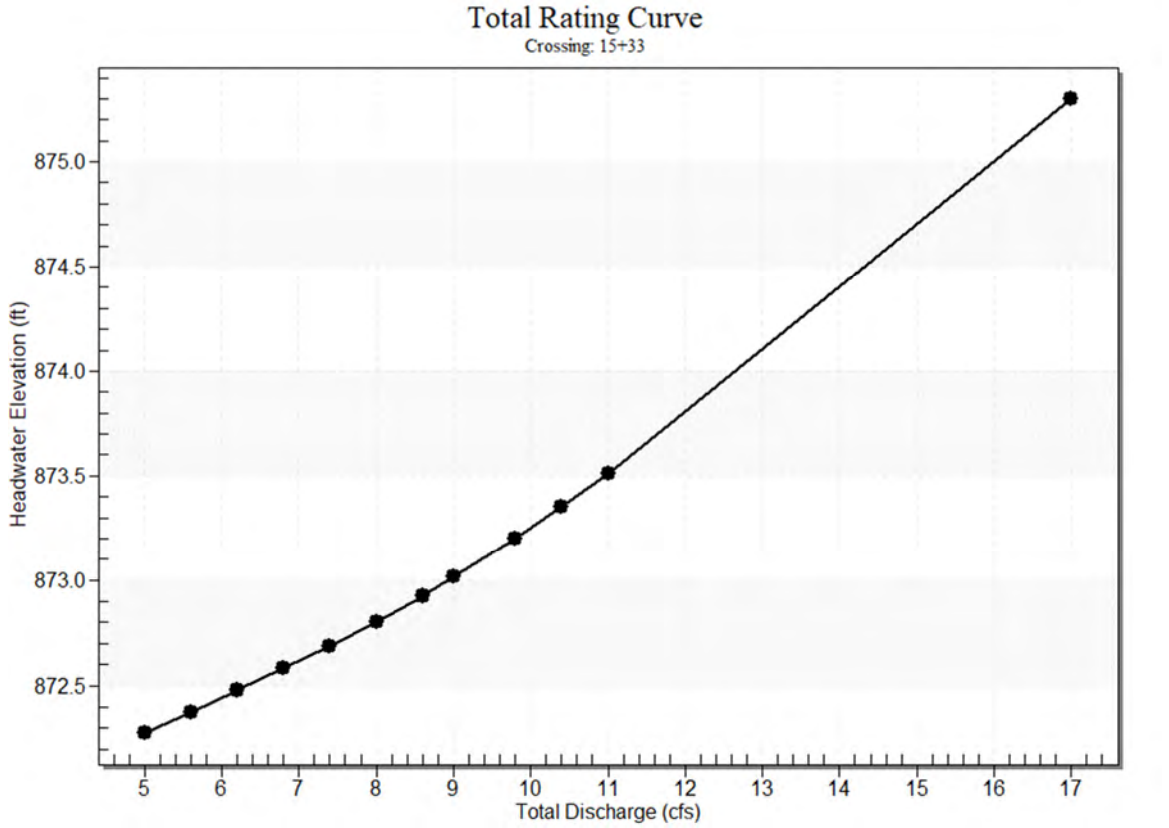
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: 15+33

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
872.28	5.00	5.00	0.00	1
872.38	5.60	5.60	0.00	1
872.48	6.20	6.20	0.00	1
872.58	6.80	6.80	0.00	1
872.69	7.40	7.40	0.00	1
872.80	8.00	8.00	0.00	1
872.93	8.60	8.60	0.00	1
873.01	9.00	9.00	0.00	1
873.20	9.80	9.80	0.00	1
873.35	10.40	10.40	0.00	1
873.51	11.00	11.00	0.00	1
875.23	15.98	15.98	0.00	Overtopping

Rating Curve Plot for Crossing: 15+33



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	872.28	1.28	0.0*	1-S2n	0.52	0.86	0.54	0.21	8.68	2.73
5.60 cfs	5.60 cfs	872.38	1.38	0.0*	1-S2n	0.55	0.91	0.58	0.22	8.90	2.84
6.20 cfs	6.20 cfs	872.48	1.48	0.079	1-S2n	0.58	0.96	0.62	0.24	9.09	2.95
6.80 cfs	6.80 cfs	872.58	1.58	0.210	5-S2n	0.61	1.01	0.65	0.25	9.28	3.05

7.40 cfs	7.40 cfs	872.69	1.69	0.347	5-S2n	0.64	1.05	0.68	0.26	9.45	3.14
8.00 cfs	8.00 cfs	872.80	1.80	0.489	5-S2n	0.67	1.10	0.72	0.27	9.61	3.22
8.60 cfs	8.60 cfs	872.93	1.93	0.819	5-S2n	0.70	1.14	0.75	0.28	9.76	3.31
9.00 cfs	9.00 cfs	873.01	2.01	0.908	5-S2n	0.71	1.16	0.77	0.29	9.86	3.36
9.80 cfs	9.80 cfs	873.20	2.20	1.095	5-S2n	0.75	1.21	0.81	0.31	10.04	3.46
10.40 cfs	10.40 cfs	873.35	2.35	1.242	5-S2n	0.78	1.24	0.84	0.32	10.18	3.53
11.00 cfs	11.00 cfs	873.51	2.51	1.396	5-S2n	0.80	1.27	0.87	0.33	10.31	3.60

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

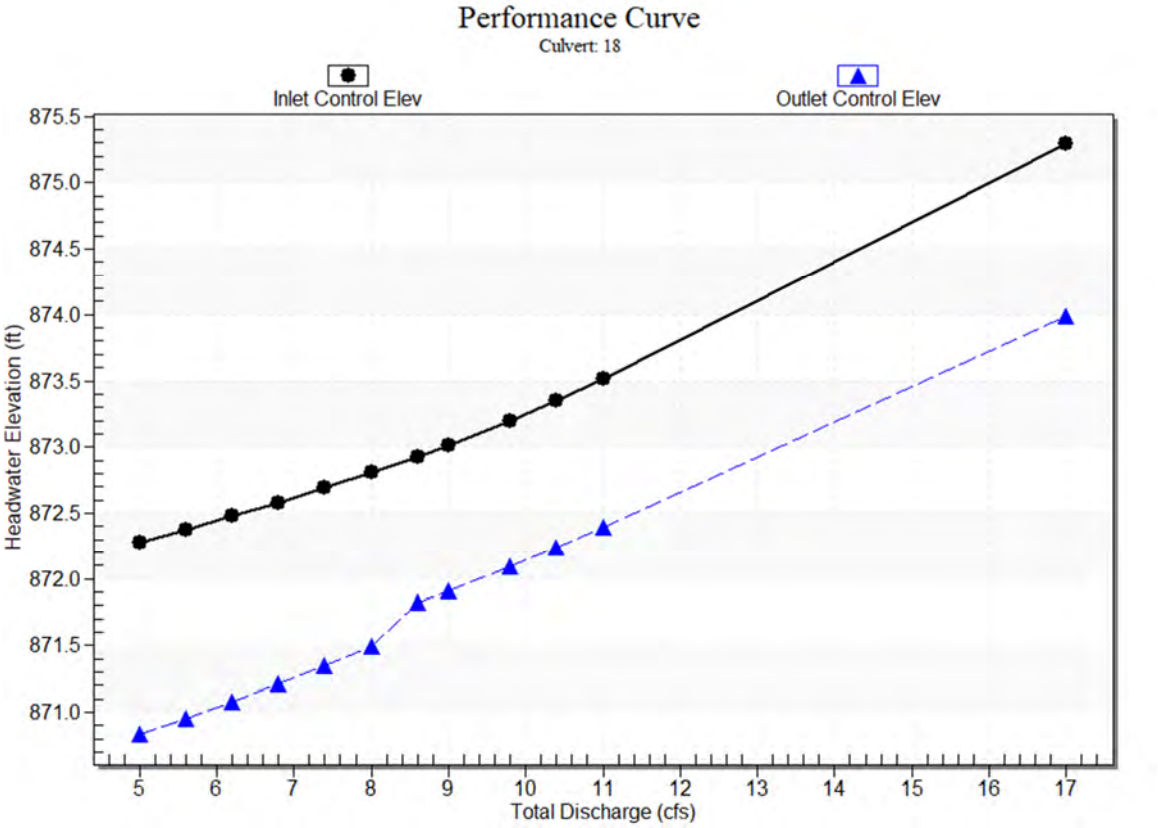
Inlet Elevation (invert): 871.00 ft,

Outlet Elevation (invert): 869.70 ft

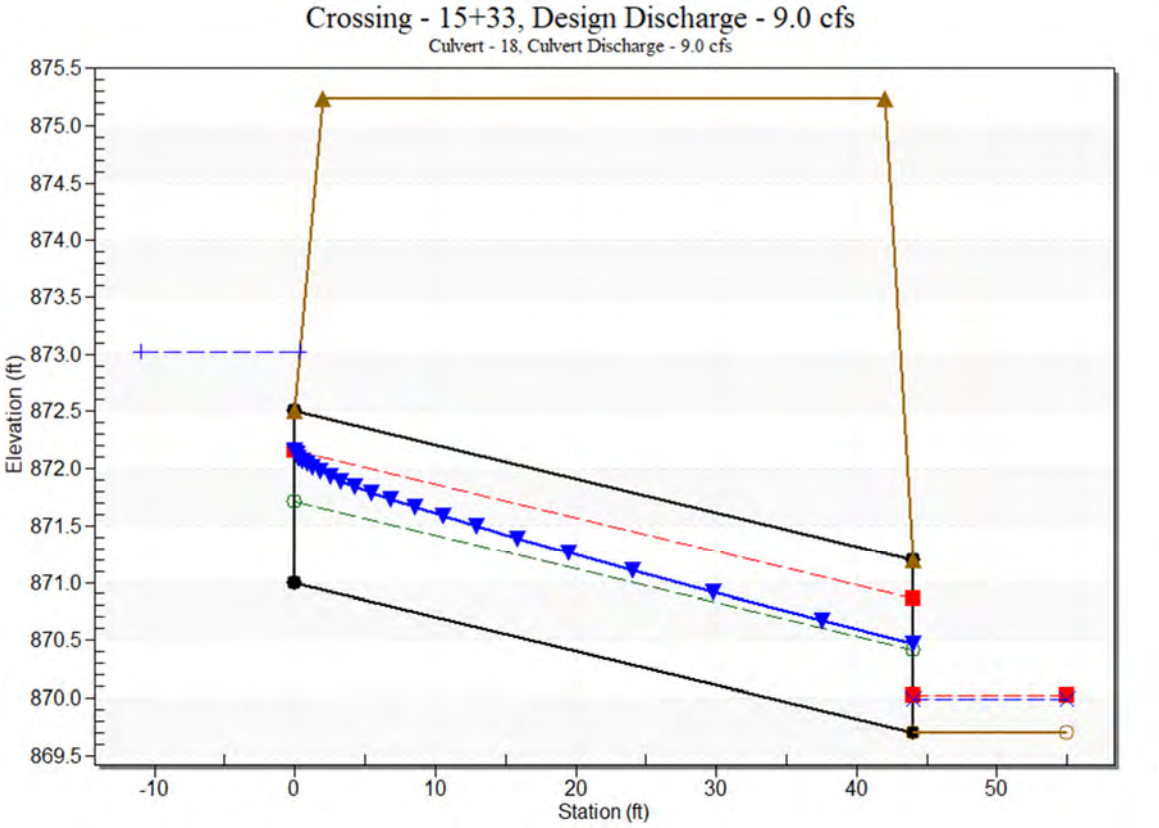
Culvert Length: 44.02 ft,

Culvert Slope: 0.0295

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 871.00 ft

Outlet Station: 44.00 ft

Outlet Elevation: 869.70 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 15+33

Table 3 - Downstream Channel Rating Curve (Crossing: 15+33)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	869.91	0.21	2.73	0.65	1.11
5.60	869.92	0.22	2.84	0.69	1.12
6.20	869.94	0.24	2.95	0.73	1.13
6.80	869.95	0.25	3.05	0.77	1.14
7.40	869.96	0.26	3.14	0.81	1.14
8.00	869.97	0.27	3.22	0.85	1.15
8.60	869.98	0.28	3.31	0.89	1.16
9.00	869.99	0.29	3.36	0.91	1.16
9.80	870.01	0.31	3.46	0.96	1.17
10.40	870.02	0.32	3.53	0.99	1.18
11.00	870.03	0.33	3.60	1.02	1.18

Tailwater Channel Data - 15+33

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 869.70 ft

Roadway Data for Crossing: 15+33

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 16.00 ft

Crest Elevation: 875.23 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Sta. 43+76 (Split Flow w/ 46+65) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

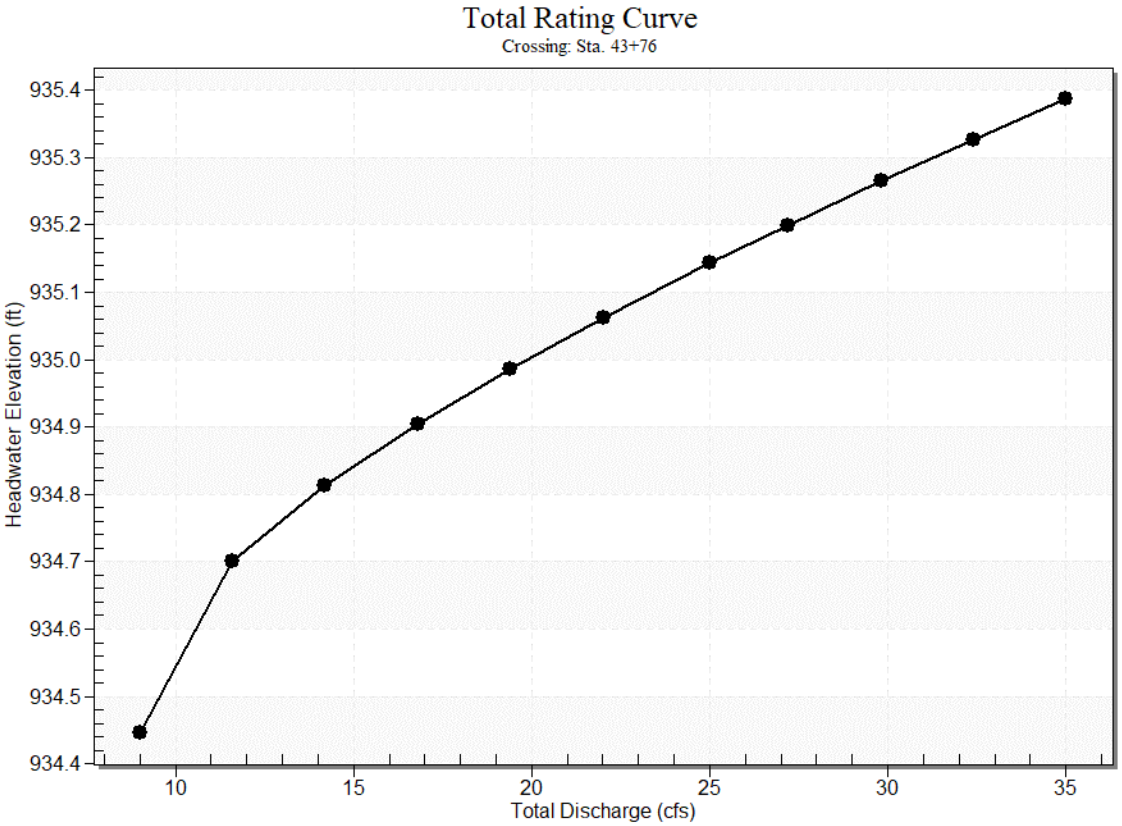
Design Flow: 25.00 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 43+76

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.45	9.00	9.00	0.00	1
934.70	11.60	9.83	1.74	8
934.81	14.20	10.18	4.01	6
934.90	16.80	10.45	6.33	5
934.99	19.40	10.69	8.69	4
935.06	22.00	10.90	11.08	4
935.14	25.00	11.13	13.86	4
935.20	27.20	11.28	15.88	3
935.26	29.80	11.46	18.31	3
935.33	32.40	11.63	20.76	3
935.39	35.00	11.78	23.21	3
934.55	9.35	9.35	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 43+76



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	9.00 cfs	934.45	1.95	0.819	5-S2n	0.59	0.89	0.61	0.27	9.00	1.44
11.60 cfs	9.83 cfs	934.70	2.20	1.106	5-S2n	0.62	0.91	0.65	0.31	9.17	1.58
14.20 cfs	10.18 cfs	934.81	2.31	1.230	5-S2n	0.64	0.92	0.66	0.35	9.25	1.69
16.80 cfs	10.45 cfs	934.90	2.40	1.332	5-S2n	0.65	0.93	0.67	0.38	9.31	1.79

19.40 cfs	10.69 cfs	934.99	2.49	1.422	5-S2n	0.66	0.93	0.68	0.42	9.34	1.88
22.00 cfs	10.90 cfs	935.06	2.56	1.505	5-S2n	0.67	0.94	0.69	0.45	9.38	1.96
25.00 cfs	11.13 cfs	935.14	2.64	1.596	5-S2n	0.68	0.94	0.70	0.48	9.43	2.05
27.20 cfs	11.28 cfs	935.20	2.70	1.657	5-S2n	0.69	0.94	0.71	0.50	9.45	2.11
29.80 cfs	11.46 cfs	935.26	2.76	1.728	5-S2n	0.69	0.95	0.72	0.53	9.48	2.17
32.40 cfs	11.63 cfs	935.33	2.83	1.797	5-S2n	0.70	0.95	0.73	0.56	9.51	2.23
35.00 cfs	11.78 cfs	935.39	2.89	1.862	5-S2n	0.71	0.95	0.73	0.58	9.53	2.29

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

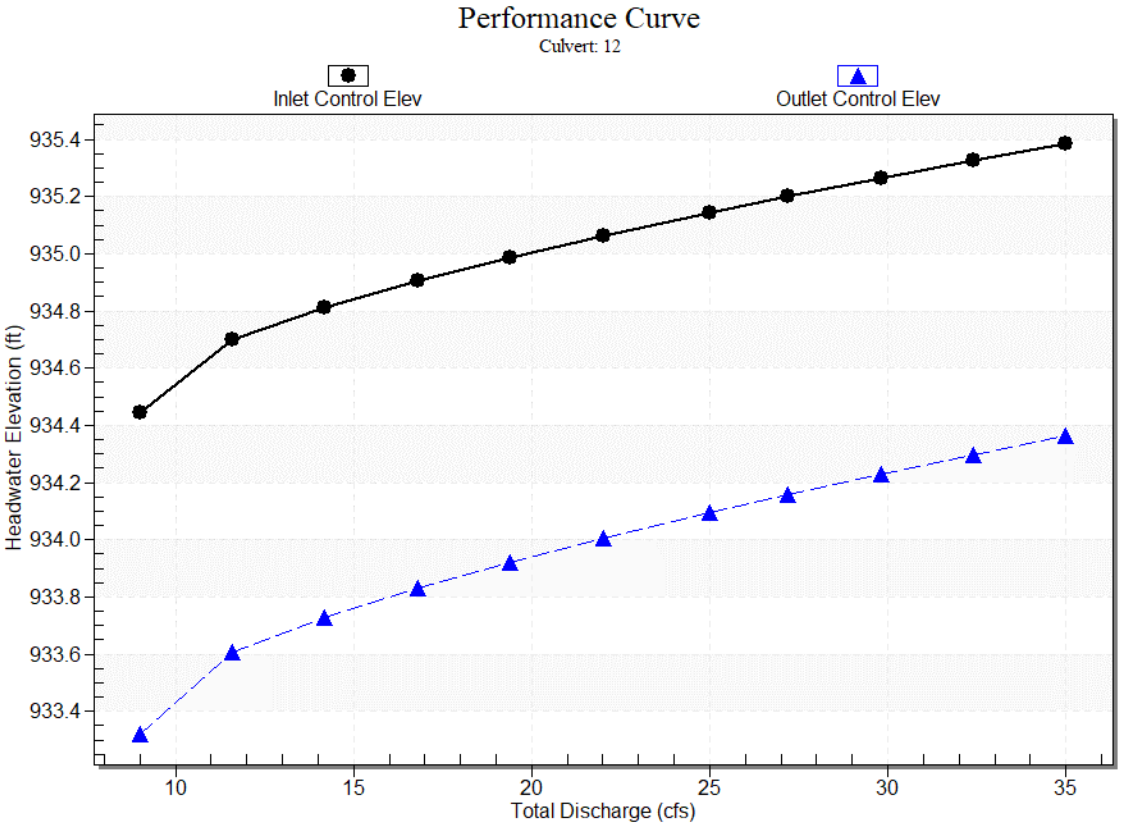
Inlet Elevation (invert): 932.50 ft,

Outlet Elevation (invert): 930.96 ft

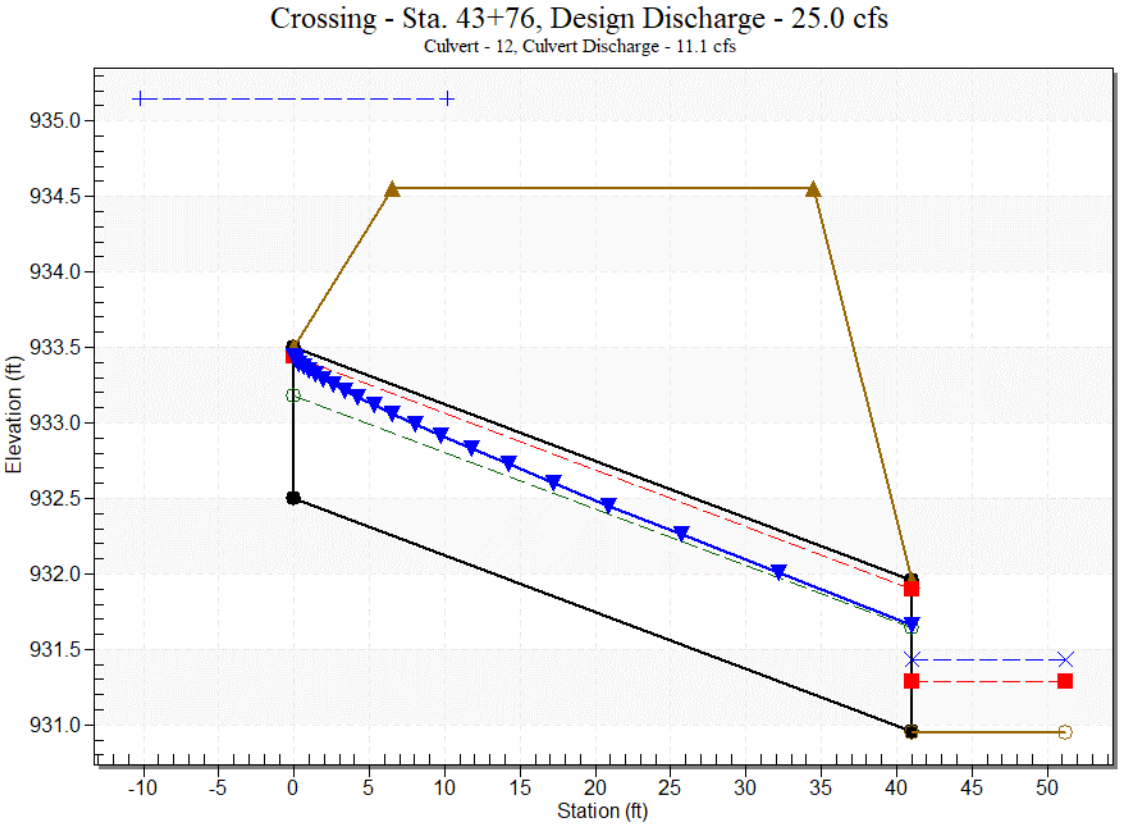
Culvert Length: 41.03 ft,

Culvert Slope: 0.0376

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 932.50 ft

Outlet Station: 41.00 ft

Outlet Elevation: 930.96 ft

Number of Barrels: 2

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 43+76

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 43+76)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	931.22	0.27	1.44	0.17	0.52
11.60	931.26	0.31	1.58	0.19	0.53
14.20	931.30	0.35	1.69	0.22	0.54
16.80	931.33	0.38	1.79	0.24	0.55
19.40	931.37	0.42	1.88	0.26	0.55
22.00	931.40	0.45	1.96	0.28	0.56
25.00	931.43	0.48	2.05	0.30	0.56
27.20	931.45	0.50	2.11	0.32	0.57
29.80	931.48	0.53	2.17	0.33	0.57
32.40	931.51	0.56	2.23	0.35	0.58
35.00	931.53	0.58	2.29	0.36	0.58

Tailwater Channel Data - Sta. 43+76

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 21.00 ft

Side Slope (H:V): 9.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 930.95 ft

Roadway Data for Crossing: Sta. 43+76

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 934.55 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Sta 46+65 (Split Flow w/ Sta 43+76) HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.00 cfs

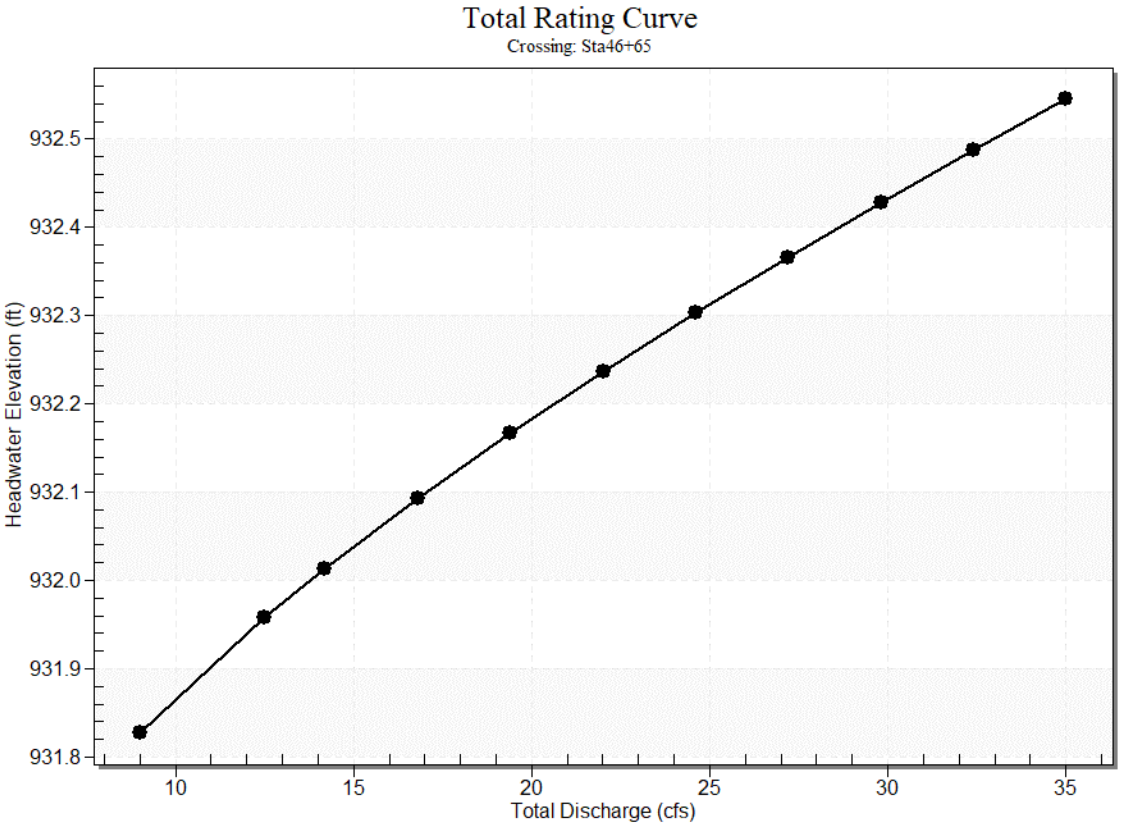
Design Flow: 12.50 cfs

Maximum Flow: 35.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta46+65

Headwater Elevation (ft)	Total Discharge (cfs)	12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
931.83	9.00	5.29	3.68	9
931.96	12.50	5.48	7.00	5
932.01	14.20	5.55	8.62	4
932.09	16.80	5.66	11.12	4
932.17	19.40	5.76	13.63	4
932.24	22.00	5.86	16.14	4
932.30	24.60	5.94	18.63	3
932.37	27.20	6.02	21.16	3
932.43	29.80	6.10	23.69	3
932.49	32.40	6.17	26.22	3
932.55	35.00	6.24	28.76	3
931.58	4.92	4.92	0.00	Overtopping

Rating Curve Plot for Crossing: Sta46+65



Culvert Data: 12

Table 2 - Culvert Summary Table: 12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00 cfs	5.29 cfs	931.83	2.43	0.0*	5-S2n	0.51	0.93	0.53	0.79	12.39	1.78
12.50 cfs	5.48 cfs	931.96	2.56	0.0*	5-S2n	0.52	0.94	0.55	0.94	12.49	1.96
14.20 cfs	5.55 cfs	932.01	2.61	0.0*	5-S2n	0.52	0.94	0.55	1.00	12.53	2.03
16.80 cfs	5.66 cfs	932.09	2.69	0.0*	5-S2n	0.53	0.95	0.56	1.09	12.59	2.12

19.40 cfs	5.76 cfs	932.17	2.77	0.083	5-S2n	0.54	0.95	0.56	1.17	12.65	2.21
22.00 cfs	5.86 cfs	932.24	2.84	0.233	5-S2n	0.54	0.95	0.57	1.24	12.70	2.28
24.60 cfs	5.94 cfs	932.30	2.90	0.374	5-S2n	0.55	0.95	0.57	1.32	12.75	2.35
27.20 cfs	6.02 cfs	932.37	2.97	0.509	5-S2n	0.55	0.95	0.58	1.38	12.79	2.42
29.80 cfs	6.10 cfs	932.43	3.03	0.638	5-S2n	0.55	0.94	0.58	1.44	12.79	2.48
32.40 cfs	6.17 cfs	932.49	3.09	0.759	5-S2n	0.56	0.92	0.59	1.50	12.85	2.53
35.00 cfs	6.24 cfs	932.55	3.15	0.875	5-S2n	0.56	0.92	0.59	1.56	12.88	2.59

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

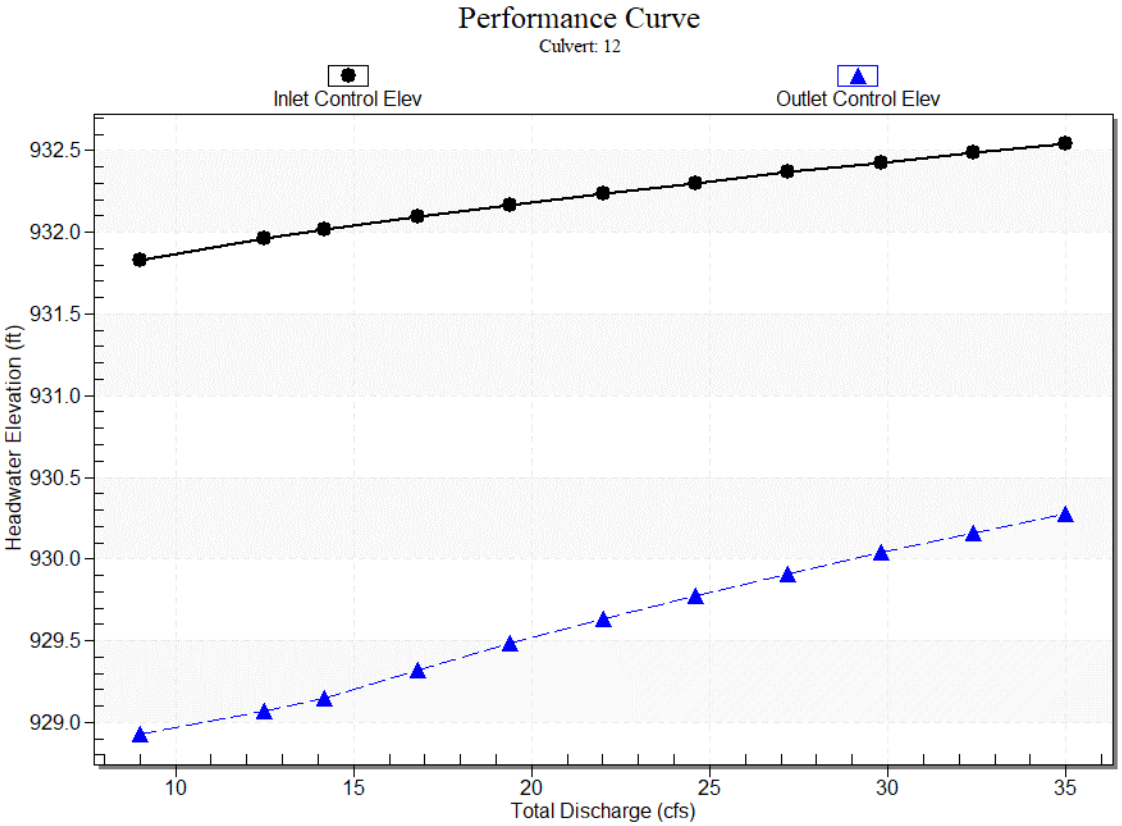
Inlet Elevation (invert): 929.40 ft,

Outlet Elevation (invert): 926.00 ft

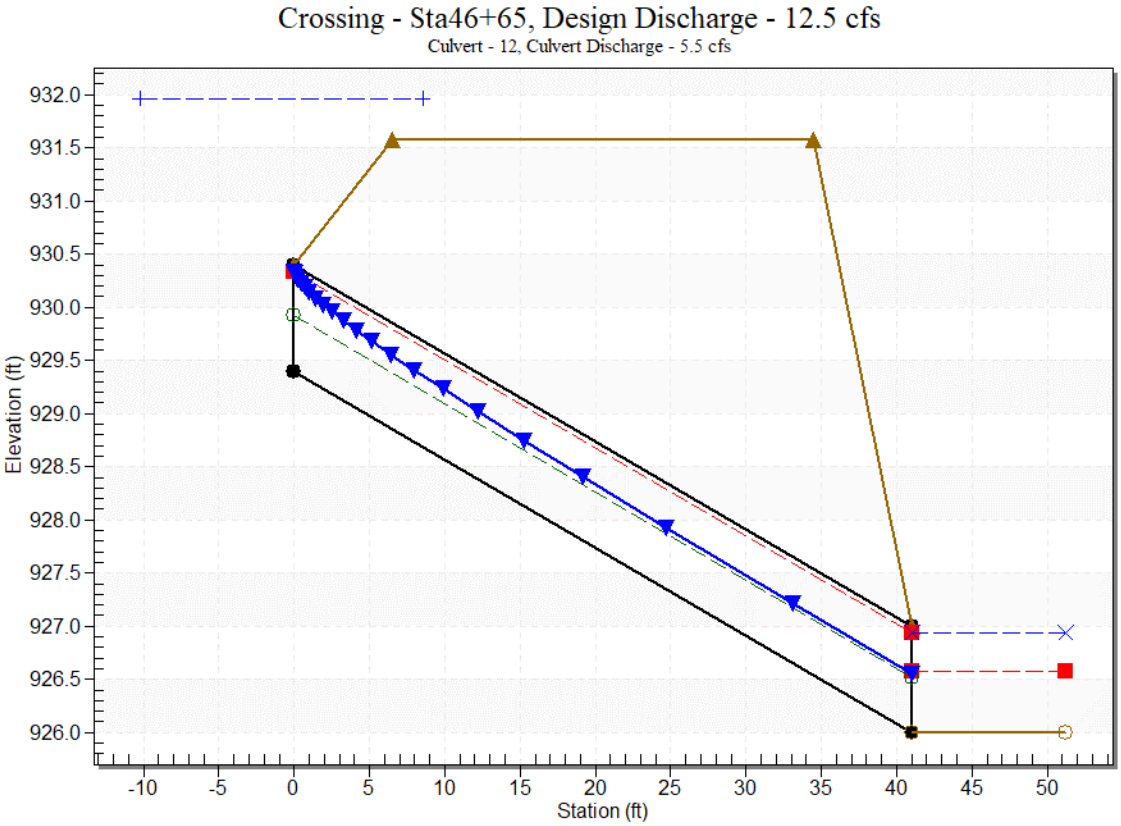
Culvert Length: 41.14 ft,

Culvert Slope: 0.0829

Culvert Performance Curve Plot: 12



Water Surface Profile Plot for Culvert: 12



Site Data - 12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 929.40 ft

Outlet Station: 41.00 ft

Outlet Elevation: 926.00 ft

Number of Barrels: 1

Culvert Data Summary - 12

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta46+65

Table 3 - Downstream Channel Rating Curve (Crossing: Sta46+65)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
9.00	926.79	0.79	1.78	0.25	0.41
12.50	926.94	0.94	1.96	0.29	0.42
14.20	927.00	1.00	2.03	0.31	0.43
16.80	927.09	1.09	2.12	0.34	0.43
19.40	927.17	1.17	2.21	0.36	0.44
22.00	927.24	1.24	2.28	0.39	0.44
24.60	927.32	1.32	2.35	0.41	0.44
27.20	927.38	1.38	2.42	0.43	0.45
29.80	927.44	1.44	2.48	0.45	0.45
32.40	927.50	1.50	2.53	0.47	0.45
35.00	927.56	1.56	2.59	0.49	0.45

Tailwater Channel Data - Sta46+65

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0400

Channel Invert Elevation: 926.00 ft

Roadway Data for Crossing: Sta46+65

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 931.58 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Proposed STA 82+07
HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

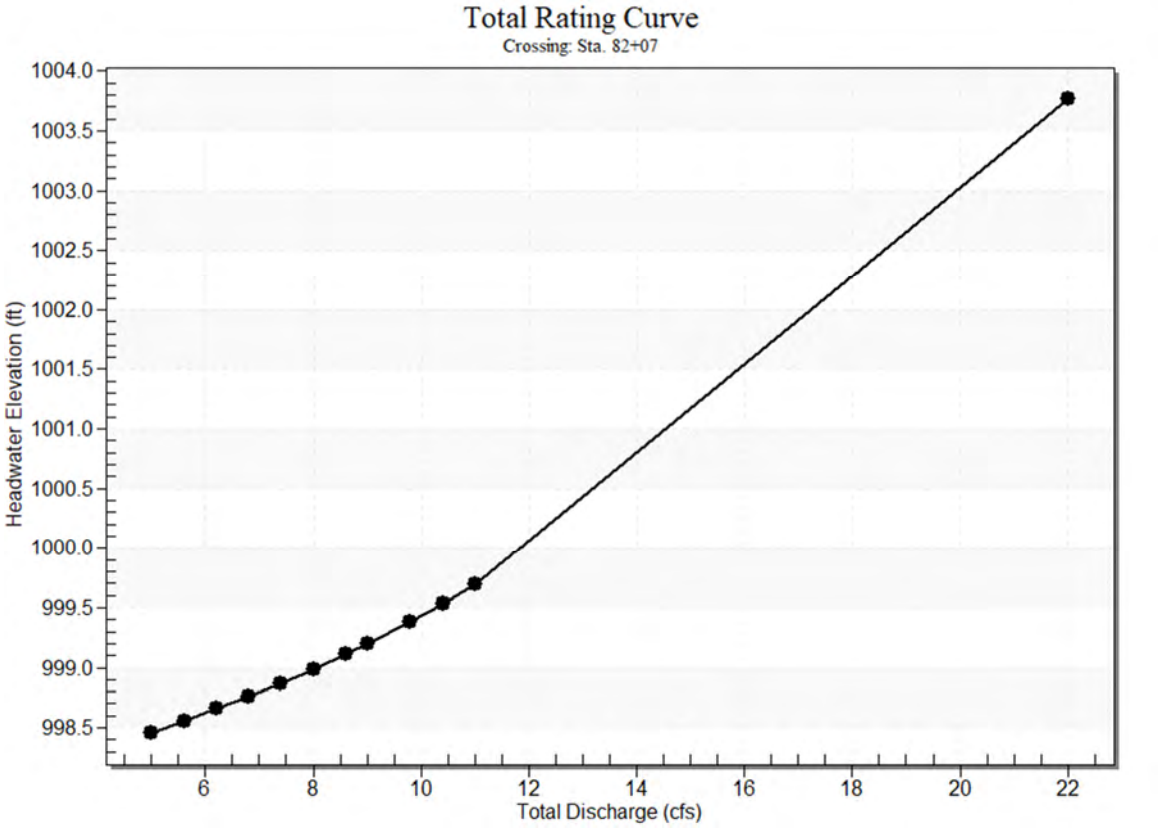
Design Flow: 9.00 cfs

Maximum Flow: 11.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta. 82+07

Headwater Elevation (ft)	Total Discharge (cfs)	18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
998.46	5.00	5.00	0.00	1
998.56	5.60	5.60	0.00	1
998.66	6.20	6.20	0.00	1
998.76	6.80	6.80	0.00	1
998.87	7.40	7.40	0.00	1
998.99	8.00	8.00	0.00	1
999.11	8.60	8.60	0.00	1
999.20	9.00	9.00	0.00	1
999.38	9.80	9.80	0.00	1
999.53	10.40	10.40	0.00	1
999.69	11.00	11.00	0.00	1
1003.70	20.61	20.61	0.00	Overtopping

Rating Curve Plot for Crossing: Sta. 82+07



Culvert Data: 18

Table 2 - Culvert Summary Table: 18

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	998.46	1.29	0.549	1-S2n	0.64	0.86	0.66	0.10	6.70	2.00
5.60 cfs	5.60 cfs	998.56	1.39	0.670	1-S2n	0.68	0.91	0.70	0.11	6.89	2.09
6.20 cfs	6.20 cfs	998.66	1.49	0.796	1-S2n	0.72	0.96	0.75	0.11	7.06	2.18
6.80 cfs	6.80 cfs	998.76	1.59	0.927	5-S2n	0.76	1.01	0.79	0.12	7.22	2.26

7.40 cfs	7.40 cfs	998.87	1.70	1.063	5-S2n	0.80	1.05	0.83	0.13	7.37	2.34
8.00 cfs	8.00 cfs	998.99	1.82	1.204	5-S2n	0.84	1.10	0.87	0.13	7.51	2.41
8.60 cfs	8.60 cfs	999.11	1.94	1.534	5-S2n	0.88	1.14	0.91	0.14	7.64	2.48
9.00 cfs	9.00 cfs	999.20	2.03	1.622	5-S2n	0.91	1.16	0.94	0.14	7.72	2.52
9.80 cfs	9.80 cfs	999.38	2.21	1.807	5-S2n	0.96	1.21	0.99	0.15	7.88	2.61
10.40 cfs	10.40 cfs	999.53	2.36	1.954	5-S2n	1.00	1.24	1.03	0.15	8.00	2.67
11.00 cfs	11.00 cfs	999.69	2.52	2.107	5-S2n	1.04	1.27	1.08	0.16	8.10	2.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

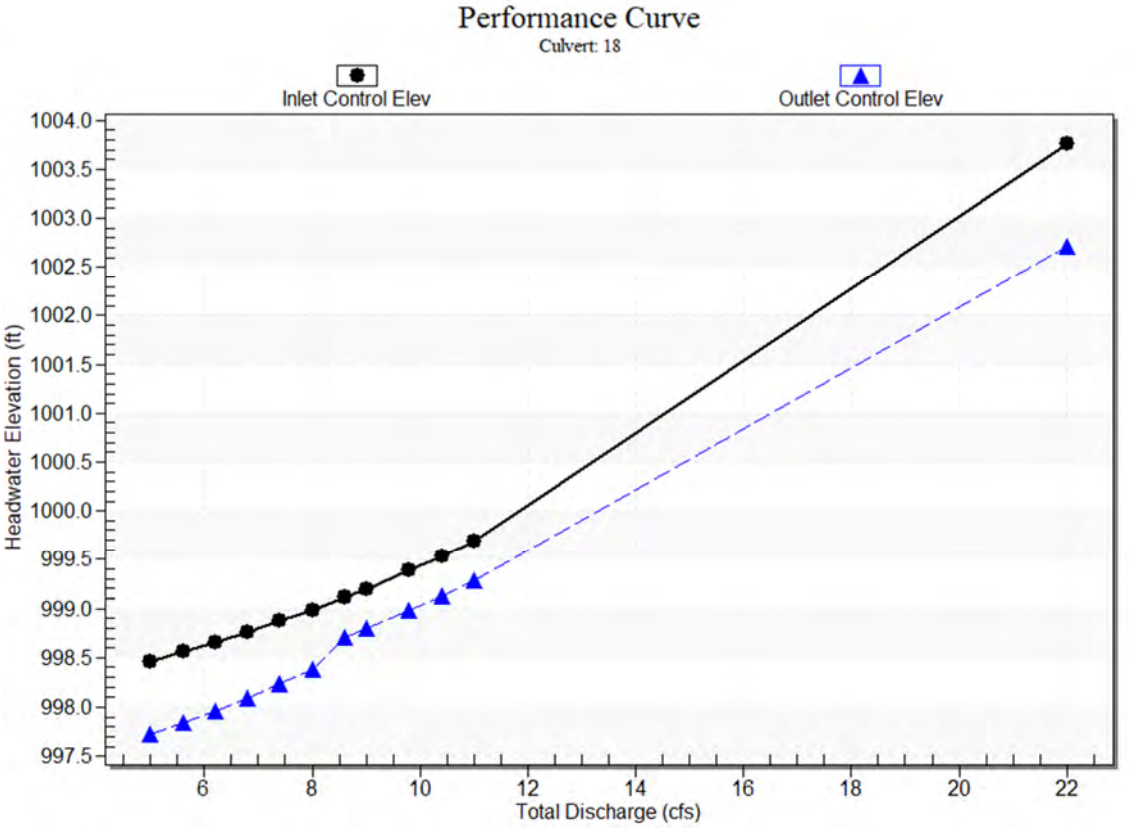
Inlet Elevation (invert): 997.17 ft,

Outlet Elevation (invert): 996.59 ft

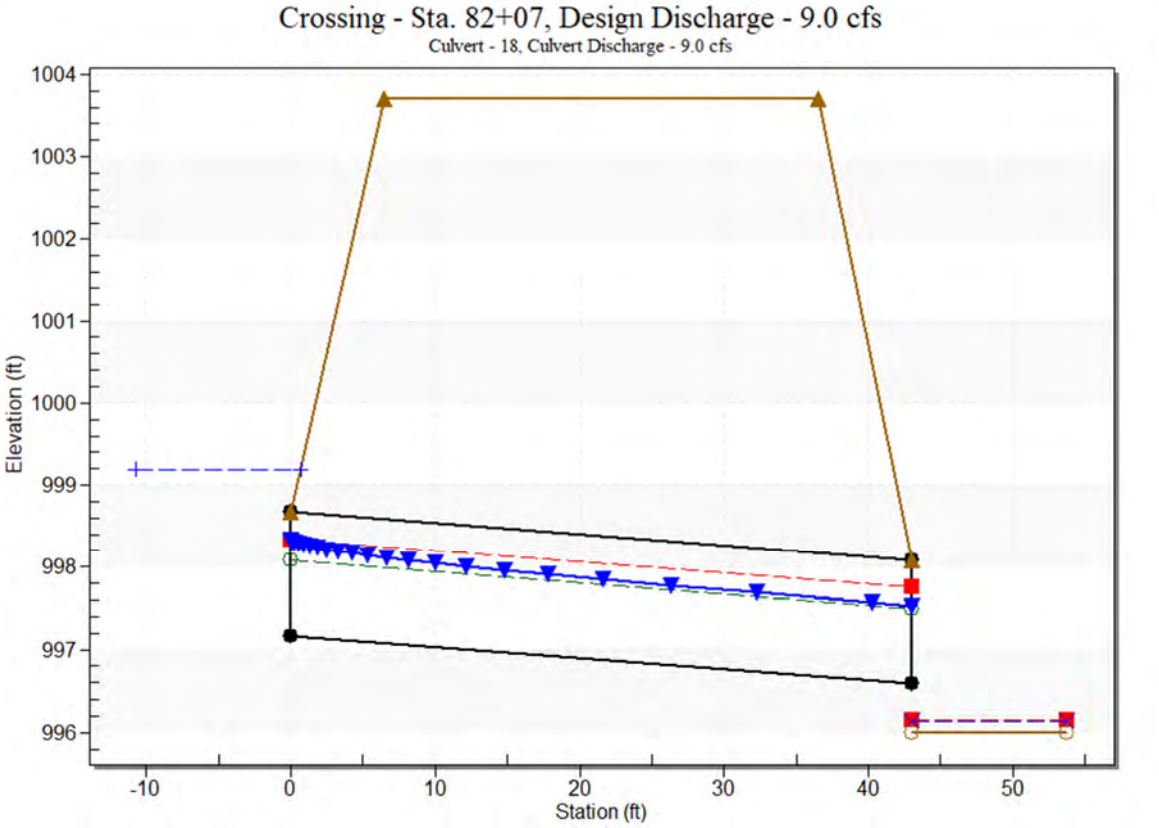
Culvert Length: 43.00 ft,

Culvert Slope: 0.0135

Culvert Performance Curve Plot: 18



Water Surface Profile Plot for Culvert: 18



Site Data - 18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 997.17 ft

Outlet Station: 43.00 ft

Outlet Elevation: 996.59 ft

Number of Barrels: 1

Culvert Data Summary - 18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sta. 82+07

Table 3 - Downstream Channel Rating Curve (Crossing: Sta. 82+07)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	996.10	0.10	2.00	0.22	1.12
5.60	996.11	0.11	2.09	0.24	1.14
6.20	996.11	0.11	2.18	0.25	1.15
6.80	996.12	0.12	2.26	0.27	1.16
7.40	996.13	0.13	2.34	0.28	1.17
8.00	996.13	0.13	2.41	0.30	1.18
8.60	996.14	0.14	2.48	0.31	1.19
9.00	996.14	0.14	2.52	0.32	1.19
9.80	996.15	0.15	2.61	0.33	1.20
10.40	996.15	0.15	2.67	0.35	1.21
11.00	996.16	0.16	2.73	0.36	1.21

Tailwater Channel Data - Sta. 82+07

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 25.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 996.00 ft

Roadway Data for Crossing: Sta. 82+07

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 25.00 ft

Crest Elevation: 1003.70 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

APPENDIX E

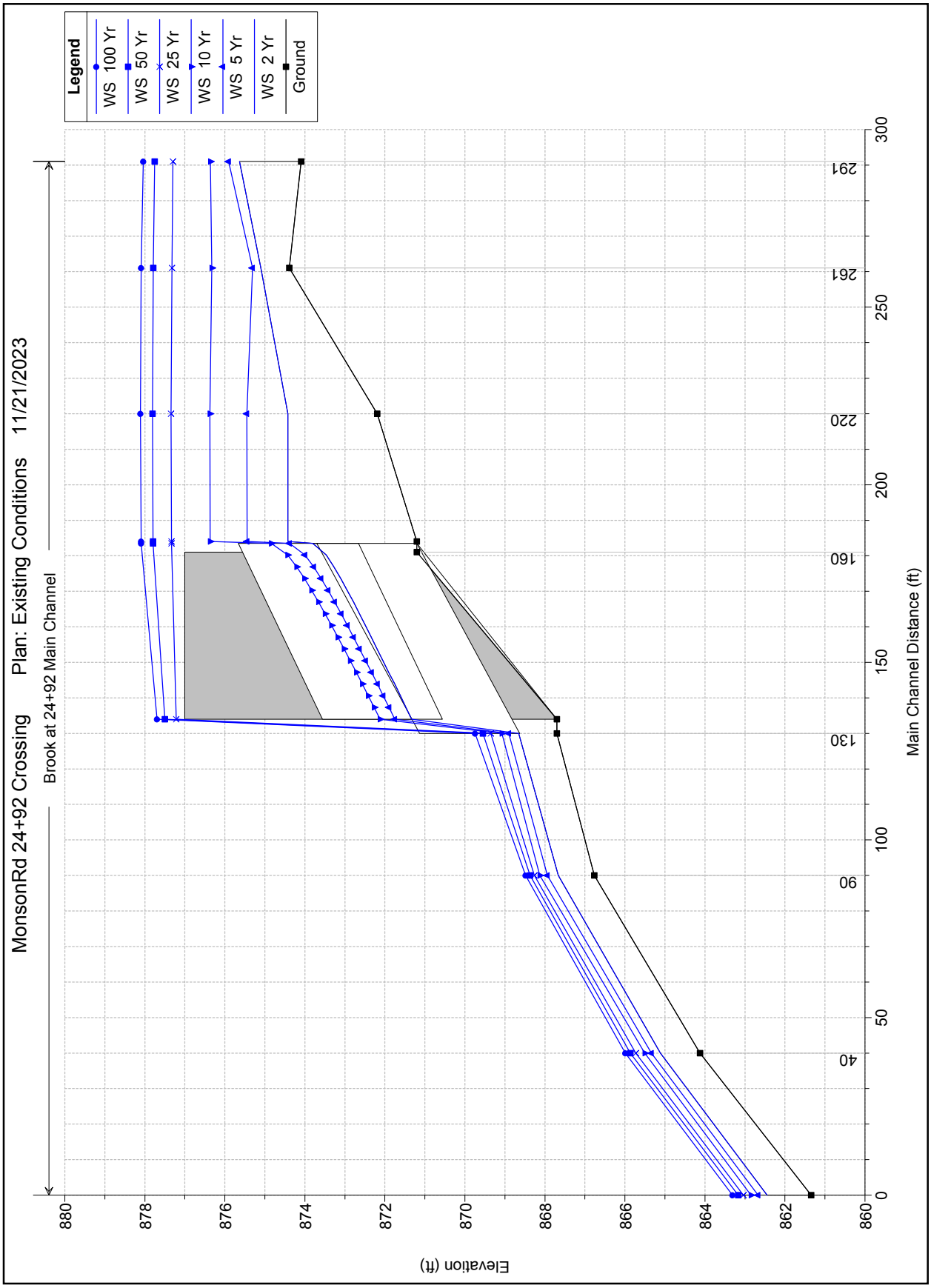
HEC-RAS

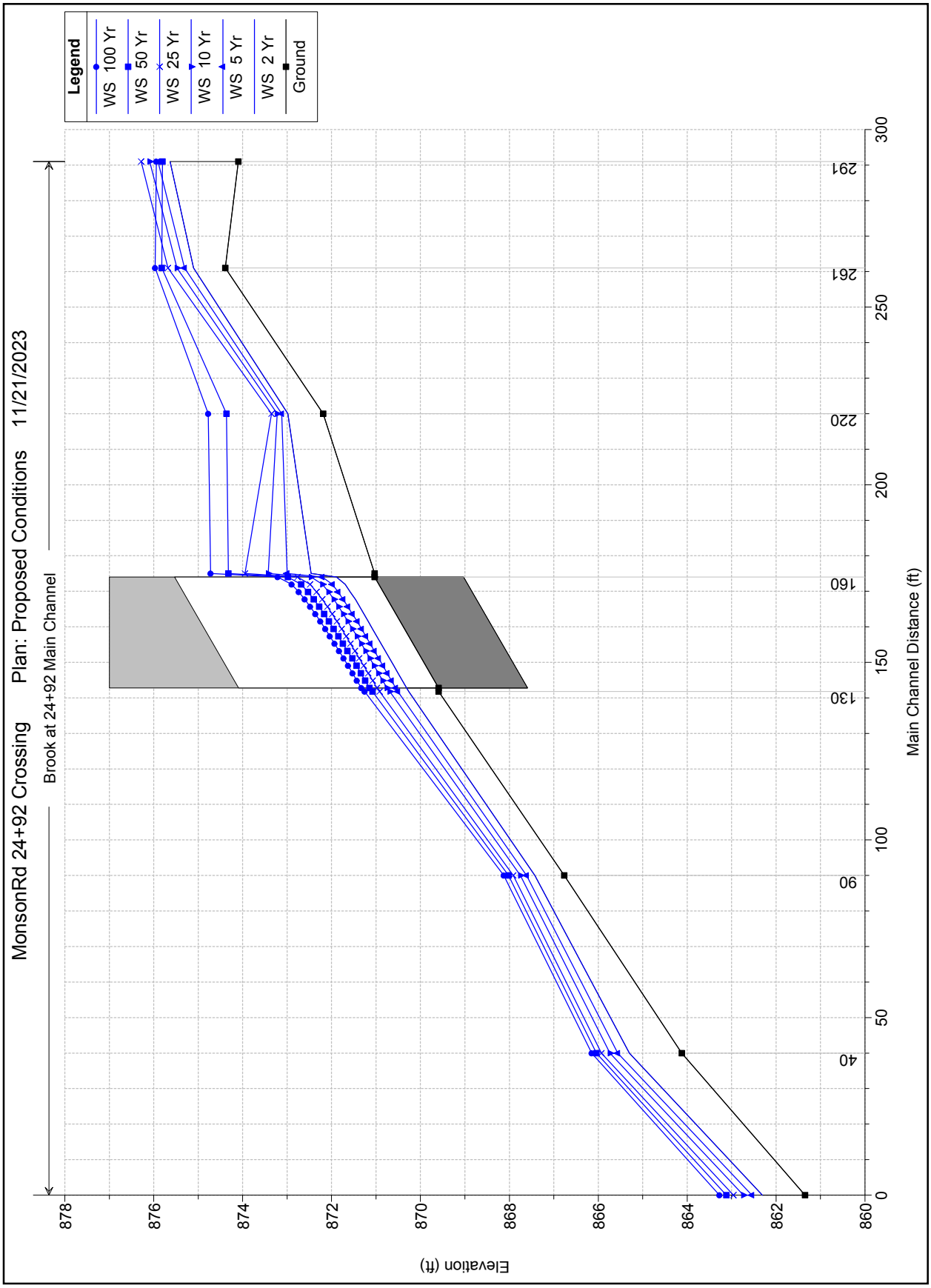
HEC-RAS Computed Results for crossing 24+92 proposed

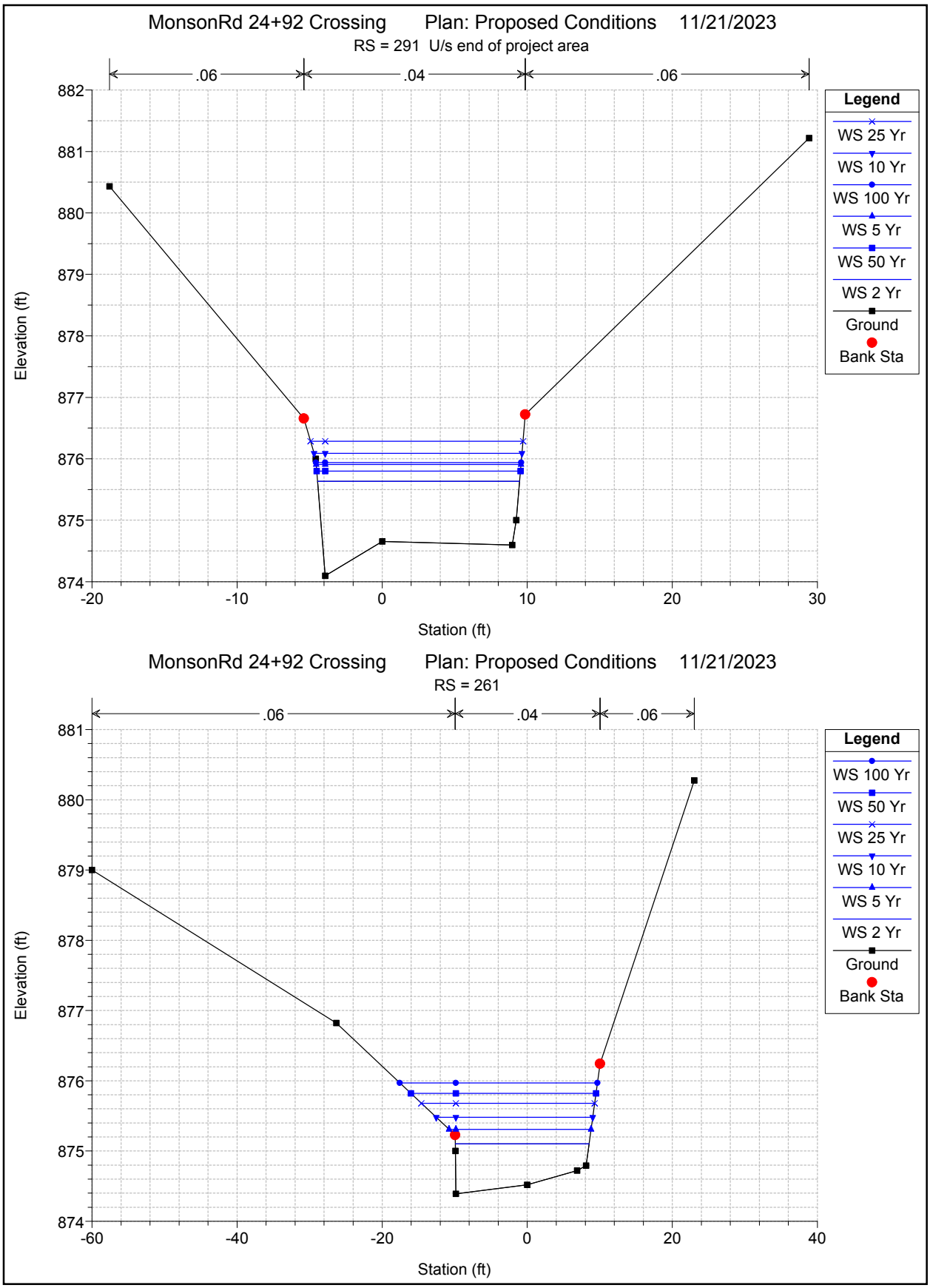
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

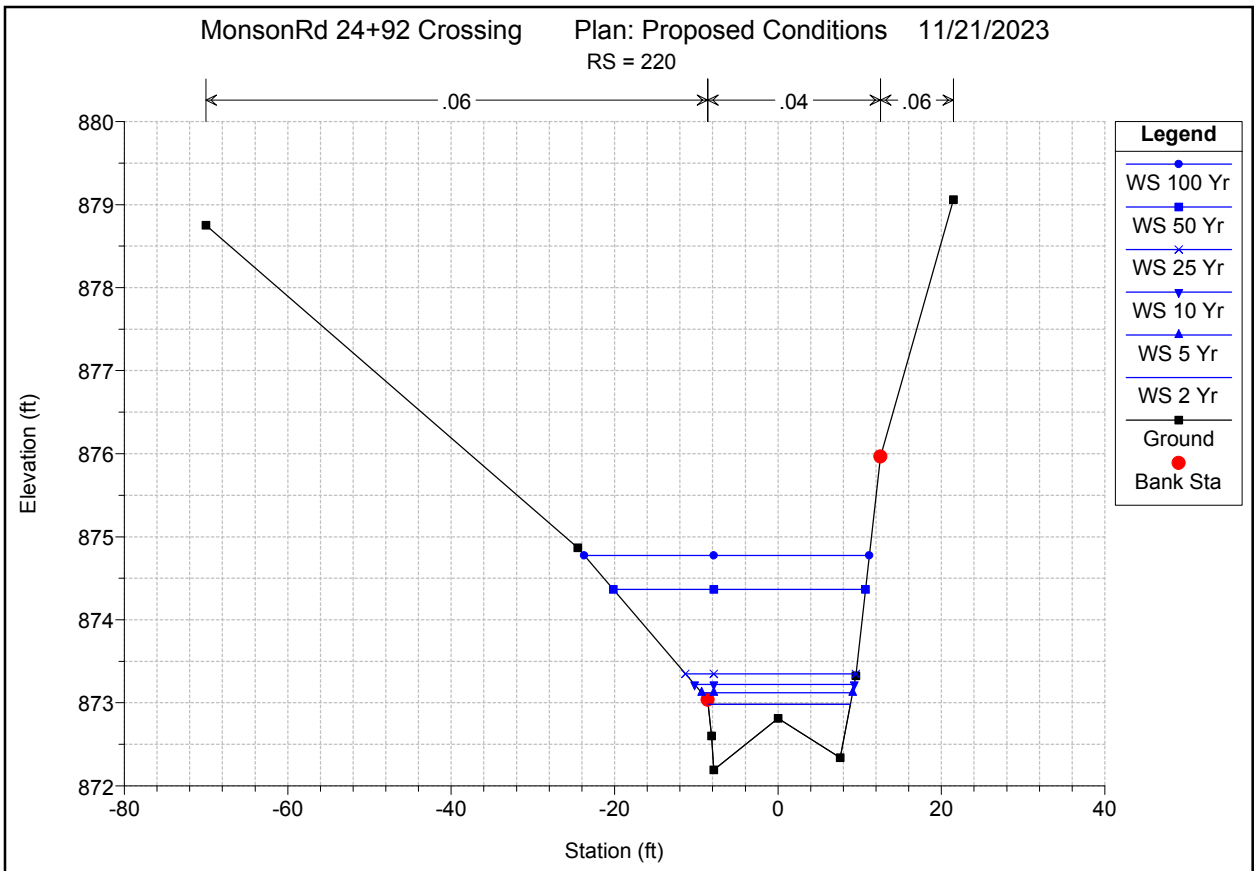
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	5.23
DESIGN FLOOD ELEVATION (FEET,NAVD)	876.1

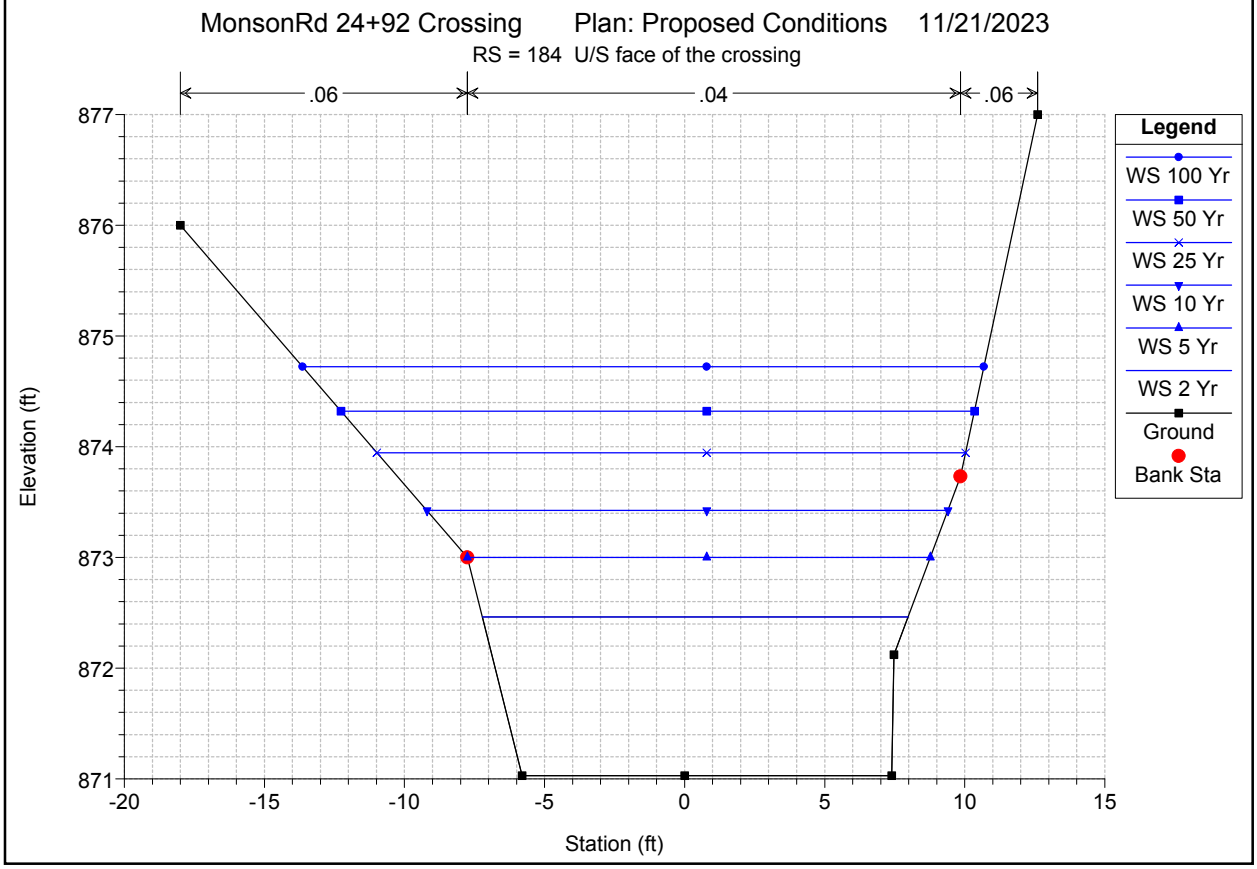
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	31.21	9.5	6.5	871.03	869.59

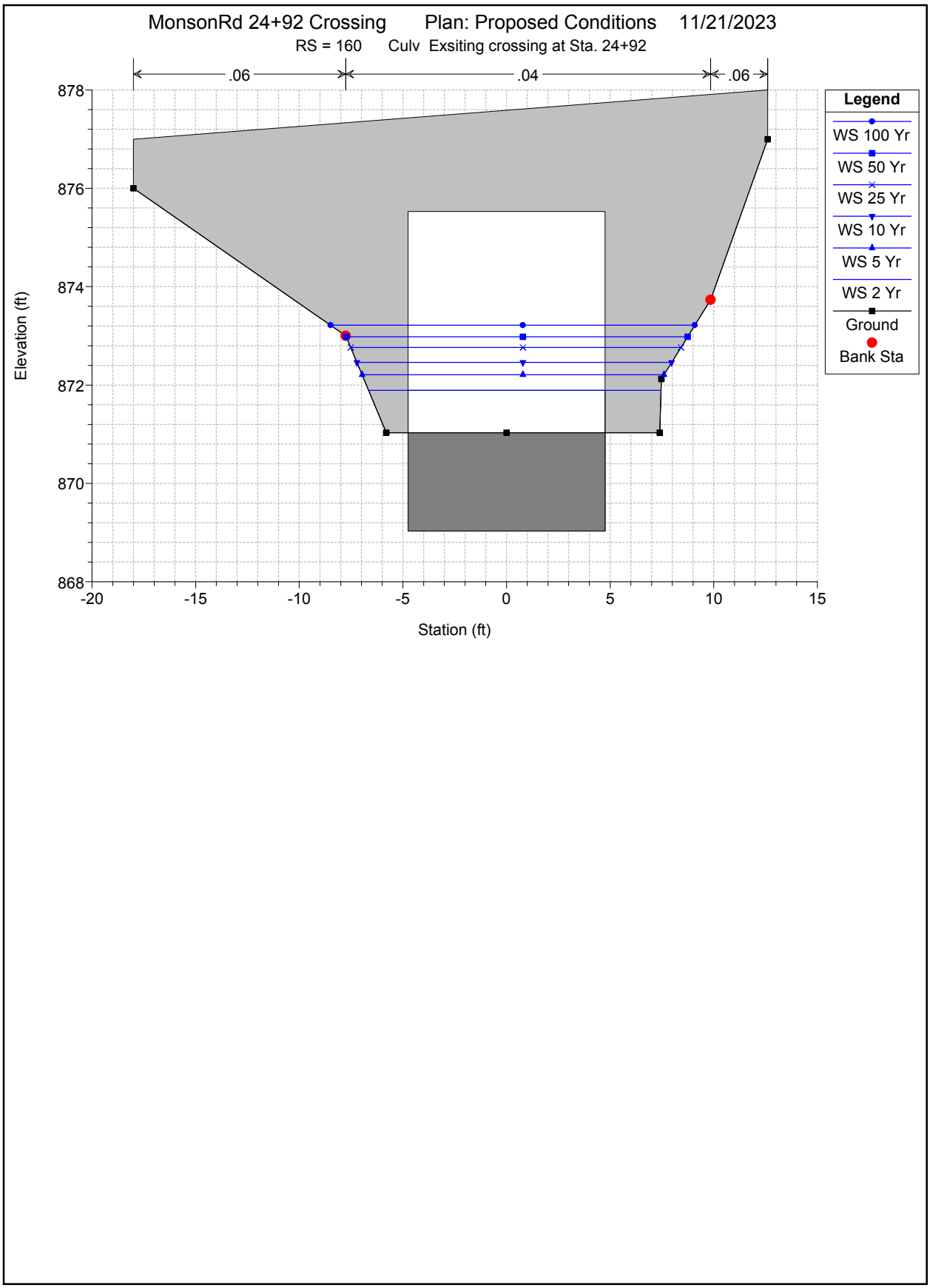

Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
MonsonRd 24+92 Crossing
Plan: Existing Conditions 11/21/2023
Brook at 24+92 Main Channel
Elevation (ft)
Main Channel Distance (ft)
880
878
876
874
872
870
868
866
864
862
860
300
250
200
150
100
50
0
291
261
220
160
130
90
40

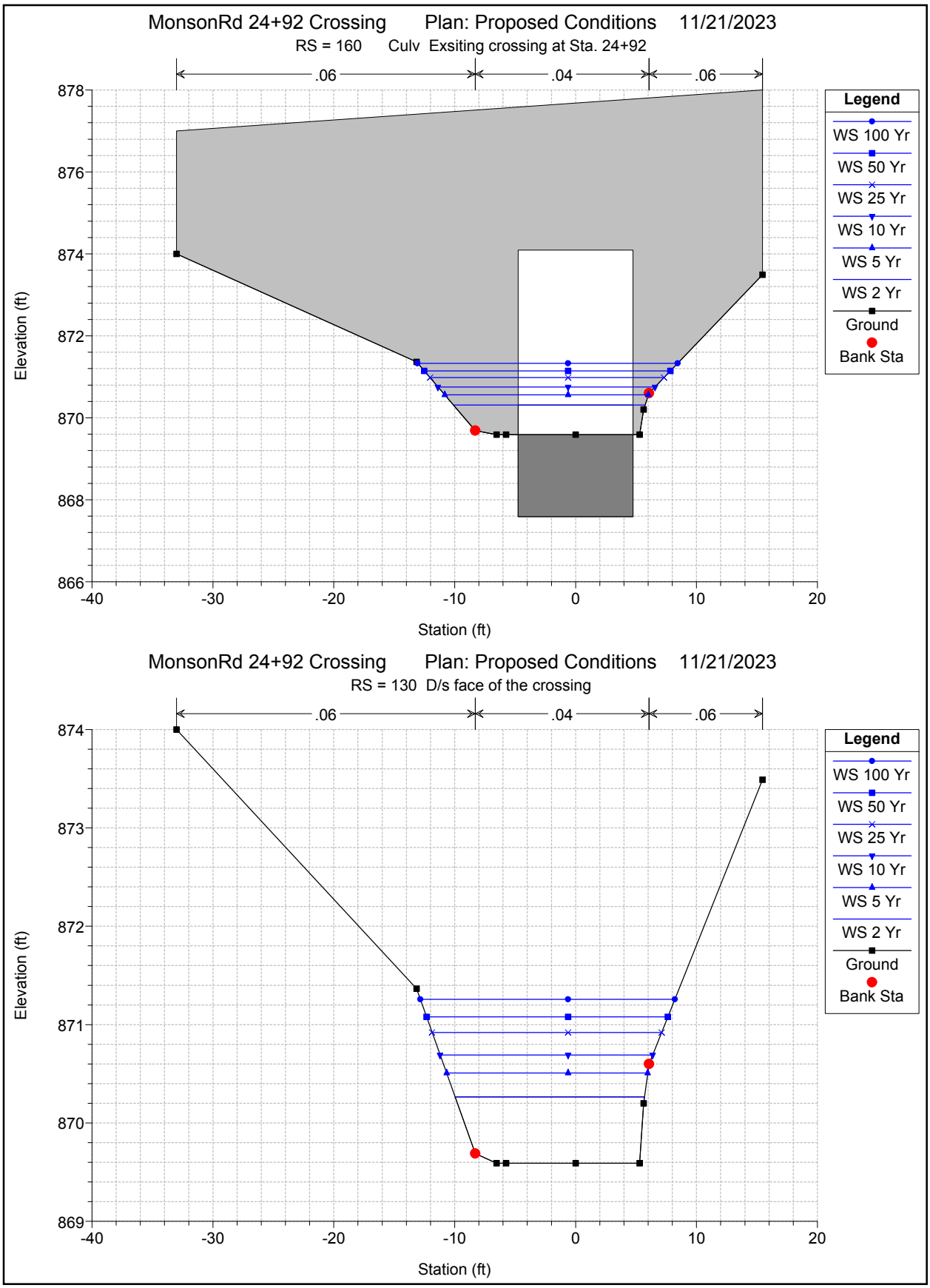

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
Brook at 24+92 Main Channel
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
878
876
874
872
870
868
866
864
862
860
0
40
50
90
100
130
150
160
200
220
250
261
291
300

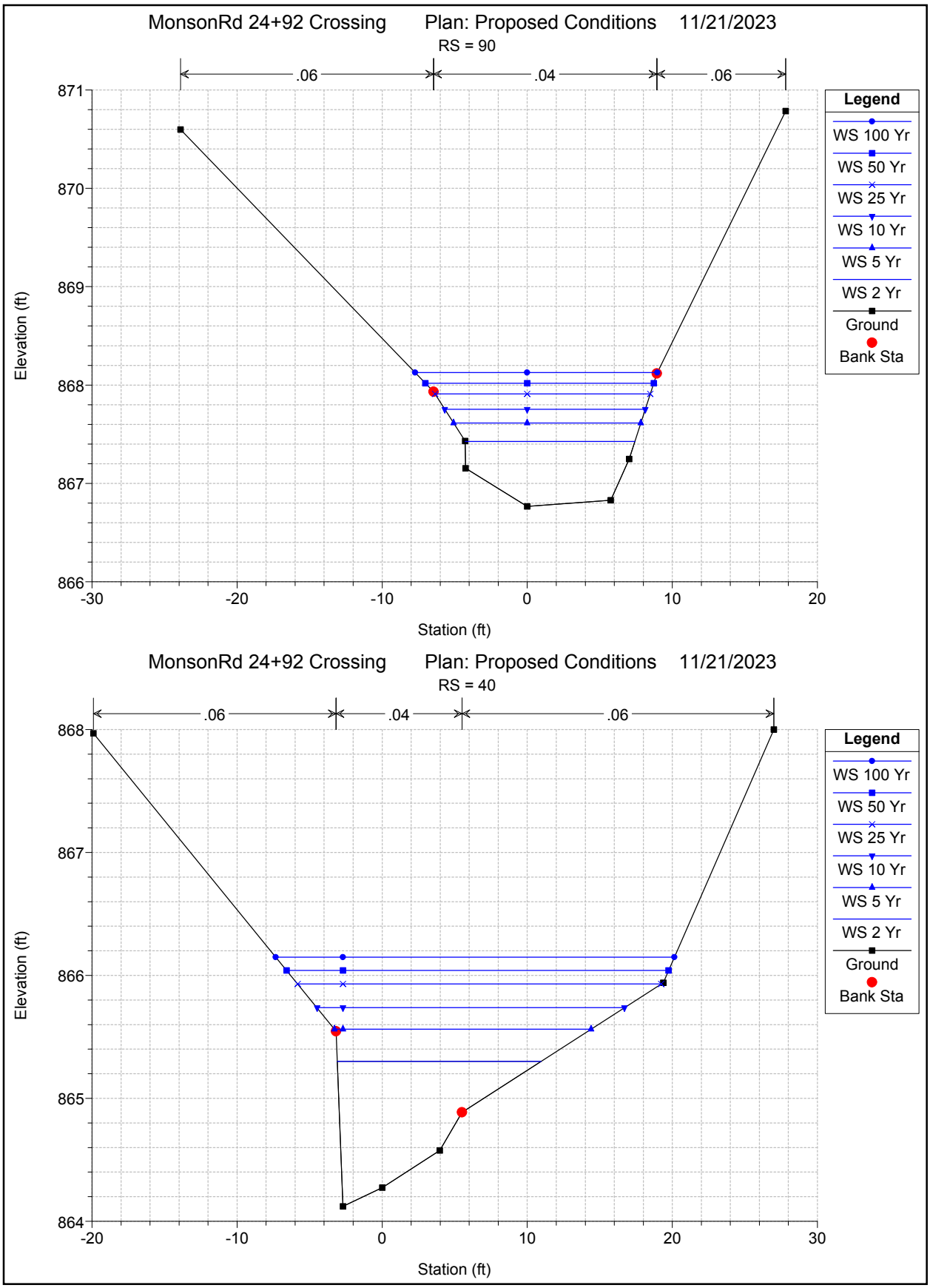

MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 291 U/s end of project area
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 25 Yr
WS 10 Yr
WS 100 Yr
WS 5 Yr
WS 50 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 261
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta

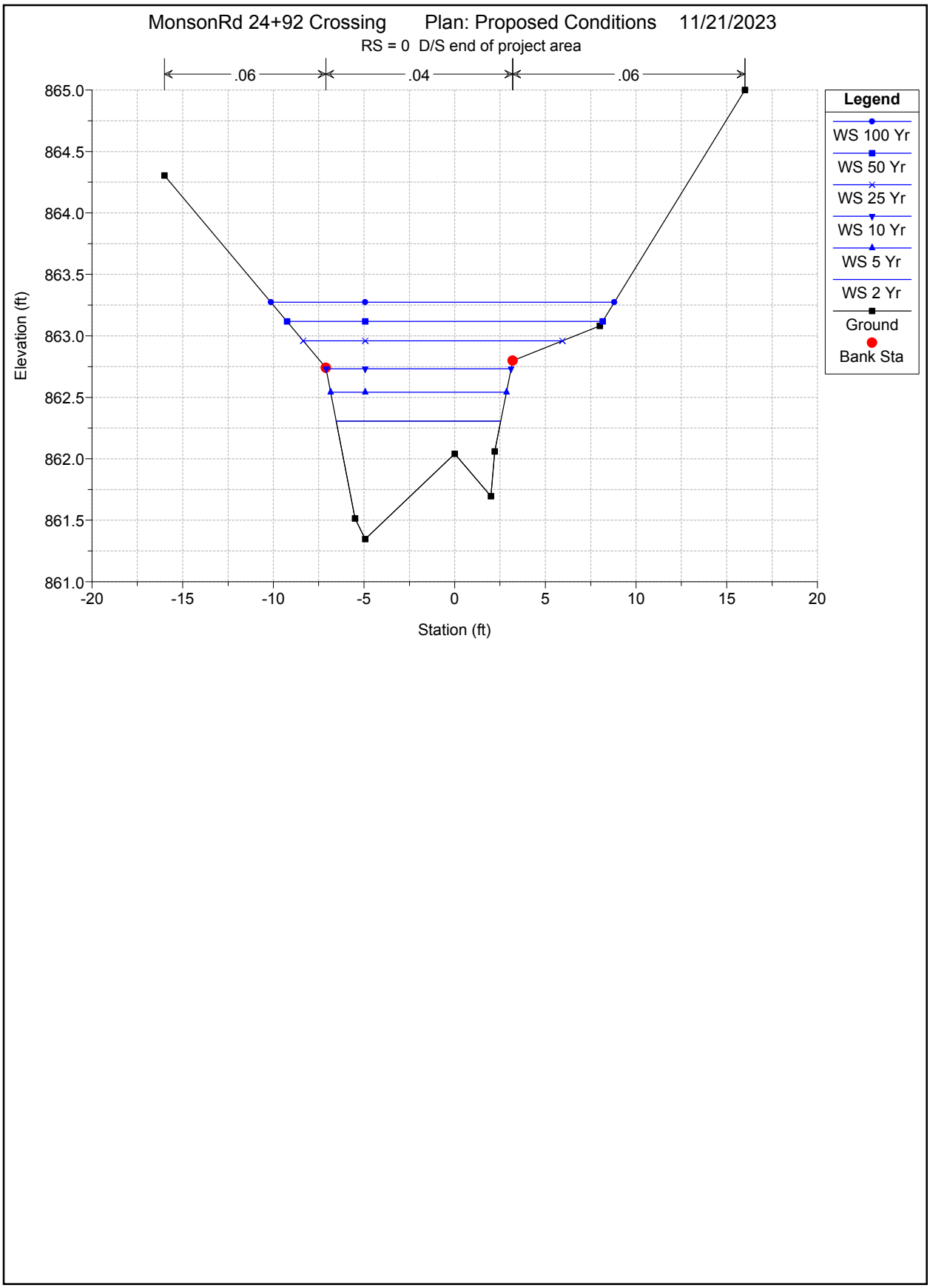

MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 220
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 184 U/S face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 160
Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
Elevation (ft)
878
876
874
872
870
868
-20
-15
-10
-5
0
5
10
15
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 160 Culv Exsiting crossing at Sta. 24+92
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 130 D/s face of the crossing
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 90
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
MonsonRd 24+92 Crossing
Plan: Proposed Conditions
11/21/2023
RS = 40
.06
.04
.06
Elevation (ft)
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta


MonsonRd 24+92 Crossing Plan: Proposed Conditions 11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Elevation (ft)
865.0
864.5
864.0
863.5
863.0
862.5
862.0
861.5
861.0
-20
-15
-10
-5
0
5
10
15
20
Station (ft)
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006791	2.93	14.70	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008508	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.36	875.68	876.57	0.006020	3.67	25.08	14.77	0.50
Main Channel	291	25 Yr	123.00	874.10	877.30	875.92	877.45	0.002536	3.11	40.73	20.05	0.34
Main Channel	291	50 Yr	147.00	874.10	877.75	876.10	877.90	0.002041	3.11	50.68	23.65	0.32
Main Channel	291	100 Yr	174.00	874.10	878.04	876.28	878.21	0.002053	3.32	57.84	25.93	0.32
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	876.33		876.43	0.002553	2.56	40.10	31.59	0.35
Main Channel	261	25 Yr	123.00	874.39	877.32		877.38	0.000818	1.97	78.88	47.62	0.21
Main Channel	261	50 Yr	147.00	874.39	877.79		877.84	0.000619	1.91	103.13	56.34	0.19
Main Channel	261	100 Yr	174.00	874.39	878.09		878.14	0.000598	2.00	120.89	61.94	0.19
Main Channel	220	2 Yr	43.00	872.19	874.43	873.12	874.45	0.000483	1.15	42.65	31.46	0.15
Main Channel	220	5 Yr	69.00	872.19	875.45	873.35	875.46	0.000244	1.06	80.46	43.27	0.12
Main Channel	220	10 Yr	92.00	872.19	876.37		876.38	0.000141	0.97	126.10	55.86	0.09
Main Channel	220	25 Yr	123.00	872.19	877.35		877.36	0.000094	0.93	187.38	70.07	0.08
Main Channel	220	50 Yr	147.00	872.19	877.81		877.82	0.000090	0.97	221.42	76.84	0.08
Main Channel	220	100 Yr	174.00	872.19	878.11		878.12	0.000098	1.05	245.16	81.22	0.08
Main Channel	184	2 Yr	43.00	871.20	874.42	871.96	874.43	0.000149	0.85	53.33	23.04	0.09
Main Channel	184	5 Yr	69.00	871.20	875.44	872.21	875.46	0.000129	0.97	79.06	27.39	0.09
Main Channel	184	10 Yr	92.00	871.20	876.37	872.41	876.38	0.000104	1.01	105.91	30.07	0.08
Main Channel	184	25 Yr	123.00	871.20	877.34	872.65	877.35	0.000094	1.08	135.44	30.60	0.08
Main Channel	184	50 Yr	147.00	871.20	877.80	872.81	877.82	0.000101	1.18	149.53	30.60	0.08
Main Channel	184	100 Yr	174.00	871.20	878.09	872.99	878.12	0.000119	1.32	158.61	30.60	0.09
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	867.70	868.66	868.57	868.96	0.020428	4.43	9.71	11.70	0.86
Main Channel	130	5 Yr	69.00	867.70	868.90	868.85	869.37	0.023223	5.47	12.63	11.91	0.94
Main Channel	130	10 Yr	92.00	867.70	869.08	869.08	869.68	0.026087	6.26	14.71	12.20	1.00
Main Channel	130	25 Yr	123.00	867.70	869.35	869.35	870.06	0.025316	6.77	18.18	12.94	1.01
Main Channel	130	50 Yr	147.00	867.70	869.55	869.55	870.33	0.024776	7.08	20.76	13.47	1.01
Main Channel	130	100 Yr	174.00	867.70	869.75	869.75	870.60	0.024193	7.41	23.49	14.02	1.00
Main Channel	90	2 Yr	43.00	866.77	867.67	867.67	868.01	0.027657	4.71	9.13	13.26	1.00
Main Channel	90	5 Yr	69.00	866.77	867.94	867.94	868.38	0.025952	5.31	12.99	15.06	1.01
Main Channel	90	10 Yr	92.00	866.77	868.13	868.13	868.65	0.024492	5.79	16.00	16.73	1.01

HEC-RAS Plan: Exist River: Brook at 24+92 Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	868.26	868.37	868.99	0.028912	6.83	18.34	18.05	1.12
Main Channel	90	50 Yr	147.00	866.77	868.37	868.54	869.23	0.030415	7.43	20.37	19.13	1.16
Main Channel	90	100 Yr	174.00	866.77	868.48	868.71	869.48	0.032139	8.07	22.50	20.20	1.21
Main Channel	40	2 Yr	43.00	864.12	865.11	865.36	865.90	0.067632	7.16	6.26	11.48	1.51
Main Channel	40	5 Yr	69.00	864.12	865.34	865.68	866.38	0.064742	8.34	9.25	14.57	1.53
Main Channel	40	10 Yr	92.00	864.12	865.50	865.93	866.71	0.063759	9.12	11.81	16.78	1.55
Main Channel	40	25 Yr	123.00	864.12	865.73	866.15	866.99	0.054635	9.56	16.05	21.03	1.48
Main Channel	40	50 Yr	147.00	864.12	865.86	866.29	867.21	0.052564	10.01	19.05	23.72	1.47
Main Channel	40	100 Yr	174.00	864.12	865.99	866.44	867.43	0.051739	10.50	22.16	25.77	1.48
Main Channel	0	2 Yr	43.00	861.35	862.45	862.65	863.19	0.066836	6.91	6.22	9.44	1.50
Main Channel	0	5 Yr	69.00	861.35	862.67	863.00	863.71	0.068697	8.18	8.44	10.04	1.57
Main Channel	0	10 Yr	92.00	861.35	862.85	863.27	864.10	0.066222	8.97	10.31	11.83	1.59
Main Channel	0	25 Yr	123.00	861.35	863.04	863.54	864.58	0.065444	10.00	12.92	16.08	1.62
Main Channel	0	50 Yr	147.00	861.35	863.17	863.72	864.87	0.063441	10.58	15.21	17.93	1.63
Main Channel	0	100 Yr	174.00	861.35	863.31	863.90	865.14	0.061000	11.09	17.79	19.30	1.62

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	291	2 Yr	43.00	874.10	875.63	875.23	875.77	0.006822	2.93	14.67	13.93	0.50
Main Channel	291	5 Yr	69.00	874.10	875.91	875.48	876.12	0.008494	3.73	18.51	14.12	0.57
Main Channel	291	10 Yr	92.00	874.10	876.09	875.68	876.38	0.010123	4.36	21.10	14.33	0.63
Main Channel	291	25 Yr	123.00	874.10	876.28	875.92	876.69	0.012395	5.14	23.92	14.65	0.71
Main Channel	291	50 Yr	147.00	874.10	875.80	876.09	876.96	0.050095	8.64	17.02	14.05	1.38
Main Channel	291	100 Yr	174.00	874.10	875.94	876.28	877.25	0.050078	9.17	18.97	14.14	1.40
Main Channel	261	2 Yr	43.00	874.39	875.10	875.10	875.38	0.029929	4.22	10.20	18.45	1.00
Main Channel	261	5 Yr	69.00	874.39	875.31	875.31	875.68	0.027589	4.92	14.04	19.58	1.00
Main Channel	261	10 Yr	92.00	874.39	875.48	875.48	875.92	0.024916	5.32	17.56	21.56	0.98
Main Channel	261	25 Yr	123.00	874.39	875.68	875.68	876.19	0.022903	5.77	22.12	23.89	0.97
Main Channel	261	50 Yr	147.00	874.39	875.82	875.82	876.38	0.021751	6.05	25.62	25.53	0.96
Main Channel	261	100 Yr	174.00	874.39	875.97	875.97	876.57	0.020640	6.32	29.57	27.26	0.95
Main Channel	220	2 Yr	43.00	872.19	872.98	873.12	873.49	0.076775	5.74	7.49	17.42	1.54
Main Channel	220	5 Yr	69.00	872.19	873.12	873.35	873.87	0.078410	6.92	10.00	18.48	1.63
Main Channel	220	10 Yr	92.00	872.19	873.22	873.51	874.17	0.082184	7.83	11.86	19.52	1.71
Main Channel	220	25 Yr	123.00	872.19	873.35	873.71	874.52	0.080896	8.69	14.48	20.87	1.74
Main Channel	220	50 Yr	147.00	872.19	874.37	873.85	874.61	0.006361	4.09	40.77	30.86	0.55
Main Channel	220	100 Yr	174.00	872.19	874.77	873.99	874.97	0.004204	3.77	54.21	34.89	0.46
Main Channel	184	2 Yr	43.00	871.03	872.46	871.71	872.53	0.002652	2.14	20.06	15.19	0.33
Main Channel	184	5 Yr	69.00	871.03	873.00	871.96	873.09	0.002383	2.41	28.59	16.52	0.32
Main Channel	184	10 Yr	92.00	871.03	873.42	872.16	873.53	0.002121	2.57	36.03	18.60	0.31
Main Channel	184	25 Yr	123.00	871.03	873.95	872.40	874.06	0.001820	2.72	46.40	21.01	0.30
Main Channel	184	50 Yr	147.00	871.03	874.32	872.57	874.44	0.001618	2.81	54.60	22.61	0.29
Main Channel	184	100 Yr	174.00	871.03	874.72	872.75	874.85	0.001449	2.90	63.98	24.32	0.28
Main Channel	160		Culvert									
Main Channel	130	2 Yr	43.00	869.59	870.26	870.26	870.59	0.027595	4.58	9.68	15.66	1.00
Main Channel	130	5 Yr	69.00	869.59	870.51	870.51	870.93	0.025058	5.30	13.60	16.64	0.99
Main Channel	130	10 Yr	92.00	869.59	870.69	870.69	871.20	0.023566	5.80	16.75	17.58	0.99
Main Channel	130	25 Yr	123.00	869.59	870.92	870.92	871.52	0.021537	6.32	20.93	18.98	0.98
Main Channel	130	50 Yr	147.00	869.59	871.08	871.08	871.74	0.020548	6.66	24.03	19.96	0.98
Main Channel	130	100 Yr	174.00	869.59	871.26	871.26	871.97	0.019231	6.96	27.66	21.05	0.96
Main Channel	90	2 Yr	43.00	866.77	867.43	867.66	868.19	0.087757	7.01	6.13	11.71	1.71
Main Channel	90	5 Yr	69.00	866.77	867.61	867.94	868.65	0.088978	8.17	8.45	12.92	1.78
Main Channel	90	10 Yr	92.00	866.77	867.75	868.13	868.99	0.089077	8.92	10.32	13.83	1.82

Proposal No. 608163-128112

HEC-RAS Plan: prop River: Brook at 24+92 Reach: Main Channel (Continued)

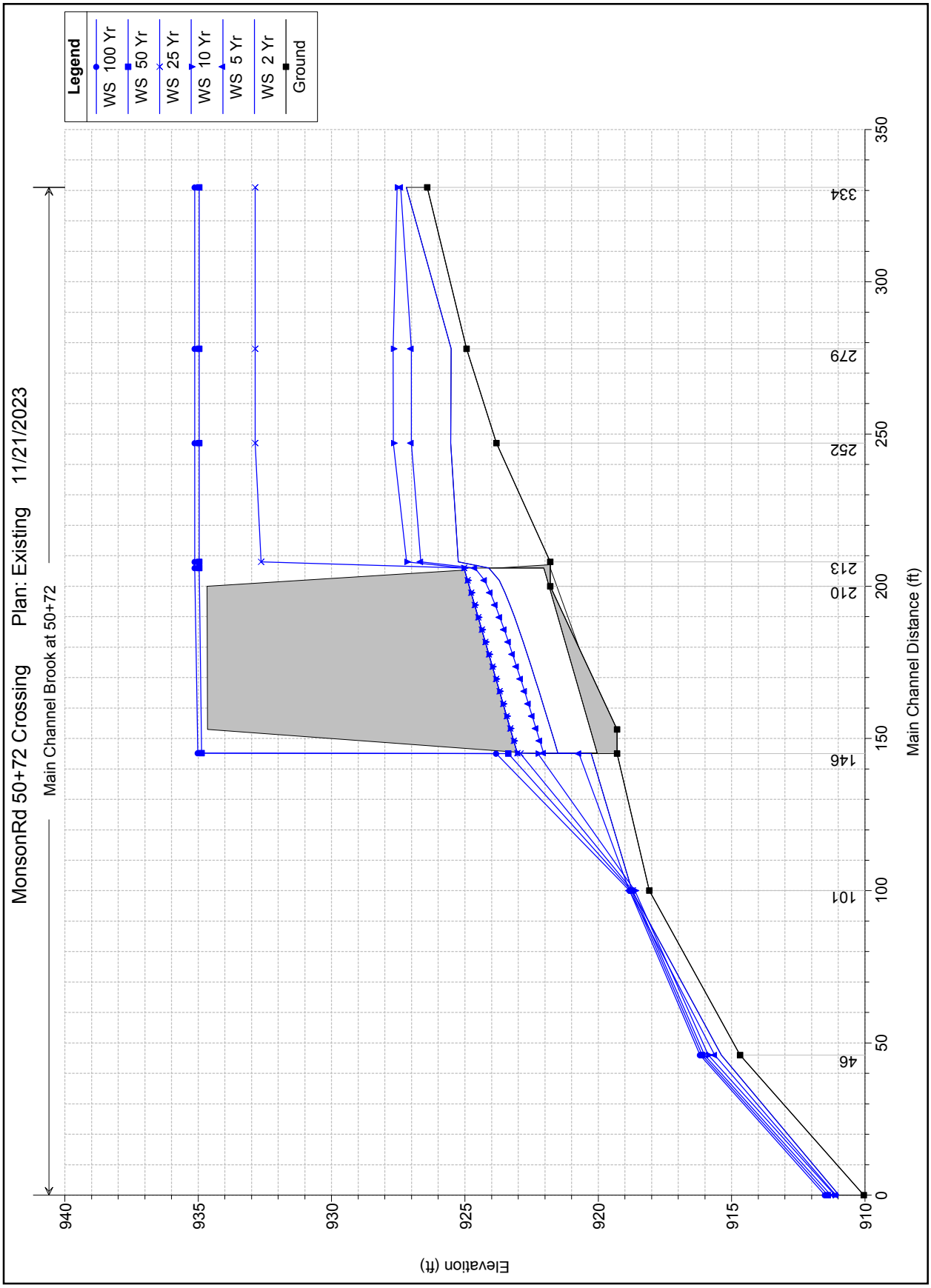
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 Yr	123.00	866.77	867.91	868.37	869.40	0.091293	9.80	12.54	14.84	1.88
Main Channel	90	50 Yr	147.00	866.77	868.02	868.54	869.69	0.089500	10.37	14.20	15.74	1.89
Main Channel	90	100 Yr	174.00	866.77	868.13	868.71	870.00	0.088274	10.98	15.96	16.70	1.91
Main Channel	40	2 Yr	43.00	864.12	865.30	865.36	865.75	0.029337	5.47	8.69	14.04	1.03
Main Channel	40	5 Yr	69.00	864.12	865.56	865.68	866.15	0.029358	6.40	12.83	17.69	1.06
Main Channel	40	10 Yr	92.00	864.12	865.74	865.93	866.43	0.029868	7.10	16.21	21.18	1.09
Main Channel	40	25 Yr	123.00	864.12	865.93	866.15	866.75	0.030526	7.86	20.67	25.06	1.13
Main Channel	40	50 Yr	147.00	864.12	866.04	866.29	866.96	0.031932	8.44	23.53	26.33	1.17
Main Channel	40	100 Yr	174.00	864.12	866.15	866.44	867.17	0.033594	9.04	26.45	27.48	1.22
Main Channel	0	2 Yr	43.00	861.35	862.31	862.65	863.49	0.135916	8.71	4.94	9.07	2.08
Main Channel	0	5 Yr	69.00	861.35	862.54	863.00	863.99	0.113529	9.67	7.14	9.69	1.99
Main Channel	0	10 Yr	92.00	861.35	862.73	863.27	864.34	0.099306	10.18	9.04	10.20	1.91
Main Channel	0	25 Yr	123.00	861.35	862.96	863.54	864.76	0.083177	10.77	11.73	14.30	1.81
Main Channel	0	50 Yr	147.00	861.35	863.12	863.72	865.00	0.073977	11.11	14.26	17.40	1.74
Main Channel	0	100 Yr	174.00	861.35	863.27	863.90	865.23	0.067208	11.44	17.09	18.94	1.69

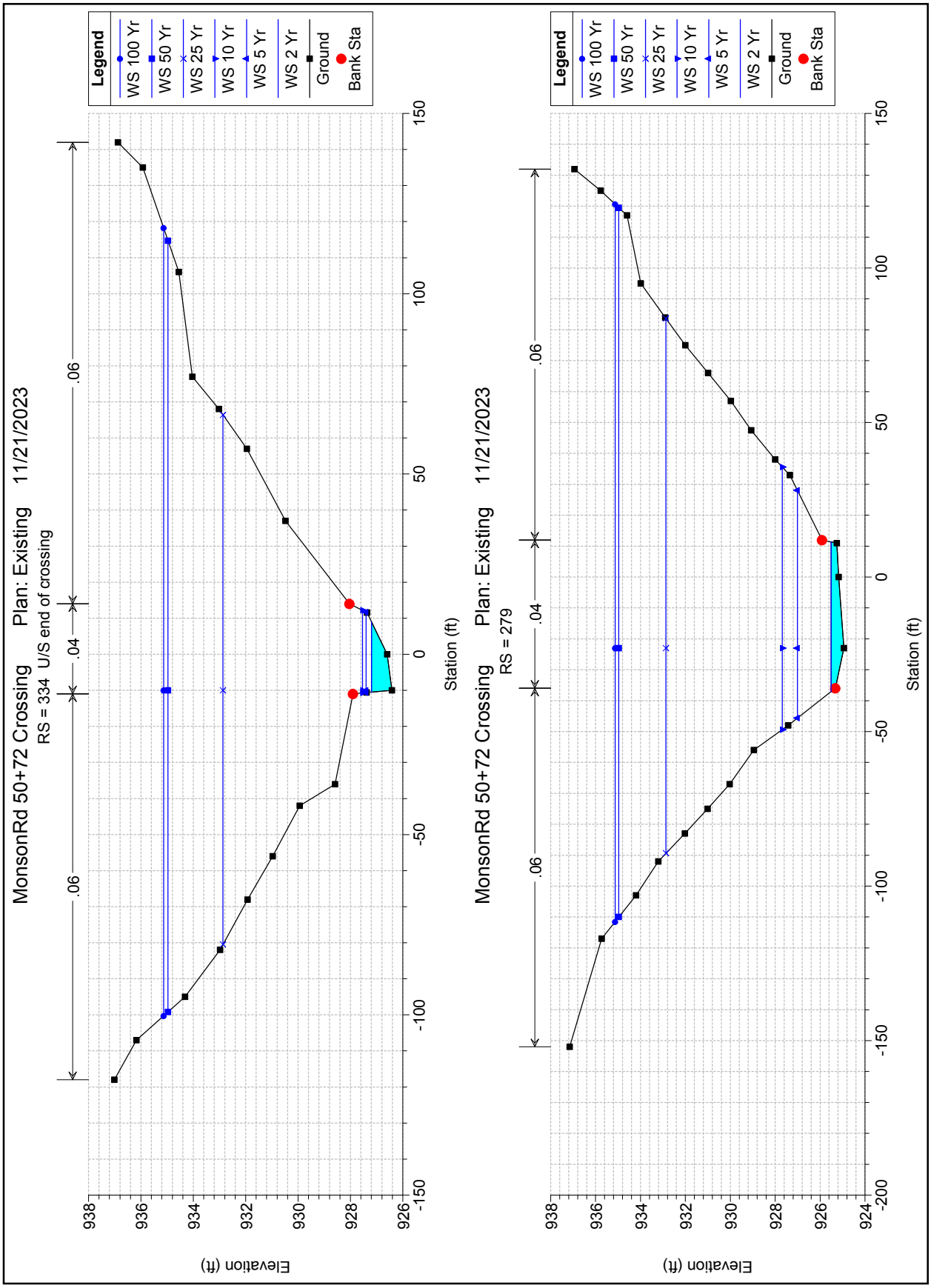
HEC-RAS Computed Results for crossing 50+72 proposed

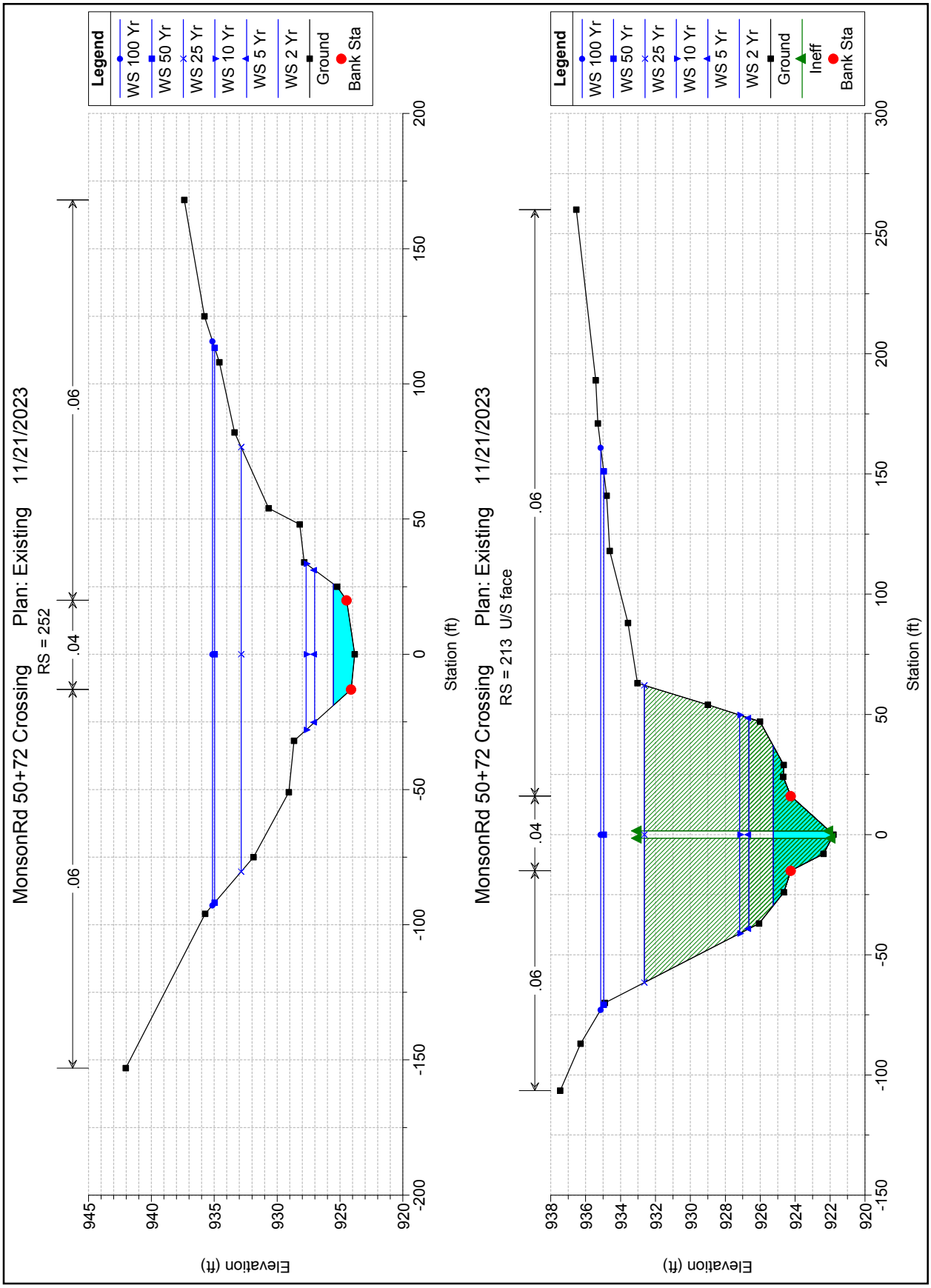
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	
DESIGN FLOOD DISCHARGE (C.F.S)	116
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	10.75
DESIGN FLOOD ELEVATION (FEET, NAVD)	932.64
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	163
BASE FLOOD ELEVATION (FEET, NAVD)	933.34
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

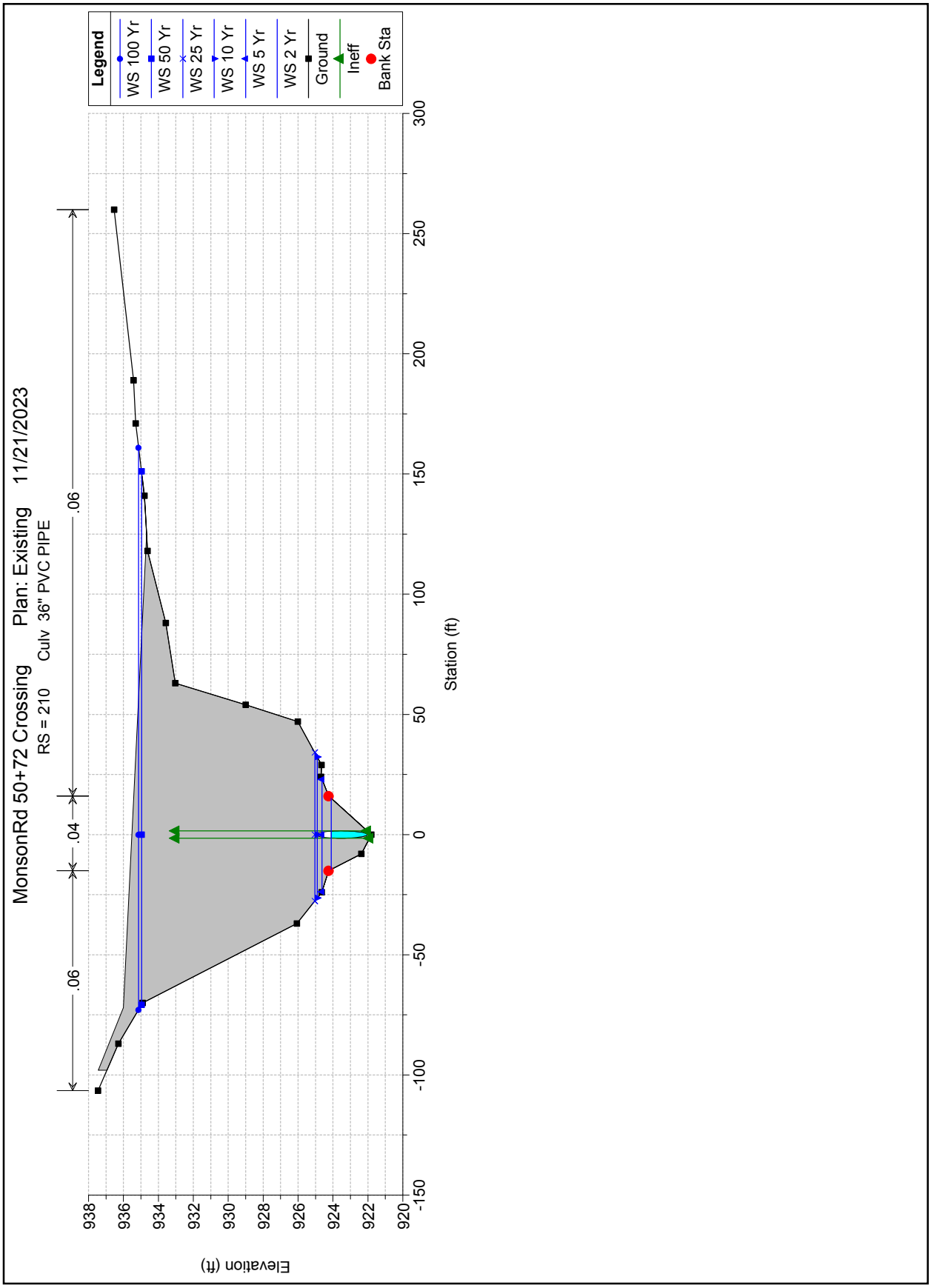
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	40
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	
DESIGN FLOOD ELEVATION (FEET,NAVD)	

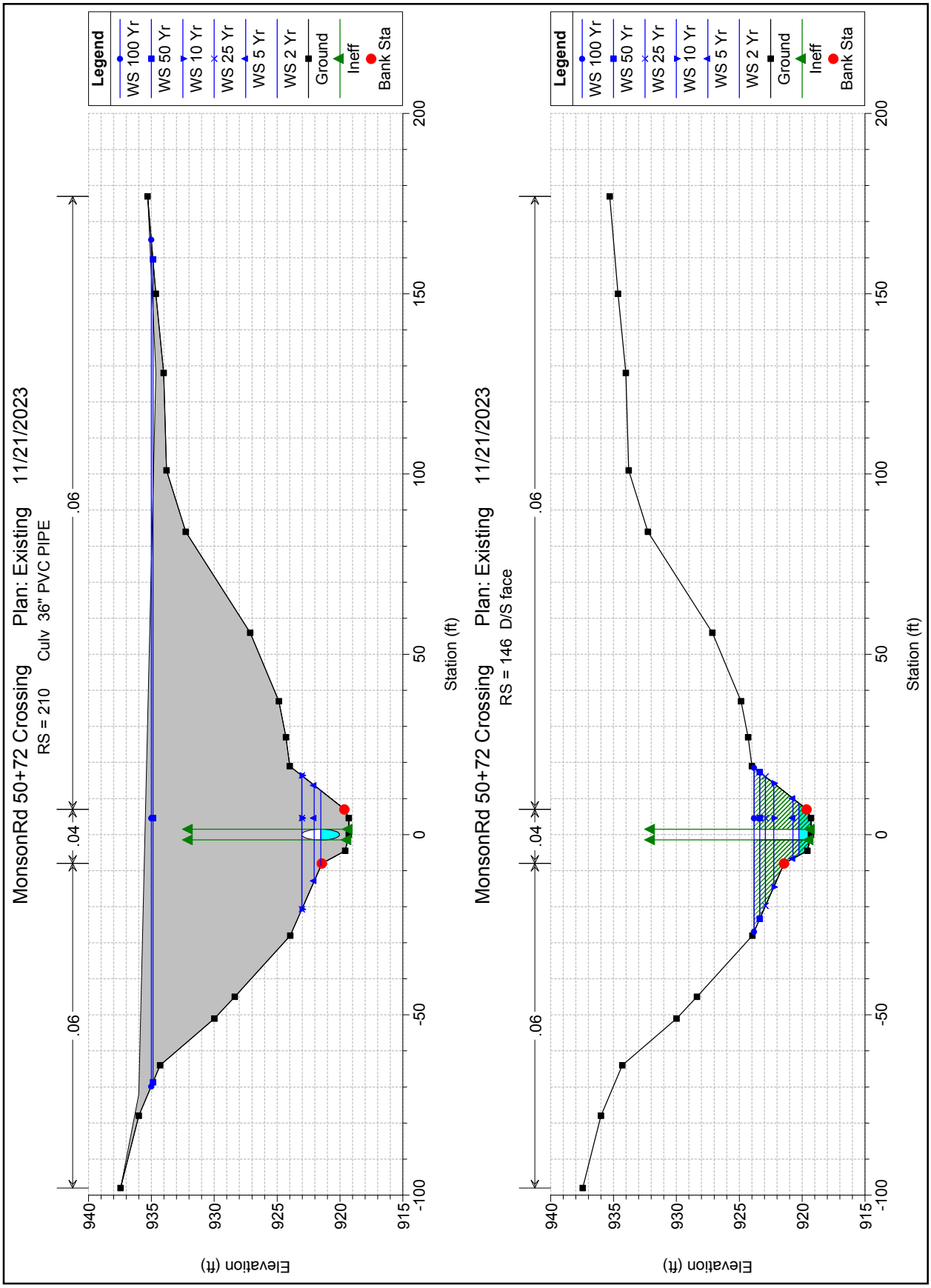
Section	Length (ft)	Span (ft)	Diameter (ft)	Invert (u/s)	Invert (d/s)
Circular Culvert	60.8	3	3	922.04	920.04

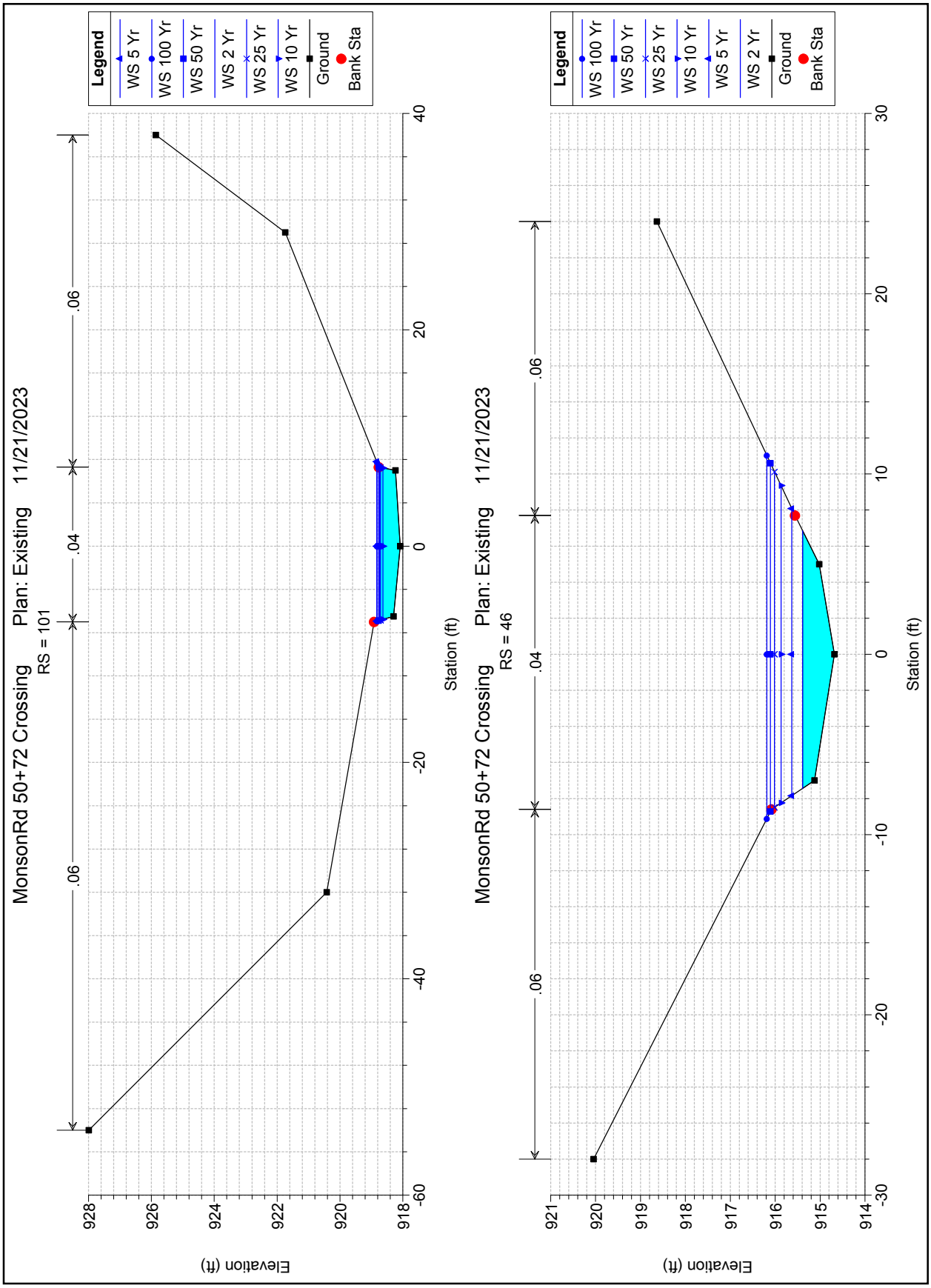

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
Main Channel Brook at 50+72
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Elevation (ft)
940
935
930
925
920
915
910
Main Channel Distance (ft)
0
50
100
150
200
250
300
350
46
101
146
210
213
252
279
334

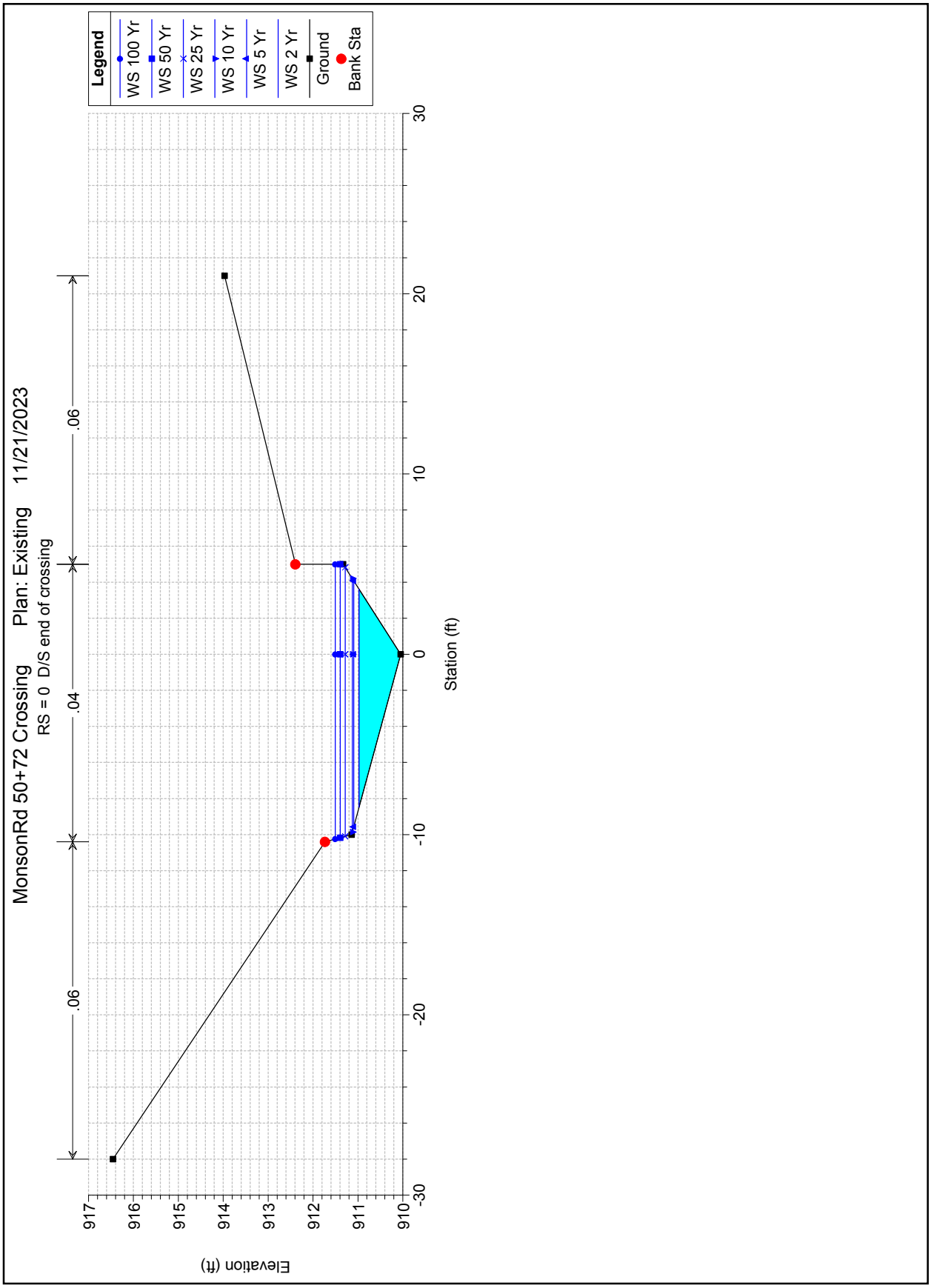

MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 334 U/S end of crossing
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 279
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 252
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
945
940
935
930
925
920
200
150
100
50
0
-50
-100
-150
-200
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 213 U/S face
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
938
936
934
932
930
928
926
924
922
920
300
250
200
150
100
50
0
-50
-100
-150


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
.06
.04
.06
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
Elevation (ft)
938
936
934
932
930
928
926
924
922
920
Station (ft)
300
250
200
150
100
50
0
-50
-100
-150


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 210 Culv 36" PVC PIPE
RS = 146 D/S face
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
940
935
930
925
920
915
200
150
100
50
0
-50
-100


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 101
Legend
WS 5 Yr
WS 100 Yr
WS 50 Yr
WS 2 Yr
WS 25 Yr
WS 10 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
928
926
924
922
920
918
40
20
0
-20
-40
-60
MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 46
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
921
920
919
918
917
916
915
914
30
20
10
0
-10
-20
-30


MonsonRd 50+72 Crossing Plan: Existing 11/21/2023
RS = 0 D/S end of crossing
Legend
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
WS 5 Yr
WS 2 Yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
917
916
915
914
913
912
911
910
Station (ft)
30
20
10
0
-10
-20
-30

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	334	2 Yr	40.00	926.41	927.20	927.20	927.46	0.030832	4.07	9.83	19.51	1.01
Brook at 50+72	334	5 Yr	65.00	926.41	927.41	927.41	927.73	0.028816	4.58	14.19	22.34	1.01
Brook at 50+72	334	10 Yr	86.00	926.41	927.54	927.54	927.93	0.027344	4.98	17.25	22.94	1.01
Brook at 50+72	334	25 Yr	116.00	926.41	932.86	927.72	932.87	0.000013	0.43	463.57	146.85	0.03
Brook at 50+72	334	50 Yr	139.00	926.41	934.96	927.84	934.97	0.000005	0.31	831.05	213.91	0.02
Brook at 50+72	334	100 Yr	163.00	926.41	935.13	927.96	935.13	0.000006	0.35	867.47	218.55	0.02
Brook at 50+72	279	2 Yr	40.00	924.94	925.51	925.40	925.58	0.011315	2.13	18.87	48.50	0.60
Brook at 50+72	279	5 Yr	65.00	924.94	927.01	925.50	927.01	0.000144	0.68	107.26	73.71	0.09
Brook at 50+72	279	10 Yr	86.00	924.94	927.69	925.58	927.69	0.000081	0.63	161.79	85.03	0.07
Brook at 50+72	279	25 Yr	116.00	924.94	932.86		932.87	0.000002	0.21	823.56	173.02	0.01
Brook at 50+72	279	50 Yr	139.00	924.94	934.96		934.97	0.000001	0.18	1241.22	229.51	0.01
Brook at 50+72	279	100 Yr	163.00	924.94	935.13		935.13	0.000001	0.21	1280.14	232.20	0.01
Brook at 50+72	252	2 Yr	40.00	923.82	925.53		925.54	0.000268	0.78	55.96	44.97	0.11
Brook at 50+72	252	5 Yr	65.00	923.82	927.01		927.01	0.000060	0.59	130.59	56.23	0.06
Brook at 50+72	252	10 Yr	86.00	923.82	927.69		927.69	0.000049	0.61	170.66	61.43	0.06
Brook at 50+72	252	25 Yr	116.00	923.82	932.86		932.87	0.000002	0.25	759.54	157.00	0.01
Brook at 50+72	252	50 Yr	139.00	923.82	934.96		934.97	0.000001	0.21	1137.50	205.18	0.01
Brook at 50+72	252	100 Yr	163.00	923.82	935.13		935.13	0.000002	0.24	1172.36	208.53	0.01
Brook at 50+72	213	2 Yr	40.00	921.80	925.25	923.65	925.49	0.002277	3.96	10.10	66.47	0.38
Brook at 50+72	213	5 Yr	65.00	921.80	926.65	924.33	926.97	0.001884	4.55	14.30	87.66	0.37
Brook at 50+72	213	10 Yr	86.00	921.80	927.19	924.83	927.64	0.002312	5.41	15.91	90.93	0.41
Brook at 50+72	213	25 Yr	116.00	921.80	932.64	925.49	932.85	0.000398	3.59	32.28	123.70	0.19
Brook at 50+72	213	50 Yr	139.00	921.80	934.96	925.94	934.97	0.000001	0.21	1214.13	221.92	0.01
Brook at 50+72	213	100 Yr	163.00	921.80	935.13	926.41	935.13	0.000001	0.24	1252.53	233.86	0.01
Brook at 50+72	210		Culvert									
Brook at 50+72	146	2 Yr	40.00	919.29	920.26	921.08	923.38	0.157973	14.17	2.82	14.54	2.58
Brook at 50+72	146	5 Yr	65.00	919.29	920.73	921.77	924.42	0.109571	15.42	4.22	16.69	2.29
Brook at 50+72	146	10 Yr	86.00	919.29	922.26	922.26	923.74	0.016438	9.76	8.81	28.77	1.00
Brook at 50+72	146	25 Yr	116.00	919.29	922.92	922.92	924.72	0.015232	10.75	10.79	35.79	1.00
Brook at 50+72	146	50 Yr	139.00	919.29	923.38	923.38	925.41	0.014659	11.43	12.16	40.68	1.00
Brook at 50+72	146	100 Yr	163.00	919.29	923.83	923.83	926.09	0.014206	12.07	13.51	45.47	1.00
Brook at 50+72	101	2 Yr	40.00	918.08	918.74	918.82	919.15	0.044569	5.14	7.78	14.15	1.22
Brook at 50+72	101	5 Yr	65.00	918.08	918.83	919.07	919.62	0.071050	7.15	9.10	14.75	1.58

HEC-RAS Plan: Exst River: Main Channel Reach: Brook at 50+72 (Continued)

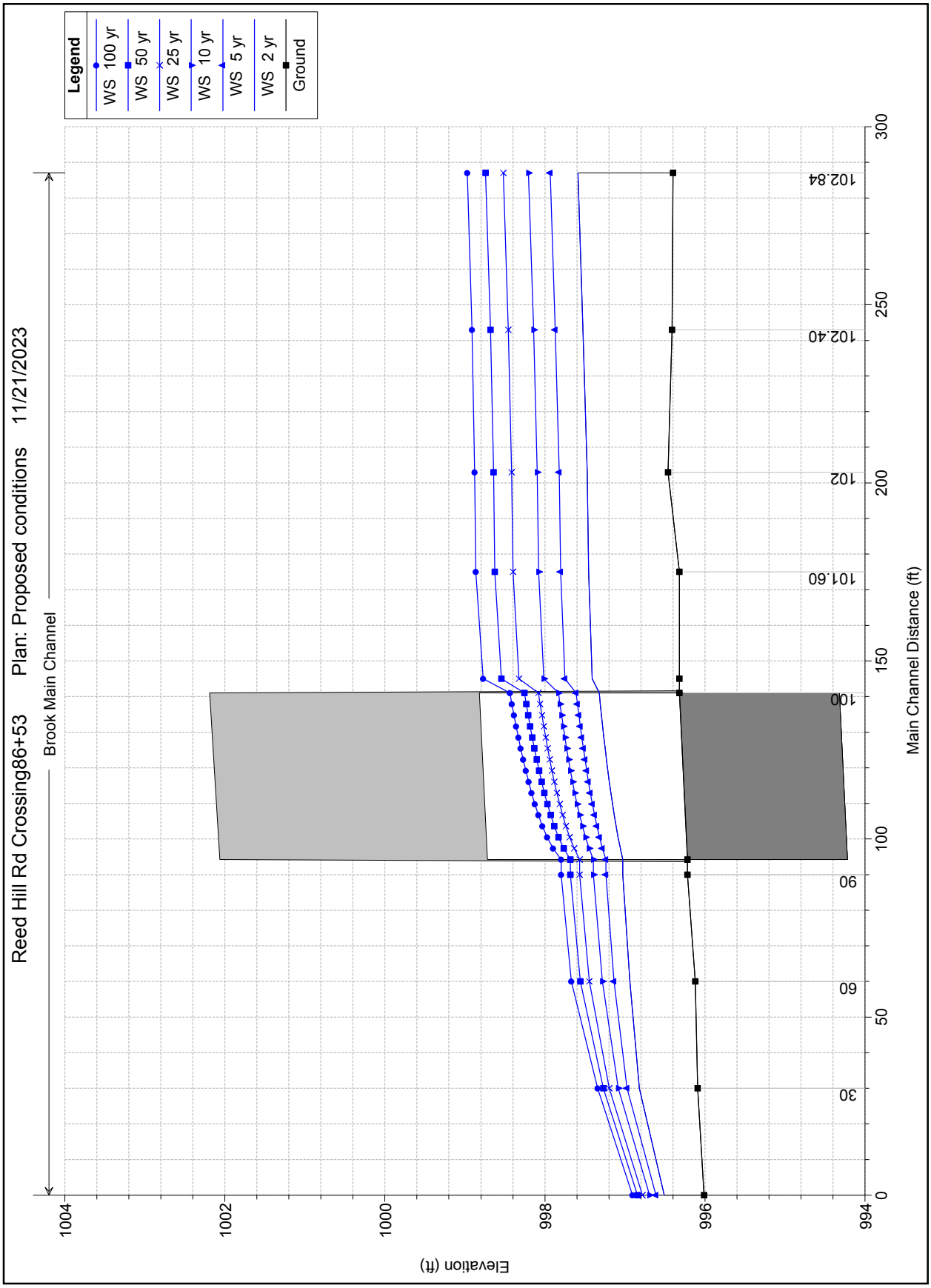
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Brook at 50+72	101	10 Yr	86.00	918.08	918.63	919.27	921.55	0.410756	13.69	6.28	14.00	3.60
Brook at 50+72	101	25 Yr	116.00	918.08	918.71	919.50	922.56	0.445820	15.74	7.37	14.11	3.84
Brook at 50+72	101	50 Yr	139.00	918.08	918.77	919.65	923.26	0.459074	17.01	8.17	14.23	3.95
Brook at 50+72	101	100 Yr	163.00	918.08	918.82	919.79	923.95	0.465437	18.16	8.99	14.69	4.03
Brook at 50+72	46	2 Yr	40.00	914.68	915.39	915.56	915.98	0.079859	6.16	6.49	14.29	1.61
Brook at 50+72	46	5 Yr	65.00	914.68	915.63	915.80	916.27	0.053473	6.40	10.16	15.93	1.40
Brook at 50+72	46	10 Yr	86.00	914.68	915.87	915.97	916.46	0.033671	6.15	14.18	17.60	1.16
Brook at 50+72	46	25 Yr	116.00	914.68	916.01	916.19	916.79	0.037296	7.09	16.77	18.60	1.25
Brook at 50+72	46	50 Yr	139.00	914.68	916.11	916.34	917.03	0.040066	7.75	18.51	19.32	1.31
Brook at 50+72	46	100 Yr	163.00	914.68	916.19	916.49	917.28	0.042985	8.43	20.12	20.15	1.37
Brook at 50+72	0	2 Yr	40.00	910.05	910.97	911.22	911.77	0.105045	7.14	5.60	12.10	1.85
Brook at 50+72	0	5 Yr	65.00	910.05	911.09	911.45	912.39	0.145922	9.12	7.13	13.65	2.22
Brook at 50+72	0	10 Yr	86.00	910.05	911.12	911.62	913.13	0.217622	11.36	7.57	14.06	2.73
Brook at 50+72	0	25 Yr	116.00	910.05	911.28	911.85	913.43	0.177670	11.74	9.88	14.92	2.54
Brook at 50+72	0	50 Yr	139.00	910.05	911.39	912.01	913.64	0.156288	12.03	11.56	15.17	2.43
Brook at 50+72	0	100 Yr	163.00	910.05	911.50	912.16	913.87	0.140339	12.34	13.21	15.25	2.34

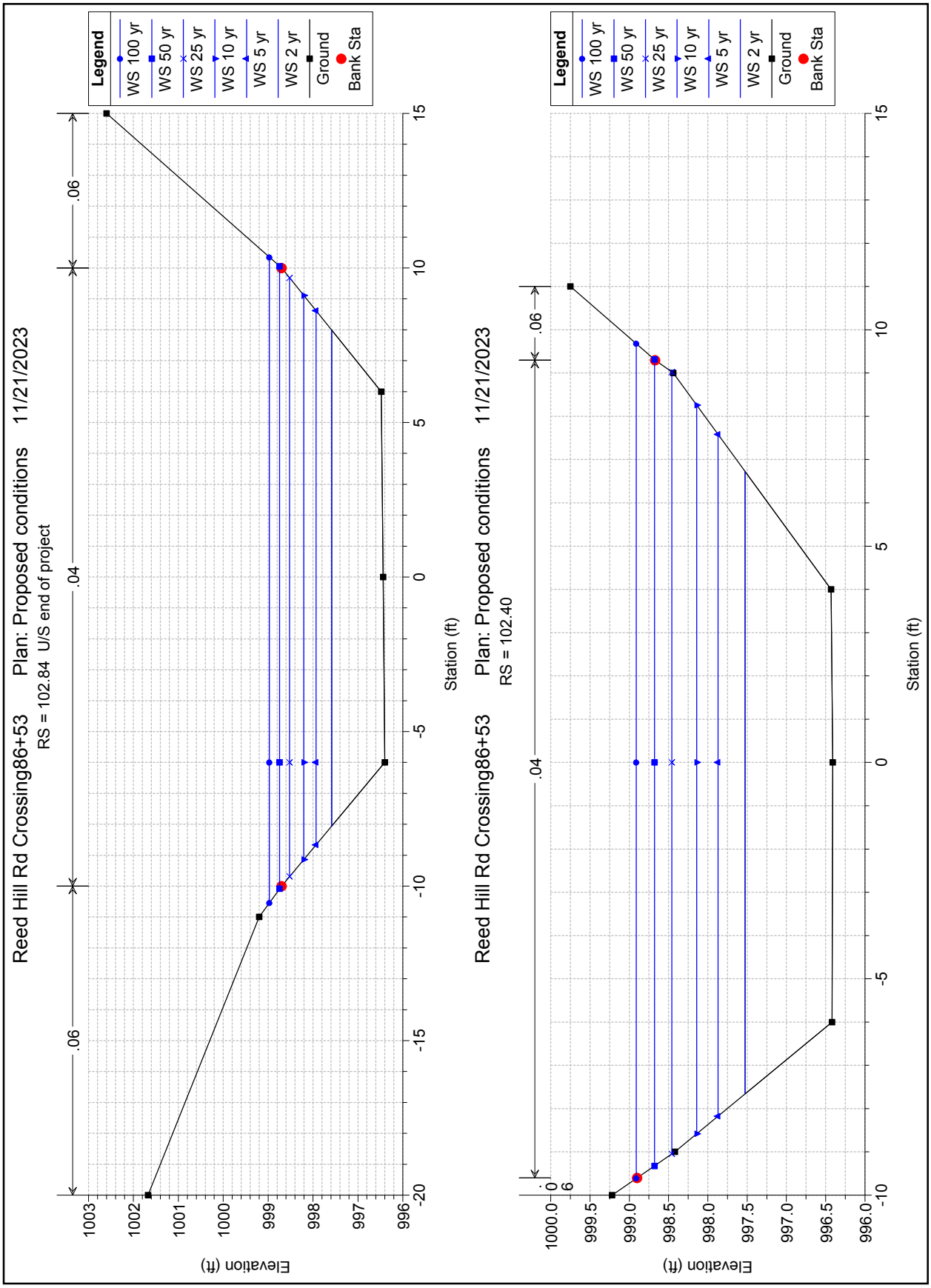
HEC-RAS Computed Results for crossing 86+53 proposed

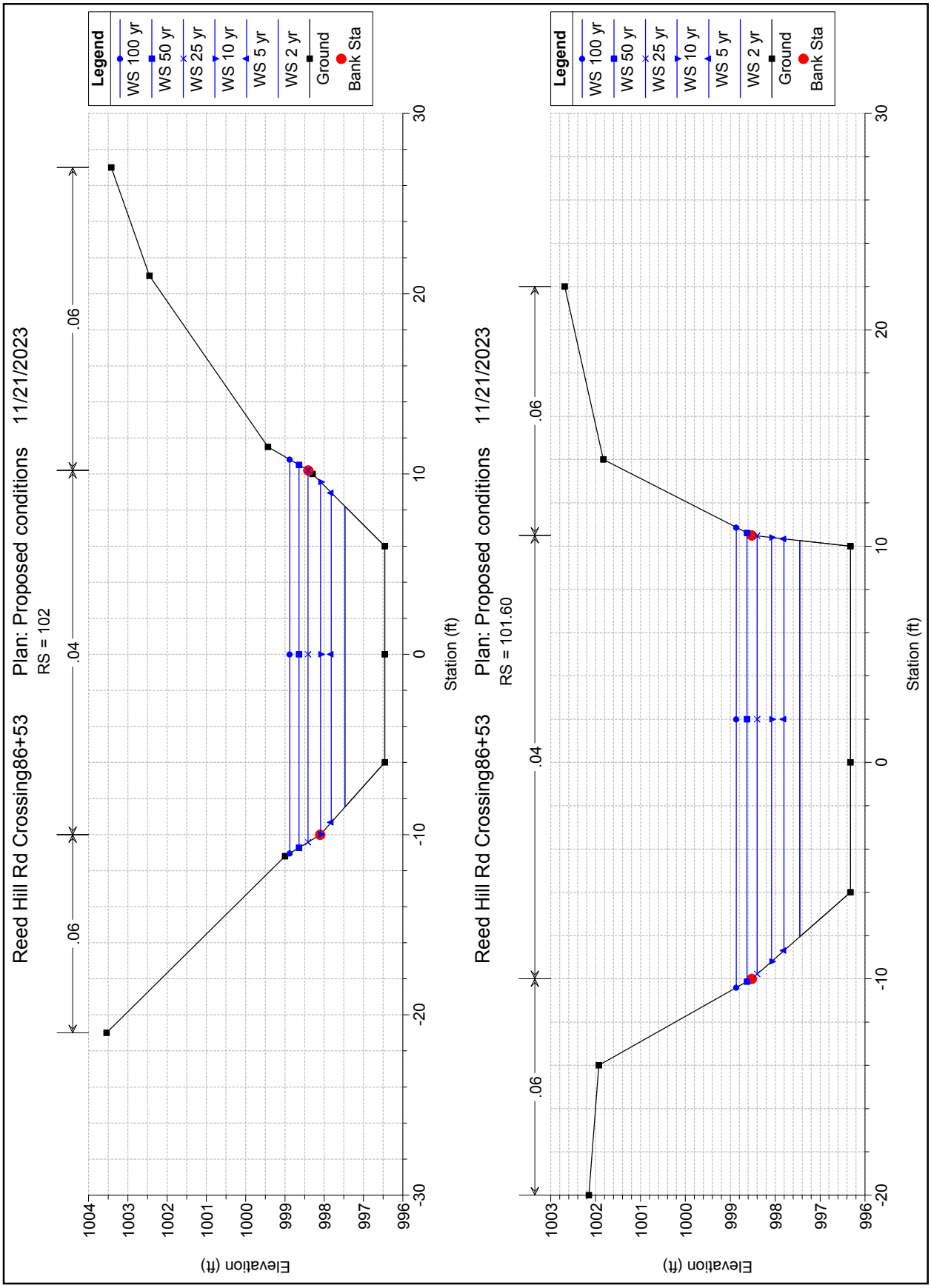
HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ.MILES)	0.33
DESIGN FLOOD DISCHARGE (C.F.S)	52
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S)	3.22
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.32
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S)	73
BASE FLOOD ELEVATION (FEET, NAVD)	998.77
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY	25
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY	100
FLOOD OF RECORD	
DISCHARGE (C.F.S)	Unknown
FREQUENCY (IF KNOWN, YEARS)	Unknown
MAXIMUM ELEVATION (FEET, NAVD)	Unknown
DATE (MM/YYYY)	Unknown
HISTORY OF ICE FLOCS	Unknown

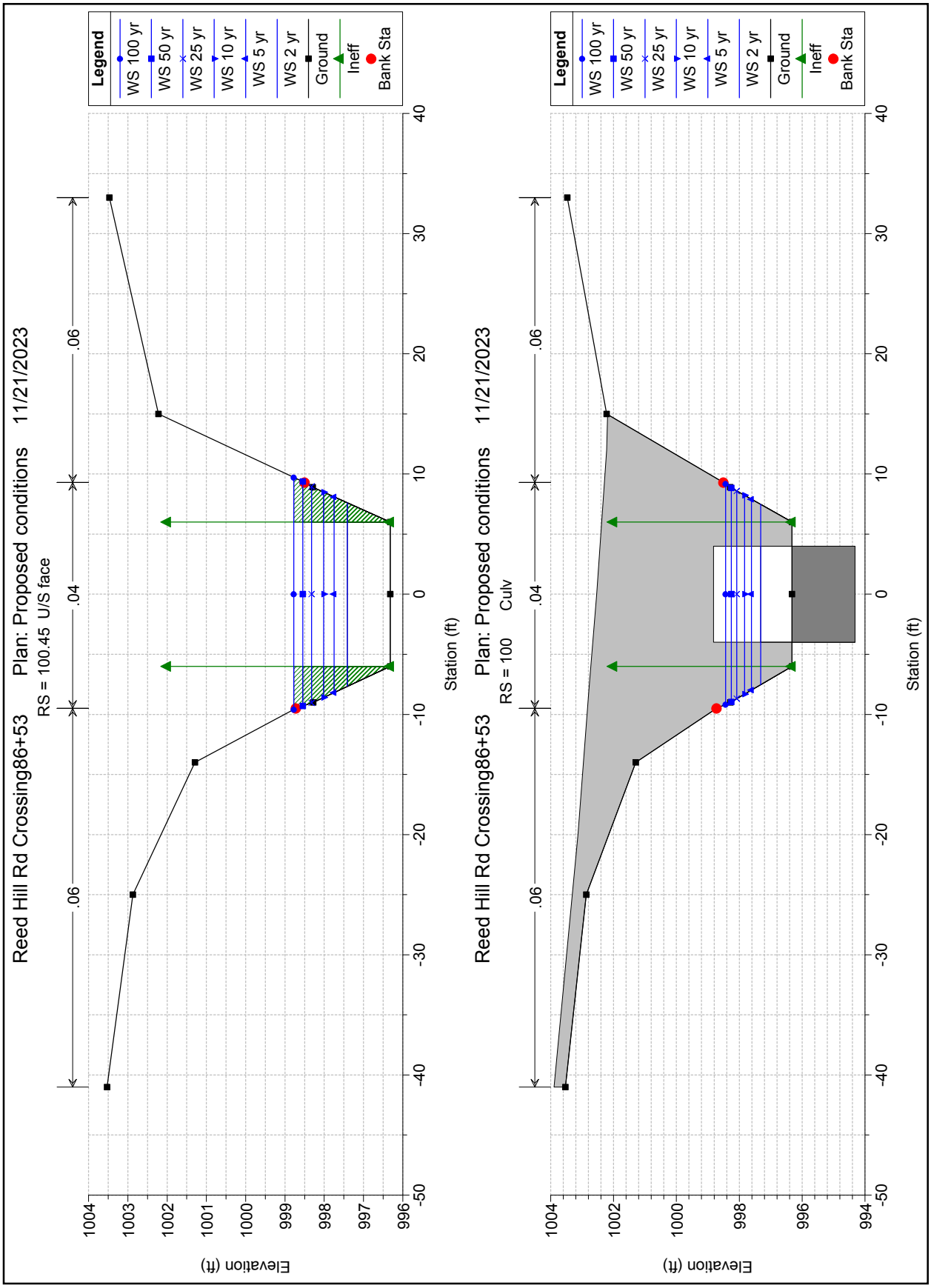
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S)	18
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY	8.91
DESIGN FLOOD ELEVATION (FEET,NAVD)	1001.42

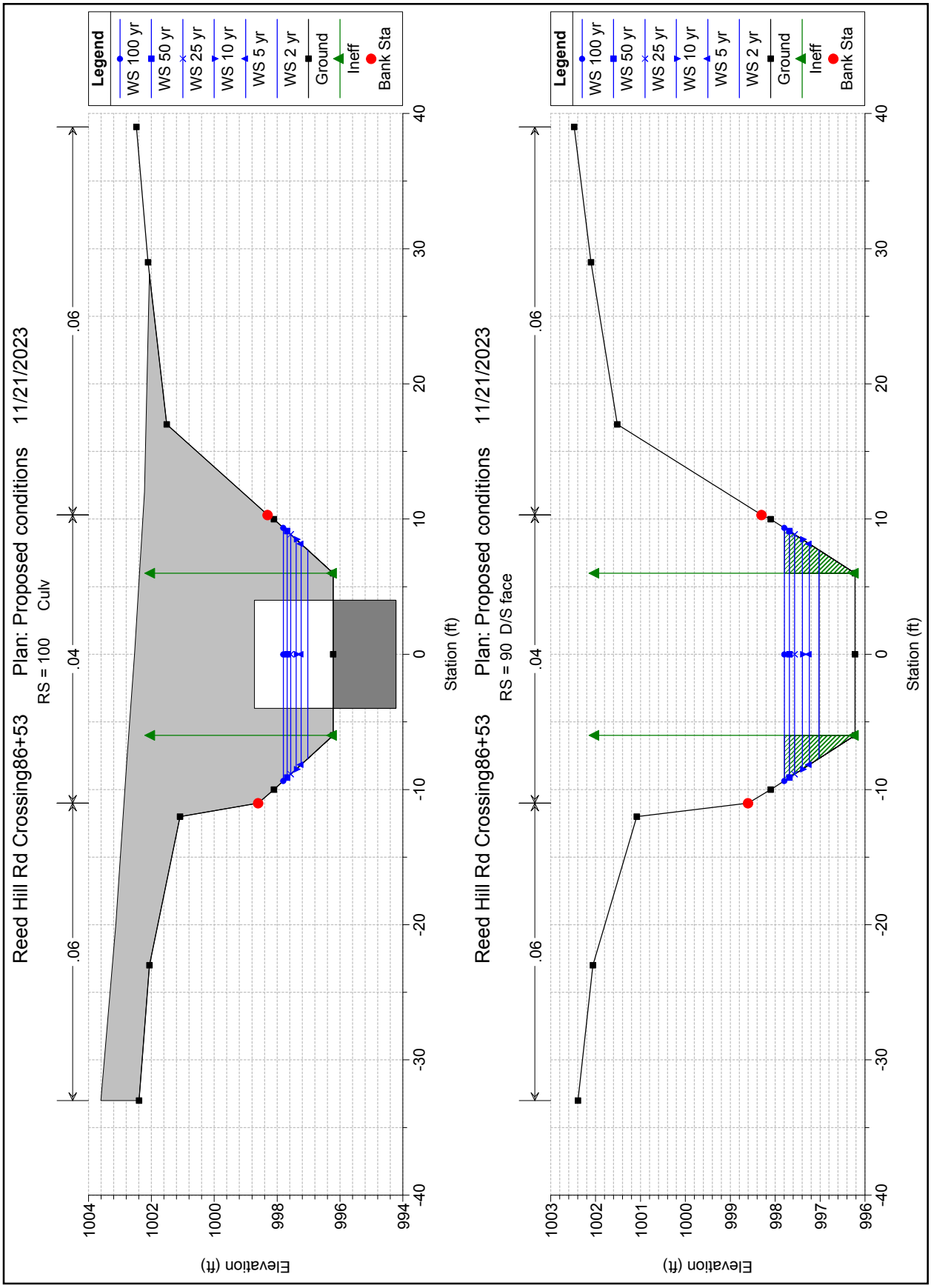
Section	Length (ft)	Span (ft)	Rise (ft)	Invert (u/s)	Invert (d/s)
R.C Box Culvert	50	8	4.5	994.32	994.22

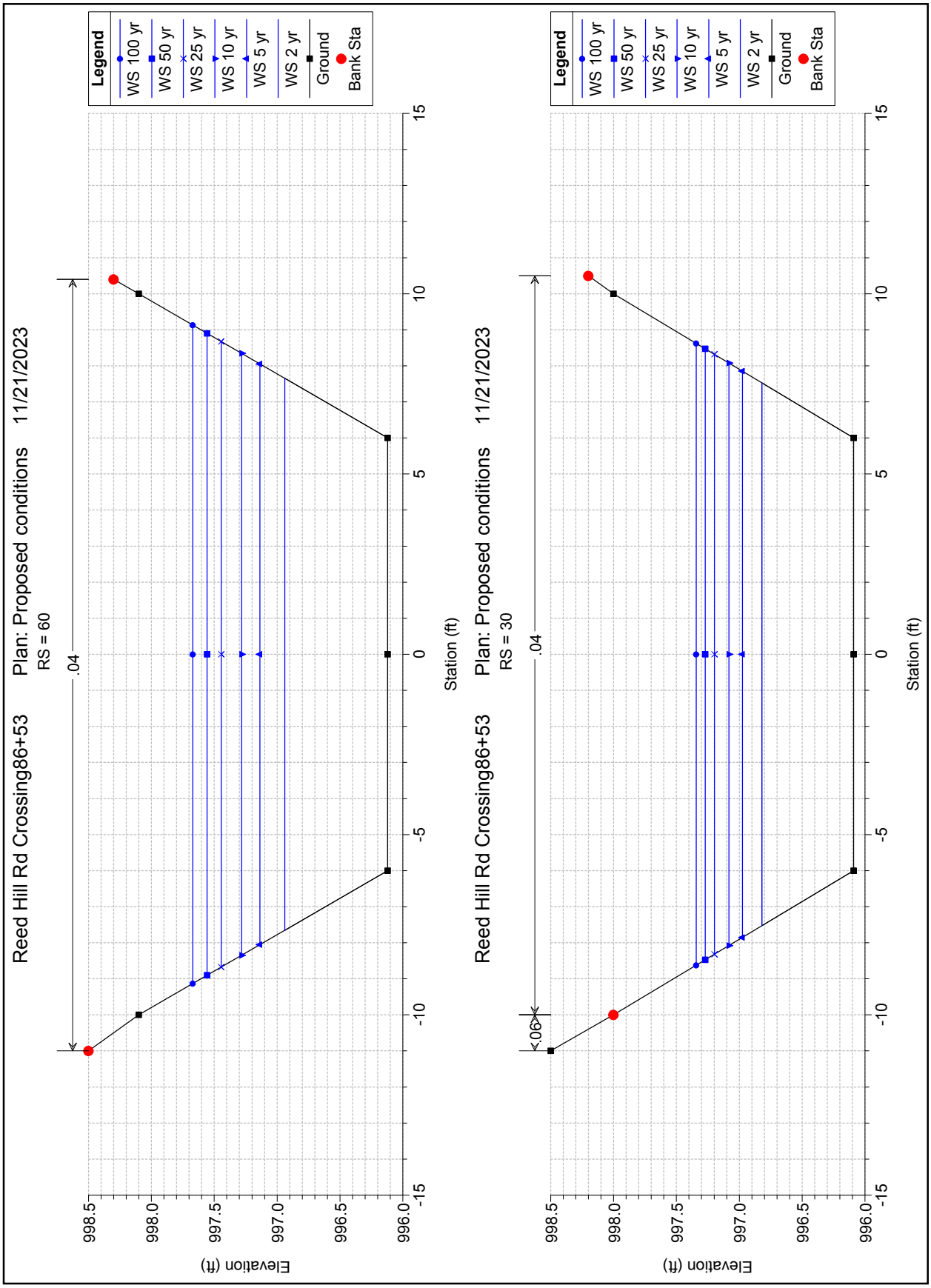

Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
Brook Main Channel
Elevation (ft)
Main Channel Distance (ft)
1004
1002
1000
998
996
994
300
250
200
150
100
90
60
50
30
0
102.84
102.40
102
101.60
100

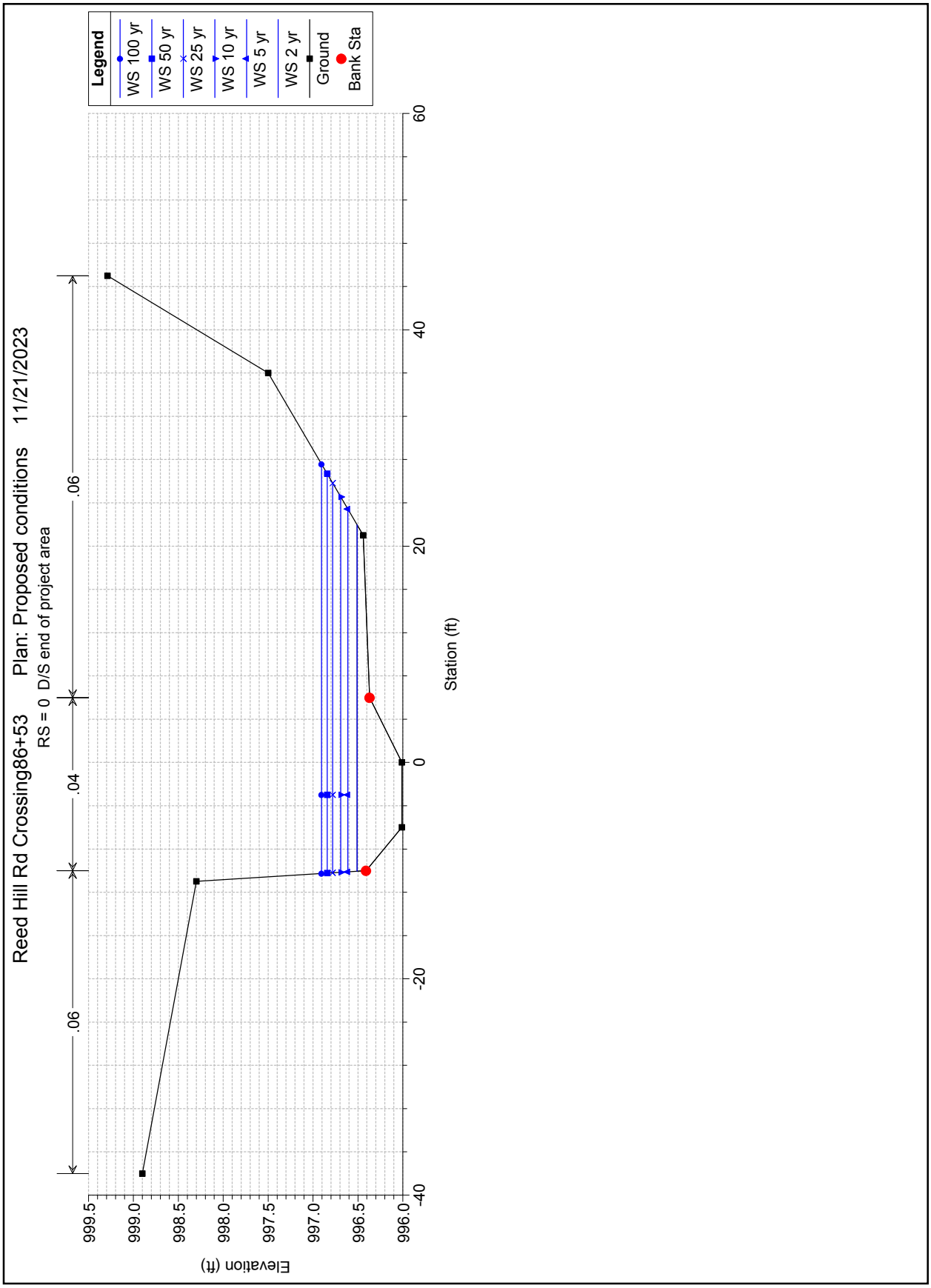

Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.84 U/S end of project
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
1003
1002
1001
1000
999
998
997
996
15
10
5
0
-5
-10
-15
-20
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102.40
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
1000.0
999.5
999.0
998.5
998.0
997.5
997.0
996.5
996.0
15
10
5
0
-5
-10


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 102
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 101.60
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100.45 U/S face
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100 Culv
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
.06
.04
.06
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 100
Culv
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 90
D/S face
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 60
.04
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
998.5
998.0
997.5
997.0
996.5
996.0
15
10
5
0
-5
-10
-15
Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 30
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reed Hill Rd Crossing86+53
Plan: Proposed conditions
11/21/2023
RS = 0 D/S end of project area
.06
.04
.06
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
999.5
999.0
998.5
998.0
997.5
997.0
996.5
996.0
-40
-20
0
20
40
60
Station (ft)

HEC-RAS Plan: prop River: Brook Reach: Main Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	102.84	2 yr	18.00	996.40	997.59	996.84	997.61	0.000952	1.12	16.08	16.06	0.20
Main Channel	102.84	5 yr	29.00	996.40	997.93	996.99	997.96	0.000986	1.33	21.88	17.29	0.21
Main Channel	102.84	10 yr	39.00	996.40	998.21	997.10	998.24	0.000992	1.46	26.72	18.25	0.21
Main Channel	102.84	25 yr	52.00	996.40	998.52	997.24	998.56	0.000986	1.59	32.64	19.37	0.22
Main Channel	102.84	50 yr	62.00	996.40	998.74	997.33	998.79	0.000966	1.67	37.02	20.14	0.22
Main Channel	102.84	100 yr	73.00	996.40	998.97	997.43	999.02	0.000908	1.75	41.71	20.89	0.21
Main Channel	102.40	2 yr	18.00	996.41	997.53		997.55	0.001475	1.33	13.50	14.38	0.24
Main Channel	102.40	5 yr	29.00	996.41	997.87		997.91	0.001473	1.55	18.70	15.76	0.25
Main Channel	102.40	10 yr	39.00	996.41	998.14		998.19	0.001444	1.69	23.12	16.84	0.25
Main Channel	102.40	25 yr	52.00	996.41	998.46		998.51	0.001393	1.82	28.63	18.07	0.25
Main Channel	102.40	50 yr	62.00	996.41	998.68		998.74	0.001332	1.90	32.71	18.64	0.25
Main Channel	102.40	100 yr	73.00	996.41	998.91		998.97	0.001248	1.97	37.10	19.29	0.25
Main Channel	102	2 yr	18.00	996.46	997.47		997.49	0.001395	1.24	14.48	16.66	0.24
Main Channel	102	5 yr	29.00	996.46	997.82		997.85	0.001276	1.41	20.59	18.28	0.23
Main Channel	102	10 yr	39.00	996.46	998.10		998.13	0.001197	1.51	25.80	19.54	0.23
Main Channel	102	25 yr	52.00	996.46	998.42		998.46	0.001068	1.62	32.24	20.64	0.23
Main Channel	102	50 yr	62.00	996.46	998.64		998.69	0.000972	1.69	36.99	21.23	0.22
Main Channel	102	100 yr	73.00	996.46	998.88		998.93	0.000897	1.75	42.05	21.84	0.22
Main Channel	101.60	2 yr	18.00	996.32	997.45		997.47	0.000625	0.93	19.44	18.32	0.16
Main Channel	101.60	5 yr	29.00	996.32	997.80		997.82	0.000662	1.12	25.98	19.03	0.17
Main Channel	101.60	10 yr	39.00	996.32	998.08		998.10	0.000680	1.25	31.30	19.60	0.17
Main Channel	101.60	25 yr	52.00	996.32	998.40		998.43	0.000690	1.38	37.71	20.25	0.18
Main Channel	101.60	50 yr	62.00	996.32	998.63		998.66	0.000680	1.46	42.37	20.74	0.18
Main Channel	101.60	100 yr	73.00	996.32	998.86		998.90	0.000657	1.55	47.33	21.27	0.18
Main Channel	100.45	2 yr	18.00	996.32	997.41	996.73	997.44	0.001225	1.38	13.08	15.27	0.23
Main Channel	100.45	5 yr	29.00	996.32	997.75	996.88	997.79	0.001288	1.69	17.15	16.29	0.25
Main Channel	100.45	10 yr	39.00	996.32	998.01	997.01	998.07	0.001319	1.92	20.34	17.09	0.26
Main Channel	100.45	25 yr	52.00	996.32	998.32	997.16	998.40	0.001340	2.16	24.06	18.02	0.27
Main Channel	100.45	50 yr	62.00	996.32	998.54	997.26	998.63	0.001347	2.32	26.69	18.67	0.27
Main Channel	100.45	100 yr	73.00	996.32	998.77	997.37	998.87	0.001349	2.48	29.43	19.31	0.28
Main Channel	100		Culvert									
Main Channel	90	2 yr	18.00	996.22	997.03	996.63	997.08	0.003347	1.86	9.67	15.43	0.37
Main Channel	90	5 yr	29.00	996.22	997.24	996.79	997.33	0.003986	2.37	12.22	16.33	0.41
Main Channel	90	10 yr	39.00	996.22	997.39	996.91	997.51	0.004479	2.77	14.09	17.00	0.45

HEC-RAS Plan: prop River: Brook Reach: Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel	90	25 yr	52.00	996.22	997.57	997.06	997.73	0.005057	3.22	16.15	17.73	0.49
Main Channel	90	50 yr	62.00	996.22	997.68	997.17	997.88	0.005461	3.54	17.54	18.22	0.52
Main Channel	90	100 yr	73.00	996.22	997.80	997.28	998.03	0.005871	3.86	18.93	18.71	0.54
Main Channel	60	2 yr	18.00	996.12	996.94		996.98	0.002948	1.61	11.18	15.31	0.33
Main Channel	60	5 yr	29.00	996.12	997.14		997.20	0.003645	2.03	14.28	16.11	0.38
Main Channel	60	10 yr	39.00	996.12	997.28		997.37	0.004144	2.34	16.67	16.70	0.41
Main Channel	60	25 yr	52.00	996.12	997.45		997.56	0.004663	2.67	19.45	17.35	0.45
Main Channel	60	50 yr	62.00	996.12	997.56		997.69	0.004990	2.90	21.41	17.81	0.47
Main Channel	60	100 yr	73.00	996.12	997.67		997.82	0.005291	3.11	23.46	18.26	0.48
Main Channel	30	2 yr	18.00	996.09	996.82		996.87	0.004345	1.82	9.88	15.06	0.40
Main Channel	30	5 yr	29.00	996.09	996.97		997.06	0.005849	2.37	12.25	15.70	0.47
Main Channel	30	10 yr	39.00	996.09	997.08	996.75	997.20	0.007099	2.79	13.98	16.16	0.53
Main Channel	30	25 yr	52.00	996.09	997.20	996.88	997.36	0.008642	3.28	15.86	16.64	0.59
Main Channel	30	50 yr	62.00	996.09	997.27	996.98	997.48	0.009811	3.63	17.10	16.95	0.64
Main Channel	30	100 yr	73.00	996.09	997.34	997.07	997.59	0.011118	3.99	18.30	17.24	0.68
Main Channel	0	2 yr	18.00	996.01	996.51	996.49	996.62	0.020035	2.76	7.67	32.01	0.79
Main Channel	0	5 yr	29.00	996.01	996.61	996.59	996.76	0.020008	3.24	11.09	33.54	0.82
Main Channel	0	10 yr	39.00	996.01	996.69	996.66	996.86	0.020010	3.58	13.78	34.70	0.84
Main Channel	0	25 yr	52.00	996.01	996.78	996.75	996.98	0.020022	3.95	16.93	36.01	0.86
Main Channel	0	50 yr	62.00	996.01	996.84	996.81	997.07	0.020016	4.20	19.19	36.92	0.88
Main Channel	0	100 yr	73.00	996.01	996.91	996.87	997.15	0.020015	4.44	21.54	37.84	0.89

APPENDIX F

Drainage Swales

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 11+50 Lt to STA 13+50 Lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.41	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.031	ft/ft	
	τ		0.79	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA14+50 to 17+00 LT

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon d S$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow From Express Calcs	0.63	ft	(10 year)
S	avg. bed slope	0.035	ft/ft	

τ	1.38	lb/ft^2

Rock Riprap (6" diameter) (Permissible Unit Shear Stress 2.00 lb/ft^2)

D50 bottom	5	in

$D50_{sides} = K_1/K_2 * (D50)_{bottom}$

K1 Ratio of shear streese on sides and bottom
Side slope of 2:1
B/d 1.59

K1	0.87

K2 Ratio of tractive force on the sides and bootm using Fig. 7-10
Angle of repose is 42°

K2	0.77

$D50_{sides}$	5.65	in

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA31+65 Lt to STA40+40

SWALE LINING DESIGN

B	Base width	1	ft	
	Side Slopes	2	ft/ft	

Equation 7.12 Maximum Shear Stress

$\tau = \Upsilon d S$

Υ	Unit Weight of Water	62.4	lb/ft^3	
d	max. dept of flow	0.57	ft	(10 year)
	From Express Calcs			
S	avg. bed slope	0.047	ft/ft	

τ	1.67	lb/ft^2

Rock Riprap (6" diameter) (Permissible Unit Shear Stress 2.00 lb/ft^2)

D50 bottom	5	in

$D50_{sides} = K_1/K_2 * (D50)_{bottom}$

K1 Ratio of shear streese on sides and bottom
Side slope of 2:1
B/d 1.75

K1	0.87

K2 Ratio of tractive force on the sides and bootm using Fig. 7-10
Angle of repose is 42°

K2	0.77

$D50_{sides}$	5.65	in

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA40+40 Lt to STA 46+50 lt

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow	0.35	ft	(10 year)
		From Express Calcs			
	S	avg. bed slope	0.016	ft/ft	
	τ		0.35	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

PROJECT:
MONSON ROAD RECONSTRUCTION
WALES, MA
JOB NO: 2170841

STA 70+50 TO 72+75

SWALE LINING DESIGN

	B	Base width	1	ft	
		Side Slopes	2	ft/ft	
Equation 7.12	Maximum Shear Stress				
	$\tau = \Upsilon dS$				
	Υ	Unit Weight of Water	62.4	lb/ft^3	
	d	max. dept of flow From Express Calcs	0.46	ft	(10 year)
	S	avg. bed slope	0.03	ft/ft	
	τ		0.86	lb/ft^2	

Turf Establishment (Permissible Unit Shear Strees 1.0 lb/ft^2)

Proposing modified rockfill to comply with MassDOT PDDG standards for a swale with 3% slope

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 11+50 to 13+50

Trapezoidal

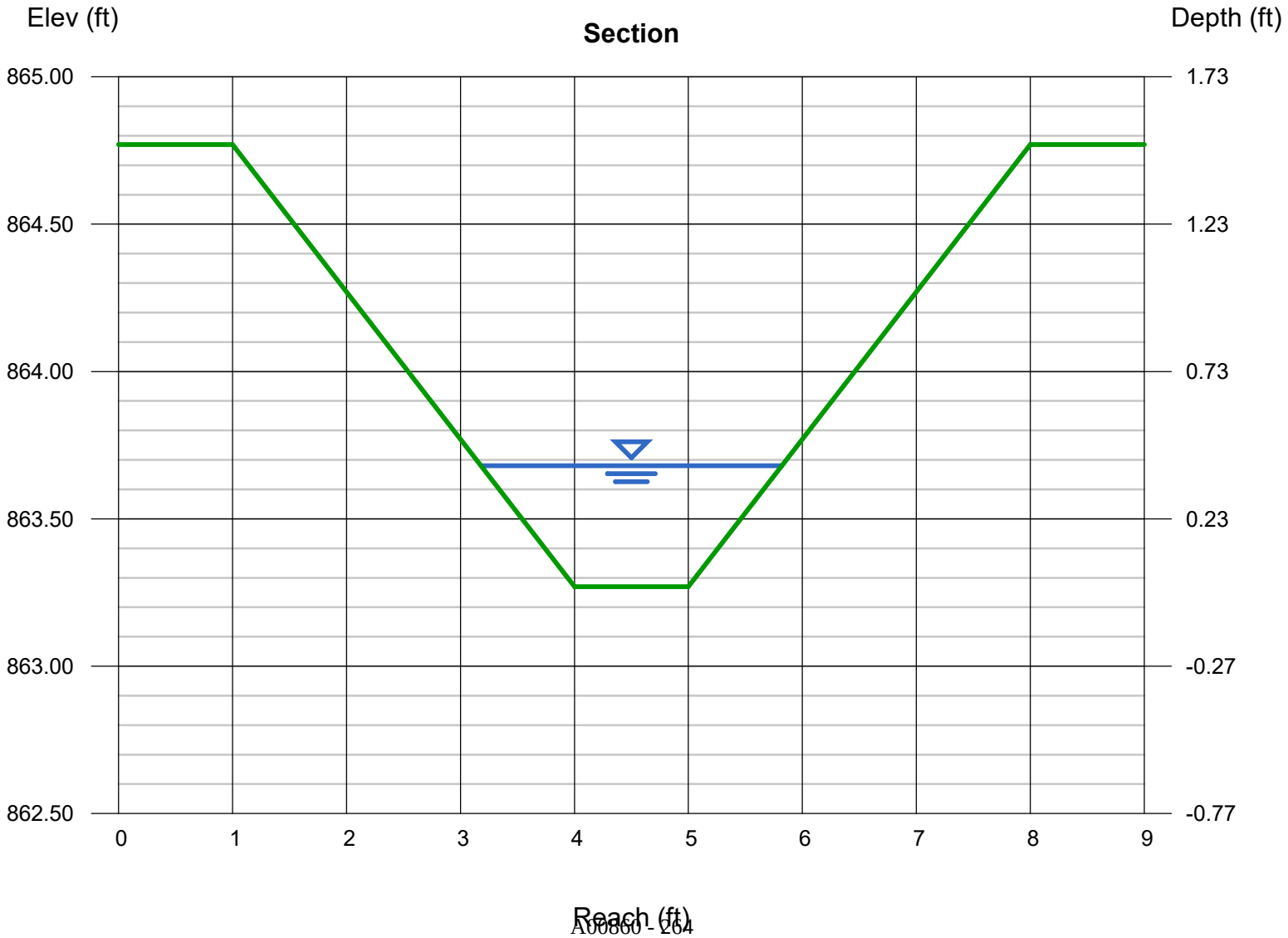
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 863.27
Slope (%)	= 3.10
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.38

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 2.380
Area (sqft)	= 0.75
Velocity (ft/s)	= 3.19
Wetted Perim (ft)	= 2.83
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 2.64
EGL (ft)	= 0.57



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 12 2020

Sta. 14+50 to 17+00

Trapezoidal

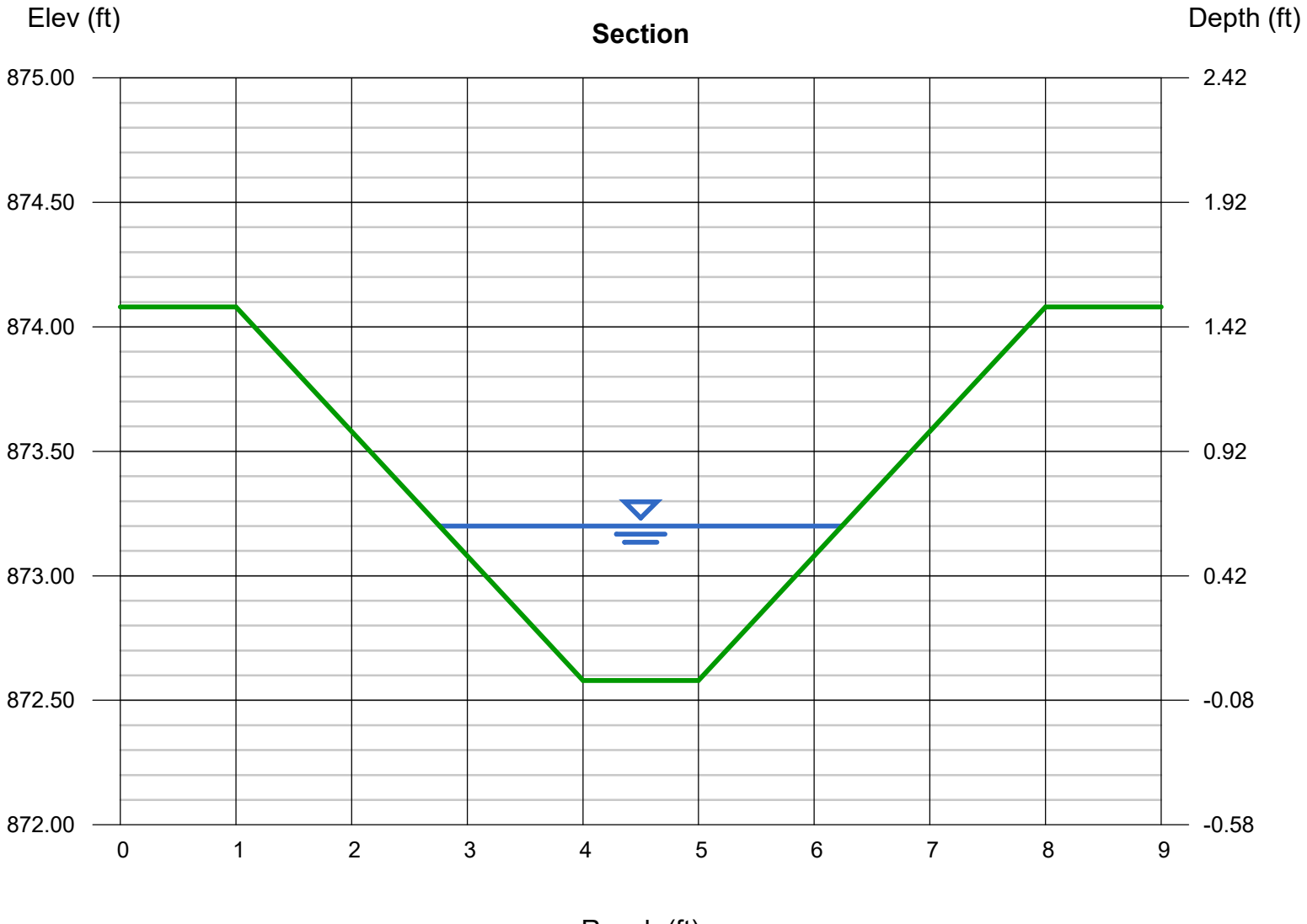
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 872.58
Slope (%)	= 3.90
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.14

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 6.140
Area (sqft)	= 1.39
Velocity (ft/s)	= 4.42
Wetted Perim (ft)	= 3.77
Crit Depth, Yc (ft)	= 0.69
Top Width (ft)	= 3.48
EGL (ft)	= 0.92



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 31+65

Trapezoidal

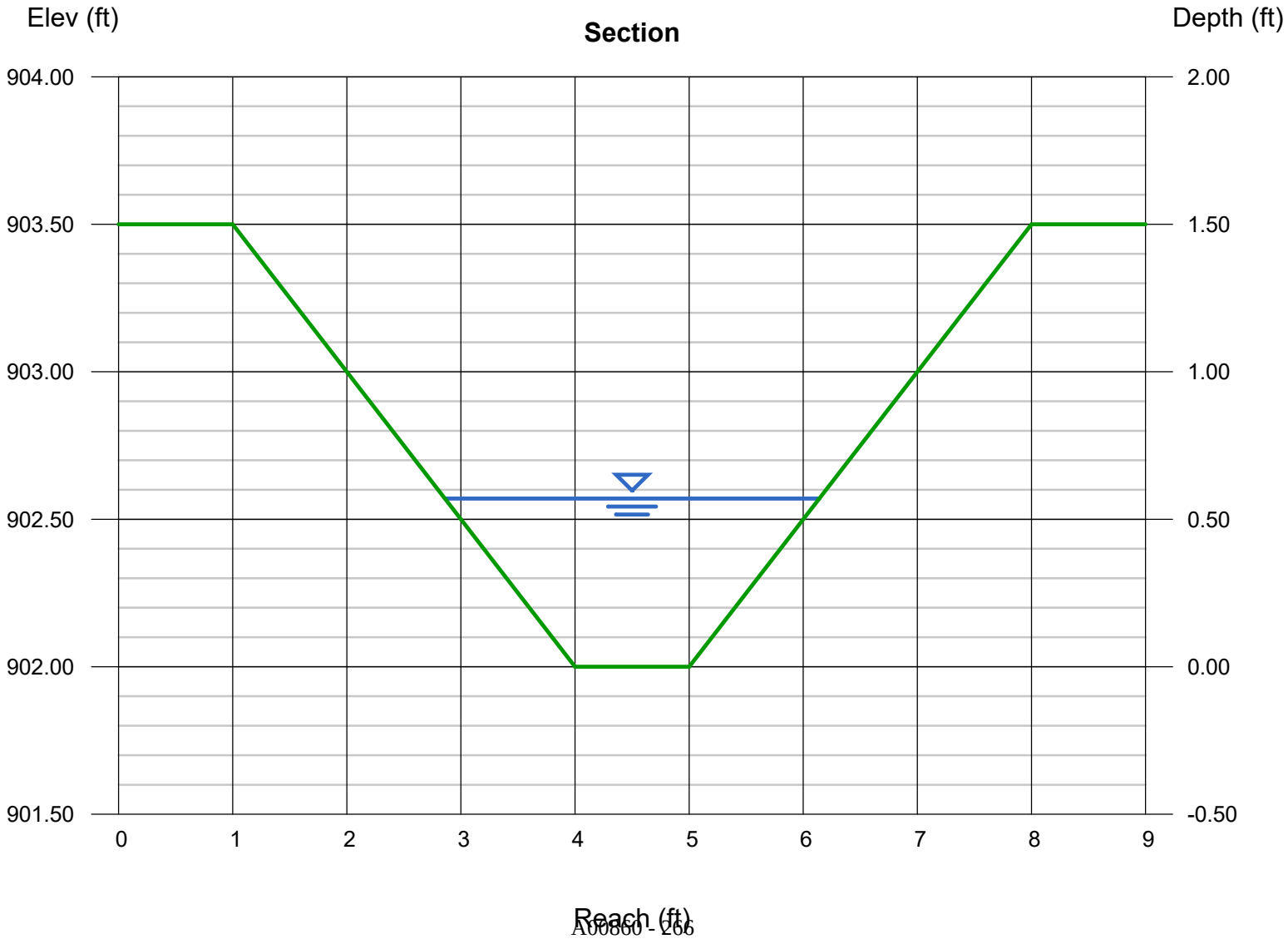
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 902.00
Slope (%)	= 4.70
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.66

Highlighted

Depth (ft)	= 0.57
Q (cfs)	= 5.660
Area (sqft)	= 1.22
Velocity (ft/s)	= 4.64
Wetted Perim (ft)	= 3.55
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 3.28
EGL (ft)	= 0.90



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

Sta. 43+70

Trapezoidal

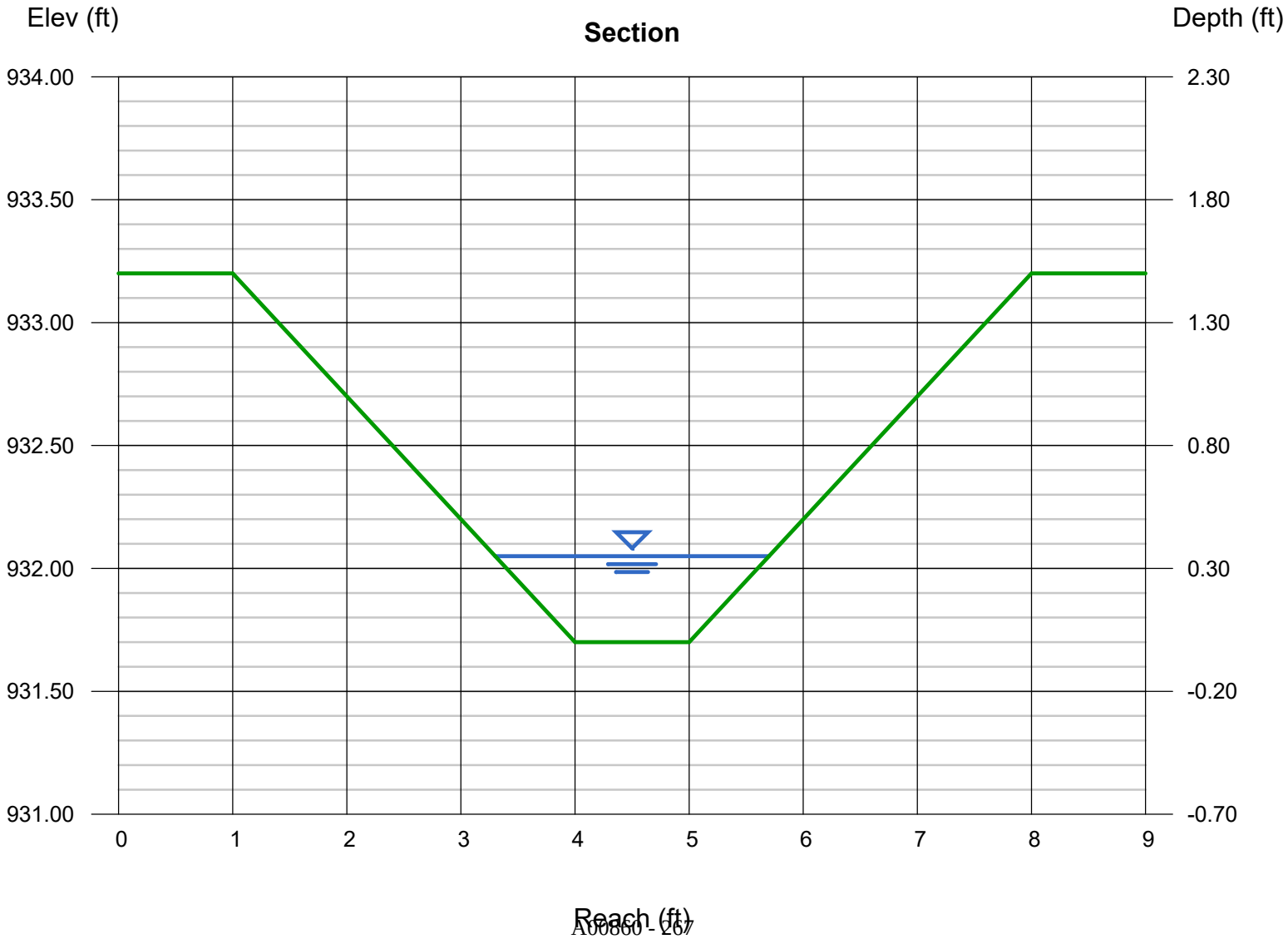
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 931.70
Slope (%)	= 1.60
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.23

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 1.230
Area (sqft)	= 0.59
Velocity (ft/s)	= 2.07
Wetted Perim (ft)	= 2.57
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 2.40
EGL (ft)	= 0.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 30 2023

Sta. 46+65

Triangular

Side Slopes (z:1)	= 6.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 930.00
Slope (%)	= 0.66
N-Value	= 0.033

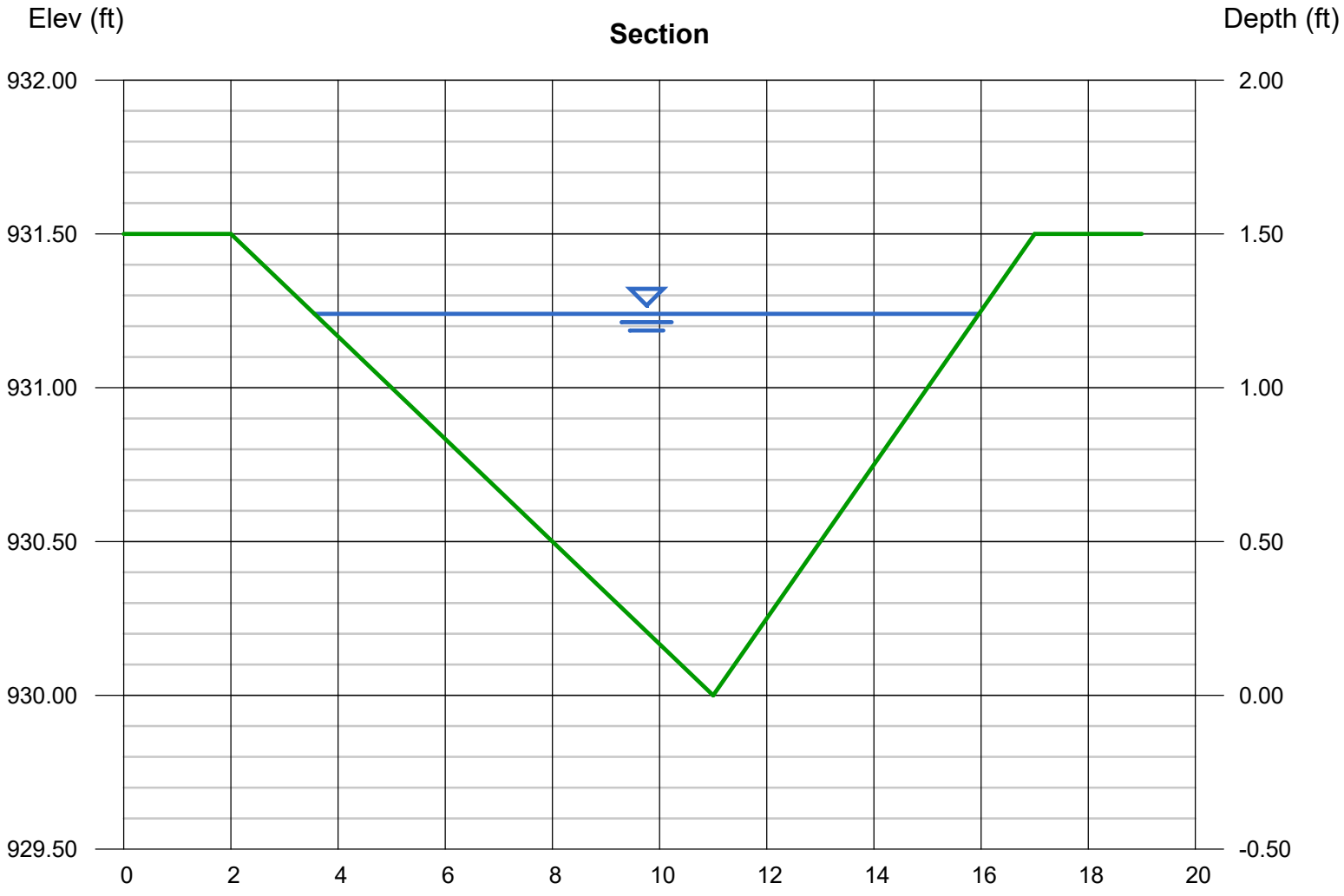
Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 20.00
Area (sqft)	= 7.69
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 12.66
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 12.40
EGL (ft)	= 1.35

Assuming diverted flow from Sta. 43+76 crossing - normal flow without diversion is 1.60 cfs



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 14 2021

STA 72+75

Trapezoidal

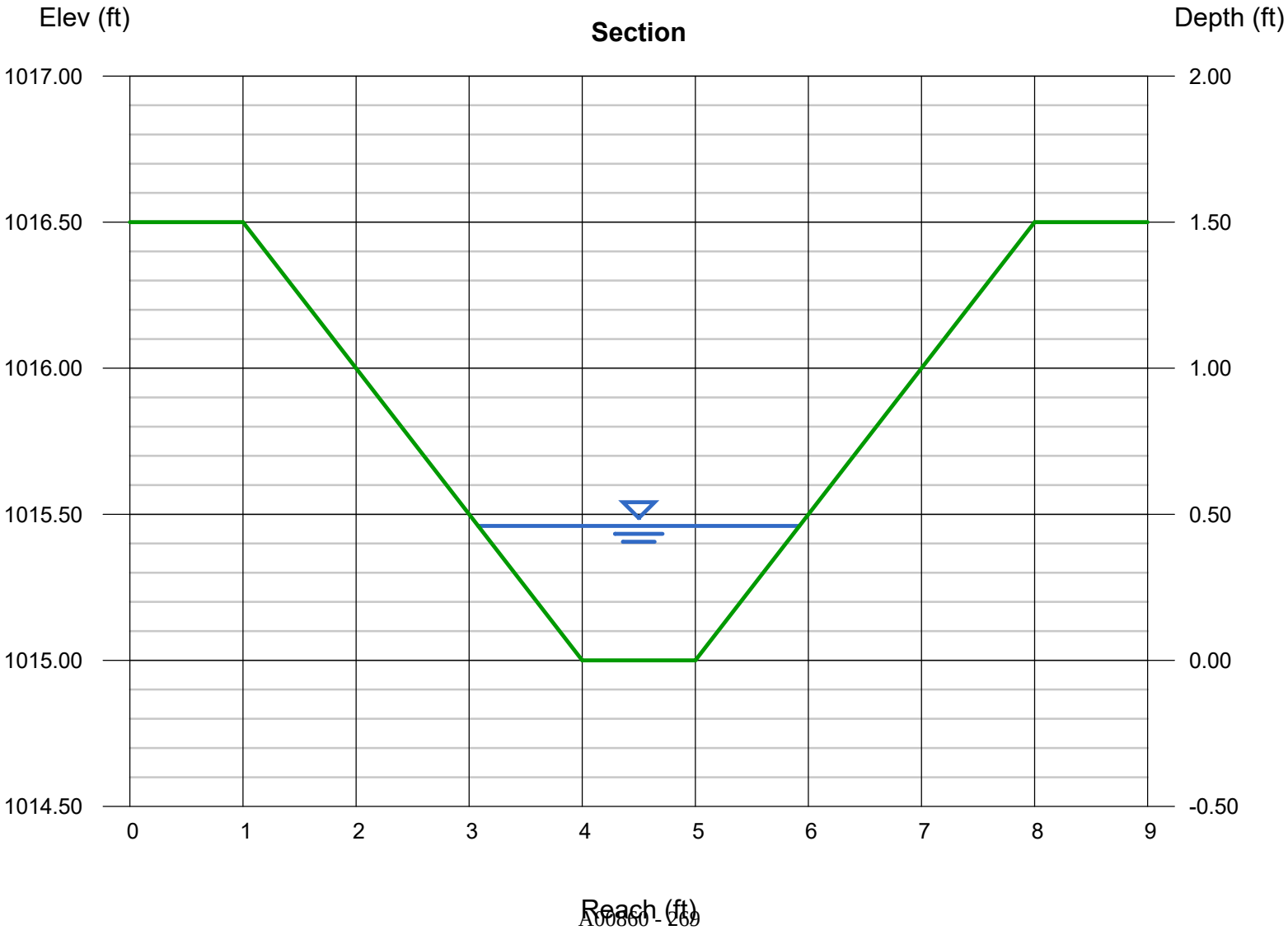
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1015.00
Slope (%)	= 3.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.94

Highlighted

Depth (ft)	= 0.46
Q (cfs)	= 2.940
Area (sqft)	= 0.88
Velocity (ft/s)	= 3.33
Wetted Perim (ft)	= 3.06
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 2.84
EGL (ft)	= 0.63



Monson Road Reconstruction
Wales, MA

Weston&Sampson ENGINEERS, INC.

Date: 4/8/2024
By: NSD
Checked By: RSV

TABLE 1

PROPOSED DRAINAGE AREA SUMMARY SHEET
HYDRAFLOW ANALYSIS

i = 7.21 for 5 min
i = 4.00 for 15 min. Tc
10-yr Storm

Area		Area (s.f)	Area (ac.)	Impervious Area (s.f)	Grass Area (s.f)	Woods Area (s.f)	C-Value	Tc (min.)	Q=CiA
Proposed Drainage System									
	STA 11+50								
Swale		146,424	**3.361**	5,227	141,197		0.32	15	4.32
	STA 15+30								
Swale		263,398	**6.047**	14,906	88,478	160,014	0.27	15	6.61
	STA 31+65								
Swale		261,651	**6.007**	16,212	18,800	226,639	0.25	15	6.02
	STA 43+70								
Swale		33,770	**0.775**	9,772	6,265	17,733	0.42	15	1.31
	STA 46+65								
Swale		48,946	**1.124**	2,570	13,201	33,175	0.26	8	1.76
	STA 72+75								
Swale		161,325	**3.704**	5,642	6,630	149,053	0.23	15	3.39

NOTES:
1) Refer to DA-1 - 3 for drainage areas.
2) C-Values were used based on Exhibit 8-8 of the MassDOT Project Development and Design Guide. Values given below.
3) Time of Concentrations (Tc) derived from Hydraflow (TR-55 Method). Refer to Tc computations included.
4) Minimum Tc used for paved areas = 5 min. and grassy areas = 10 min.

Land Cover		C
Impervious		0.9
Grass		0.3
Unimproved (Woods)		0.2

APPENDIX G

Outlet Protection

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 15+33					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.29	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	9.86			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.74	ft	8.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT
Depth=	$3.3D_{50}$	2.45	FT
W1= 3Wo	(min.)	4.5	FT
W2=3Wo + 2/3L		11.17	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	4	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 22+25					
Wo	pipe diameter or span	(ft)	1.25			Input
Q	pipe(design) discharge	(cfs)	5.55	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1.25			
	Velocity	(ft/s)	5.36			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.44	ft	17.31	in

Calculated Riprap Apron Dimensions

L=	4D	5.00	FT
Depth=	$3.3D_{50}$	4.76	FT
W1= 3Wo	(min.)	3.75	FT
W2=3Wo + 2/3L		7.08	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 25+00					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.22	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	4.53

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.26	ft	3.09	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	0.85	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	7.5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 43+76	Twin 12" diameter pipes				
Wo	pipe diameter or span	(ft)	2			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.32	(HY-8)		
D	pipe rise	(ft)	2			

Velocity	(ft/s)	6.27

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.71	ft	8.54	in

Calculated Riprap Apron Dimensions

L=	4D	8.00	FT
Depth=	$3.3D_{50}$	2.35	FT
W1= 3Wo	(min.)	6	FT
W2=3Wo + 2/3L		12.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	16	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 46+65					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	12.5	25-yr storm		Output
TW	tailwater depth	(ft)	0.94	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	6.75

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.61	ft	7.32	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.01	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	3	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 50+55					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	2.05	25-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	3.5

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.51	ft	6.18	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	1.70	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 51+20					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.75	10-yr storm		Output
TW	tailwater depth	(ft)	0.1	(HY-8)		
D	pipe rise	(ft)	1			

Velocity	(ft/s)	5.83

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.15	ft	13.82	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.80	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	1.5	FT
W1	5	FT
W2	12	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 73+25					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.58	10-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	3.38

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.73	ft	8.73	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	2.40	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		9.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	9.5	FT
Depth	1.5	FT
W1	10	FT
W2	10	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 81+97					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	3.31	10-yr storm		Output
TW	tailwater depth	(ft)	0.1			
D	pipe rise	(ft)	1			

Velocity	(ft/s)	6.12

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.98	ft	11.70	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT
Depth=	$3.3D_{50}$	3.22	FT
W1= 3Wo	(min.)	3	FT
W2=3Wo + 2/3L		5.67	FT

Proposed Riprap Apron (Modified Rockfill)

Ls	5	FT
Depth	1.5	FT
W1	4	FT
W2	6	FT

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 82+07					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	9	25-yr storm		Output
TW	tailwater depth	(ft)	0.14	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	7.72			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	1.54	ft	18.48	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	5.08	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed Riprap Apron (Modified Rockfill)

Ls	10	FT
Depth	2	FT
W1	5	FT
W2	14	FT

Project	Monson Road	Date:	4/8/2024
Project Number:	ENG23-0621	By:	NSD
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels
Chapter 10 Riprap Basins and Aprons

Location	Sta 85+72					
Wo	pipe diameter or span	(ft)	1			Input
Q	pipe(design) discharge	(cfs)	1.78	25-yr storm		Output
TW	tailwater depth	(ft)	0.05			
D	pipe rise	(ft)	1			
	Velocity	(ft/s)	3.96			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.85	ft	10.24	in

Calculated Riprap Apron Dimensions

L=	4D	4.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	2.81	FT			
W1= 3Wo	(min.)	3	FT			
W2=3Wo + 2/3L		9.67	FT			

Proposed **Modified Rockfill Scour Hole**

Ls	8	FT
Depth	2	FT
W1	4.5	FT
W2	7	FT

Dimensions based on site conditions
and proposed headwall configuration

Project	Monson Road	Date:	11/30/23
Project Number:	ENG23-0621	By:	LEC
Client	Wales, MA	Checked By:	RSV

OUTLET PROTECTION

Source: FHWA HEC-14 Hydraulic Design of Energy Dissipators for Culverts and Channels

Chapter 10 Riprap Basins and Aprons

Location	Sta 1+50					
Wo	pipe diameter or span	(ft)	1.5			Input
Q	pipe(design) discharge	(cfs)	1	25-yr storm		Output
TW	tailwater depth	(ft)	0.15	(HY-8)		
D	pipe rise	(ft)	1.5			
	Velocity	(ft/s)	4.96			

Riprap Diameter

D_{50}	0.2D(Q/g^0.5*D^2.5)^(4/3)*(D/TW)	0.08	ft	0.92	in

Calculated Riprap Apron Dimensions

L=	4D	6.00	FT	Use	10	FT
Depth=	$3.3D_{50}$	0.25	FT			
W1= 3Wo	(min.)	4.5	FT			
W2=3Wo + 2/3L		11.17	FT			

Proposed

Existing Wetlands to Remain. Velocity is under 5 ft/s.

ATTACHMENT D

Operation and Maintenance Plan

LONG-TERM POLLUTION PREVENTION PLAN/
OPERATION AND MAINTENANCE PLAN
Town of Wales

I. Purpose and Scope

The purpose of this plan is to provide the maintenance staff of the Town of Wales guidelines and procedures for the operation and maintenance of the drainage systems for the Monson Road Transportation Improvement Project. Checklists will be utilized during the inspection and cleaning process and kept on file in the maintenance office.

The proposed site plan includes the following stormwater structures:

- Catch Basins
- Drainage Manholes
- Drainage Swales
- Discharge Points

II. Ownership

The Town of Wales Highway Department operates and maintains Town-wide roadways and drainage systems.

III. Responsible Party

The following individual is the primary contact for the implementation of this plan.

Name: Christopher Ryan, Highway Superintendent

Phone #: (413) 245-7494

IV. Schedule for Inspection and Maintenance Activities

A. Inspection

i. Structures, swales, and outfalls will be inspected annually for excess accumulation of sediment and debris, erosion or other problems.

B. Routine and Non-Routine Maintenance

i. Structures, swales, and outfalls shall be cleaned at least once a year, at a minimum, after the snow and ice removal

season and before spring rainfall events or as required due to conditions noted during inspections.

ii. Street sweeping: The roadways shall be swept once a year after the snow and ice removal season has ended and prior to spring rains.

iii. Erosion repairs will be completed on an as-needed basis.

V. Access to System

The drainage system is located within the Town right-of-way.

VI. Funding

The Highway Department maintains a budget as required to complete all highway related services. Inspection and maintenance of the systems is part of this yearly budget process.

VII. Illicit Discharges

No illicit discharges to watercourses or drainage structures are permitted in the Town of Wales.

VIII. Operation and Maintenance Log Forms

See attached sheets.

STORMWATER MANAGEMENT SYSTEM INSPECTION CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
STRUCTURES				

STRUCTURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

STRUCTURE	*SATISFACTORY (YES OR NO)*	*COMMENTS*	*ACTION*	*DATE COMPLETED*
OUTFALLS				

ATTACHMENT E

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

Erosion and Sedimentation Control Plan and Pollution Prevention Plan

For Construction Activities At:

Monson Road Transportation Improvement Project
Wales, MA

Prepared For:

Town of Wales
3 Hegan Street
Wales, MA
(413) 245-7494– Christopher Ryan

Prepared By:

Weston & Sampson Engineers, Inc.
712 Brook Street, Suite 103
Rocky Hill, CT 06067
(860) 513-1473

Site Contractor:

To Be Determined

1. Narrative

The purpose of this plan is to provide general guidelines and operation and maintenance procedures to the contractor during construction specifically with regards to erosion and sediment control.

The proposed project includes construction activities in, or close to, the limit of work includes bordering vegetated wetlands, mean annual high water and top of bank to perennial and intermittent stream). Activities includes excavation within existing pavement limits for the installation of storm drainage systems and the reconstruction of the existing paved roadways. Soils in the project area per the NRCS Web Soil Survey include:

- 307C – Paxton fine sandy loam, 8 to 15 percent slopes –Hydrologic Soil Group C
- 316B – Scituate fine sandy loam , 3 to 8 percent slopes, very stony – Hydrologic Soil Group C/D

Imported fill material will likely be limited to new road base and pipe bedding material unless excessive unsuitable materials are encountered within the paving limit.

2. Operation and Maintenance

A. The work covered by this plan consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this plan apply to all land disturbing activities required for this project

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as all other stated requirements.

D. The proposed erosion and sediment control measures that are to be installed are located on the construction drawings.

E. A rain gauge shall be placed at the project in a workable location and monitored during rainfall periods until all disturbed areas are stabilized. In the event, there is a rainfall greater than 1/2" in a 12 hour period, all erosion control measures shall be checked and repaired as required. If no rain gauge is used, all erosion control measures shall be checked after all rainfall events. A checklist (sample provided at the end of this plan) will be filled out by the contractor each week. The contractor shall designate a party to be responsible for the maintenance of all erosion and sediment control measures for the duration of the project. Inspections shall be completed weekly or

within 24 hours of a rain event as described above. When maintenance is required it shall be completed within 24 hours of being identified.

Designated Party: _____

F. All soil erosion and sediment control measures shall be installed, maintained, and implemented as shown on the construction drawings. It is the intent of this plan that soil erosion control measures are the first to be installed and the last to be removed. Surface waters on and adjacent to the site and abutting properties are to be protected from degradation and sedimentation. If other watercourses, streams, drainage-ways or abutting properties are jeopardized by construction, it shall be the contractor's responsibility to protect those waters and properties.

G. Make all necessary repairs to erosion control facilities as soon as possible. Silt fences and straw bale barriers, temporary sediment traps, and inlet protection which accumulate sediment and debris shall be cleaned and re-set as needed.

3. Notification

The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions. The Contractor shall, after receipt of such notice, 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 to act promptly, the Engineer may order stoppage of all or part of the work until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

4. Implementation

A. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer and the Conservation Commission to develop mutual understandings relative to compliance of the environmental protection program.

B. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands and 200 feet of watercourses.

C. Once a construction schedule has been established a person shall be named and will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials,

installation, and maintenance of erosion and sediment structures, the communication and detailed explanation to all people involved in the site work of the requirements and objective of the erosion and sediment control measures.

D. The Engineer shall be notified of any proposed alteration to the erosion and sediment control plan, prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

5. Area of Construction Activity

Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

6. Protection of Water Resources

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

7. Location of Storage Areas

A. The location of the Contractor's storage areas for equipment and/or materials shall be as negotiated with the Owner. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled hay or straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

8. Spill Prevention Measures

A. Vehicle Maintenance: Vehicles and equipment maintenance shall occur at the off-site staging area over a spill containment pallet or sufficiently impervious surface. Only minor maintenance shall be conducted. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets inside a materials storage container. Fluids shall be removed from the site and dispose of in accordance with applicable regulations as soon as feasible. All vehicles and equipment including subcontractor vehicles shall be checked for leaking oil and fluids. Vehicles leaking fluid shall not be allowed onsite.

B. Spill Kits: Spill kits will be stored within the designated fueling area and concrete washout areas. Spill kits shall be readily available during all fueling operations. Spill kits must contain absorbent pads or other sorbent materials. Spill kits shall be inspected weekly to insure that adequate cleanup materials are on site at all times.

C. Spills: All spills will be cleaned up immediately upon discovery. Spent absorbent materials and rags will be hauled offsite immediately after the spill is cleaned up for disposal at an approved location. Spills large enough to discharge to surface water will be reported to the National Response Center at 1-800-424-8802.

D. Material safety data sheets: A material inventory and emergency contact information shall be maintained onsite.

9. Vehicle Fueling Operations

A. Several types of vehicles and equipment will be used on-site throughout the project, including graders, excavators, loaders, concrete equipment, rollers, trucks and trailers, backhoes, and forklifts. Equipment/vehicle fueling will be performed onsite. Fueling activities are to be situated so that drainage facilities or watercourses located in the area are not at risk from potential infiltration. Fueling shall take place on an impervious surface and shall be conducted at least 100 feet from a drainage structure, wetland or watercourse. Absorbent, spill-cleanup materials and spill kits will be available at the designated fueling areas. Fuel will be delivered to the site on an as needed basis by a fuel delivery service.

B. Maintenance and Inspection: Inspect equipment/vehicle storage areas and fueling area weekly. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately or the problem vehicle(s) or

equipment will be removed from the project site. Keep ample supply of spill-cleanup materials onsite and immediately clean up spills and dispose of materials properly.

10. Washing of Equipment and Vehicles

Washing of equipment and vehicles is prohibited. Vehicle and equipment washing shall occur off-site at a permitted facility.

11. Materials Storage and Staging Area

A. Construction equipment and maintenance materials will be stored at a designated staging area and materials storage areas. A watertight shipping container will be used to store hand tools, small parts, and other construction materials. All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the storage container, until such time they can be properly disposed of. Very large items, such as piping, valves, and structures, will be stored in the open in the materials storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

B. The storage areas will be inspected weekly. The storage areas will be kept clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners will be repaired or replaced as needed to maintain proper function.

C. It is not anticipated that pesticides, herbicides, insecticides, fertilizers and landscape materials will be stored on site. These materials will be delivered as needed during the installation of the limited landscaping features. If it is determined that these materials are required to be stored on site they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

D. It is not anticipated that diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals will be stored on site. These materials will be delivered as needed over the course of construction. If it is determined that these materials are required to be stored on site, they shall be stored in the watertight shipping container, in a spill containment pallet, with a spill cleanup kit.

E. All hazardous waste materials including oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers, within a hazardous materials storage area in a designated staging area. Hazardous waste materials will be stored in appropriate and clearly marked containers and segregated from other non-

waste materials. Secondary containment will be provided for all waste materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous waste materials will be disposed of in accordance with federal, state, and local regulations. Hazardous waste materials will not be disposed of into the on-site dumpsters. The hazardous waste materials area will be inspected weekly and after storm events. The storage area will be kept clean, well-organized and equipped with ample cleanup supplies as appropriate for the materials being stored. Material safety datasheets, material inventory, and emergency contact numbers will be maintained on site.

F. All waste materials will be collected and disposed of into a dumpster in the designated staging area. Dumpsters will have a secure tight lid, be placed away from stormwater drains and structures, and will meet all federal, state, and local regulations. Only trash and construction debris will be placed in the dumpsters. Construction materials will not be buried on site. The dumpsters will be inspected weekly and immediately after storm events. The dumpsters will be emptied weekly, or more frequently if needed, and taken to the appropriate disposal facility.

12. Sanitary Waste

Portable toilets, located in the staging area, will be provided at the site throughout all the phases. The toilets will be located away from concentrated drainage flow paths. Sanitary waste will be collected a minimum of once a week and shall be inspected weekly for evidence of leaking holding tanks.

13. Concrete Truck Washout Procedures

A. A designated temporary, above-grade concrete washout area will be constructed at an approved onsite location. The washout area shall be constructed in a location approved by the engineer. The temporary concrete washout area will be constructed using staked hay bales with a recommended minimum length and minimum width of 10 feet, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. The washout area will be lined with plastic sheeting at least 10 mils thick and free of holes or tears.

B. Concrete pours will not be conducted during or before an anticipated storm event. Concrete mixer trucks and chutes will be washed in the designated area or concrete wastes will be properly disposed of offsite. When the temporary washout area is no longer needed for the construction project, the hardened concrete and materials used to construct the area will be removed and disposed as described below and the area will be stabilized.

C. The washout areas will be inspected weekly and each day of use to ensure that all concrete washing is being discharged into the washout area, no leaks

or tears are present and to identify when concrete wastes need to be removed. The washout areas will be cleaned out once the area is filled to 75 percent of the holding capacity. Once the area's holding capacity has been reached, the concrete wastes will be allowed to harden, the concrete will be broken up, removed, and taken to the appropriate landfill for disposal. The plastic sheeting will be replaced if tears occur during removal of concrete wastes from the washout area.

14. Recycling Practices

Wood pallets, cardboard boxes, and other recyclable construction scraps will be disposed of in a separate designated dumpster for recycling. The dumpster will have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all local and state solid waste management regulations. Only solid recyclable construction scraps from the site will be deposited in the dumpster. The recycling dumpster will be inspected weekly. The recycling dumpster will be emptied when full and taken to an approved recycling center by the contractor. If recyclable construction wastes are exceeding the dumpster's capacity, the dumpsters will be emptied more frequently.

15. Construction in Areas Designated as Wetland Resources on the Drawings

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetland resources. Total construction widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetland resources shall not be unduly disturbed by the Contractor's operations. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

16. Protecting and Minimizing Exposed Areas

A. The Contractor shall limit the area of land which is exposed and erodible during construction. In areas where the period of exposure will be greater than two (2) months, temporary stabilization or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

17. Protection of Landscape

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as required.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. 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.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled, and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

18. Clearing and Grubbing

A. The Contractor shall clear and grub only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.

B. The Contractor shall not remove trees without permission of the Engineer.

19. Discharge of Dewatering Operations

A. Any water that is pumped and discharged as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to an approved filtration method before discharging to the nearest drainage system, stream, or waterway.

C. The pumped water shall be filtered through baled hay, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

20. 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 streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as required.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

21. Separation and Replacement of Topsoil

Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

22. Compost Filter tubes

To trap sediment and to prevent sediment from discharging downhill, compost filter tubes shall be used where shown on the drawings. The tubes should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

23. Sediment Fence

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

B. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a 22-foot wide, continuous length support netting, and stapled to pre-weathered oak posts installed as shown on the drawings. The oak posts shall be 1½-inches by 1½-inches (Minimum Dimension) by 48 inches and shall be tapered. The support netting shall be industrial strength polypropylene. The bottom edge of the sediment control fabric shall be buried as shown on the drawings. The sediment control fabric shall conform to the following properties:

Property	Value	Test Method
1. Grab Strength (lbs.)	124	ASTM D-4632
2. Elongation (%)	15%	ASTM D-4632
3. Puncture Strength (lbs.)	65	ASTM D-4833
4. Burst Strength (psi)	300	ASTM D-3786
5. Trapezoid Tear (lbs.)	60	ASTM D-4533
6. Equivalent Opening Size (U.S. Sieve)	No. 30	ASTM D-4571
7. Permittivity (sec^{-1})	0.10	ASTM D-4491
8. Water Flow Rate (gal/min/sf.)	10	ASTM D-4491
9. UV Resistance (%)	70	ASTM D-4355

C. The silt fence shall be Mirafi Envirofence manufactured by Mirafi, Inc. or approved equal.

24. Inlet Protection

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall install and maintain inlet protection. At a minimum inlet protection is required on all drainage structures in the project area. The inlet protection shall be SiltSack or approved equal. The inlet protection shall be cleaned or replaced as needed to insure proper operation for the duration of construction.

EROSION CONTROL MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Sediment Barriers				
Inlet Protection				
Discharge Points				

POLLUTION PREVENTION MEASURES INSPECTION AND MAINTENANCE CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

MEASURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
Trash Dumpster with Cover				
Recycling Dumpster with Cover				
Staging Area				
Bulk Material Storage Area				
Material Storage Containers				
Fueling Area				
Equipment Storage Area				
Sanitary Facilities				
Concrete Washout Area				
Spill Kits				

Appendix E

Abutter Notification Information

In consultation with Ms. Sarah Ryan from the Town of Wales, the Conservation Agent will be obtaining the abutters list for the project and will notify abutters of the project in accordance with the requirements of the Massachusetts Wetlands Protection Act.

The applicant will pay the fee for the abutter notification mailings and public notice in consultation with Sarah Ryan.

Notification to Abutters

By Hand Delivery, Certified Mail (return receipt requested), or Certificates of Mailing

This is a notification required by law. You are receiving this notification because you have been identified as the owner of land abutting another parcel of land for which certain activities are proposed. Those activities require a permit under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40).

In accordance with the second paragraph of the Massachusetts Wetlands Protection Act, and 310 CMR 10.05(4)(a) of the Wetlands Regulations, you are hereby notified that:

A. A Notice of Intent was filed with the Wales Conservation Commission on June 6, 2024 seeking permission to remove, fill, dredge, or alter an area subject to protection under M.G.L. c. 131 §40. The following is a description of the proposed activity/activities:

Proposed reconstruction and rehabilitation of a 1.5-mile stretch Monson Road beginning west of the intersection with Lynch Road and continuing east to the intersection with Reed Hill Road. Portions of the work will occur within Bordering Vegetated Wetland (BVW), Riverfront Area (RFA), and the 100-foot buffer zone to BVW/Bank.

B. The name of the applicant is: Town of Wales.

C. The address of the land where the activity is proposed is: along a 1.5-mile stretch Monson Road beginning west of the intersection with Lynch Road and continuing east to the intersection with Reed Hill Road.

D. Copies of the Notice of Intent may be examined or obtained at the office of the Wales Conservation Commission, located at 3 Hollow Rd, Wales, MA 01081. The regular business hours of the Commission are Mon, Tues, Thurs 8AM-2:45 PM and the Commission may be reached at 413-245-7571 x 108.

E. Copies of the Notice of Intent may be obtained from the applicant or Weston & Sampson Engineers representative by calling Mike Joyce,(representative) at 860-616-6495. An administrative fee may be applied for providing copies of the NOI and plans.

F. Information regarding the date, time, and location of the public hearing regarding the Notice of Intent may be obtained from the Wales Conservation Commission. Notice of the public hearing will be published at least five business days in advance in a newspaper of local circulation.

Notification provided pursuant to the above requirement does not automatically confer standing to the recipient to request Departmental Action for the underlying matter. See 310 CMR 10.05(7)(a)4.

Appendix F

Wetland Delineation Report

Weston & Sampson

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Wetland Delineation Report

October 2023
Updated May 2024

Monson Road
Wales, MA

Wetland Delineation Conducted By:
Devin Herrick, CWS on 10/31/2023

Delineation Report Reviewed By:
Megan Kearns, PWS

TABLE OF CONTENTS

Page

1.0 SITE DESCRIPTION....1-1

2.0 DELINEATION OF WETLAND RESOURCES....2-1
2.1 Site Observations....2-1
2.2 Wetland Delineation Methodology....2-1
2.3 Bordering Vegetated Wetlands (BVW)....2-2
2.4 Isolated Vegetated Wetland (IW)....2-3
2.4 Bank....2-4
2.5 Other Protected Areas....2-7

3.0 SUMMARY....3-1

4.0 REFERENCES....4-1

FIGURES

Figure 1.1-1.6....Wetlands Field Map
Figure 2....USGS Topographic Map
Figure 3.1-3.4....FEMA FIRM Map
Figure 4....Environmental Resources Map

APPENDICES

Appendix A ....ACOE Wetland Determination Data Forms

1.0 SITE DESCRIPTION

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA on a section of road approximately 1.5 miles in length. The western limit of investigation terminated at the intersection with Lynch Road while the eastern limit terminated at the intersection with Reed Hill Road. The area under consideration is in a rural community within a topographically variable landscape composed of glacial till transected by numerous streams running with north/south trajectories. Please see Figure 1.1-1.6 (Wetlands Field Map) and Figure 2 (USGS Topographic Map) attached to this report for the investigation area.

Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field using pink flagging by a Weston & Sampson employee who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) and the US Army Corps of Engineers methodologies. A further description of these wetland resource areas is presented in the following sections.

2.0 DELINEATION OF WETLAND RESOURCES

2.1 Site Observations

The Weston & Sampson wetland scientist, trained in the ACOE Wetland Delineation Manual and Massachusetts Department of Environmental Protection (MassDEP) Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetland Protection Act guidance document, observed the following protected wetland resources at the site:

- Bordering Vegetated Wetlands (BVW)
- Isolated Vegetated Wetland (IW)
- Bank – Perennial Stream
- Bank – Intermittent Stream
- Bank – Non-Jurisdictional Intermittent Stream

Field data were recorded on U.S. Army Corps of Engineers (ACOE) Wetland Determination Data Forms which are included in Appendix A.

2.2 Wetland Delineation Methodology

A wetland delineation assessment was conducted in accordance with the Massachusetts Wetland Protection Act Regulations (310 CMR 10.55(2)(c)), Massachusetts Department of Environmental Protection (MassDEP) Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands (Second Edition, September 2022), and ACOE Wetland Manual (Technical Report Y-87-1).

The bordering vegetated wetlands (BVW) delineation methodology included the characterization of vegetation, hydrologic conditions, and soil in both wetland and upland areas to identify the transitional area, which was used as the wetland limit. Pink flags with distinct flag numbers were left in the field to show wetland resource area limits.

Vegetation, hydrology and soils were assessed in both wetland and upland areas to accurately place the wetland limits at each site. The percentage of vegetative species was estimated by creating sample plots. Sample plot radius for trees, saplings, shrubs, groundcover and woody vine strata was 30', 15', 15', 5' and 30', respectively. After creating the sample plot areas, the percent basal area coverage of

each species within the monitoring plot was recorded. Using these field observations, the percent dominance of each species within its stratum was calculated. The 50/20 Rule was then used to determine dominance. Dominant species were considered the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceeds 50% of the total dominance measure (basal area) for the stratum, plus any additional species comprising 20% or more of the total dominance measure for the stratum. Once the dominant species were determined, they were treated equally to determine the presence of hydrophytic vegetation. If the number of dominant species with a Wetland Indicator Status of FAC (excluding FAC-), FACW or OBL is greater than, or equal to, the number of remaining dominant species, the area was considered a jurisdictional wetland resource area based on vegetation.

A soil sample from each wetland sample plot were also taken. Each soil sample goes to a depth of at least 12-24 inches. The soil was characterized to determine if the soil sample was considered a hydric (wetland) soil. Soil samples, including mottles, were characterized based on color using Munsell Soil-Color charts as a color reference.

The general area was then assessed for hydrologic conditions, including, but not limited to, site inundation, depth to free water, depth of soil saturation, water marks, drift lines, sediment deposits, water stained leaves.

2.3 Bordering Vegetated Wetlands (BVW)

A total of sixteen BVW series were delineated at the site. The limits of the BVW resource areas were determined by locating the transitional areas between wetlands and uplands vegetation, soils and hydrologic conditions. Wetland flags left in the field included:

- BVW-A1 through BVW-A6 (Bordering Vegetated Wetland “A” Series)
- BVW-B1 through BVW-B10 (Bordering Vegetated Wetland “B” Series)
- BVW-C1 through BVW-C6 (Bordering Vegetated Wetland “C” Series)
- BVW-D1 through BVW-D4 (Bordering Vegetated Wetland “D” Series)
- BVW-E1 through BVW-E6 (Bordering Vegetated Wetland “E” Series)
- BVW-F1 through BVW-F3 (Bordering Vegetated Wetland “F” Series)
- BVW-G1 through BVW-G11 (Bordering Vegetated Wetland “G” Series)

- BVW-H1 through BVW-H12 (Bordering Vegetated Wetland "H" Series)
- BVW-I1 through BVW-I10 (Bordering Vegetated Wetland "I" Series)
- BVW-J1 through BVW-J13 (Bordering Vegetated Wetland "J" Series)
- BVW-K1 through BVW-K4 (Bordering Vegetated Wetland "K" Series)
- BVW-L1 through BVW-L15 (Bordering Vegetated Wetland "L" Series)
- BVW-M1 through BVW-M10 (Bordering Vegetated Wetland "M" Series)
- BVW-O1 through BVW-O3 (Bordering Vegetated Wetland "O" Series)
- BVW-AA1 through BVW-AA4 (Bordering Vegetated Wetland "AA" Series)
- BVW-BB1 through BVW-BB4 (Bordering Vegetated Wetland "BB" Series)

Dominant vegetation within this resource area included red maple (*Acer rubrum*), winterberry (*Ilex verticillate*), crested fern (*Dryopteris cristata*), sensitive fern (*Onoclea sensibilis*), and riverbank grape (*Vitis riparia*), all species that thrive in wet conditions. Soils within the BVW were considered sandy mucky mineral. Other indicators of wetland hydrology included surface water, water-stained leaves, drainage patterns, highwater table and saturation.

Dominant upland vegetation next to this BVW included red oak (*Quercus rubra*) and Japanese barberry (*Berberis thunbergii*). Soil in the upland area consisted of dry sandy loam, with no evidence of mottling or hydrology within the top 12 inches.

BVWs are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.4 Isolated Vegetated Wetland (IW)

Two isolated wetlands were delineated at the site. The limit of the IW resource area was determined by locating the transitional area between wetland and upland vegetation, soils and hydrologic conditions. Vegetation, hydrology and soils were assessed in the same manner as described above for identifying BVW. Wetland flags left in the field included:

- WET-A1 through WET-A10 (Isolated Wetland "A" Series)
- WET-B1 through WET-B11 (Isolated Wetland "B" Series)

Dominant vegetation within this resource area included reed canary grass (*Phalaris arundinacea*), rough-leaved goldenrod (*Solidago patula*), and grass-leaved goldenrod (*Euthamia graminifolia*), all species that thrive in wet conditions. Soils within the wetland limits were considered sandy loam (sandy redox). Indicators of wetland hydrology included surface water, soil saturation, and oxidized rhizospheres.

Dominant upland vegetation next to this isolated wetland included red oak (*Quercus rubra*). Soil in the upland area consisted of dry sandy loam. No indicators of wetland hydrology were observed.

The Massachusetts Wetland Protection Act does not protect isolated vegetated wetlands.

2.4 Bank

Water bodies, including perennial streams, intermittent streams, ponds and lakes, have banks which are protected by the Massachusetts Wetland Protection Act. Bank is a wetland resource area defined by 310 CMR 10.54(2)(a) as "the portion of land surface which normally abuts and confines a water body. It occurs between a waterbody and a vegetated bordering wetland and adjacent floodplain, or, in absence of these, it occurs between a waterbody and an upland." Vegetated banks provide valuable functions such as flood control, stormwater prevention, fisheries protection, and water quality protection. The limit of this resource area is identified by Top of Bank (TOB) which is located at the first observable break in slope or the Mean Annual Flood Level (MAFL), whichever is lower. TOB is easily identified in the field so that indicator was utilized for this wetland delineation.

Perennial Stream Banks

Three perennial streams were identified within the investigation area. All three of these perennial streams are unnamed. These streams are shown as perennial on the current United States Geographical Survey (USGS) map which classifies them as perennial per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the perennial streams were identified by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-E1 through TOB-E8 (Perennial Stream Bank "E" Series)
- TOB-F1 through TOB-F9 (Perennial Stream Bank "F" Series)
- TOB-I1 through TOB-I17 (Perennial Stream Bank "I" Series)
- TOB-J1 through TOB-J18 (Perennial Stream Bank "J" Series)

- WET-C1 through WET-C8 (Perennial Stream Bank "C" Series)
- TOB-K1 through TOB-K6 (Perennial Stream Bank "K" Series)
- TOB-L1 through TOB-L6 (Perennial Stream Bank "L" Series)

Perennial streams are subject to a 200-foot Riverfront Area under the Massachusetts Wetland Protection Act per 301 CMR 10.58(2)(a)(2)(c).

Intermittent Stream Banks (Jurisdictional)

Five jurisdictional intermittent streams were identified within the investigation area. Four of these intermittent streams are unnamed and not shown on the current United States Geographical Survey (USGS) map. The easternmost intermittent stream is shown on the current United States Geographical Survey (USGS) map and called Vinica Brook. These intermittent streams have a watershed size less than 0.5 square miles in size according to USGS Stream Stats which classifies the streams as intermittent per 310 CMR 10.58 (2)(a)(1)(b-c). The boundaries of the intermittent streams were identified in the field by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-A1 through TOB-A5 (Intermittent Stream Bank "A" Series)
- TOB-B1 through TOB-B5 (Intermittent Stream Bank "B" Series)
- TOB-C1 through TOB-C5 (Intermittent Stream Bank "C" Series)
- TOB-D1 through TOB-D5 (Intermittent Stream Bank "D" Series)
- TOB-CC1 through TOB-CC3 (Intermittent Stream Bank "CC" Series)
- TOB-DD1 through TOB-DD3 (Intermittent Stream Bank "DD" Series)
- TOB-GG1 through TOB-GG2 (Intermittent Stream Bank "GG" Series)
- TOB-HH1 through TOB-HH2 (Intermittent Stream Bank "HH" Series)
- TOB-AA1 through TOB-AA3_March 2024 (Intermittent Stream Bank "AA" Series)
- TOB-BB1 through TOB-BB15_March 2024 (Intermittent Stream Bank "BB" Series)
- TOB-CC1 through TOB-CC16_March 2024 (Intermittent Stream Bank "CC" Series)
- TOB-KK1 through TOB-KK9 (Intermittent Stream Bank "KK" Series)
- TOB-LL1 through TOB-LL6 (Intermittent Stream Bank "LL" Series)
- TOB-EE1 through TOB-EE6 (Intermittent Stream Bank "EE" Series)
- TOB-FF1 through TOB-FF6 (Intermittent Stream Bank "FF" Series)
- TOB-M1 through TOB-M4 (Intermittent Stream Bank "M" Series)

- TOB-N1 through TOB-N4 (Intermittent Stream Bank "N" Series)
- TOB-AA1 through TOB-AA3 (Intermittent Stream Bank "AA" Series)
- TOB-BB1 through TOB-BB3 (Intermittent Stream Bank "BB" Series)
- TOB-JJ1 through TOB-JJ6 (Intermittent Stream Bank "JJ" Series)

Intermittent stream banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

Intermittent Stream Banks (Non-Jurisdictional)

Three intermittent streams were identified within the investigation area which do originate within a wetland resource area. Per 310 CMR 10.04 Stream means "*a body of running water, including brooks and creeks, which moves in a definite channel in the ground due to a hydraulic gradient, and which flows within, into or out of an Area Subject to Protection under M.G.L. c. 131, § 40. A portion of a stream may flow through a culvert or beneath a bridge. Such a body of running water which does not flow throughout the year (i.e., which is intermittent) is a stream except for that portion upgradient of all bogs, swamps, wet meadows and marshes*". Since these streams are located upgradient of any wetland there are non-jurisdictional. Wetland flags left in the field included:

- TOB-G1 through TOB-G2 (Intermittent Stream Bank "G" Series)
- TOB-H1 through TOB-H2 (Intermittent Stream Bank "H" Series)
- WET-N1 through WET-N8 (Intermittent Stream Bank "N" Series)
- TOB-DD1 through TOB-DD2_March 2024 (Intermittent Stream Bank "DD" Series)
- TOB-EE1 through TOB-EE2_March 2024 (Intermittent Stream Bank "EE" Series)

Pond Bank

A single unnamed pond was located within the investigation area. According to the Massachusetts Wetland Protection Act a pond is defined as "any body of fresh water with a surface area observed or recorded within the last ten years of at least 10,000 square feet". Based on aerial imagery the unnamed pond identified on site is approximately 14,000 SF. According to the Massachusetts Wetland Protection Act "ponds may be either naturally occurring or human made by impoundment, excavation or otherwise". Wetland flags left in the field included:

- TOB-II1 through TOB-II3 (Pond Bank "II" Series)

Pond banks are subject to a 100-foot buffer under the Massachusetts Wetland Protection Act per 310 CMR 10.02(2)(b).

2.5 Other Protected Areas

Weston & Sampson created environmental resources maps (see Figure 4) of the site to determine the presence of other protected areas. The data source of these map layers was the Massachusetts Geographic Information System (MassGIS). These areas included:

- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Certified and Potential Vernal Pools
- Areas of Critical Environmental Concern (ACEC)
- Outstanding Resource Waters (ORW)
- Coldwater Fisheries
- Article 97 Land

Wetland resources identified in the field were also added to these maps. Based on the MassGIS information, a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

FEMA Flood Insurance Rate Maps (FIRM) were created online from the FEMA website to determine if there is a 100-year flood zone at the site. See Figure 3 for FIRM map. Based on FEMA flood maps the investigation area is not located within the 100-year flood zone.

3.0 SUMMARY

On October 31, 2023 and March 17, 2024, the presence of wetland resources was investigated on Monson Road, in Wales, MA. Wetland resource areas including bordering vegetated wetlands (BVW), isolated wetlands (IW), perennial streams, intermittent streams and a pond were identified and flagged in the field.

Additional environmental mapping was conducted using MassGIS data layers and FEMA FIRM mapping. This additional mapping indicates that a portion of the investigation area is located within NHESP Priority Habitats of Rare Species, and NHESP Estimated Habitat of Rare Wildlife. Additionally, the three perennial streams identified on site are shown as coldwater fisheries.

4.0 REFERENCES

Massachusetts Department of Environmental Protection. September 2022. "Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands – Second Edition".

Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. Massachusetts Natural Heritage Atlas, 13th Edition with 2017 web updates. Accessed on 1/23/2024.

Massachusetts Geographic Information System. January 2009. Outstanding Resource Waters. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Massachusetts Geographic Information System. December 2003. Areas of Critical Environmental Concern. Massachusetts Department of Environmental Protection. Accessed on 1/23/2024.

Newcomb, Lawrence. 1977. Newcomb's Wildflower Guide. Little, Brown and Company.

Web Soil Survey of Hampden County, Massachusetts. United States Department of Agriculture, Soil Conservation Service, in cooperation with Massachusetts Agricultural Experiment Station

United States Department of Agriculture, Natural Resources Conservation Service. *2018. Field Indicators of Hydric Soils in the United States, Version 8.2.* L. M. Vasilas, G. W. Hurt, and J.F. Berkowitz (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.

USACOE, January 1987, Corps of Engineers Wetlands Delineation Manuel, Wetlands Research Program Technical Report Y-87-1.

FEMA Flood Map Service Center, online at msc.fema.gov/portal Assessed on 1/23/2024.
Tiner, Jr., Ralph W., 2005, Field Guide to Nontidal Wetland Identification

Tiner, Jr., Ralph W, 2009, Field Guide to Tidal Wetland Plants of the Northeastern United States and Neighboring Canada.

Wojtec, Michael, Bard – A field Guide to Trees of the Northeast.

New England Hydric Soils Technical Committee, 2019, Version 4, *Field Indicator of Identifying Hydric Soils in New England*. New England Interstate Water Pollution Control Commission, Lowell, MA.

.

Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation_2023\GIS\Maps\Wetland Flags 1.1.mxd User: Herrick.Devin Saved: 4/15/2024 3:56:01 AM Opened: 4/15/2024 3:56:36 AM

Legend

- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

N
W E
S

1,000 500 0 1,000
Feet

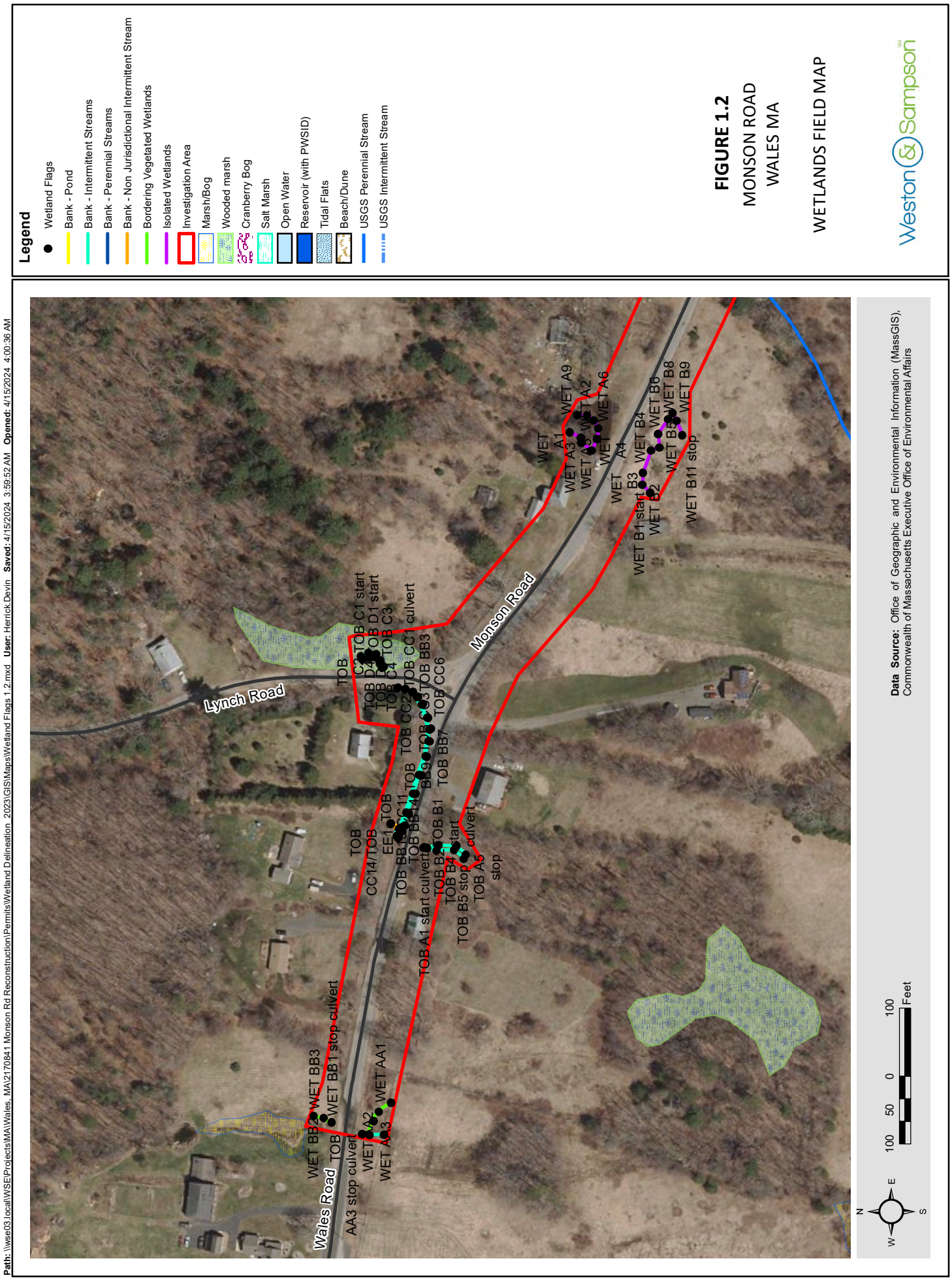
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

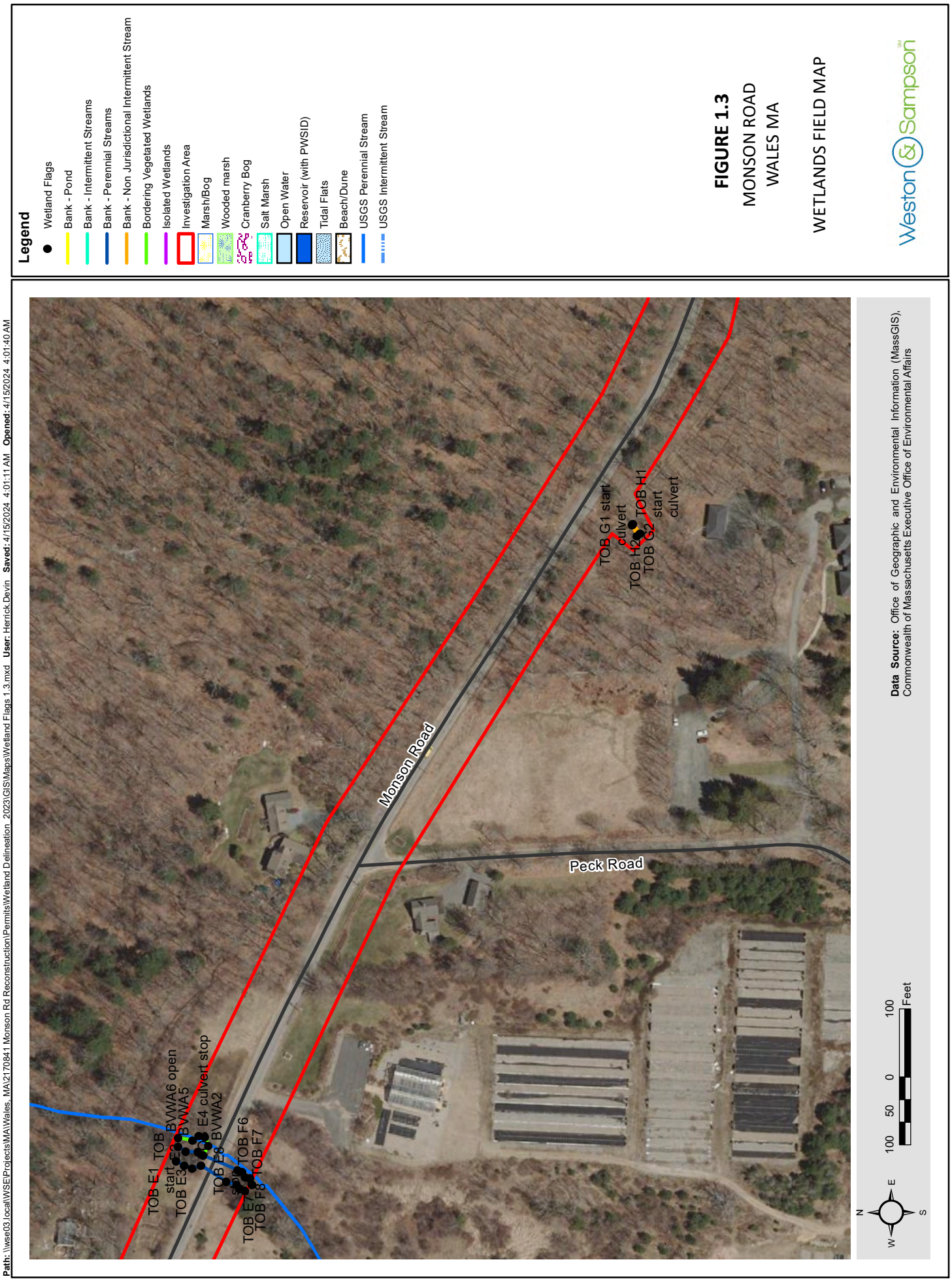
FIGURE 1.1

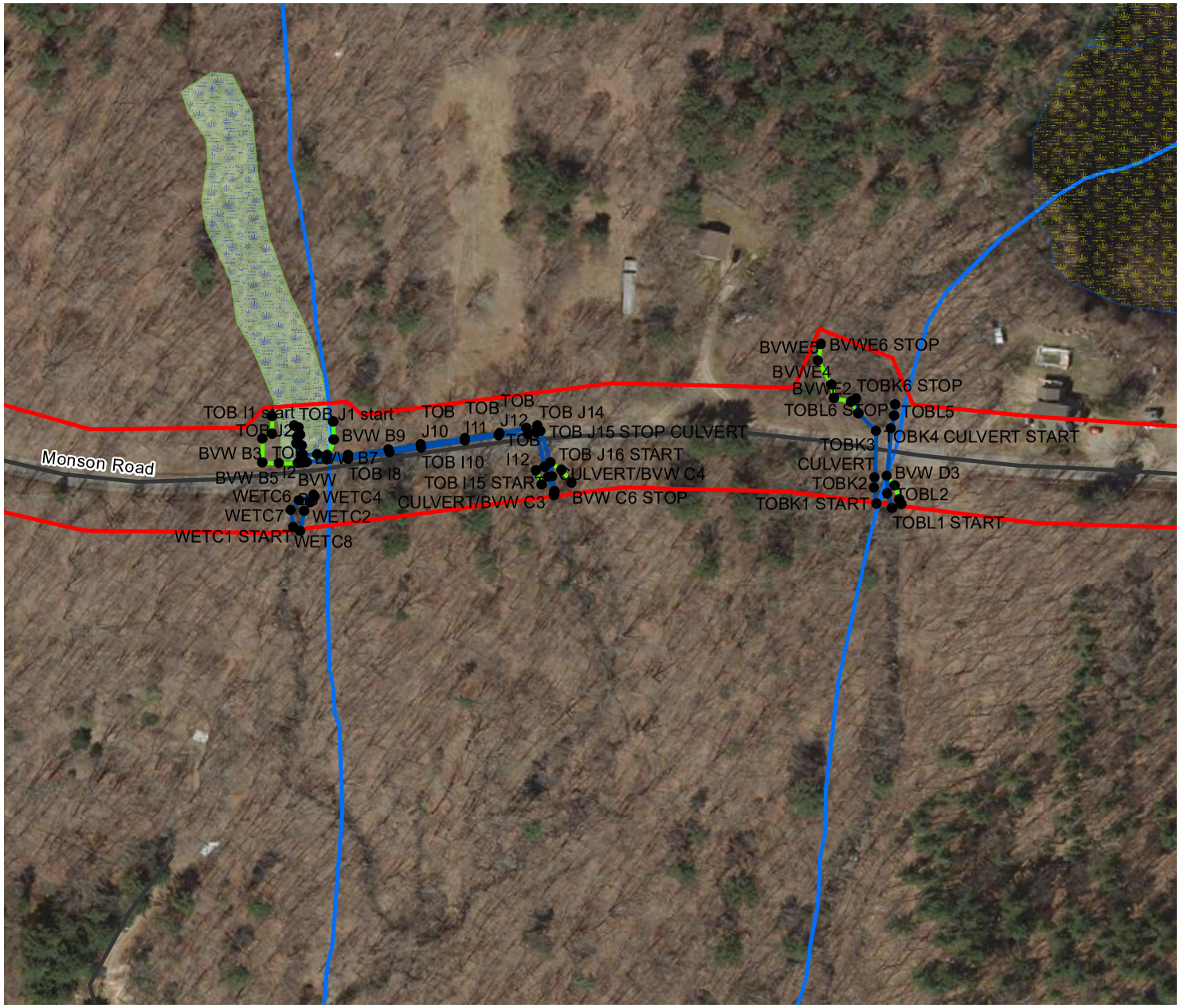
MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson


Legend
Wetland Flags
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.2
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Lynch Road
Monson Road
Wales Road
WET BB3
WET BB2
WET BB1 stop culvert
TOB
AA3 stop culvert
WET A2
WET A3
WET AA1
TOB CC14/TOB EE1
TOB CC11
TOB BB10
TOB BB9
TOB BB8
TOB BB7
TOB A1 start culvert
TOB B1
TOB B4
TOB B5 stop culvert
TOB A5 stop
TOB CC6
TOB BB3
TOB CC1 culvert
TOB CC2
TOB C3
TOB C4
TOB C2
TOB C1 start
TOB D1 start
TOB C3
WET A1
WET A3
WET A5
WET A2
WET A6
WET A9
WET A4
WET B3
WET B1 start
WET B2
WET B4
WET B6
WET B5
WET B8
WET B9
WET B11 stop
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
100 50 0 100 Feet
N
E
S
W
Path: \\wse03.local\WSEProjects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.2.mxd User: Herrick.Devin Saved: 4/15/2024 3:59:52 AM Opened: 4/15/2024 4:00:36 AM


Legend
Wetland Flags
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
Marsh/Bog
Wooded marsh
Cranberry Bog
Salt Marsh
Open Water
Reservoir (with PWSID)
Tidal Flats
Beach/Dune
USGS Perennial Stream
USGS Intermittent Stream
FIGURE 1.3
MONSON ROAD
WALES MA
WETLANDS FIELD MAP
Weston & Sampson
Monson Road
Peck Road
TOB G1 start
culvert
TOB H2
TOB G2
TOB H1
start
culvert
TOB E1
start
TOB E3
BVWA6 open
BVWA5
E4 culvert stop
BVWA2
TOB E8
TOB F6
TOB E7
TOB F8
TOB F7
N
W
E
S
100
50
0
100
Feet
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
Path: \\wse03.local\WSEProjects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Wetland Flags 1.3.mxd User: Herrick.Devin Saved: 4/15/2024 4:01:11 AM Opened: 4/15/2024 4:01:40 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.4

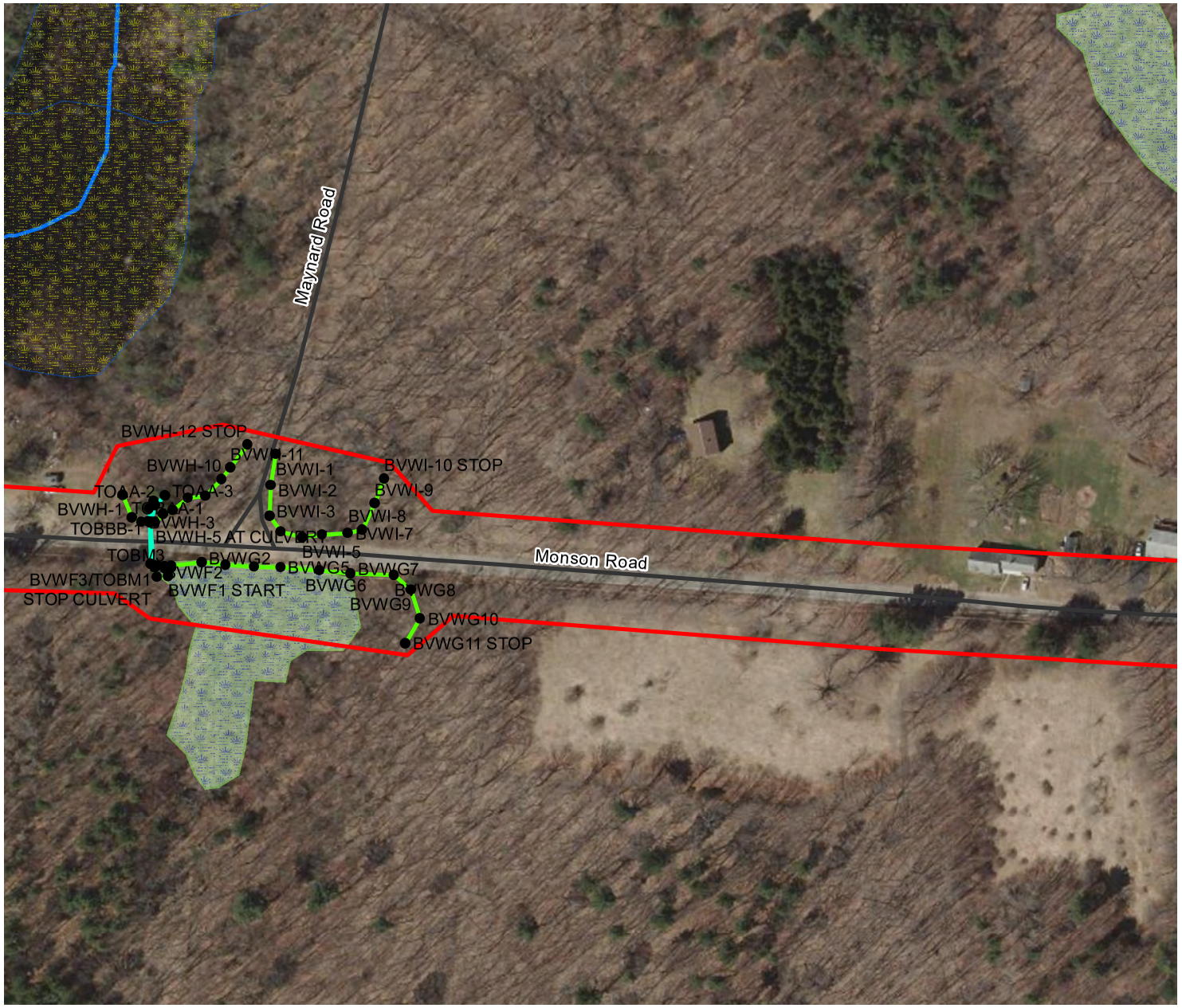
MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00860 - 324

Proposal No. 608163-128112



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

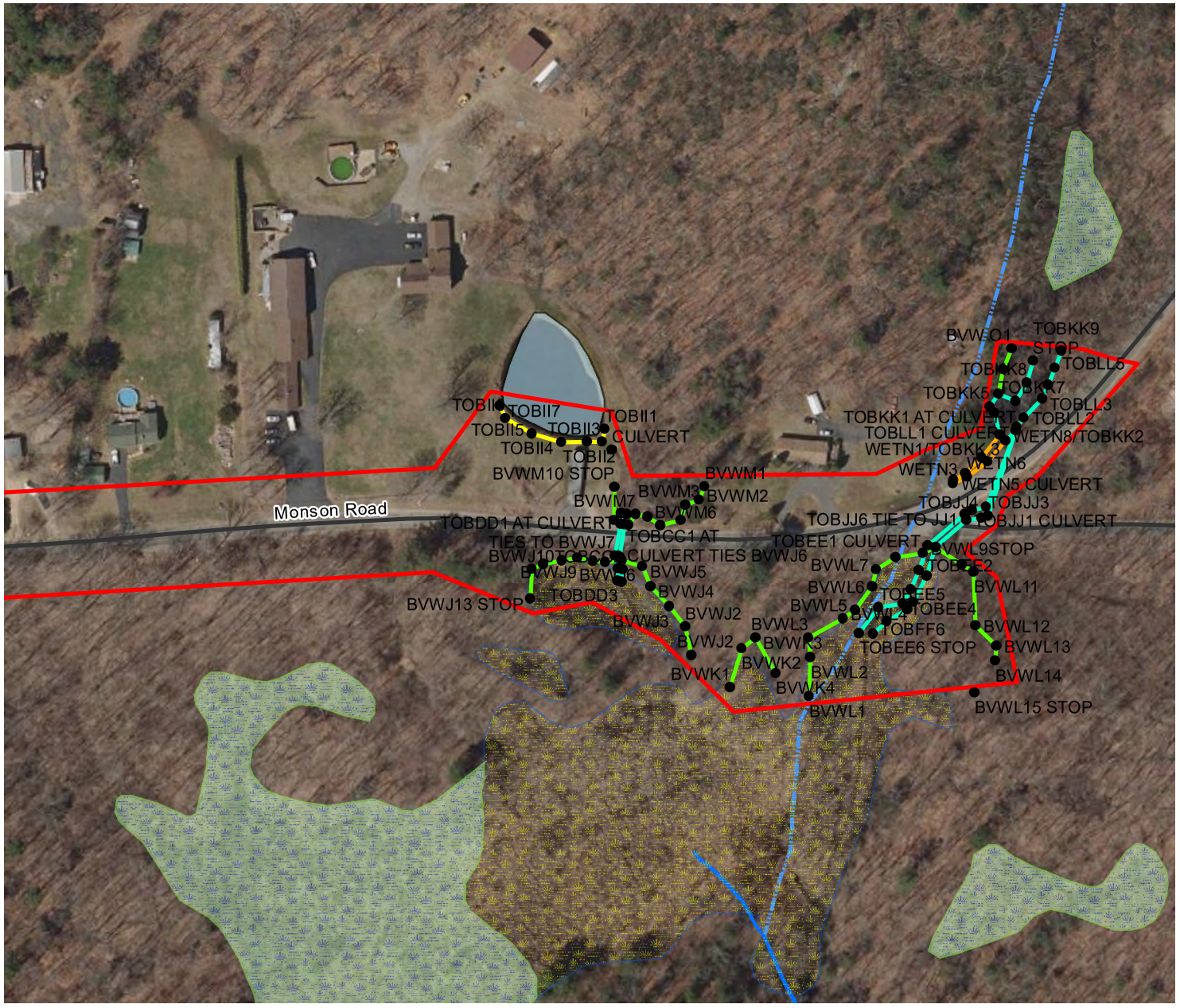
- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.5

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson



N
W E
S

100 50 0 100
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Wetland Flags
- Bank - Pond
- Bank - Intermittent Streams
- Bank - Perennial Streams
- Bank - Non Jurisdictional Intermittent Stream
- Bordering Vegetated Wetlands
- Isolated Wetlands
- Investigation Area
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- USGS Perennial Stream
- USGS Intermittent Stream

FIGURE 1.6

MONSON ROAD
WALES MA

WETLANDS FIELD MAP

Weston & Sampson

A00860 - 326

Proposal No. 608163-128112

N W E S

1,000 500 0 1,000 Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

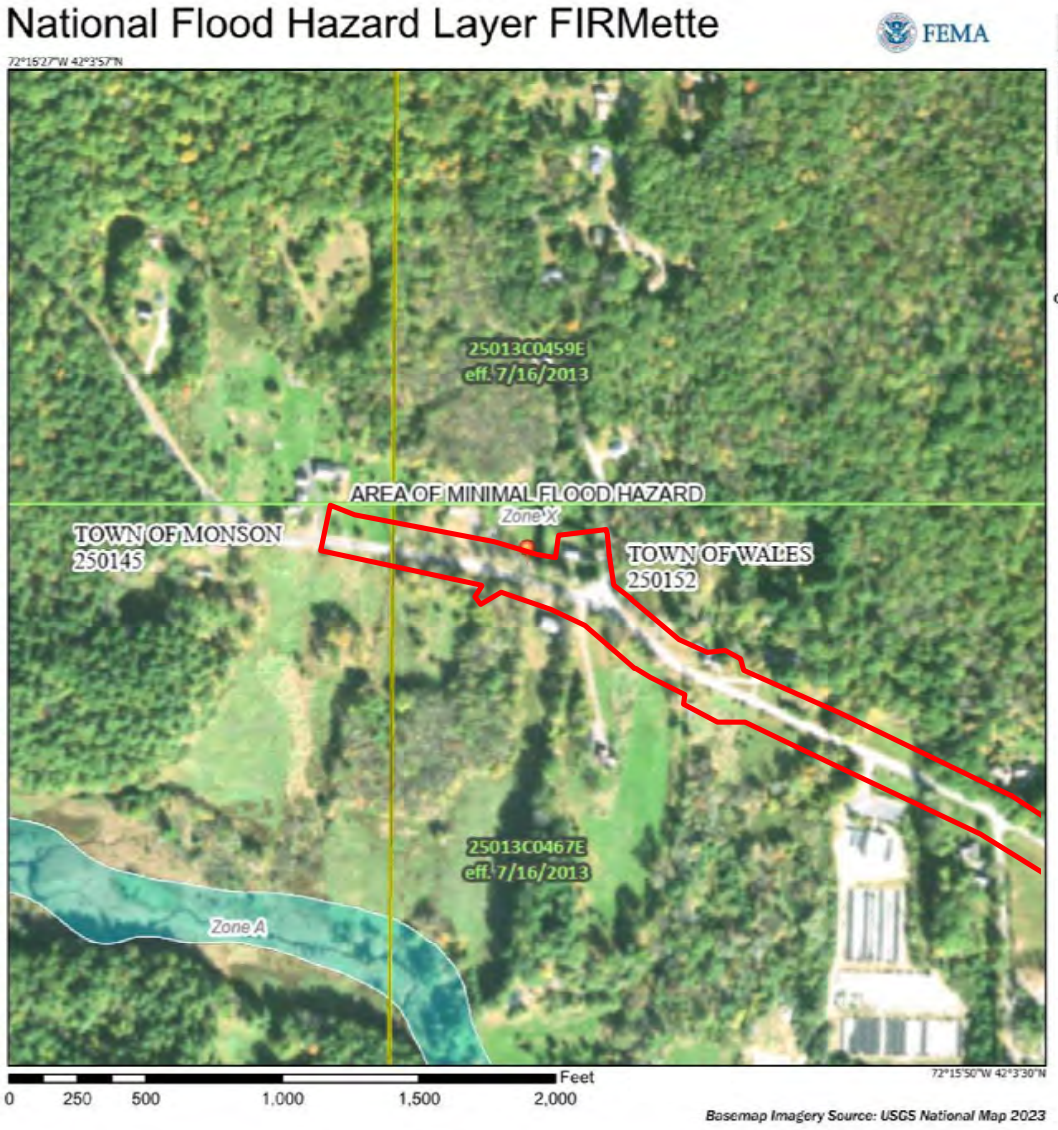
Investigation Area

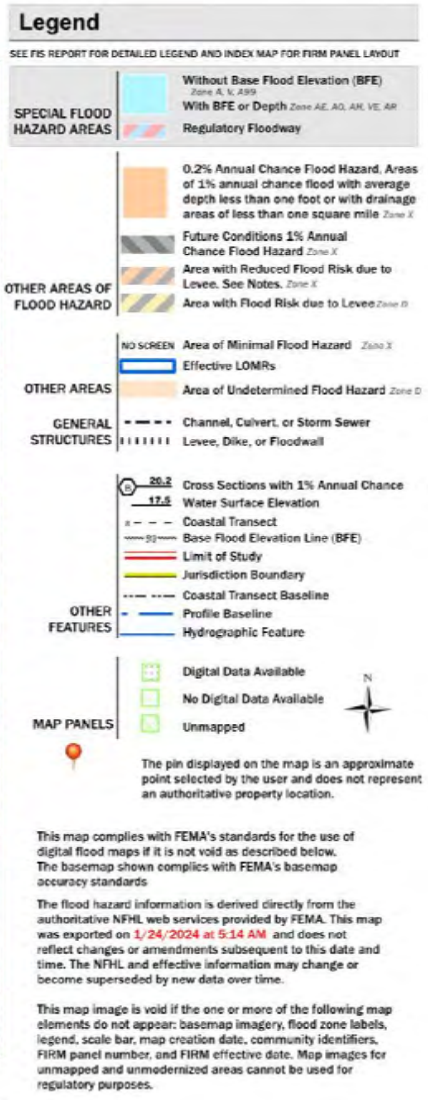
FIGURE 2

MONSON ROAD
WALES MA

USGS TOPOGRAPHIC MAP

Weston & Sampson





Legend

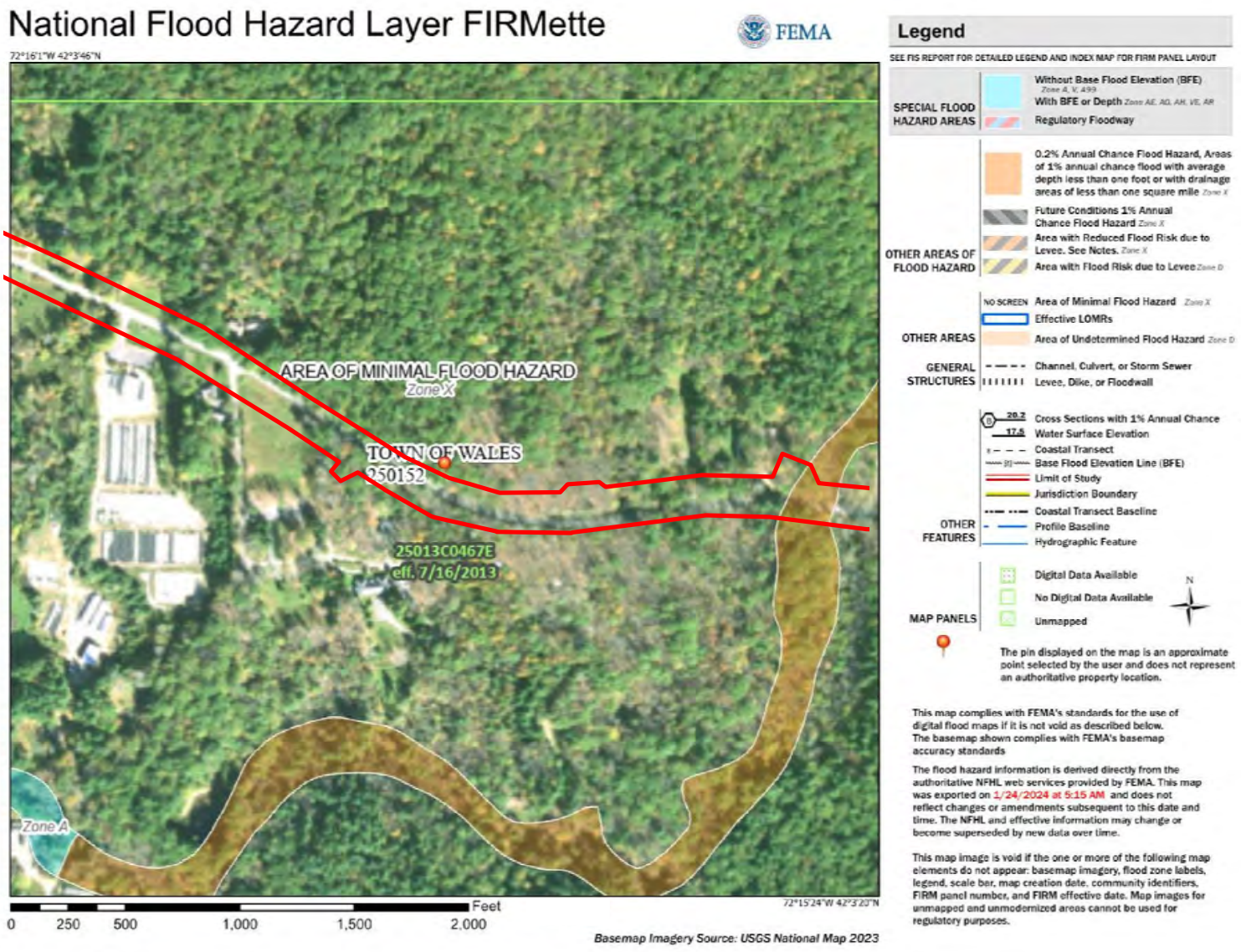
Investigation Area

FIGURE 3.1

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

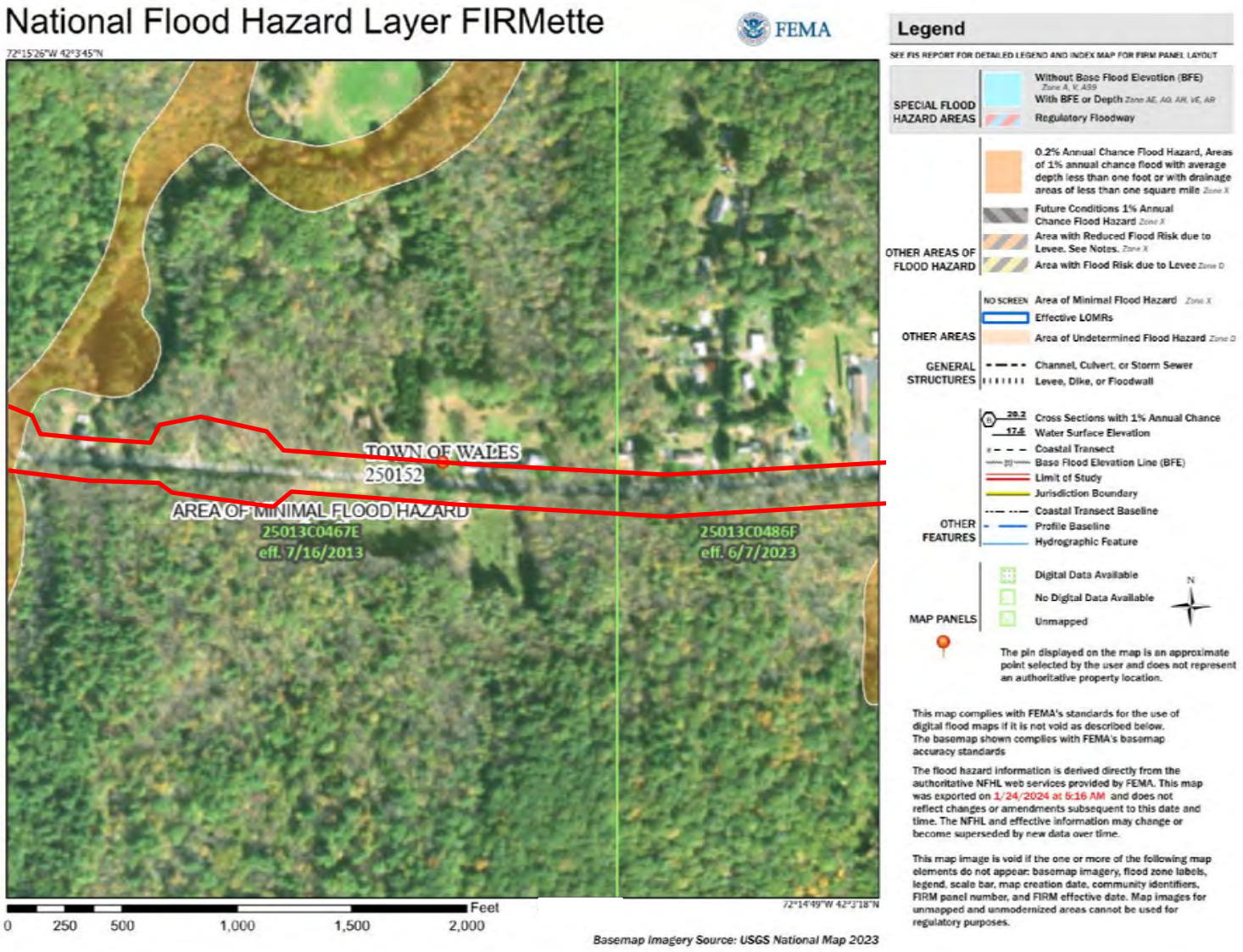
Investigation Area

FIGURE 3.2

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

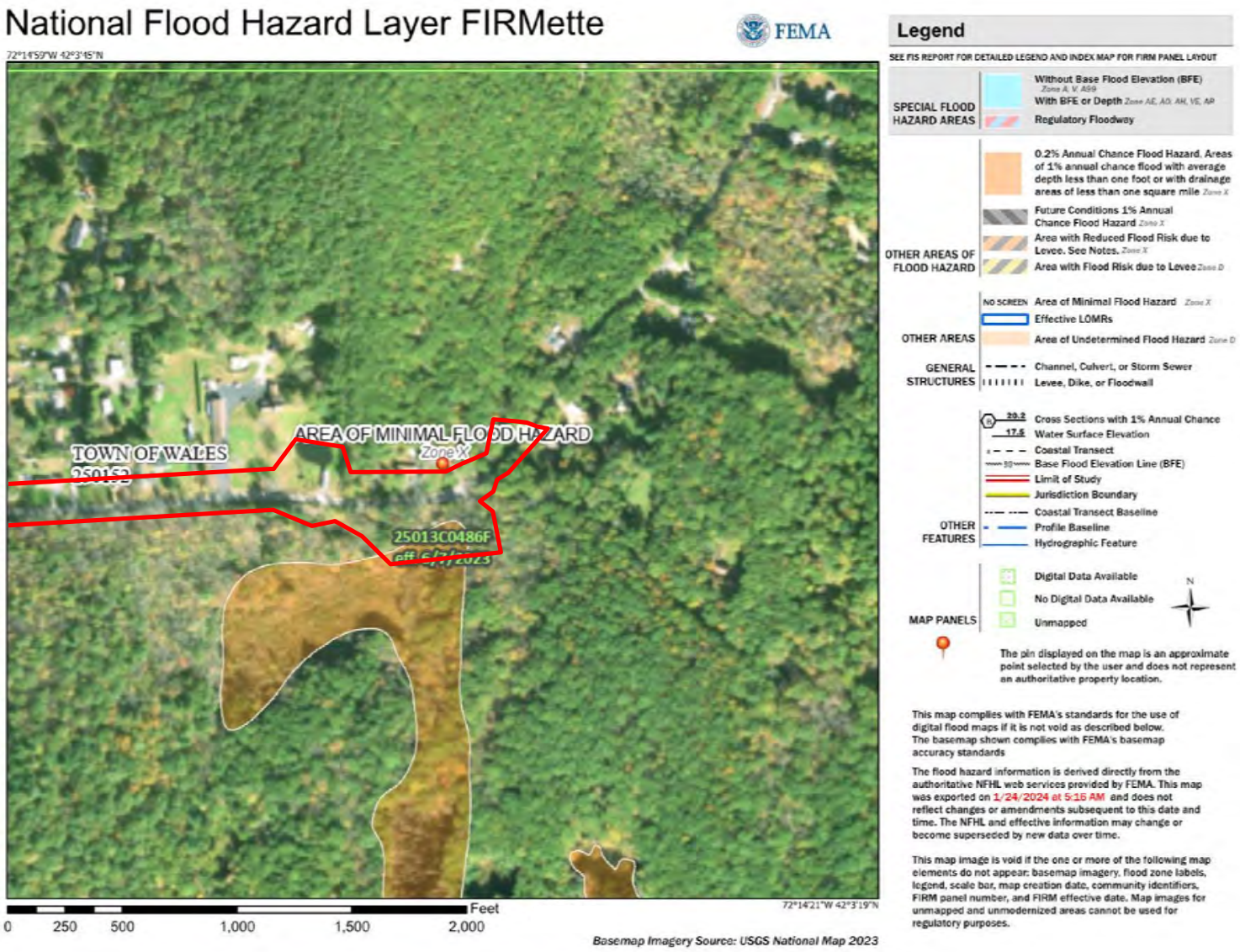
Investigation Area

FIGURE 3.3

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson



Legend

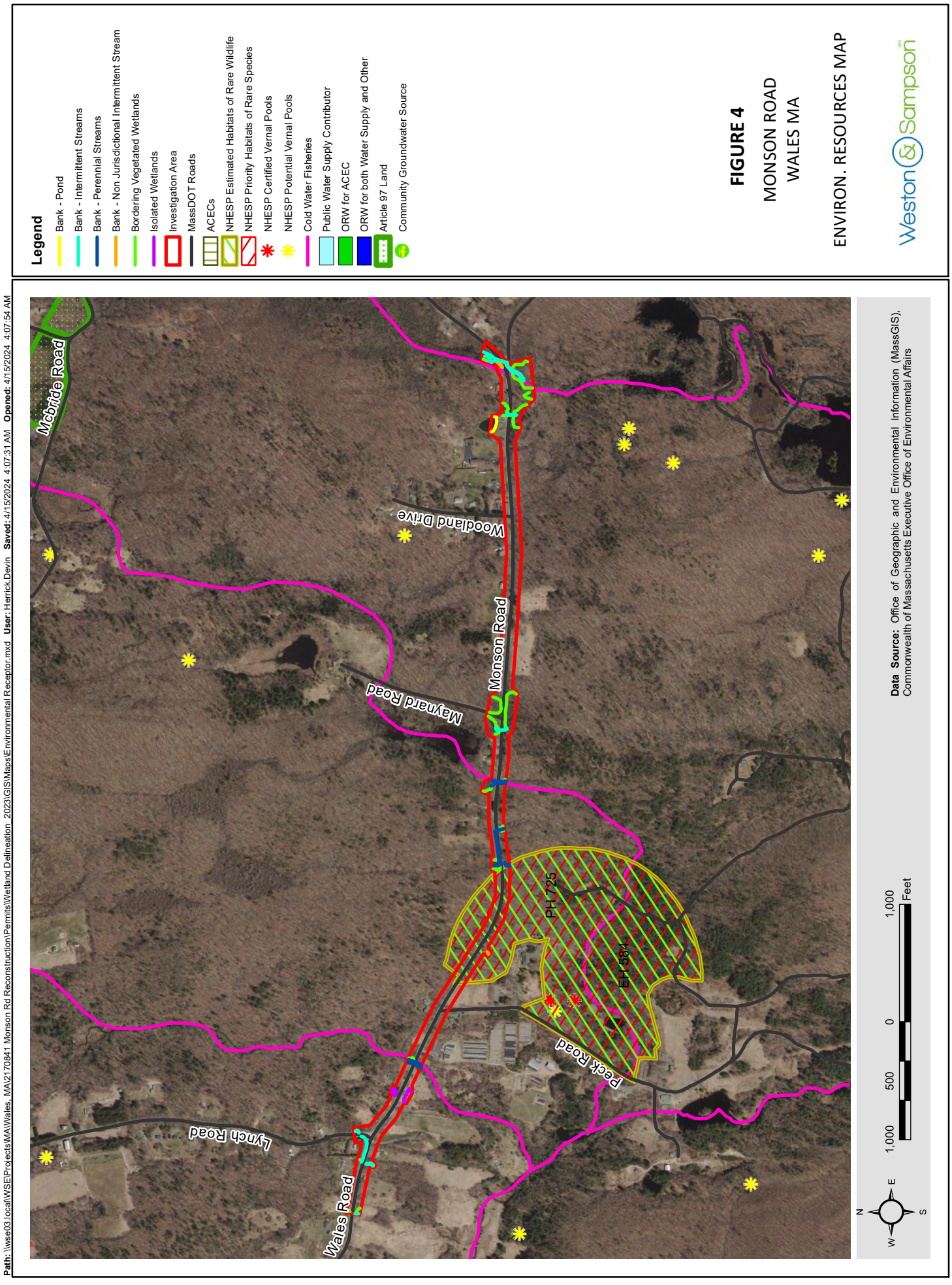
Investigation Area

FIGURE 3.4

MONSON ROAD
WALES MA

FEMA MAP

Weston & Sampson


Legend
Bank - Pond
Bank - Intermittent Streams
Bank - Perennial Streams
Bank - Non Jurisdictional Intermittent Stream
Bordering Vegetated Wetlands
Isolated Wetlands
Investigation Area
MassDOT Roads
ACECs
NHESP Estimated Habitats of Rare Wildlife
NHESP Priority Habitats of Rare Species
NHESP Certified Vernal Pools
NHESP Potential Vernal Pools
Cold Water Fisheries
Public Water Supply Contributor
ORW for ACEC
ORW for both Water Supply and Other
Article 97 Land
Community Groundwater Source
FIGURE 4
MONSON ROAD
WALES MA
ENVIRON. RESOURCES MAP
Weston & Sampson
Mcbride Road
Woodland Drive
Maynard Road
Monson Road
Lynch Road
Wales Road
Beck Road
PH 725
EH 584
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
1,000
500
0
1,000
Feet
N
E
S
W
Path: \\wse03.local\WSE\Projects\MA\Wales, MA\2170841 Monson Rd Reconstruction\Permits\Wetland Delineation 2023\GIS\Maps\Environmental Receptor.mxd User: Herrick.Devin Saved: 4/15/2024 4:07:31 AM Opened: 4/15/2024 4:07:54 AM

APPENDIX A

ACOE Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	90	Yes	FAC
2. green ash (***Fraxinus pennsylvanica***)	10	No	FACW
3. white pine (***Pinus Strobus***)	10	No	FACU
4. shagbark hickory (***Carya ovata***)	10	No	FACU
5.			
6.			
7.			
	120	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. common winterberry (***Ilex verticillata***)	80	Yes	FACW
2. Japanese barberry (***Berberis thunbergii***)	15	No	FACU
3.			
4.			
5.			
6.			
7.			
	95	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. crested fern (***Dryopteris cristata***)	30	Yes	FACW
2. sensitive fern (***Onoclea sensibilis***)	20	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1. riverbank grape (***Vitis riparia***)	10	Yes	FAC
2.			
3.			
4.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 140	x 2 = 280
FAC species 100	x 3 = 300
FACU species 35	x 4 = 140
UPL species	x 5 =
Column Totals: 275 (A)	720 (B)

Prevalence Index = B/A = 2.61

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 8	10YR 2/1	90	10YR 5/2 & 2.5YR 2.5/4	10	C/D	M	sandy muck	could not get below 8" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 8 inches as materials were very stoney.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-A16 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.71" N Long: 72° 15' 19.2" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

0

0

0

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-A16 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (Quercus rubra)	70	Yes	FACU
2. white pine (***Pinus Strobus***)	20	No	FACU
3. shagbark hickory (***Carya ovata***)	20	No	FACU
4.			
5.			
6.			
7.			
	110	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (***Berberis thunbergii***)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 125	x 4 = 500
UPL species	x 5 =
Column Totals: 125 (A)	500 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-A16 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 4/3	100					sandy loam	soils moist to dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Marshes, depressions, kettles, bogs, swamps Local relief (concave, convex, none): Concave

Slope (%): 0 - 1 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Freetown muck NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. common winterberry (***Ilex verticillata***)	30	Yes	FACW
2. highbush blueberry (***Vaccinium corymbosum***)	30	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. unidentified sedge	60	Yes	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 60	x 2 = 120
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 130 (A)	330 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/1	100					muck	saturated soils

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 30.23" N Long: 72° 14' 43.53" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

0

0

0

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer rubrum***)	60	Yes	FAC
2. shagbark hickory (***Carya ovata***)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (***Berberis thunbergii***)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 60	x 3 = 180
FACU species 55	x 4 = 220
UPL species	x 5 =
Column Totals: 115 (A)	400 (B)

Prevalence Index = B/A = 3.47

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-C1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. mulitflora rose (Rosa multiflora)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. broad-leaved cattail (***Typha latifolia***)	10	Yes	OBL
2. sensitive fern (***Onoclea sensibilis***)	15	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1. riverbank grape (***Vitis riparia***)	10	Yes	FAC
2.			
3.			
4.			
	10 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	15	x 2 =	30
FAC species	70	x 3 =	210
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	115 (A)		330 (B)

Prevalence Index = B/A = 2.87

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-C1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.21" N Long: 72° 14' 44.56" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-C1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	30	Yes	FAC
2. red oak (***Quercus rubra***)	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1. manicured lawn	60		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	30	x 3 =	90
FACU species	40	x 4 =	160
UPL species		x 5 =	
Column Totals:	70 (A)		250 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-C1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 6	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: BVW-D5 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. highbush blueberry (***Vaccinium corymbosum***)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. crested fern (***Dryopteris cristata***)	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 30	x 2 = 60
FAC species 70	x 3 = 210
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 100 (A)	270 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					saturated loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-D5 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 31.03" N Long: 72° 14' 39.5" W Datum: NAD 1983

Soil Map Unit Name: Gloucester gravelly fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

0

0

0

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-D5 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer rubrum***)	40	Yes	FAC
2. red oak (***Quercus rubra***)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (***Berberis thunbergii***)	100	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	100	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 40	x 3 = 120
FACU species 160	x 4 = 640
UPL species	x 5 =
Column Totals: 200 (A)	760 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-D5 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/2	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 2	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: BVW-E1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1. crested fern (***Dryopteris cristata***)	15	Yes	FACW
2. sensitive fern (***Onoclea sensibilis***)	10	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25	= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	25	x 2 =	50
FAC species	70	x 3 =	210
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	95 (A)		260 (B)

Prevalence Index = B/A = 2.74

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/2	95	10YR 5/6	5	C/CS		sandy loam	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: BVW-E1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills, ground moraines, drumlins Local relief (concave, convex, none): Linear, convex

Slope (%): 8 - 15 Lat: 42° 3' 32.76" N Long: 72° 15' 35.47" W Datum: NAD 1983

Soil Map Unit Name: Paxton fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BVW-E1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	30	Yes	FAC
2. red oak (***Quercus rubra***)	60	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	90	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species 30	x 3 = 90
FACU species 60	x 4 = 240
UPL species	x 5 =
Column Totals: 90 (A)	330 (B)

Prevalence Index = B/A = 3.67

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BVW-E1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 16' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 3	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-B1 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red maple (***Acer Rubrum***)	50	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. silky dogwood (***Cornus amomum***)	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40	= Total Cover	
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species 40	x 2 = 80
FAC species 50	x 3 = 150
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 90 (A)	230 (B)

Prevalence Index = B/A = 2.56

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 2/2	100					sandy muck	could not get below 5" due to stones

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Soils were saturated. Could not sample below 5 inches as materials were very stony.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-B1 (up)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, convex

Slope (%): 3 - 8 Lat: 42° 3' 41.54" N Long: 72° 15' 0.47" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

0

0

0

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-B1 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. black cherry (***Prunus serotina***)	20	Yes	FACU
2. white pine (***Pinus Strobus***)	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 feet)			
1. Japanese barberry (***Berberis thunbergii***)	10	Yes	FACU
2. American red raspberry (***Rubus idaeus***)	15	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	25	= Total Cover	

Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

Woody Vine Stratum (Plot size: 30 feet)			
1. American bittersweet (***Celastrus scandens***)	15	Yes	FACU
2.			
3.			
4.			
	15	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 70	x 4 = 280
UPL species	x 5 =
Column Totals: 70 (A)	280 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-B1 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Materials stony below 10 inches.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-C4 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (***Phalaris arundinacea***)	80	Yes	FACW
2. rough-leaved goldenrod (***Solidago patula***)	20	No	OBL
3. grass-leaved goldenrod (***Euthamia graminifolia***)	20	No	FAC
4. broadleaf cattail (***Typha latiifolia***)	20	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	140 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	80	x 2 =	160
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	140 (A)		260 (B)

Prevalence Index = B/A = 1.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	100					sandy muck	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-C4 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 39.5" N Long: 72° 16' 0.64" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-C4 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. white pine (***Pinus strobus***)	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 15	x 4 = 60
UPL species 90	x 5 = 450
Column Totals: 105 (A)	510 (B)

Prevalence Index = B/A = 4.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-C4 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 3/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42º 3' 44.81" N Long: 72º 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: PEM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0	
Water Table Present?	Yes X	No _____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: WA-A3 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (***Phalaris arundinacea***)	60	Yes	FACW
2. rough-leaved goldenrod (***Solidago patula***)	20	Yes	OBL
3. grass-leaved goldenrod (***Euthamia graminifolia***)	20	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	60	x 2 =	120
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: WA-A3 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 44.81" N Long: 72° 16' 13.87" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: WA-A3 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1. red oak (***Quercus rubra***)	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species 20	x 4 = 80
UPL species 90	x 5 = 450
Column Totals: 110 (A)	530 (B)

Prevalence Index = B/A = 4.82

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA-A3 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (wet)

Investigator(s): Nathaniel Parker Section, Township, Range:

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

θ

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: IW-B6 (wet)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Herb Stratum (Plot size: 5 feet)			
1. reed canarygrass (***Phalaris arundinacea***)	70	Yes	FACW
2. rough-leaved goldenrod (***Solidago patula***)	20	No	OBL
3. grass-leaved goldenrod (***Euthamia graminifolia***)	20	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110 = Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	70	x 2 =	140
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	110 (A)		220 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (wet)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 2/2	98	2.5YR 3/6	2	CS	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Monson Road Improvement Project City/County: Wales/Hampden Sampling Date: 11/24/2020

Applicant/Owner: Town of Wales State: MA Sampling Point: IW-B6 (up)

Investigator(s): Nathaniel Parker Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hills Local relief (concave, convex, none): Linear, concave

Slope (%): 3 - 8 Lat: 42° 3' 43.76" N Long: 72° 16' 14.55" W Datum: NAD 1983

Soil Map Unit Name: Scituate fine sandy loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: IW-B6 (up)

Tree Stratum (Plot size: 30 feet)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 feet)			
1. unidentified upland grass	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	90 = Total Cover		
Herb Stratum (Plot size: 5 feet)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: 30 feet)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species 90	x 5 = 450
Column Totals: 90 (A)	450 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: IW-B6 (up)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 2/3	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Appendix G

Site Photographs

Photo 1: Wet AA Flag Series

Photo 2: Wet BB Flag Series

Photo 3: TOB AA Flag Series

Photo 4: TOB BB and TOB CC Flag Series

Photo 5: TOB A and TOB B Flag Series

Photo 6: WET A Flag Series

Photo 7: WET B Flag Series

Photo 8: TOB E and TOB F Flag Series

Photo 9: BVW A Flag Series

Photo 10: TOB J and TOB I Flag Series

Photo 11: BVW B Flag Series

Photo 12: TOB K and TOB L Flag Series

Photo 13: BVW D Flag Series

Photo 14: TOB AA and TOB BB Flag Series

Photo 15: BVW G Flag Series

Photo 16: TOB AA and TOB BB Flag Series

Appendix H

Previous Correspondence with MESA & Proof of Mailing NOI to NHESP

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

Jack Buckley, *Director*

February 09, 2018

Bruce Cadiuex
1 Hegan St.
Wales MA 01081

RE: Project Location: Monson Rd, Wales
Project Description: Road widening, drainage improvements
NHESP File No.: 18-37517

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans entitled "MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION PLAN AND PROFILE OF MONSON ROAD IMPROVEMENTS IN THE CITY/TOWN OF WALES HAMPDEN COUNTY 25% SUBMITTAL" (dated February 2018) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at (508) 389-6357.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

cc: Alan Nafis, Weston & Sampson Engineers, Inc.

7009 1410 0002 5157 1397

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	

Postmark Here

Total Posta

Sent To Natural Heritage & Endangered Species Program

Street, Apt. N or PO Box Nc Division of Fisheries and Wildlife

City, State, Zi 1 Rabbit Hill Road

Westborough, MA 01581

PS Form 3800, August 2006 See Reverse for Instructions

Appendix I

Project Plans (provided under separate cover)

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

June 18, 2024

Massachusetts Department of Environmental Protection
Western Regional Office
Attn: Mr. Mark Stinson
436 Dwight Street
Springfield, MA 01103

Submitted via email to mark.stinson@mass.gov

Re: Response to MassDEP Comments – Monson Road Transportation Improvements Project, Wales, Massachusetts (DEP File No. WE 314-0183)

Dear Mr. Stinson:

In response to the comments issued by MassDEP on June 13, 2024 for the Monson Road Transportation Improvements Project Notice of Intent (NOI) submitted by the Town of Wales, Weston & Sampson is providing a written response to comments.

MassDEP's comments on the NOI are provided in italics below, followed by our responses in **bold** font.

1. *The Commission needs to wait to close the public hearing until NHESP has issued its determination.*

   The Applicant acknowledges this comment and understands that NHESP must issue a determination before the Wales Conservation Commission can close the public hearing.

2. *Regarding the BVW replication area, because the work is eligible to be reviewed as a limited project, the replication area may be done outside of the project area, if a more suitable location is found. The two proposed wetland mitigation areas have been designed and sited based on field conditions and have been designed to comply with the performance standards for BVW relating to replication area design to the maximum extent practicable.*

   The Applicant acknowledges this comment and understands that the wetland replication areas could be constructed outside of the project area, if a more suitable location is found. The two replication areas have been carefully sited and designed to occur adjacent to the project area, while in areas that are suitable for construction and adjacent to existing wetlands. The replication areas have been designed to meet the requirements of the performance standards relating to replication area design at 310 CMR 10.55(5)(b) to the maximum extent practicable, as a limited project. The two proposed wetland replication areas have been designed to provide greater than 1:1 mitigation for the total BVW impacts for the overall project, which includes those impacts proposed as part of the stream crossing work under the 401 WQC application.

3. *Regarding the proposed Riverfront Area mitigation, see pages 14, 15, and 16, shade tree plantings or other mitigation can be done offsite, see the language of 310 CMR 10.58(5)(g), if other areas in town owned land will benefit by the plantings. Also, review the language of 310 CMR 10.58(5)(h). Simply monitoring for 2 years is not adequate as it also requires that the mitigation area be maintained as a mitigation area, in perpetuity.*

   No additional land is needed to mitigate the loss of shade trees. See below.

   As a limited project, the project is seeking flexibility with meeting this performance standard and proposes to meet the RFA mitigation requirements to the maximum extent practicable.

This project is a roadway project with three perennial stream crossings. The crossing are also unique as they run parallel to the road in several locations which creates larger RFAs than a simple perpendicular stream crossing. Due to the unique conditions and the work needing to occur within the existing roadway corridor and right-of-way, impacts to RFA were unavoidable. That being said, the proposed work in RFA will result in an improvement to the existing conditions. Subsurface drainage systems consisting of catch basins and manholes are proposed to improve the existing drainage conditions along the roadway. Currently, this section of roadway and associated culvert crossings are in poor condition with aging infrastructure and drainage issues. Stormwater collection does not meet current development standards. The existing culverts are undersized, and overtopping of the roadway occurs during large storms. Additionally, Monson Road in this area is experiencing deteriorating roadway conditions. The proposed project will improve conditions through reconstruction and widening of the roadway, and through the proposed culvert replacements and new subsurface drainage improvements to improve stormwater management.

Due to space constraints on the site (limited to the roadway corridor), and the need to reconstruct and widen the roadway in order to meet the project purpose and need, there is limited space available for RFA mitigation on site. However, where space allows, shade tree plantings are proposed within RFA along the roadway corridor. Overall, the project will replace shade tree plantings at a greater than 2:1 ratio of trees removed throughout the project corridor (23 trees are proposed to be removed and 53 trees are proposed to be planted).

Regarding monitoring and maintenance, please see MassDOT special provisions which provide items for Wetland Restoration, Wetland Specialist, Wetland Monitoring Reports, etc. which includes the needed maintenance and regulatory compliance checks prior to acceptance.

4. *Swales by themselves provide minimal infiltration. To provide more treatment and some infiltration, you must look at Volume 2 Chapter 2 of the Stormwater Handbook on how to design, construct, operate and maintain the swale, or grass swale or water quality swale, per the handbook. There are specific differences between dry water quality swales, wet water quality swales, bioretention cells, and drainage channels.*

Regarding compliance with Volume 2 Chapter 2 of the Handbook, limited or insufficient space is available within the public layout to allow for the installation of additional water quality measures. Linear stormwater infiltration practices were considered for the project. However, due to the need to relocate and preserve the existing stone walls within the project limits to reduce the total length of stone wall removal below the MEPA threshold, many of the stone walls occupy locations where wider infiltration and/or wet/dry water quality swales could be installed without resulting in more significant right-of-way and permit impacts.

Additionally, in many areas long, linear and parallel wetlands and watercourses run along the roadway and occupy portions of the town layout which also normally would be considered for linear practices. In order to qualify as a linear stormwater practice, the design would need to provide a certain depth and width in order to provide the minimum water quality volume characteristics which would significantly increase the easements needed on the abutting private properties. These properties include single family developed and undeveloped residential and large parcels of an undeveloped wildlife sanctuary property all of which are densely vegetated with mature shade and other tree species. To mitigate the removal of 23 shade trees 14” d.b.h. or greater due to the project, 53 new trees are proposed as mitigation along the entire corridor, often within or adjacent areas which might be used for linear BMPs.

Lastly, the roadway design includes 10-foot travel lanes and 4-foot shoulders. This required a design criteria exception from MassDOT to provide the 4-foot shoulders instead of 5-foot bikes lanes/shoulders or 5-foot buffered bike lanes / shoulders, which most MassDOT projects must provide in accordance with MassDOT's complete streets requirements. This limited the widening of the road to twenty-eight feet wide instead of thirty feet or thirty-four feet.

Given these constraints, we believe the project has met the stormwater standards for this limited project and the recommendations of the handbook to the maximum extent practicable.

5. *As a reminder, a log book must be kept and made available for commission or MassDEP upon request, for the maintenance of the stormwater system. This item should be discussed at the hearing as this requirement is frequently not complied with and the maintenance not done.*

   The Applicant acknowledges this comment and will keep a log book for this project.

6. *Page 2 of the Stormwater Report, under the Rational Method, shouldn't impervious areas use a runoff coefficient of at least 0.95? What was the basis for using the CN for open fields and woods? Was any soil analysis conducted?*

   Chapter 8 of the MassDOT PDDG (Drainage and Erosion Control), Exhibit 8-9 indicates a recommended range for runoff coefficients for the Rational Method for pavement as 0.70 to 0.95.

   2006 Project Development and Design Guide - Chapter 8 Drainage and Erosion Control (mass.gov)

   We typically use 0.90 which is the higher end of that range. It is our understanding that the MassDEP handbook for Con Coms also uses this same range.

   For the CN value (which we believe was intended to inquire about the runoff coefficient), the same Chapter 8 of the PDDG was used along with Exhibit 8-8. For CN values, it would typically be based on ground cover and hydrologic soil group.

If you have any questions regarding this submittal, please contact me at 978-548-6301.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Michael Joyce, P.E.
Senior Team Leader - Transportation

cc: Wales Conservation Commission
Wales Board of Selectmen
Courtney Walker, MassDOT
Melissa Lenker, MassDOT
Kimberly Sloan, MassDOT

THIS PAGE IS INTENTIONALLY LEFT BLANK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE TOWN OF

WALES

HAMPDEN COUNTY

100% SUBMITTAL

ROADWAY NOI & MEPA ENVIRONMENTAL PERMIT PLAN SET

WALES
MONSON ROAD

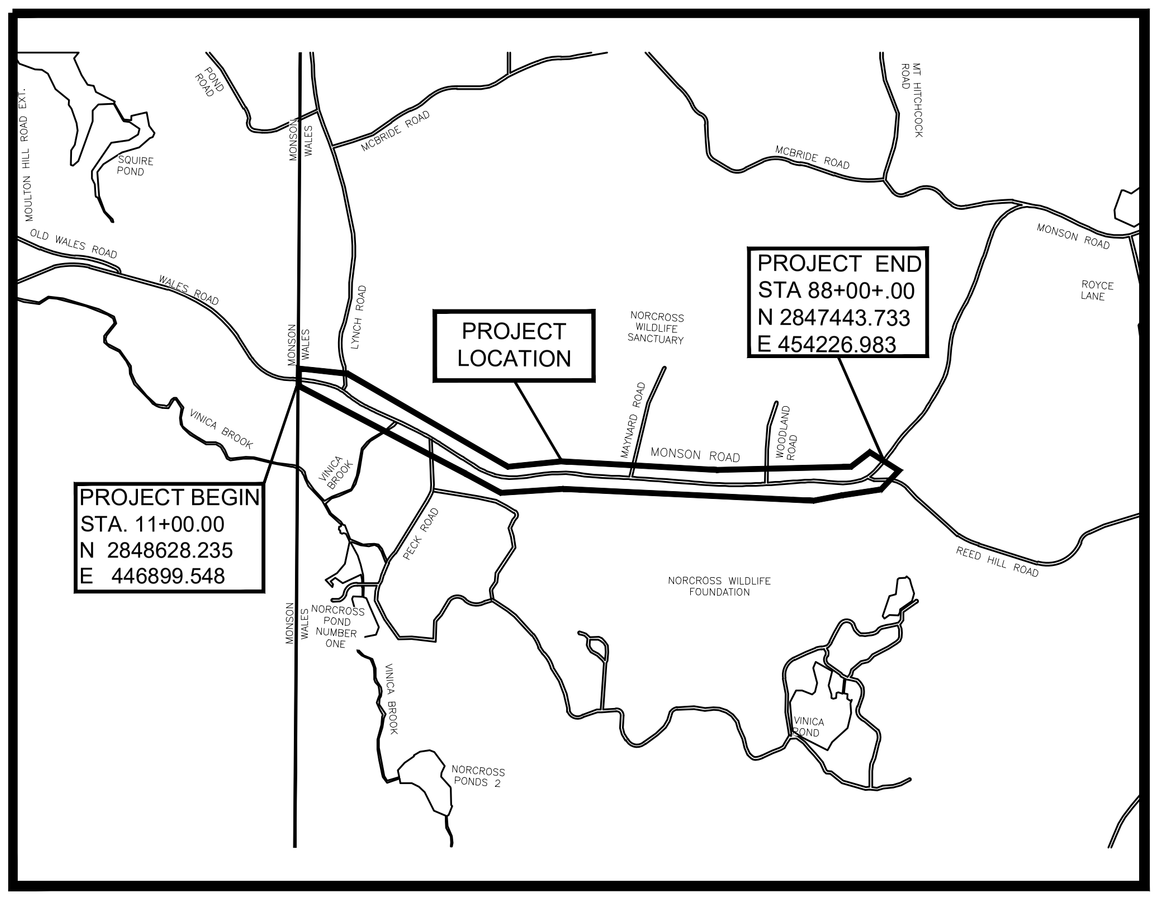
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	180
PROJECT FILE NO.	608163		

TITLE SHEET & INDEX

THESE PLANS ARE SUPPLEMENTED BY THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2024, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND, ABBREVIATIONS & GENERAL NOTES
4-6	BORING LOGS
7	TYPICAL SECTIONS
8-21	CONSTRUCTION PLANS
22-33	PROFILES
34-47	CURB TIE & GRADING PLANS
48-61	TRAFFIC SIGN AND PAVEMENT MARKING PLANS
62	TRAFFIC CONTROL SIGN SUMMARY
63-68	TEMPORARY TRAFFIC CONTROL DETAILS
69-82	UTILITY PLANS
83-85	CONSTRUCTION DETAILS
86-162	CROSS SECTIONS
163-174	STRUCTURAL PLANS
175	CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION
176-177	CULVERT 3 CHANNEL CROSS SECTIONS
178-179	TEMPORARY WATER HANDLING PLAN
180	WETLAND REPLICATION AREA DETAIL



2000 0 2000 4000

LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

June 2024

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

COMMONWEALTH OF MASSACHUSETTS
SCOTT R. BRUSO
STRUCTURAL
No. 48061
REGISTERED PROFESSIONAL ENGINEER
2024.06.05 12:41:48-04'00'

Weston & Sampson℠
712 Brook Street, Suite 103
Rocky Hill, CT 06067
860.513.1473
www.westonandsampson.com

DATE	DESCRIPTION	REV #

MassDOT Massachusetts Department of Transportation Highway Division

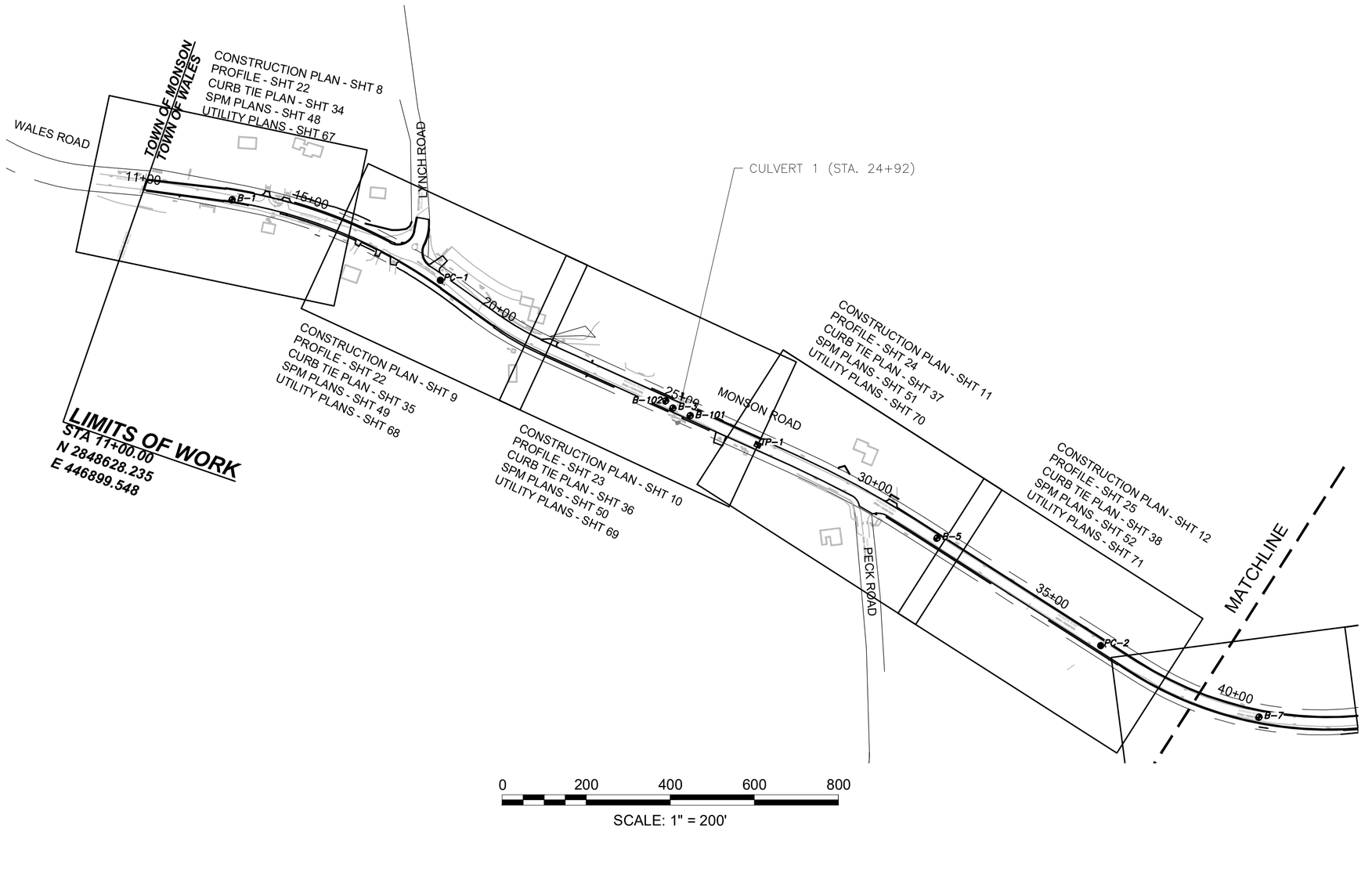
APPROVED

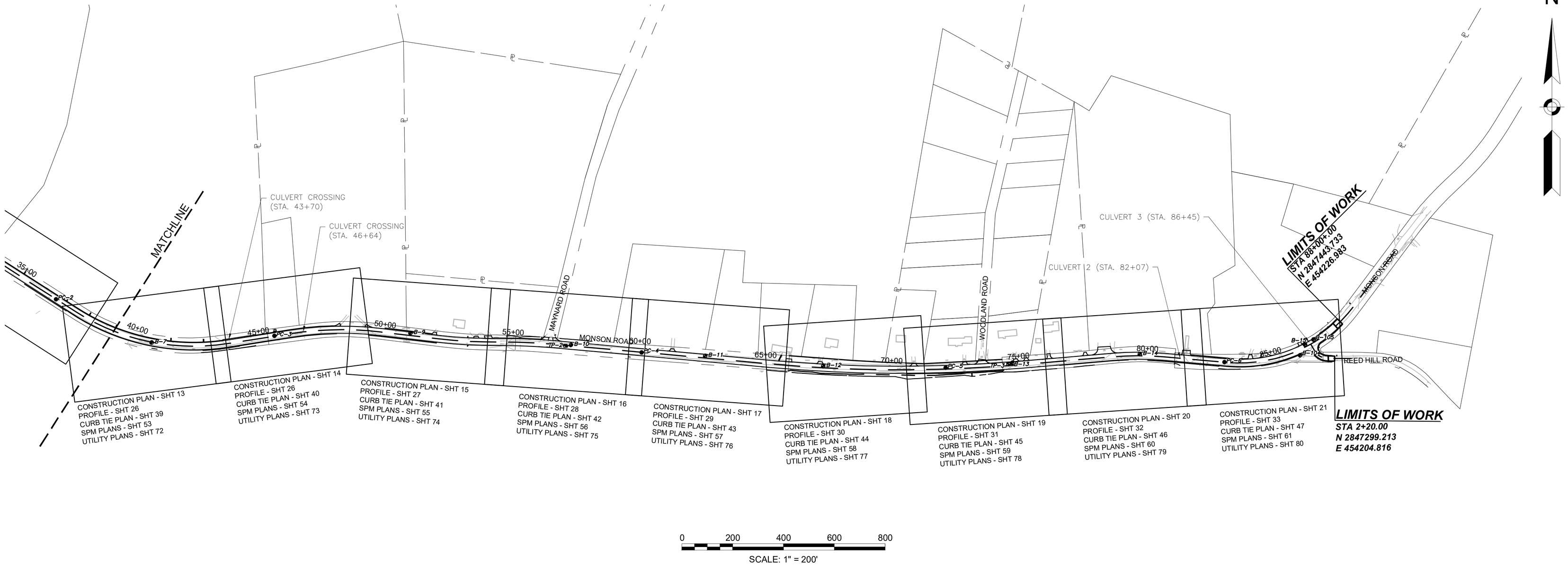
CHIEF ENGINEER **DATE**

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Jun-2024 10:20 AM
Proposal No. 608163-128112
A0080 - 405

NOTES:

1. BENCH MARK:
   MAGNAIL U.P.L. LOCATED EAST OF NORTH STREET AT STATION 12+79.94 AND EL. 869'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 21+37.43 AND EL. 877'
   MAGNAIL U.P.L LOCATED WEST OF NORTH STREET AT STATION 29+56.65 AND EL 900'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 29+94.76 AND EL 902'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 38+22.13 AND EL 938'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 56+22.73 AND EL 957'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 65+94.25 AND EL 1007'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 74.95.16 AND EL 1022'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 81+31.62 AND EL 1006'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 47+02.17 AND EL 934'
   SPIKE U.P.L. LOCATED WEST OF NORTH STREET AT STATION 87+05.97 AND EL 1008'
   BRASS RIVET LOCATED WEST OF NORTH STREET AT STATION 87+15.35 AND EL 1001'





WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	180
PROJECT FILE NO.	608163		

KEY PLAN

BORING LOCATIONS (FEET)

BORING	NORTHING	EASTING	STATION	OFFSET	SURFACE EL.	H.B.E.
B-1	2,848,584	447,074	12+80	22.4 RT	868.0	861.5
B-3	2,848,121	448,154	24+56	10.0 LT	877.0	865.2
B-5	2,847,789	448,792	31+89	10.8 LT	902.0	897.5
B-7	2,847,423	449,318	38+27	18.1 RT	941.0	937.0
B-9	2,847,397	450,584	51+05	9.6 LT	933.0	916.5
B-10	2,847,355	451,197	57+19	6.7 LT	956.0	951.5
B-11	2,847,315	451,727	62+51	14.1 LT	989.0	984.5
B-12	2,847,272	452,354	68+80	16.0 LT	1011.0	1007.0
B-13	2,847,294	452,969	74+98	19.4 LT	1019.0	1014.5
B-14	2,847,322	453,443	79+72	12.1 LT	1009.0	1004.5
B-15	2,847,355	454,092	86+37	9.1 LT	1002.0	999.1
B-101	2,848,098	448,155	24+80	4.2 RT	877.1	861.9
B-102	2,848,103	448,186	25+06	12.85 LT	877.5	849.0
B-104	2,847,316	454,080	86+09	20.6 RT	1002.4	974.4
B-105	2,847,367	454,110	85+59	11.0 RT	1001.8	987.7

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Jun-2024 11:22 AM
Proposal No. 608163-128112
A008680 - 405

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
	CBCI	CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
C	C	CABLE MANHOLE
D	D	DRAINAGE MANHOLE
E	E	ELECTRIC MANHOLE
G	G	GAS MANHOLE
M	M	MISC MANHOLE
S	S	SEWER MANHOLE
T	T	TELEPHONE MANHOLE
W	W	WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
	OHU	OVERHEAD CABLE/WIRE
		CURBING
99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		EROSION AND SEDIMENT CONTROL BARRIER
		TREE LINE
		LIMITS OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT AREA BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
		SIGN AND POST

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CBCI-DB	DOUBLE GRATE CATCH BASIN W/ CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN

ABBREVIATIONS (cont.)

GENERAL

LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCCE	REINFORCED CONCRETE CULVERT END
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STA
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
SWTU	STORMWATER TREATMENT UNIT
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
	SL	12"-WIDE STOP LINE
	SWL	6"-WIDE SOLID WHITE LINE
	DBYL	DOUBLE YELLOW LINE (2 - 6"-WIDE YELLOW LINES)

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	180
PROJECT FILE NO.	608163		

LEGEND, ABBREVIATIONS & GENERAL NOTES

GENERAL NOTES:

1. TOPOGRAPHICAL INFORMATION BASED ON AN ON THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ON DECEMBER 2017 AND SUPPLEMENTED BY CHAPPELL ENGINEERING IN OCTOBER 2023. WETLAND FLAGGING WAS PERFORMED BY WESTON & SAMPSON IN NOVEMBER 2020 AND REFLAGGED IN SEPTEMBER OF 2023.
2. THE HORIZONTAL COORDINATES ARE BASED ON NAD 83, THE VERTICAL DATUM IS NAVD 88.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL DIG TEST PITS WITH THE LOCATIONS BEING APPROVED BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK TO EXACTLY LOCATE EXISTING UTILITIES.
4. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY OWNER. ANY ALTERATIONS SHALL BE INCIDENTAL TO THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY SUPPORT OF ALL UTILITIES TO REMAIN IN PLACE AND SHALL DESCRIBE IN WRITING, TO THE SATISFACTION OF THE ENGINEER, HIS METHOD OF TEMPORARY SUPPORT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. THE TERM "PROPOSED (PROP)" INDICATES WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET (R&R)".
8. ALL EXISTING STATE, COUNTY AND TOWN LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
9. ALL EXCESS MATERIAL FROM ROADWAY RECONSTRUCTION OR THE EXCAVATION PROCESS SHALL BE REUSED ON SITE OR REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL AND PROPER MANNER.
10. THE CONTRACTOR SHALL CALL DIGSAFE AT 1-888-344-7233 AT LEAST 72 HOURS, SATURDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE TOWN PRIOR TO EXCAVATION.
11. JOINTS BETWEEN HOT MIX ASPHALT TRENCH PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.
12. IF DEEMED NECESSARY DUE TO THE WORK, THE CONTRACTOR SHALL COORDINATE WITH THE TOWN OF WALES HIGHWAY DEPARTMENT, THE WALES FIRE DEPARTMENT, AND THE ENGINEER FOR APPROVAL OF SHUTTING DOWN ANY EXISTING WATER MAINS AND SHALL ALSO OBTAIN APPROVAL FOR DISRUPTING ANY EXISTING SEWER FLOWS.
13. THE CONTRACTOR SHALL BE AWARE THAT ONLY TOWN PERSONNEL ARE ALLOWED TO OPERATE WATER GATES AND HYDRANTS. ANY REQUESTS TO OPERATE THE GATES SHALL BE COORDINATED THROUGH THE ENGINEER.
14. THE CONTRACTOR SHALL COORDINATE ANY WORK FOR THE PROJECT WITH ALL ADJACENT/CONCURRENT PROJECTS AND CONTRACTORS.
15. THE CONTRACTOR SHALL INSTALL PRIOR TO COMMENCEMENT OF WORK, MAINTAIN, AND REMOVE AT THE END OF THE PROJECT INLET SEDIMENT CONTROL BAGS IN ALL CATCH BASINS, WITHIN OR ADJACENT TO THE PROJECT LIMITS. THE CONTRACTOR SHALL ALSO MAINTAIN SILT FENCE AND COMPOST FILTER TUBES AS SHOWN ON THE PLANS THROUGHOUT THE DURATION OF THE PROJECT AND REMOVE AT THE END.
16. ANY GRASS AREAS DISTURBED BY THE WORK SHALL BE RESTORED WITH LOAM AND SEED.
17. ANY LANDSCAPED AREAS DISTURBED BY THE WORK SHALL BE RESTORED TO EXISTING CONDITIONS WITH EXISTING OR NEW GROUND COVER MATERIALS AS DIRECTED BY THE ENGINEER. ANY PLANTS, SHRUBS, OR FLOWERS DISTURBED BY THE WORK SHALL BE RESET TO EXISTING CONDITIONS OR REPLACED WITH NEW PLANTS, SHRUBS, OR FLOWERS AS DIRECTED BY THE ENGINEER. ALL WORK TO RESTORE LANDSCAPE AREAS, NEW GROUND COVER MATERIALS, NEW PLANTS, NEW SHRUBS, OR NEW FLOWERS REQUIRED BY THE ENGINEER SHALL BE INCIDENTAL TO THE PROJECT.
18. CONTRACTOR TO COORDINATE WITH UTILITY POLE OWNERS IN AREAS WHERE UNDERGROUND UTILITY WORK IS WITHIN CLOSE PROXIMITY AND POSSIBLE UTILITY POLE SHORING IS REQUIRED WHILE INSTALLING PROPOSED UTILITIES.
19. RAISE AND ADJUST FRAMES AND GRATES, FRAMES AND COVERS AND GATE BOXES PRIOR TO PAVEMENT OVERLAY, IF REQUIRED.
20. CONTRACTOR IS RESPONSIBLE FOR REPLACING ANY PROPERTY PINS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION, TO THEIR LOCATION JUST PRIOR TO CONSTRUCTION.
21. ALL TRAFFIC SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS OTHERWISE NOTED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
22. CONTRACTOR TO ESTABLISH TEMPORARY BENCHMARKS EVERY 1000 FEET BASED ON THE PERMANENT BENCHMARKS LOCATED AT STA 29+85.04, 24.73 LEFT AND STA 87+27.18, 41.17 LEFT OR AS REQUIRED BY THE ENGINEER.
23. CONTRACTOR TO PROVIDE ADDITIONAL TRAVERSE POINTS AND TRAVERSE LINES IN THE VICINITY OF EXISTING TRAVERSE POINTS WHERE THE EXISTING TRAVERSE POINT IS LOCATED IN "SOFT GROUND" OR AS REQUIRED BY THE ENGINEER.

A080609 - 407

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Jun-2024 11:22 AM

Proposal No. 608163-128112

BORING NUMBER: B-1

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2848585 E: 447074.83
GROUND ELEVATION: 868 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	4 ft. +/-	Water level measured upon completion of boring

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 868.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	11/24	45 12 16 19	28				FILL	Medium dense, brown, fine to medium SAND, little fine to coarse gravel, trace silt; moist. [FILL]	
	S-2	2.5	0/24	9 5 4 7	9					*No sample recovery; gravel observed in tip of sampler.*	
5 863.0	S-3	4.5	12/24	12 13 11 23	24		30.1	56.9	SANDY SILT	Very stiff, brown, fine to medium sandy SILT, trace fine gravel; wet.	

Bottom-of-boring at 6.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-1**

BORING NUMBER: B-3

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2848121 E: 448138
GROUND ELEVATION: 877 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	5 ft. +/-	Water level measured upon completion of boring

OBSERVED GROUNDWATER NOVEMBER 21, 2017 ELEV. = 864.00

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 877.0										Asphalt concrete (AC) pavement, multiple layers (9" total thickness).	
	S-1	1.0	4/24	31 40 17 5	57				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	3.0	10/24	3 2 4 5	6	36.7	50.2			Medium stiff, dark brown-brown, fine to medium sandy SILT, little clay; moist. [FILL]	
5 872.0	S-3	5.0	16/24	14 30 28 23	58				SAND	Top 3" - Grey-brown SILT, trace fine sand; wet. Bottom 13" - Very dense, orange-brown, gravelly fine to coarse SAND, some silt; wet.	
10 867.0	S-4	10.0	8/15	25 58 100/3"					SILTY SAND	Brown, silty fine to medium SAND, trace fine gravel; wet.	

Drilling refusal at 11.8 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-3**

BORING NUMBER: B-5

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847789 E: 448792
GROUND ELEVATION: 902 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

OBSERVED GROUNDWATER NOVEMBER 21, 2017 ELEV. = 872.00

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 902.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	6/24	24 28 17 38	45				FILL	Dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	4/24	24 7 19 17	26					Medium dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	

Bottom-of-boring at 4.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-5**

BORING NUMBER: B-7

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847423 E: 449318
GROUND ELEVATION: 941 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 941.0										Asphalt concrete (AC) pavement, multiple layers (8" total thickness).	
	S-1	1.0	12/24	19 78 34 43	112				FILL	Very dense, light grey, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	3.0	10/12	33 67 100/0"						Brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	

Bottom-of-boring at 4.0 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-7**

BORING NUMBER: B-9

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847397 E: 450584
GROUND ELEVATION: 933 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	14.5 ft. +/-	Water level measured upon completion of boring

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 933.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	9/24	18 12 6 4	18				FILL	Medium dense, brown, gravelly fine to coarse SAND, trace silt, trace debris (asphalt millings); moist. [FILL]	
	S-2	2.5	10/24	11 17 8 16	25					Medium dense, brown, gravelly fine to coarse SAND, some debris (asphalt millings); moist. [FILL]	
5 928.0	S-3	5.0	9/24	12 7 15 9	22					Medium dense, brown, gravelly fine to coarse SAND, little silt; moist. [FILL]	
	S-4	7.0	7/24	16 34 20 19	54					Very dense, brown, gravelly fine to coarse SAND, little silt; moist. [FILL]	
10 923.0	S-5	9.0	1/24	9 13 14 17	27					Medium dense, brown, medium to coarse SAND, some fine gravel, trace silt; moist. [FILL]	
	S-6	12.5	18/24	12 14 21 29	35	13.5	49.5			Dense, brown, silty fine to medium SAND, little fine to coarse gravel; moist.	Drilling refusal at 12.5 ft. (due to accumulation of gravels and cobbles in the borehole)
15 918.0	S-7	14.5	13/24	19 41 40 38	81				SILTY SAND	Very dense, brown, silty fine to medium SAND, little fine to coarse gravel; wet.	

Bottom-of-boring at 16.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-9**

BORING NUMBER: B-10

PAGE 1 OF 1

Weston & Sampson

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847355 E: 451197
GROUND ELEVATION: 956 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC.-PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 956.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	10/24	31 23 27 21	50				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	18/24	6 19 19 20	38	14.1	62.8		SANDY SILT	Hard, brown-dark brown, fine to medium sandy SILT, trace fine gravel; moist.	

Bottom-of-boring at 4.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS	
SYMBOL	TYPE	N-Value	Density
S	Split spoon	0-4	Very Loose
ST	Shelby tube	4-10	Loose
AG	Auger grab	10-30	Med. Dense
NX	Rock core	30-50	Dense
DP	Direct push	> 50	Very Dense

COHESIVE SOILS	
N-VALUE	CONSISTENCY
< 2	Very Soft
2-4	Soft
4-8	Med. Stiff
8-15	Stiff
15-30	Very Stiff
> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-10**

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	180
PROJECT FILE NO.	608163		

BORING LOGS
1 OF 3

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-#
   LOCATION OF TEST PITS SHOWN ON THE PLAN THUS: TP-#
   LOCATION OF PAVEMENT CORES SHOWN ON THE PLANS THUS: PC-#
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRCUTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL TO BE ENCOUNTERED DURING CONSTRCUTION.
4. FIGURES TO THE LEFT OF THE COLUMNS INDICATE DEPTH AND ELEVATION BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 2" O.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30 INCHES.
6. BORING SAMPLES MADE ON: 11/21/2017, 09/13/2023, 09/14/2023
   TEST PITS MADE ON :
   PAVEMENT CORES MADE ON:
7. BORINGS WERE MADE BY:
   SEABAORD DRILLING INC.
   649 MEADOW ST, CHICOPEE, MA 01013
8. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ORUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

W&S BORING LOG - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAD\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
W&S BORING LOGS - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAD\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
W&S BORING LOG - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAD\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
W&S BORING LOG - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAD\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
W&S BORING LOG - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAD\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
Plotted on 5-Jun-2024 11:07 AM
608163_HD2(BORING LOGS).DWG
Proposal No. 608163-128112
A0809 - 408

BORING NUMBER: B-11
PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847315 E: 451727
GROUND ELEVATION: 989 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 989.0										Asphalt concrete (AC) pavement, multiple layers (5" total thickness).	
	S-1	0.5	11/24	25 28 27 20	55				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	11/24	12 9 16 18	25				FILL	Medium dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 30-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-11

BORING NUMBER: B-12
PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847272 E: 452354
GROUND ELEVATION: 1011 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 1011.0										Asphalt concrete (AC) pavement, multiple layers (4" total thickness).	
	S-1	0.5	8/9	90 100/3"					FILL	Grey-brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.0	20/24	10 8 14 27	22				SANDY SILT	Very stiff, grey-brown, fine to medium sandy SILT, little fine gravel; moist.	
										Bottom-of-boring at 4.0 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-12

BORING NUMBER: B-13
PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847294 E: 452969
GROUND ELEVATION: 1019 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 1019.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	16/24	25 21 13 22	34	11.2	41.8		SAND	Dense, grey-brown, silty fine to coarse SAND, little fine gravel; moist.	
	S-2	2.5	20/24	23 54 60 89	114				SAND	Very dense, grey-brown, silty fine to coarse SAND, little fine gravel; moist.	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-13

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	180
PROJECT FILE NO.		608163	

BORING LOGS
2 OF 3

NOTES:
1. FOR BORING NOTES, SEE SHEET 4.

BORING NUMBER: B-14
PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847322 E: 453443
GROUND ELEVATION: 1009 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 1009.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	12/24	21 58 8 10	66				SAND	Top 6" - Grey, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	10/24	16 40 34 85	74				SAND	Bottom 6" - Very dense, orange-brown, silty fine to medium SAND, trace fine to coarse gravel; moist. Very dense, brown, fine to coarse SAND, some fine to coarse gravel, trace silt; moist.	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-14

BORING NUMBER: B-15
PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: N: 2847355 E: 454092
GROUND ELEVATION: 1002 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

Culvert proposed B.F.E = 992.0'

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 1002.0										Asphalt concrete (AC) pavement, multiple layers (5" total thickness).	
	S-1	0.5	9/24	22 29 21 8	46				FILL	Dense, brown, gravelly medium to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	0/6	100 100/0"						Possible boulder or bedrock. Drilling refusal at 2.9 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-15

W&S BORING LOG - GINT STD US.GDT - 1/22/18 19:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAL\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ

608163_HD2(BORING LOGS).DWG Plotted on 5-Jun-2024 11:07 AM

Proposal No. 608163-128112

AN08050 - 409

A00960 - 410

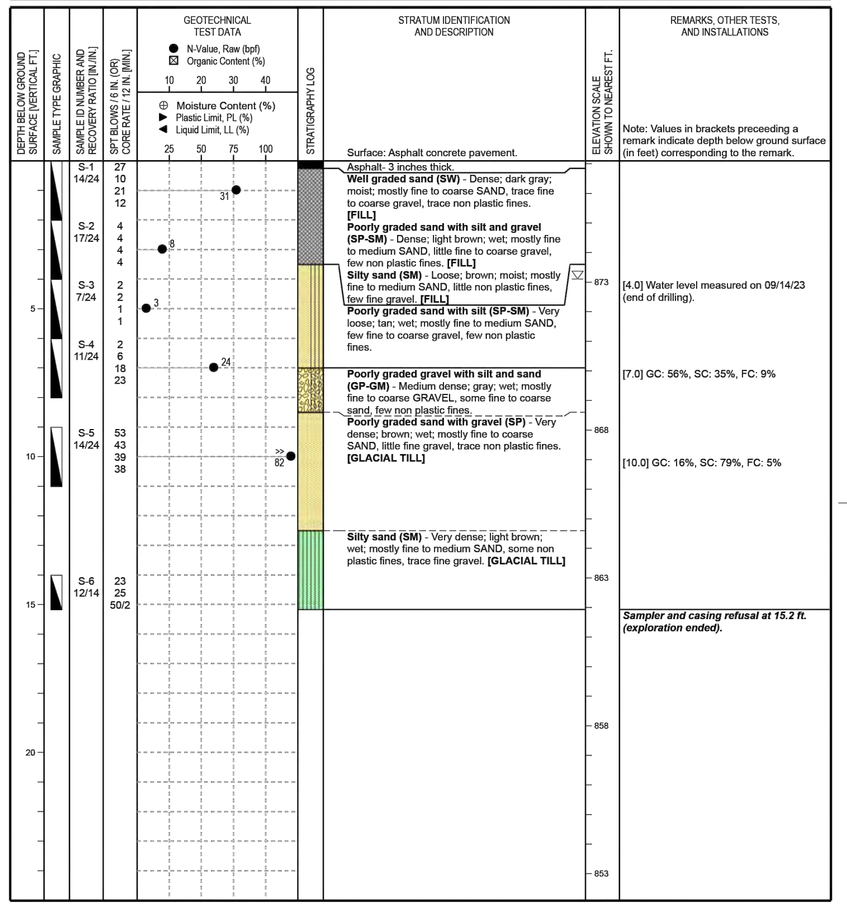
Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-101

WSE Project: ENG23-0621 — Page 1 of 1

CONTRACTOR:	Northern Drill Service, Inc.	BORING LOCATION:	See Attached Figure	DATE START:	September 14, 2023
FOREMAN:	Jon Beirholm	ADVANCE METHOD:	Rotary Wash Drilling	DATE FINISH:	September 14, 2023
LOGGED BY:	A. Chabot, EIT	AUGER DIAMETER:	N/A	GROUND EL:	877.1 ± (NAVD88)
CHECKED BY:	H. Flores, PE	SUPPORT CASING:	Driven Flush-Joint Casing (4" ID)	FINAL DEPTH:	15.2 ft. (Refusal)
EQUIPMENT:	Mobile B-57, Truck Mounted	CORING METHOD:	N/A	GRID COORDS:	N:2848098.4050 / E:448154.5950
SPT HAMMER:	Automatic (140-lb.)	BACKFILL MATERIAL:	Drill Cuttings and Asphalt Patch	GRID SYSTEM:	NAD83 State Plane (MA)



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

OBSERVED GROUNDWATER SEPTEMBER 14, 2023 ELEV. = 873.20

Culvert proposed B.F.E = 865.50'

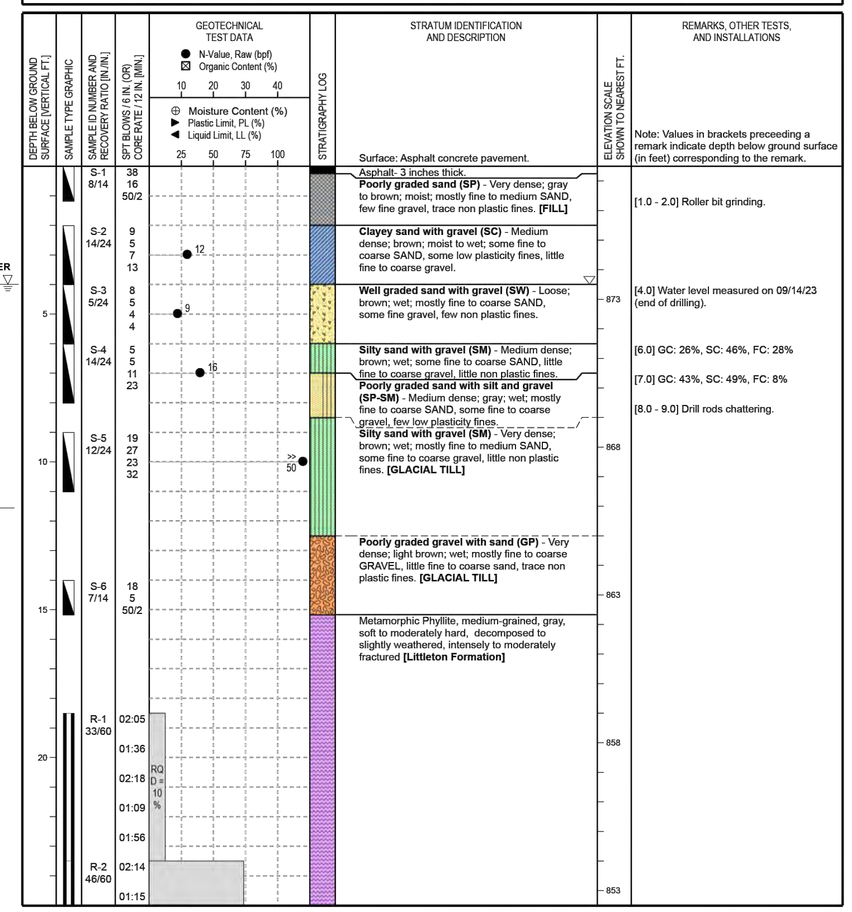
Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-102

WSE Project: ENG23-0621 — Page 1 of 2

CONTRACTOR:	Northern Drill Service, Inc.	BORING LOCATION:	See Attached Figure	DATE START:	September 13, 2023
FOREMAN:	Jon Beirholm	ADVANCE METHOD:	Rotary Wash Drilling	DATE FINISH:	September 14, 2023
LOGGED BY:	A. Chabot, EIT	AUGER DIAMETER:	N/A	GROUND EL:	877.5 ± (NAVD88)
CHECKED BY:	H. Flores, PE	SUPPORT CASING:	Driven Flush-Joint Casing (4" ID)	FINAL DEPTH:	28.5 ft.
EQUIPMENT:	Mobile B-57, Truck Mounted	CORING METHOD:	NX Conventional	GRID COORDS:	N:2848103.1880 / E:448185.5660
SPT HAMMER:	Automatic (140-lb.)	BACKFILL MATERIAL:	Drill Cuttings and Asphalt Patch	GRID SYSTEM:	NAD83 State Plane (MA)



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

OBSERVED GROUNDWATER SEPTEMBER 13, 2023 ELEV. = 873.50

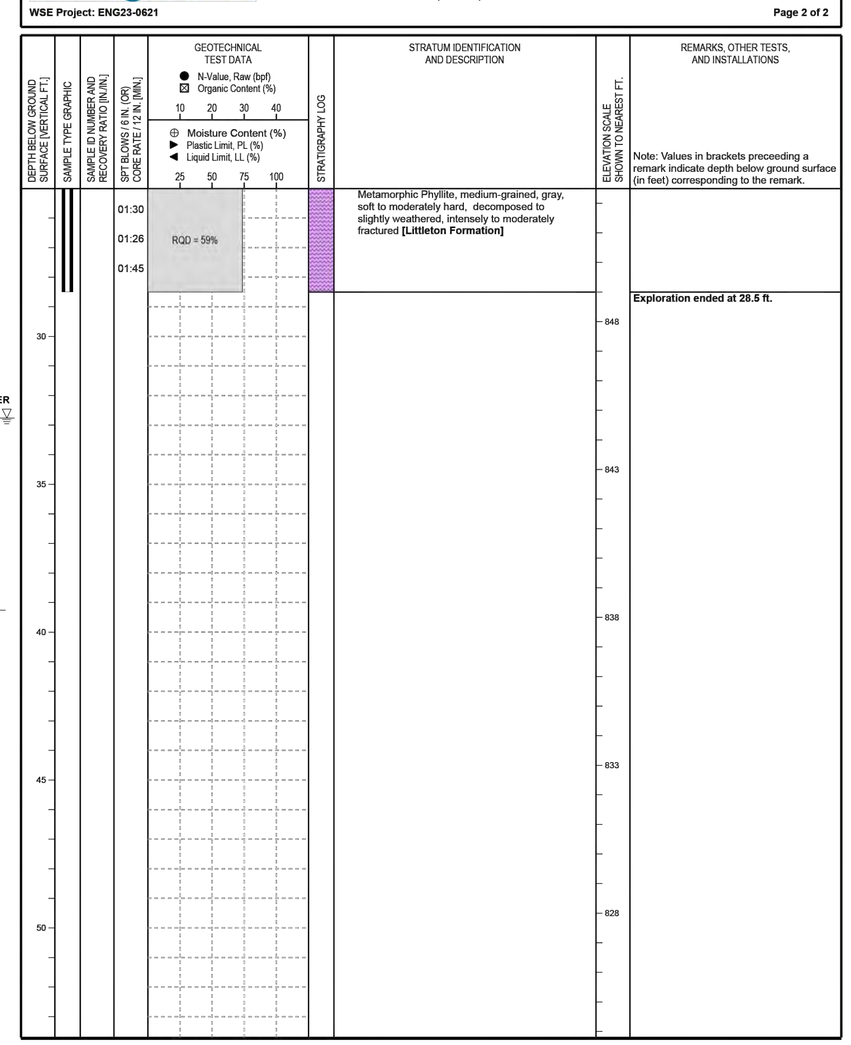
Culvert proposed B.F.E = 867.0

Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-102

WSE Project: ENG23-0621 — Page 2 of 2



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

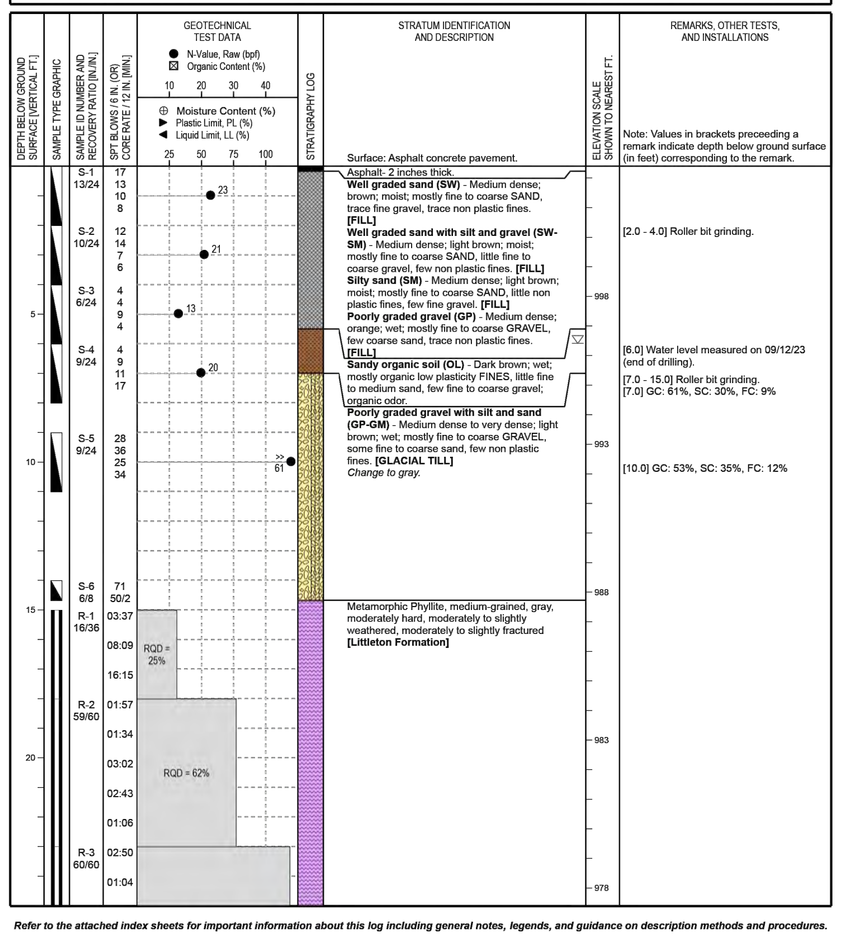
Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-104

WSE Project: ENG23-0621 — Page 2 of 2

CONTRACTOR:	Northern Drill Service, Inc.	BORING LOCATION:	See Attached Figure	DATE START:	September 12, 2023
FOREMAN:	Zachary Nader	ADVANCE METHOD:	Rotary Wash Drilling	DATE FINISH:	September 12, 2023
LOGGED BY:	A. Chabot, EIT	AUGER DIAMETER:	N/A	GROUND EL:	1002.4 ± (NAVD88)
CHECKED BY:	H. Flores, PE	SUPPORT CASING:	Driven Flush-Joint Casing (4" ID)	FINAL DEPTH:	28.0 ft.
EQUIPMENT:	Mobile B-57, Truck Mounted	CORING METHOD:	NX Conventional	GRID COORDS:	N:2847316.0980 / E:454079.8980
SPT HAMMER:	Automatic (140-lb.)	BACKFILL MATERIAL:	Drill Cuttings and Asphalt Patch	GRID SYSTEM:	NAD83 State Plane (MA)



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

OBSERVED GROUNDWATER SEPTEMBER 12, 2023 ELEV. = 996.30

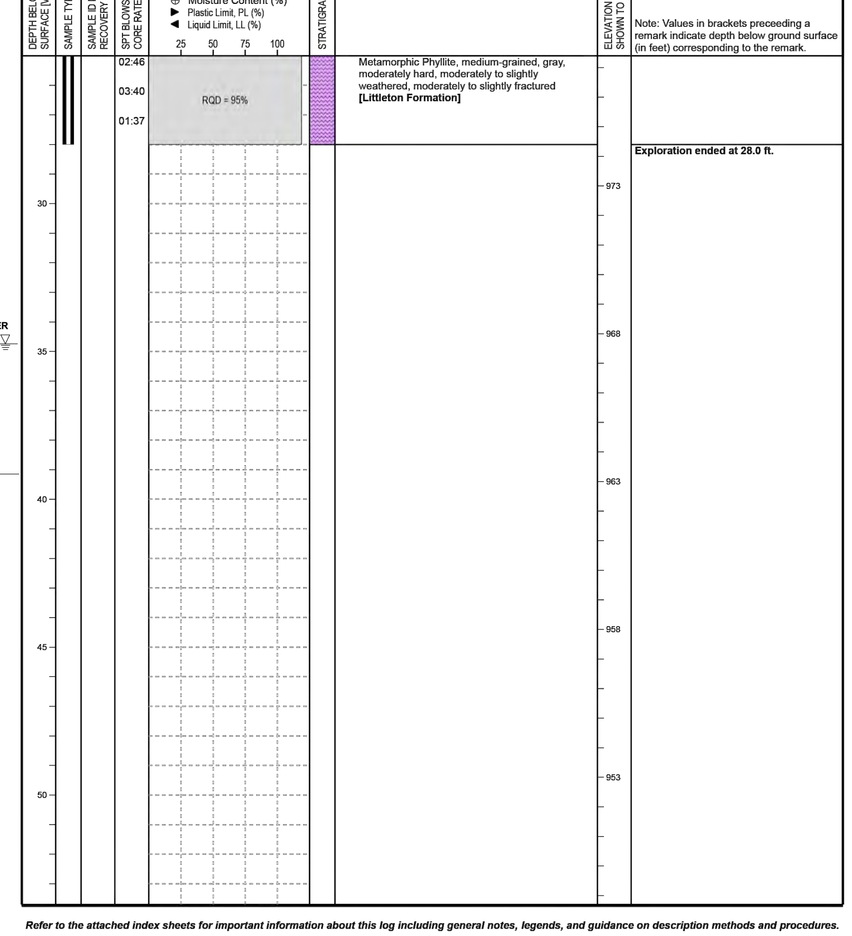
Culvert proposed B.F.E = 992.0'

Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-104

WSE Project: ENG23-0621 — Page 2 of 2



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

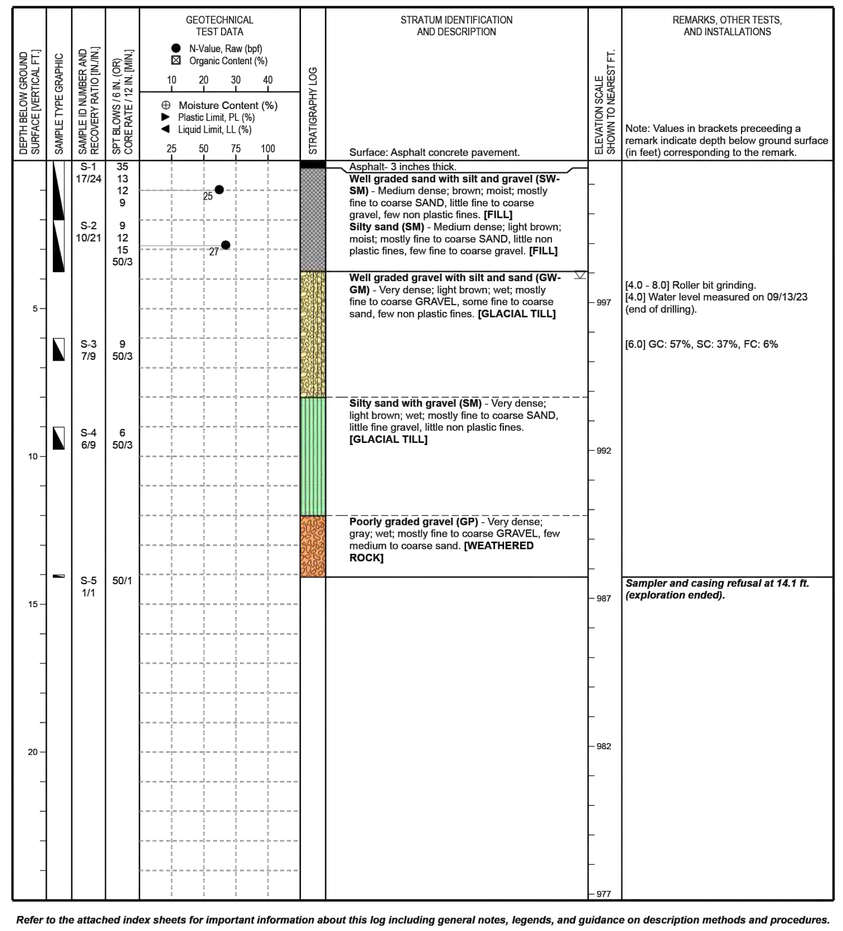
Weston & Sampson

Monson Road Reconstruction
Monson Road, Wales, MA

BORING ID: B-105

WSE Project: ENG23-0621 — Page 1 of 1

CONTRACTOR:	Northern Drill Service, Inc.	BORING LOCATION:	See Attached Figure	DATE START:	September 13, 2023
FOREMAN:	Zachary Nader	ADVANCE METHOD:	Rotary Wash Drilling	DATE FINISH:	September 13, 2023
LOGGED BY:	A. Chabot, EIT	AUGER DIAMETER:	N/A	GROUND EL:	1001.8 ± (NAVD88)
CHECKED BY:	H. Flores, PE	SUPPORT CASING:	Driven Flush-Joint Casing (4" ID)	FINAL DEPTH:	14.1 ft. (Refusal)
EQUIPMENT:	Mobile B-57, Truck Mounted	CORING METHOD:	N/A	GRID COORDS:	N:2847367.4630 / E:454109.7660
SPT HAMMER:	Automatic (140-lb.)	BACKFILL MATERIAL:	Drill Cuttings and Asphalt Patch	GRID SYSTEM:	NAD83 State Plane (MA)



Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

OBSERVED GROUNDWATER SEPTEMBER 13, 2023 ELEV. = 997.30

Culvert proposed B.F.E = 992.0'

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	180
PROJECT FILE NO.	608163		

BORING LOGS
3 OF 3

NOTES:

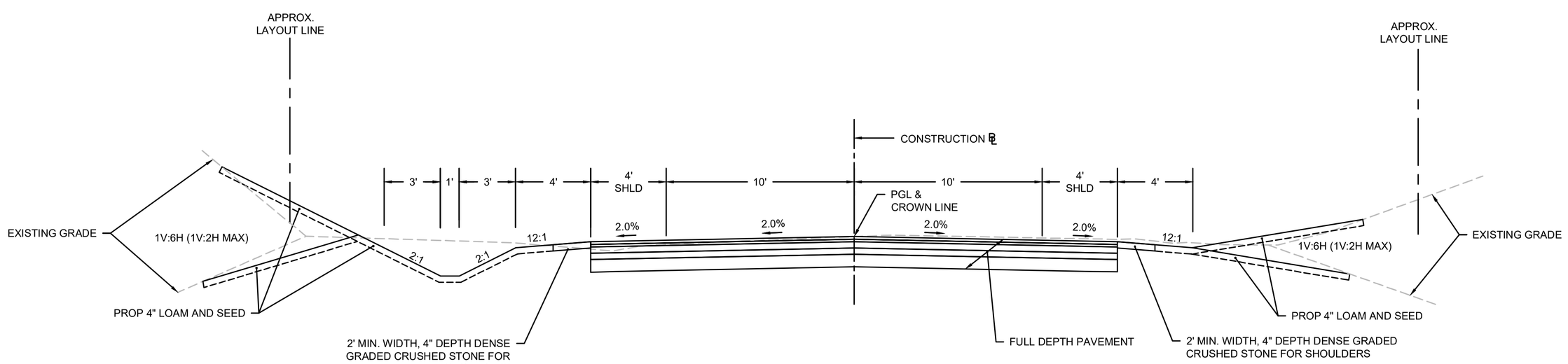
1. FOR BORING NOTES, SEE SHEET 4.

608163_HD2(BORING LOGS).DWG Plotted on 5-Jun-2024 11:08 AM
Proposal No. 608163-128112

WALES
MONSON ROAD

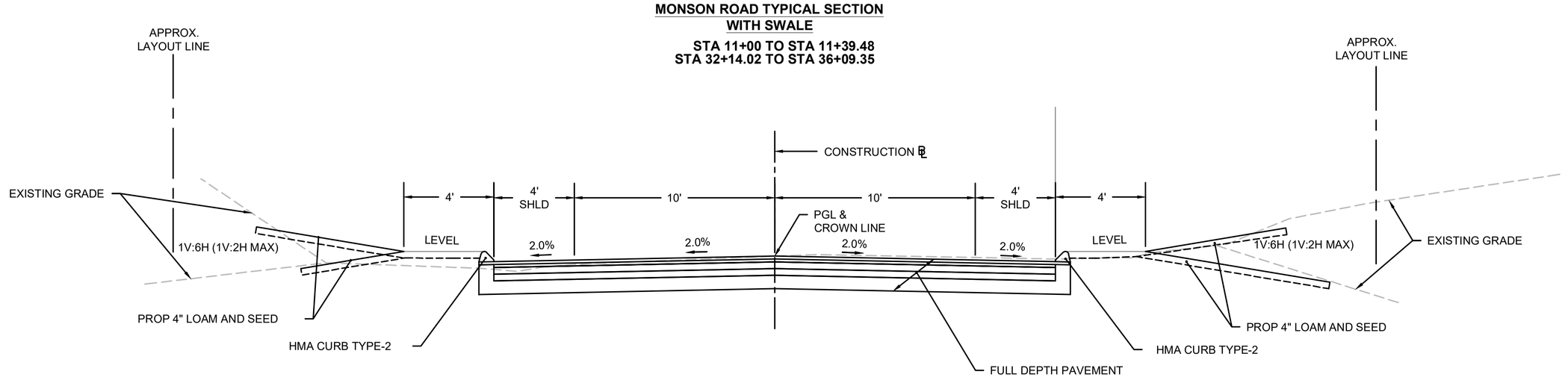
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	180
PROJECT FILE NO.	608163		

TYPICAL SECTIONS



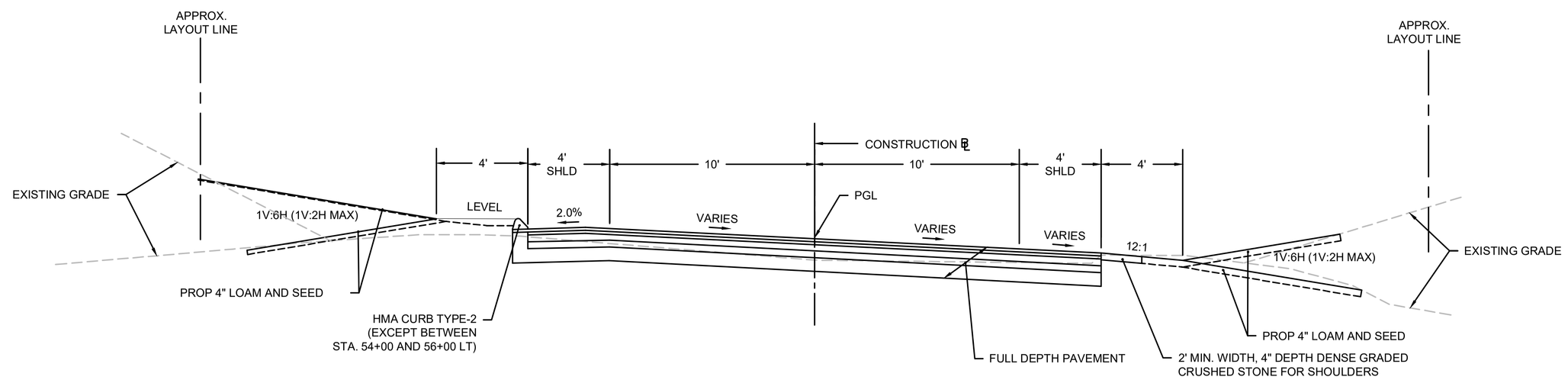
MONSON ROAD TYPICAL SECTION
WITH SWALE

STA 11+00 TO STA 11+39.48
STA 32+14.02 TO STA 36+09.35



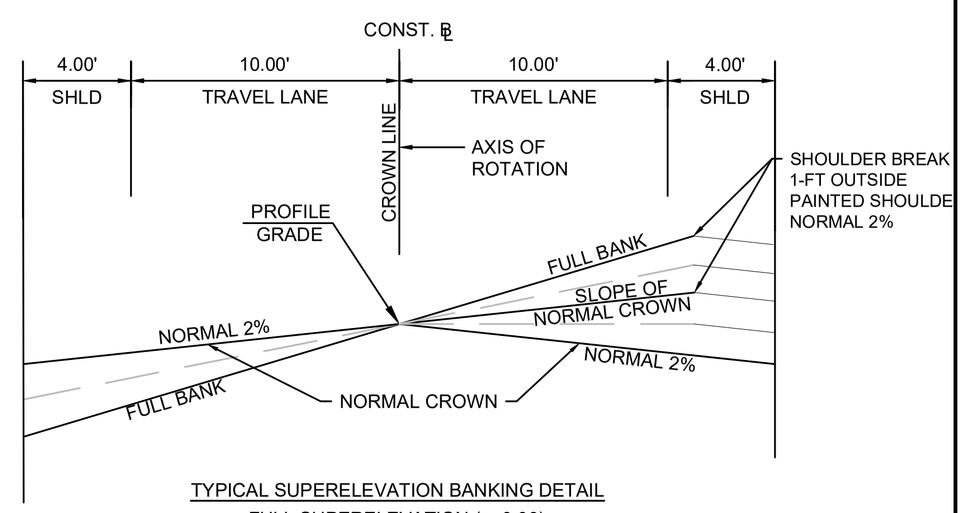
MONSON ROAD TYPICAL SECTION
WITH CURBING

STA 22+70.43 TO STA 26+98.72
STA 57+46.79 TO STA 64+41.04
STA 75+70.50 TO STA 77+39.51



MONSON ROAD TYPICAL SECTION
FULL SUPERELEVATION AND TRANSITIONS

STA 11+39.48 TO STA 22+70.43
STA 26+98.72 TO STA 32+14.02
STA 36+09.35 TO STA 57+46.79
STA 64+41.04 TO STA 75+70.50
STA 77+39.51 TO STA 88+00



TYPICAL SUPERELEVATION BANKING DETAIL
FULL SUPERELEVATION (e=0.06)
N.T.S.

PAVEMENT NOTES

PROPOSED PAVEMENT MILLING AND OVERLAY:

1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.50" PAVEMENT MILLING

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).

BASE COURSE: 3.25" SUPERPAVE INTERMEDIATE COURSE 19 (SIC-19.0) PLACED IN ONE LAYER.

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT A RATE OF 0.07 TO 0.09 GAL/SY OVER MILLED SURFACES AND 0.06 TO 0.08 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY :

SURFACE COURSE: 1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2.50" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5)

FOUNDATION: 8" GRAVEL BORROW, TYPE B

PROPOSED GRAVEL DRIVEWAY:

8" GRAVEL BORROW, TYPE B

PROPOSED CEMENT CONCRETE WALK

4" CEMENT CONCRETE OVER
8" GRAVEL BORROW, TYPE B

608163_HD1(TITLE, LEGEND, KEY & TYPICAL SECTIONS).DWG Plotted on 5-Jun-2024 11:22 AM
Proposal No. 608163-128112
A00860 - 411

HIGHWAY GUARD DETAILS

STA 14+65 TO STA 14+78 LT TANGENT END TREATMENT TL-3
STA 14+78 TO STA 16+88 LT (TL-3)
STA 14+50 TO STA 14+63 RT TANGENT END TREATMENT TL-3
STA 14+63 TO STA 16+02 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

RIVERFRONT AREA IMPACT SUMMARY
(DOES NOT INCLUDE BRIDGE EXEMPTION AREA)

TOTAL RIVERFRONT REDEVELOPMENT AREA	PROPOSED PROJECT ACTIVITY WITHIN 200' RFA	PROPOSED PROJECT ACTIVITY WITHIN 100' BVW AND BANK BUFFER	EXISTING IMPERVIOUS (DEGRADED) IN RFA (47.5% OF RFA)	PROPOSED IMPERVIOUS WITHIN DEGRADED RFA	INCREASE IN IMPERVIOUS SURFACE IN RFA
86402 SF	75329 SF	48817 SF	41010 SF	31206 SF	9804 SF

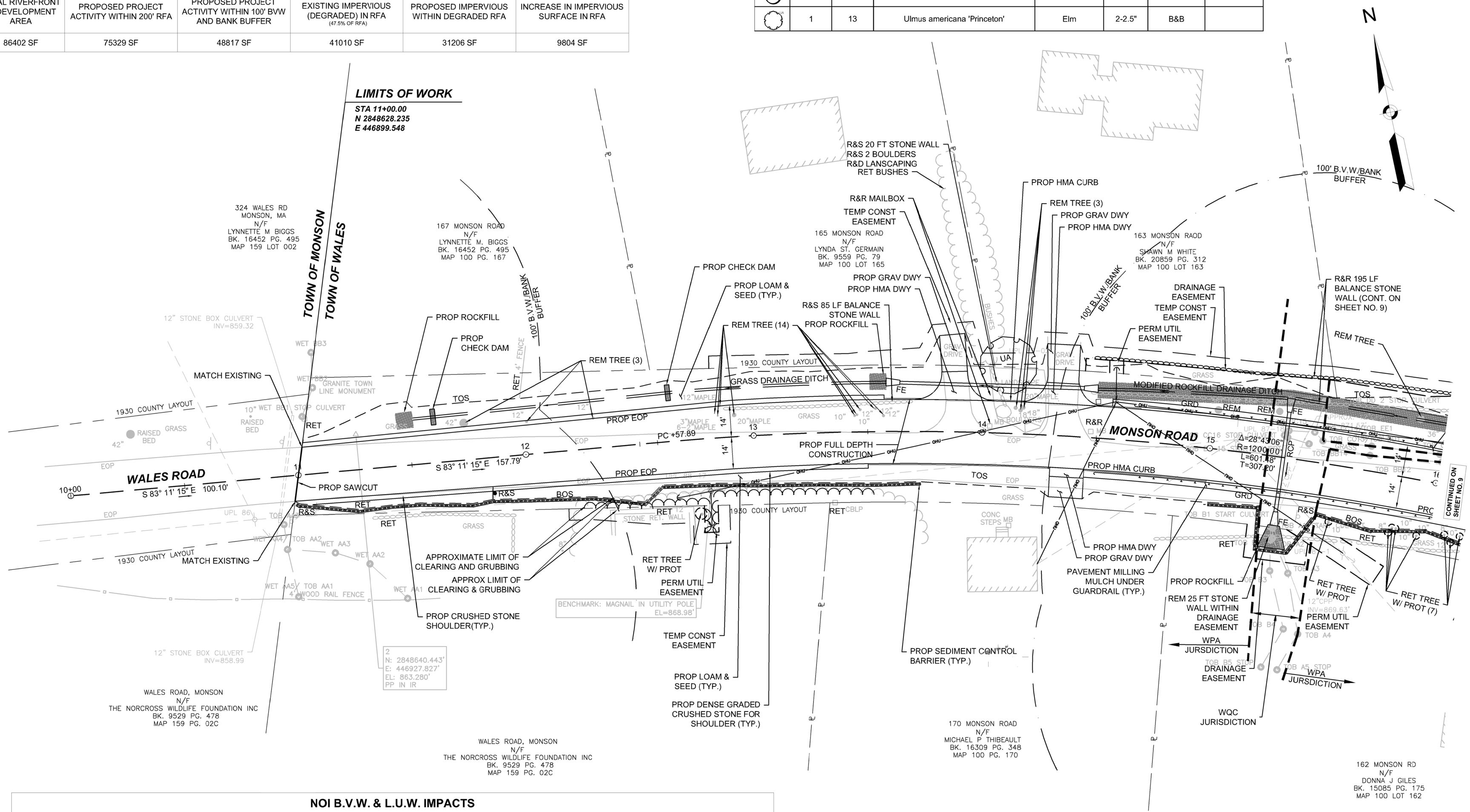
PLANT SCHEDULE

TREES	QTY (PER SHEET)	QTY (TOTAL)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	13	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	25	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	13	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	180
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



NOI B.V.W. & L.U.W. IMPACTS

	PROJECT TOTAL B.V.W. IMPACTS	BRIDGE EXEMPT B.V.W. IMPACTS	**NET NOI B.V.W. IMPACTS**	WETLAND REPLICATION AREA 1	WETLAND REPLICATION AREA 2	**NOI L.U.W IMPACTS**
PERMANENT	891 SF	653 SF	**238 SF**	217 SF	1204 SF	**0 SF**
TEMPORARY	333 SF	199 SF	**134 SF**	0 SF	0 SF	**0 SF**

FOR PROFILE SEE SHEET NO. 22

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 1:18 PM
Proposal No. 608163-128112
A00860 - 412

HIGHWAY GUARD DETAILS

STA 14+78 TO STA ´6+88 LT (TL-3)
STA 16+88 TO STA 17+00 LT TANGENT END TREATMENT TL-3
STA 14+63 TO STA ´6+02 RT (TL-3)
STA 16+02 TO STA ´6+14 RT TANGENT END TREATMENT TL-3
STA 20+25 TO STA 20+37 RT TANGENT END TREATMENT TL-3
STA 20+37 TO STA 23+10 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

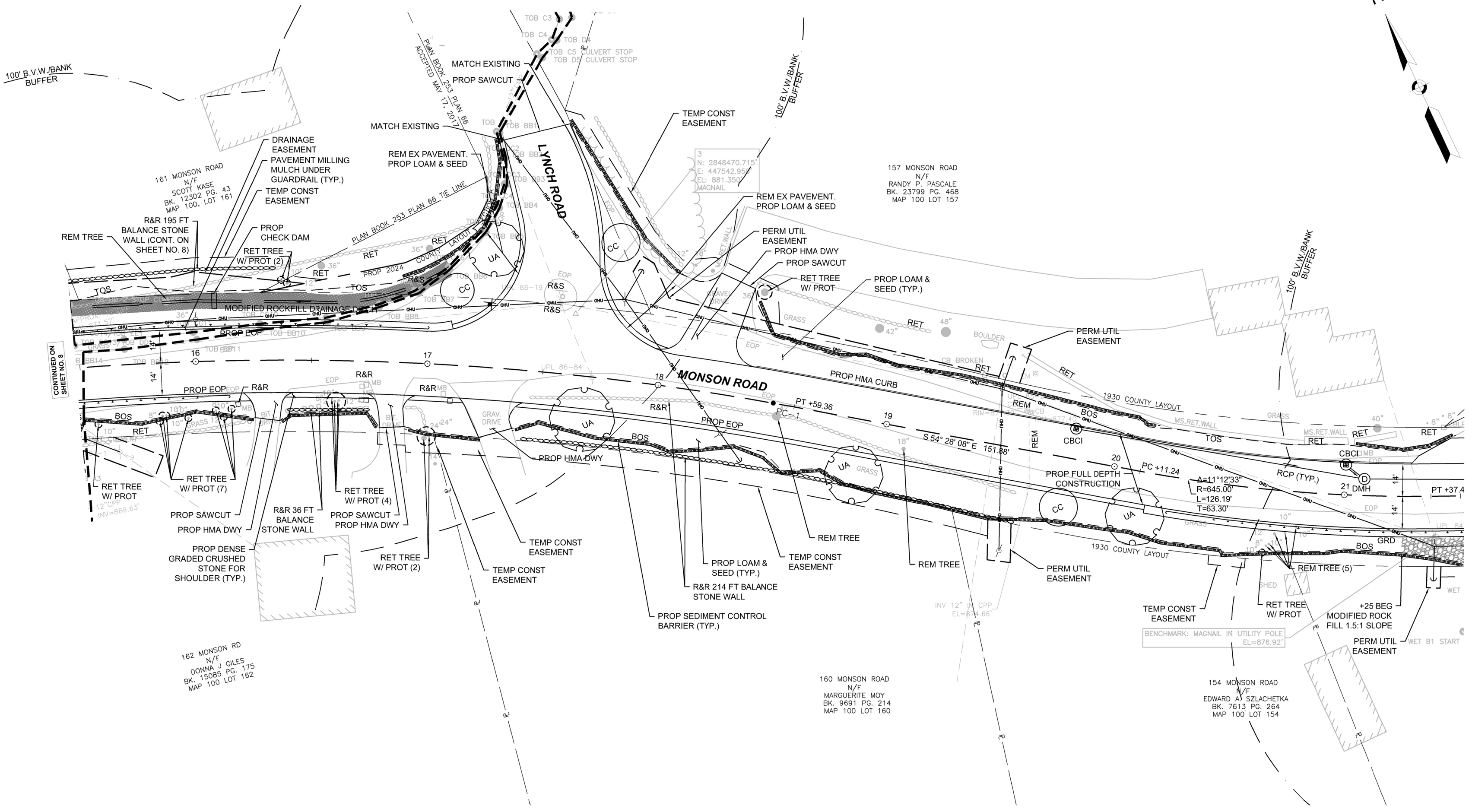
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
	4	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 22

608163_HD3(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:25 PM
Proposal No. 608163-128112
A080690 - 413

HIGHWAY GUARD DETAILS

STA 20+37 TO STA 23+10 RT (TL-3)
STA 23+10 TO STA 23+22 RT TANGENT END TREATMENT TL-3
STA 23+86 TO STA 23+98 RT TANGENT END TREATMENT TL-3
STA 23+98 TO STA 25+61 RT (TL-3)
STA 24+25 TO STA 24+37 RT TANGENT END TREATMENT TL-3
STA 24+25 TO STA 24+37 LT TANGENT END TREATMENT TL-3
STA 24+37 TO STA 24+77 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 24+37 TO STA 24+77 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 RT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+06 TO STA 25+46 LT TRANSITION TO BRIDGE RAIL (SINGLE FACED)
STA 25+46 TO STA 25+60 RT (TL-3)
STA 25+46 TO STA 25+79 LT (TL-3)
STA 25+60 TO STA 25+72 RT TANGENT END TREATMENT TL-3
STA 25+79 TO STA 25+91 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

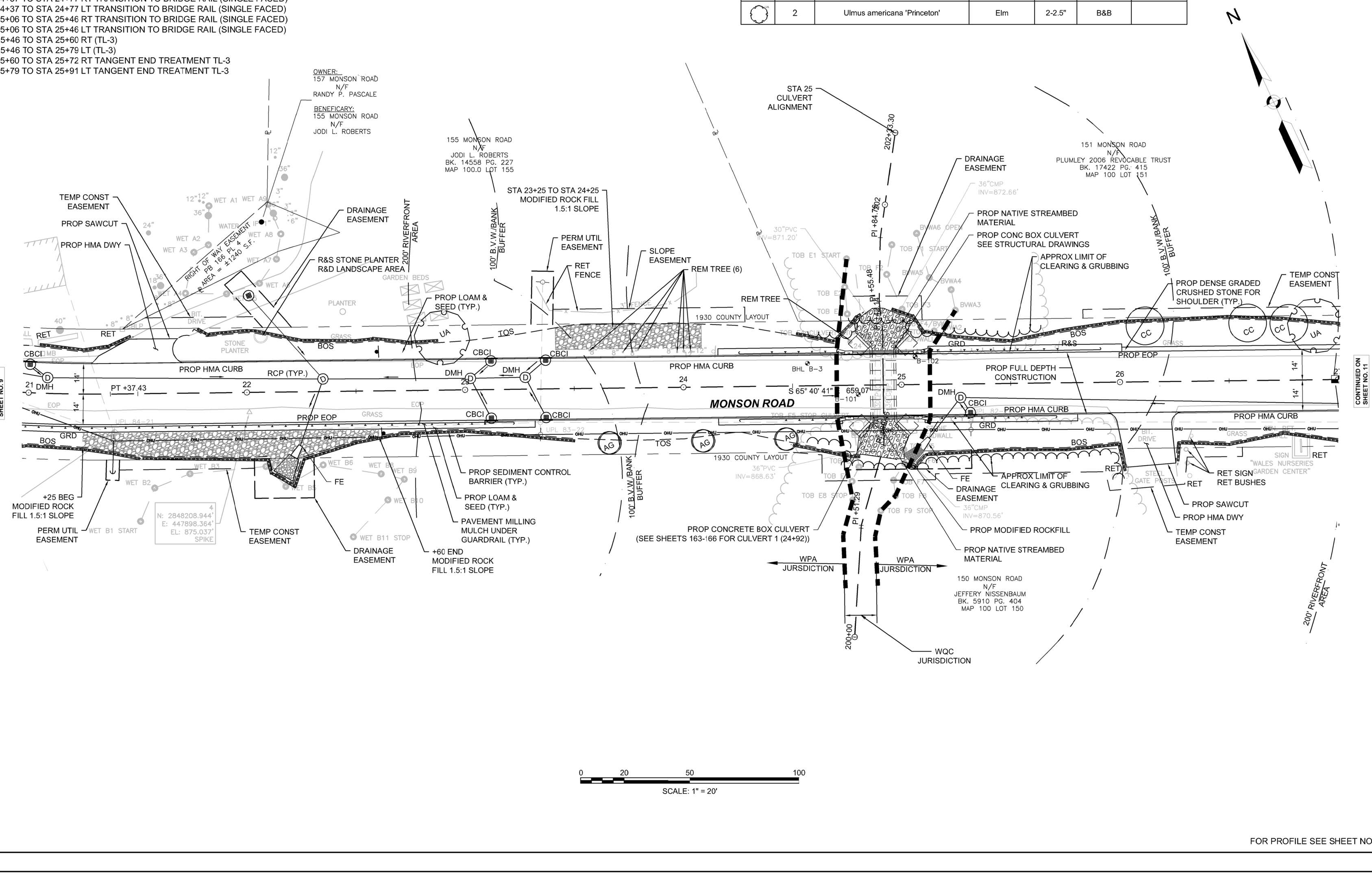
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	10	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 23

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:25 PM
Proposal No. 608163-128112
A00860 - 414

HIGHWAY GUARD DETAILS

STA 30+62 TO STA 30+75 RT TANGENT END TREATMENT TL-3
STA 30+75 TO STA 33+25 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

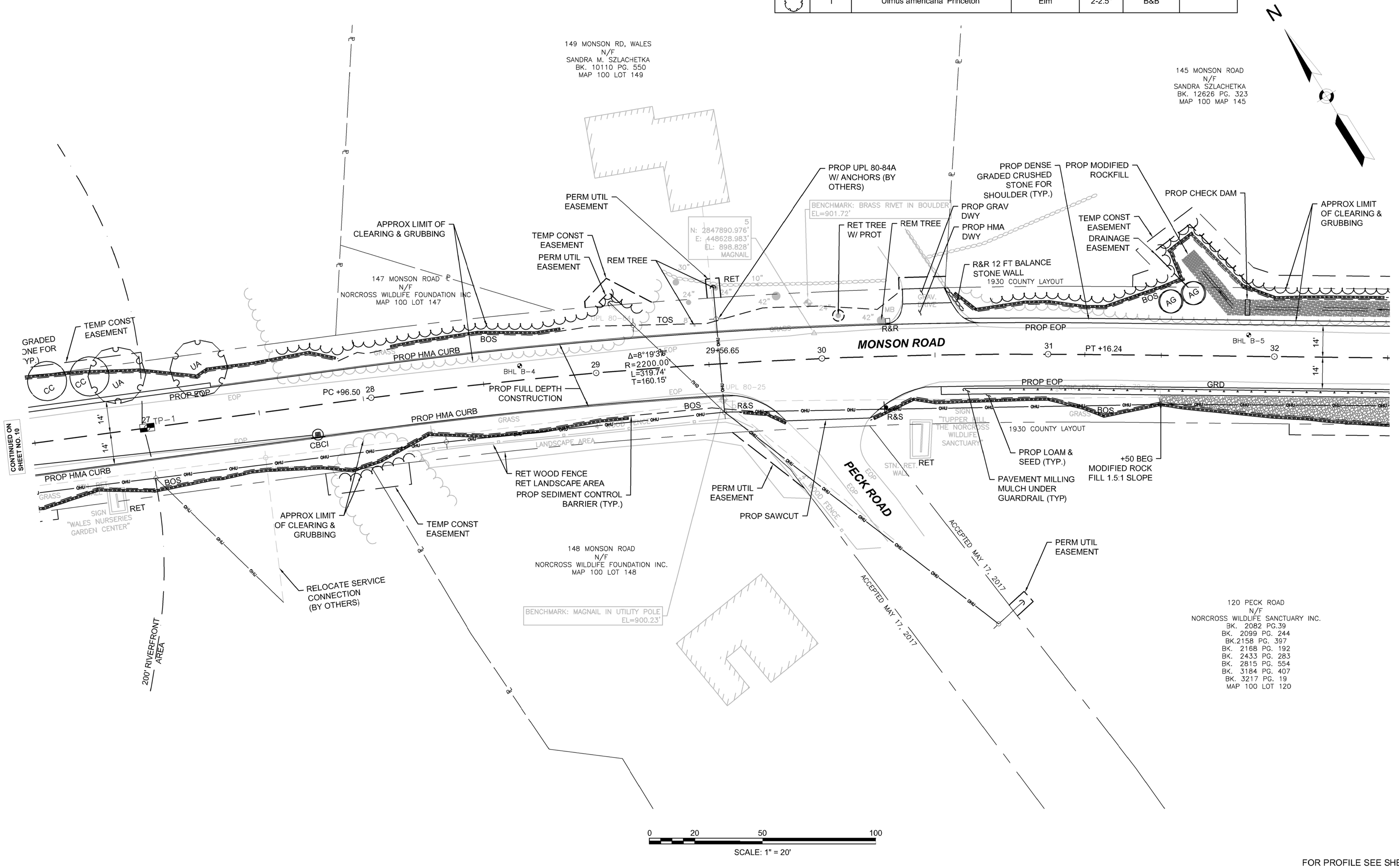
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
ULA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	11	180
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 24

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:25 PM
Proposal No. 608163-128112
A00860 - 415

HIGHWAY GUARD DETAILS

STA 30+75 TO STA 33+25 RT (TL-3)
STA 33+25 TO STA 33+38 RT TANGENT END TREATMENT TL-3
STA 35+22 TO STA 35+34 RT TANGENT END TREATMENT TL-3
STA 35+34 TO STA 36+84 RT (TL-3)
STA 36+84 TO STA 36+97 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

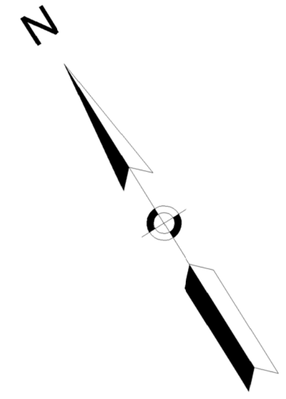
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
SD	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
MD	3	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
LG	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	12	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



139 MONSON ROAD
N/F
NORCROSS WILDLIFE FOUNDATION INC.
PL. BK. 147 PL. 11
MAP 100 LOT 139

TEMP CONST EASEMENT
TEMP CONST EASEMENT
APPROX LIMIT OF CLEARING & GRUBBING
APPROX LIMIT OF CLEARING & GRUBBING
APPROX LIMIT OF CLEARING & GRUBBING
PROP CHECK DAM
PROP CHECK DAM
PROP CHECK DAM
PROP LOAM & SEED (TYP.)
PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)
INV 15" STONE OPENING EL=912.83'
TOS
TOS
AG
AG
AG
MODIFIED ROCKFIL. DRAINAGE DITCH
1930 COUNTY LAYOUT
1930 COUNTY LAYOUT
EOP
EOP
EOP
EOP
GRASS
GRASS
CONTINUED ON SHEET NO.11
32
33
34 **MONSON ROAD**
S 57° 21' 04" E 623.60'
35
36
PC-2
37
PC +39.84
CONTINUED ON SHEET NO. 13
14'
14'
14'
14'
PROP EOP
GRD
PROP HMA CURB
PROP FULL DEPTH CONSTRUCTION
PROP EOP
GRD
OHU
UA
BOS
RET
UPL 78-27
UPL 77-28
+64 END MODIFIED ROCK FILL 1.5:1 SLOPE
TEMP CONST EASEMENT
APPROXIMATE LIMIT OF CLEARING & GRUBBING
RELOCATE UPL 78-27 (BY OTHERS)
R&R 25 FT BALANCE STONE WALL
PROP LOAM & SEED (TYP.)
100' B.V.W./BANK BUFFER
PAVEMENT MILLING MULCH UNDER GUARDRAIL (TYP.)
RELOCATE UPL 77-28 (BY OTHERS)
TEMP CONST EASEMENT
APPROX LIMIT OF CLEARING & GRUBBING
PROP SEDIMENT CONTROL BARRIER (TYP.)
PROP UPL 76-50 (BY OTHERS)
TOB G1 START CULVERT
TOB H1 START CULVERT
TOB G2
TOB H2
18" CMP
INV=911.51

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
BK.
MAP 100 LOT 120

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 25

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-121212
A00860 - 416

HIGHWAY GUARD DETAILS

STA 42+75 TO STA 42+87 RT TANGENT END TREATMENT TL-3
STA 42+87 TO STA 43+86 RT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

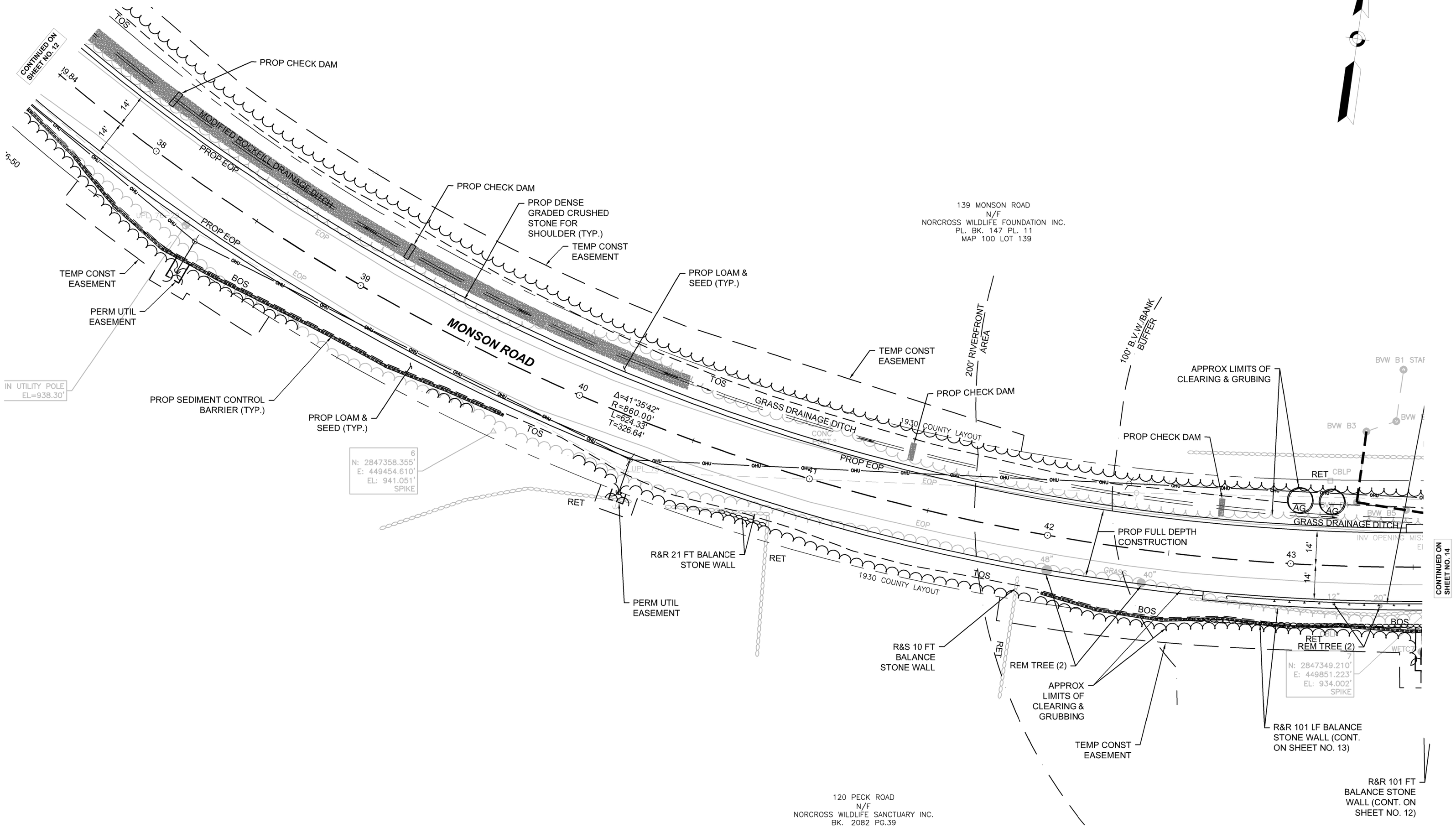
PLANT SCHEDULE						
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	13	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS

N



FOR PROFILE SEE SHEET NO. 26

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM

Proposal No. 608163-128112

A00880 - 417

HIGHWAY GUARD DETAILS

STA 42+87 TO STA 43+86 RT (TL-3)
STA 43+86 TO STA 43+98 RT TANGENT END TREATMENT TL-3
STA 43+57 TO STA 43+70 LT TANGENT END TREATMENT TL-3
STA 43+70 TO STA 44+57 LT (TL-3)
STA 44+57 TO STA 44+70 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

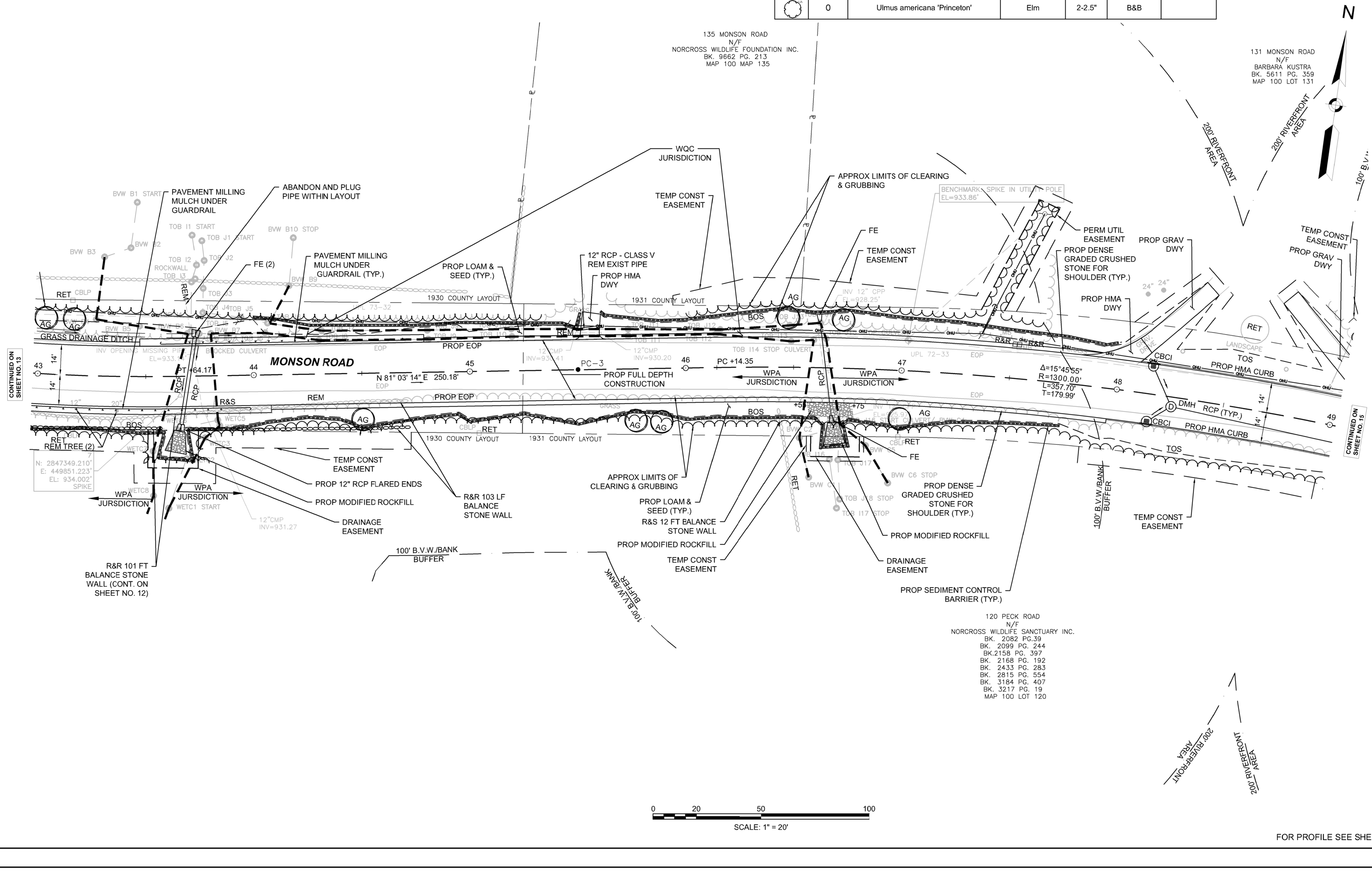
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CR	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AB	6	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	14	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 26

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A008060 - 418

HIGHWAY GUARD DETAILS

STA 49+96 TO STA 50+08 LT TANGENT END TREATMENT TL-3
STA 50+08 TO STA 51+46 LT (TL-3)
STA 51+46 TO STA 51+58 LT TANGENT END TREATMENT TL-3
STA 49+33 TO STA 49+46 RT TANGENT END TREATMENT TL-3
STA 49+46 TO STA 51+71 RT (TL-3)
STA 51+71 TO STA 51+84 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

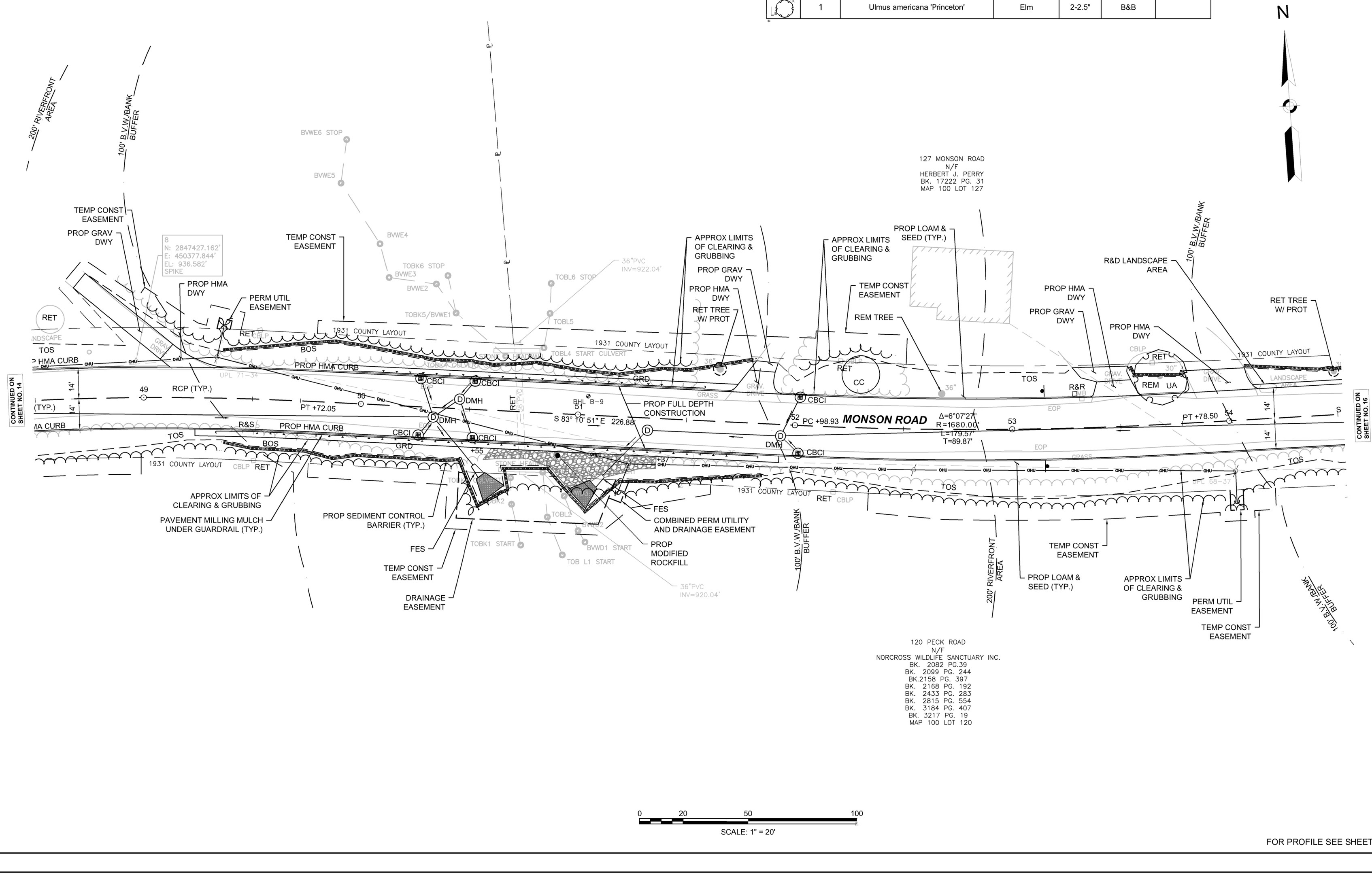
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CS	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 27

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A00060 - 419

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CE	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AB	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UAP	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	178
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 1:15 PM

Proposal No. 608163-128112

AM0809 - 420

121 MONSON ROAD
N/F
MICHAEL P & VIRGINIA S. LATO
BK. 5961 PG. 267
MAP 100 LOT 121

BORDERING VEGETATED WETLAND IMPACT = 217 SF ± WETLAND REPLICATION AREA 1 = 217 SF ± **NOTE: SEE WETLAND SOIL AND SEED MIX ON SHEET 180 AND SPECIAL PROVISION FOR ITEM 755.35.**

TEMPORARY V.W. IMPACT = 74 SF

TEMPORARY B.V.W. IMPACT = 6 SF ±

100' B.V.W./BANK BUFFER

TEMP CONST EASEMENT

RET TREE W/ PROT

REM TREE

RET CBLP

R&R 132 FT BALANCE STONE WALL

PROP DENSE GRADED CRUSHED STONE FOR SHOULDER (TYP.)

REM TREE

RET CONC. POST

PROP GRAV DWY

MATCH EXISTING

PROP HMA DWY

RET TREE W/ PROT

PROP LOAM & SEED (TYP.)

MATCH EXISTING

PROP HMA DWY

R&R 127 LF BALANCE STONE WALL

TEMP CONST EASEMENT

PROP LOAM & SEED (TYP.)

APPROX LIMITS OF CLEARING & GRUBBING

MAYNARD ROAD

ACCEPTED MAY 17, 2017

ACCEPTED MAY 17, 2017

BVWH-12 STOP

BVWH-11

BVWH-10

BVWH-1

BVWH-2

BVWH-3

BVWH-4 AT CULVERT

BVWH-5

BVWH-6

BVWH-7

BVWH-8

BVWH-9

BVWI-1

BVWI-2

BVWI-5

BVWI-7

BVWI-8

BVWI-9

BVWI-10 STOP

TOAA-3

TOAA-2

TOBB-3

TOBB-2

TOBB-1

1931 COUNTY LAYOUT

1932 COUNTY LAYOUT

LANDSCAPE AREA

GRASS

GRAV. ROAD

CONC. POST

MB

30"

36"

12"CMP
INV=949.28'

Δ=4°28'52"
R=1680.00'
L=131.40'
T=65.73'

R&R

PT +40.51

S 89° 18' 18" E 130.61'

PC +09.11

54

55

56

57

58

59

60

BHL B-10

TP-2

DMH

CBCI

RCP (TYP.)

14'

EOP

BOS

RET

CBCI

PROP HMA CURB

R&S

PROP FULL DEPTH CONSTRUCTION

MONSON ROAD

CONTINUED ON SHEET NO. 15

CONTINUED ON SHEET NO. 17

TOBN1

TOBN2

TOBN3

TOBN4/BVWG1

TOBM1

TOBM2

TOBM3

TOBM4 STOP

CBLP

BVWF1 START

12"CMP
INV=949.90'

BVWF2

BVWG1

BVWG2

BVWG3

BVWG4

BVWG5

BVWG6

BVWG7

BVWG8

BVWG9

BVWG10

BVWG11 STOP

DFL 975.97'

GATE

9
N: 2847349.856'
E: 450938.592'
EL: 951.597'
SPIKE

BENCHMARK: SPIKE IN UTILITY POLE
EL=956.75'

THE PROPOSED TREELINE REPRESENTS LIMITED OVERHEAD TREE CANOPY TRIMMING ONLY ALONG THE EXISTING OVERHEAD UTILITY LINES. NO DIRECT GROUND WETLAND IMPACTS ARE PROPOSED OR REQUIRED

PERM UTIL EASEMENT

TEMP CONST EASEMENT

PROP SEDIMENT CONTROL BARRIER (TYP.)

PROP LOAM & SEED (TYP.)

APPROX LIMITS OF CLEARING & GRUBBING

R&R 7 FT BALANCE STONE WALL

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

0 20 50 100

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 28

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

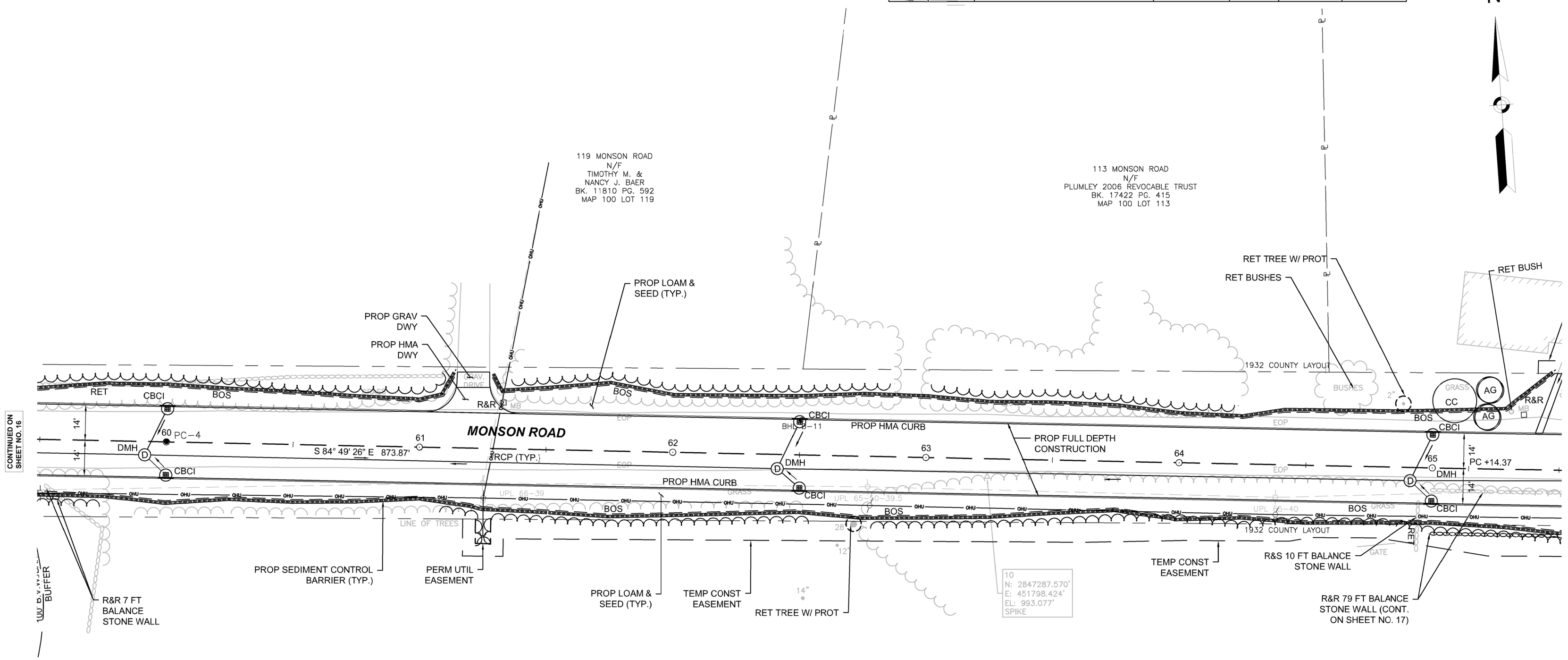
TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
	2	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
	0	Ulmus americana 'Frinceton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	17	180
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N



120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

0 20 50 100

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 29

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A0008G0 - 421

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

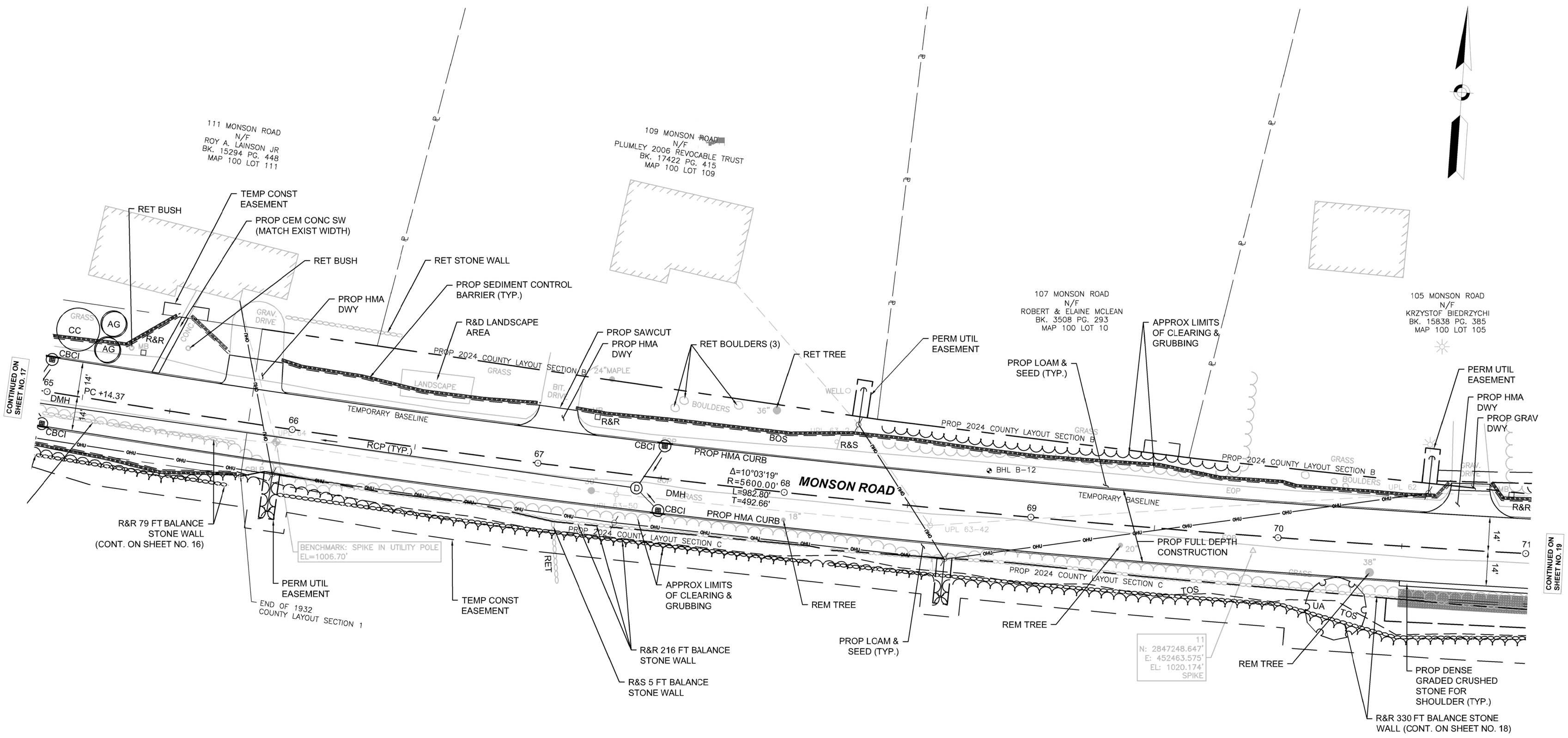
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	0	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	1	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	18	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



0 20 50 100

SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 30

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG.39
BK. 2099 PG. 244
BK.2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-12812
A00860 - 422

HIGHWAY GUARD DETAILS

STA 71+83 TO STA 71+95 RT TANGENT END TREATMENT TL-3
STA 71+95 TO STA 74+07 RT (TL-3)
STA 74+07 TO STA 74+19 RT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

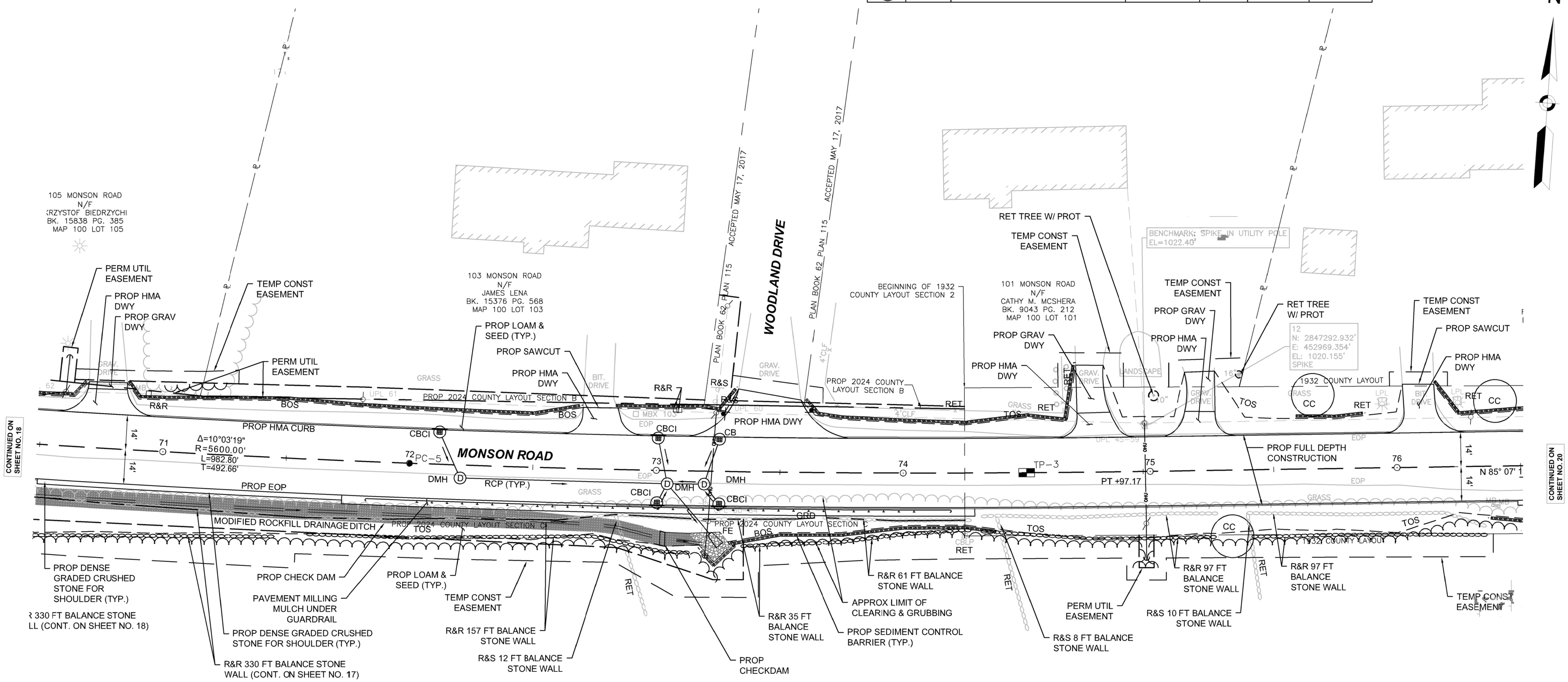
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
	3	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
	0	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	19	180
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
BK. 2082 PG. 39
BK. 2099 PG. 244
BK. 2158 PG. 397
BK. 2168 PG. 192
BK. 2433 PG. 283
BK. 2815 PG. 554
BK. 3184 PG. 407
BK. 3217 PG. 19
MAP 100 LOT 120

0 20 50 100
SCALE: 1" = 20'

FOR PROFILE SEE SHEET NO. 31

608163_HDA(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A00060 - 423

HIGHWAY GUARD DETAILS

STA 80+08 TO STA 80+21 RT TANGENT END TREATMENT TL-3
STA 80+21 TO STA 82+59 RT (TL-3)
STA 81+79 TO STA 81+92 LT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

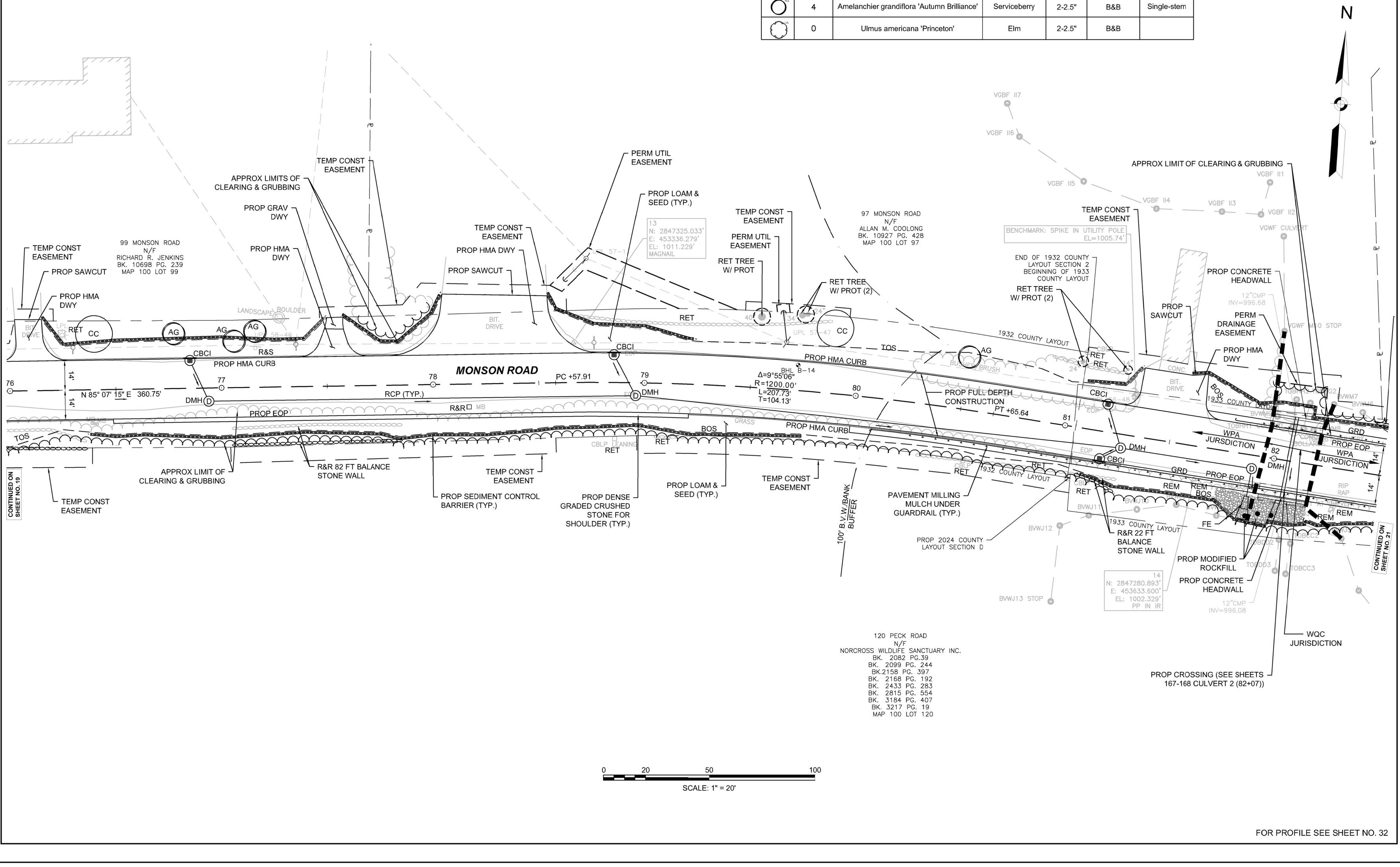
PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
CC	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
AG	4	Amelanchier grandiflora 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
UA	0	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	20	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



FOR PROFILE SEE SHEET NO. 32

608163_HDD(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A00860 - 424

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	180
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS

N

HIGHWAY GUARD DETAILS

STA 80+21 TO STA 82+59 RT (TL-3)
STA 82+59 TO STA 82+72 RT TANGENT END TREATMENT TL-3
STA 81+92 TO STA 82+92 LT (TL-3)
STA 82+92 TO STA 83+04 LT TANGENT END TREATMENT TL-3
STA 84+54 TO STA 84+66 RT TANGENT END TREATMENT TL-3
STA 84+66 TO STA 85+64 RT (TL-3)
STA 85+64 TO STA 86+04 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+43 TO STA 1+83 RT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 1+83 TO STA 2+07 RT (TL-3)
STA 02+07 TO STA 02+20 RT TANGENT END TREATMENT TL-3

STA 02+20 TO STA 02+07 LT TANGENT END TREATMENT TL-3
STA 02+07 TO STA 87+79 RT (TL-3)
STA 87+79 TO STA 87+92 RT TANGENT END TREATMENT TL-3
STA 87+02 TO STA 87+42 LT TRANSITION TO RIGID BARRIER (SINGLE FACED)
STA 87+42 TO STA 87+87 LT (TL-3)
STA 87+87 TO STA 88+00 LT TANGENT END TREATMENT TL-3

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

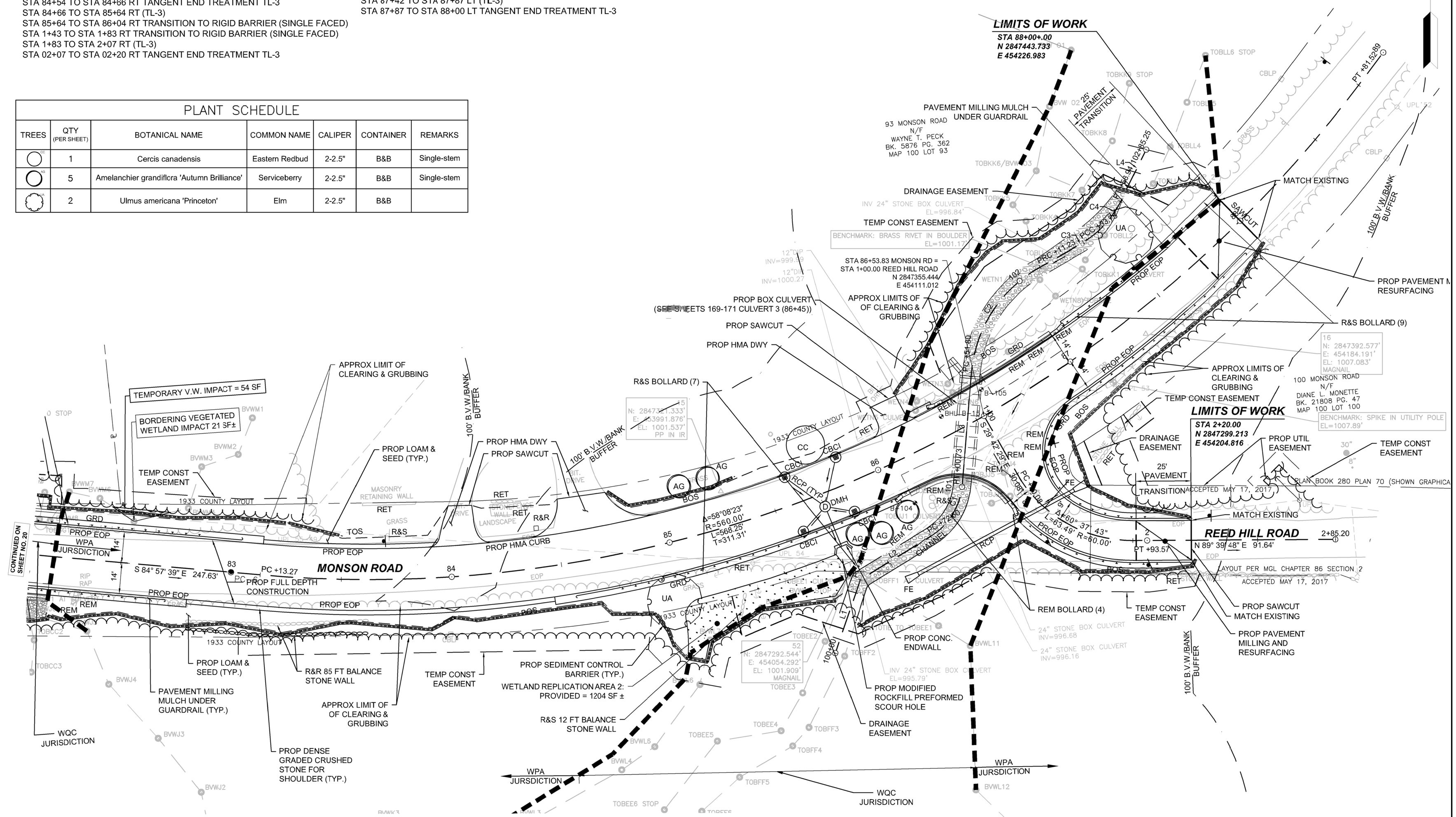
NONE

DRAINAGE DETAILS

SEE UTILITY PLANS

PLANT SCHEDULE

TREES	QTY (PER SHEET)	BOTANICAL NAME	COMMON NAME	CALIPER	CONTAINER	REMARKS
	1	Cercis canadensis	Eastern Redbud	2-2.5"	B&B	Single-stem
	5	Amelanchier grandiflcra 'Autumn Brilliance'	Serviceberry	2-2.5"	B&B	Single-stem
	2	Ulmus americana 'Princeton'	Elm	2-2.5"	B&B	

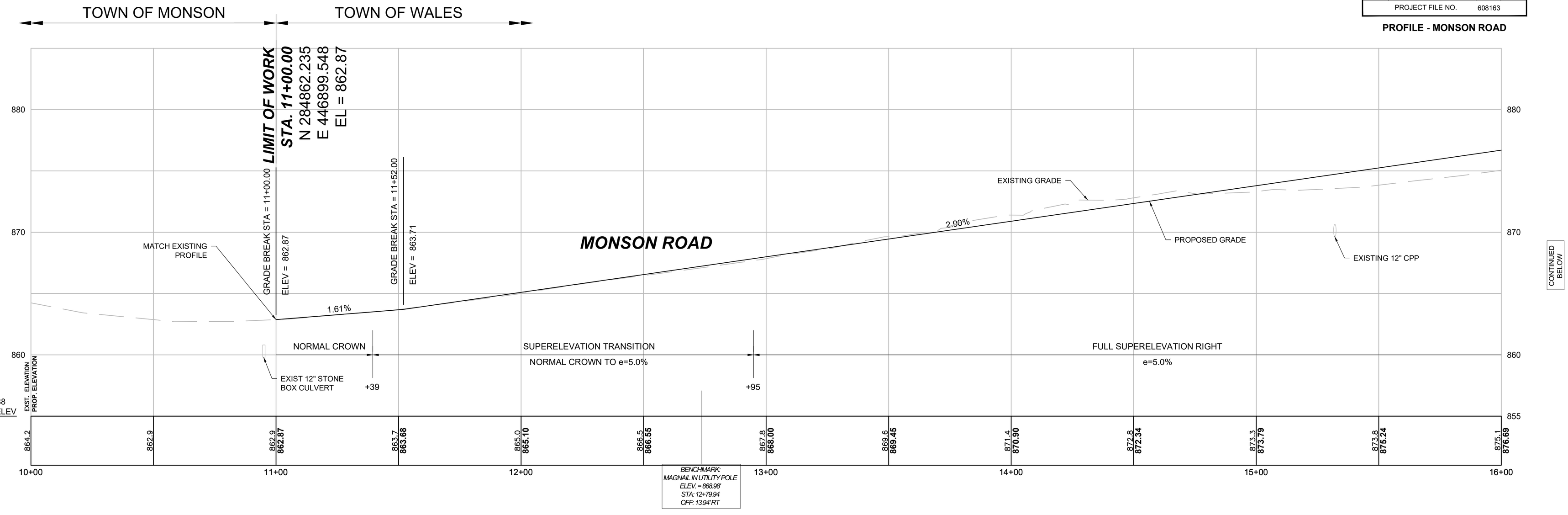


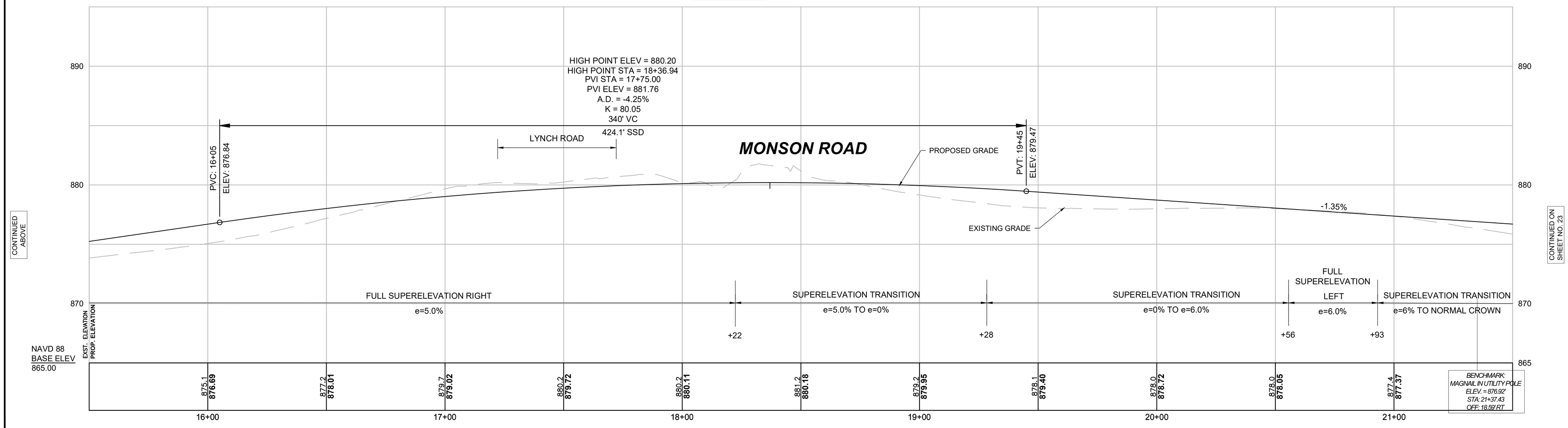
608163_HDD(CONSTRUCTION PLANS).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
A00600 - 425

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD





HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

FOR CONSTRUCTION PLANS
SEE SHEET NOS. 8 AND 9

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:17 PM

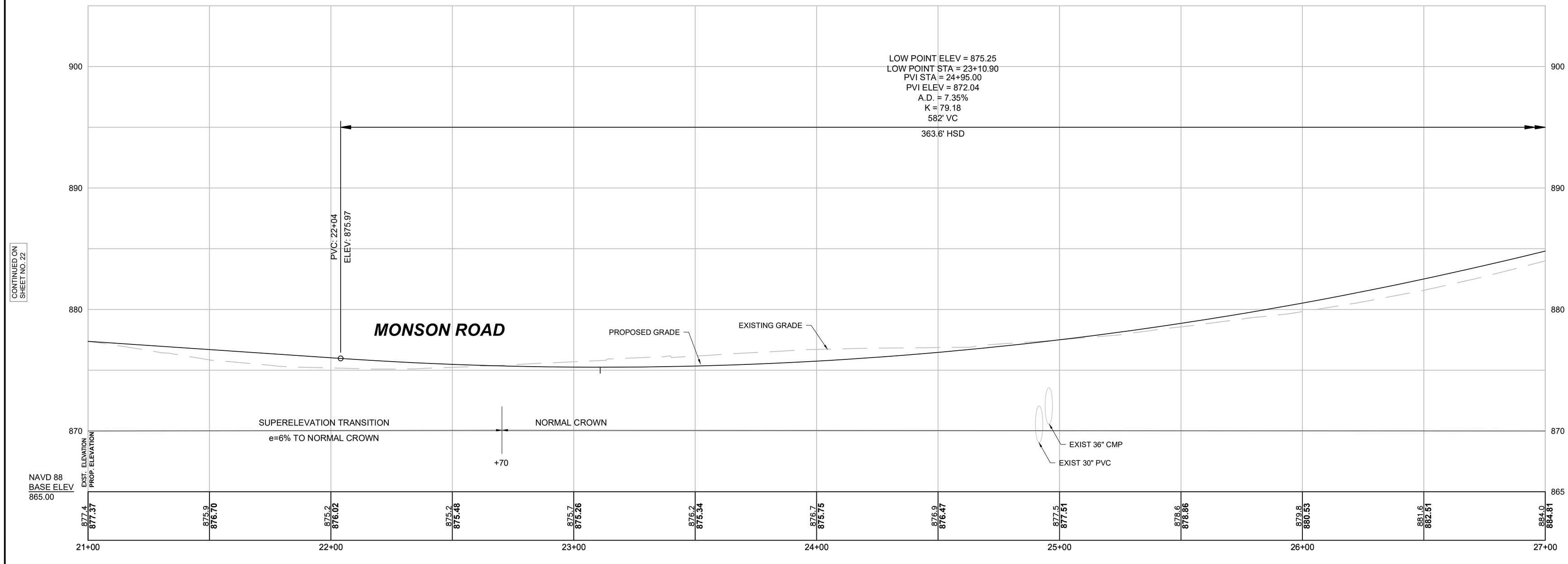
Proposal No. 608163-128112

A00809 - 426

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS
SEE SHEET NO. 10

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:17 PM

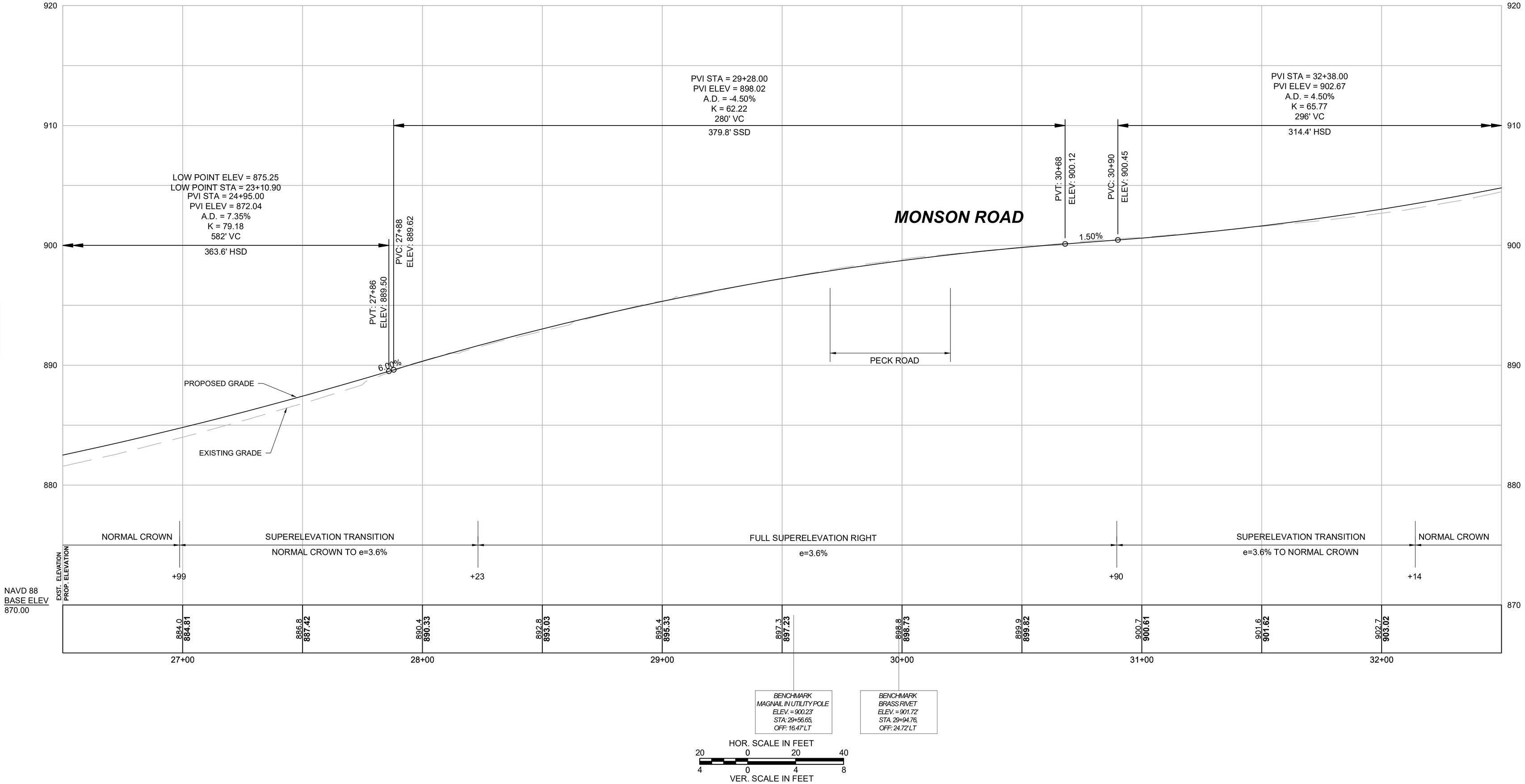
Proposal No. 608163-128112

A00960 - 427

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 11

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:18 PM

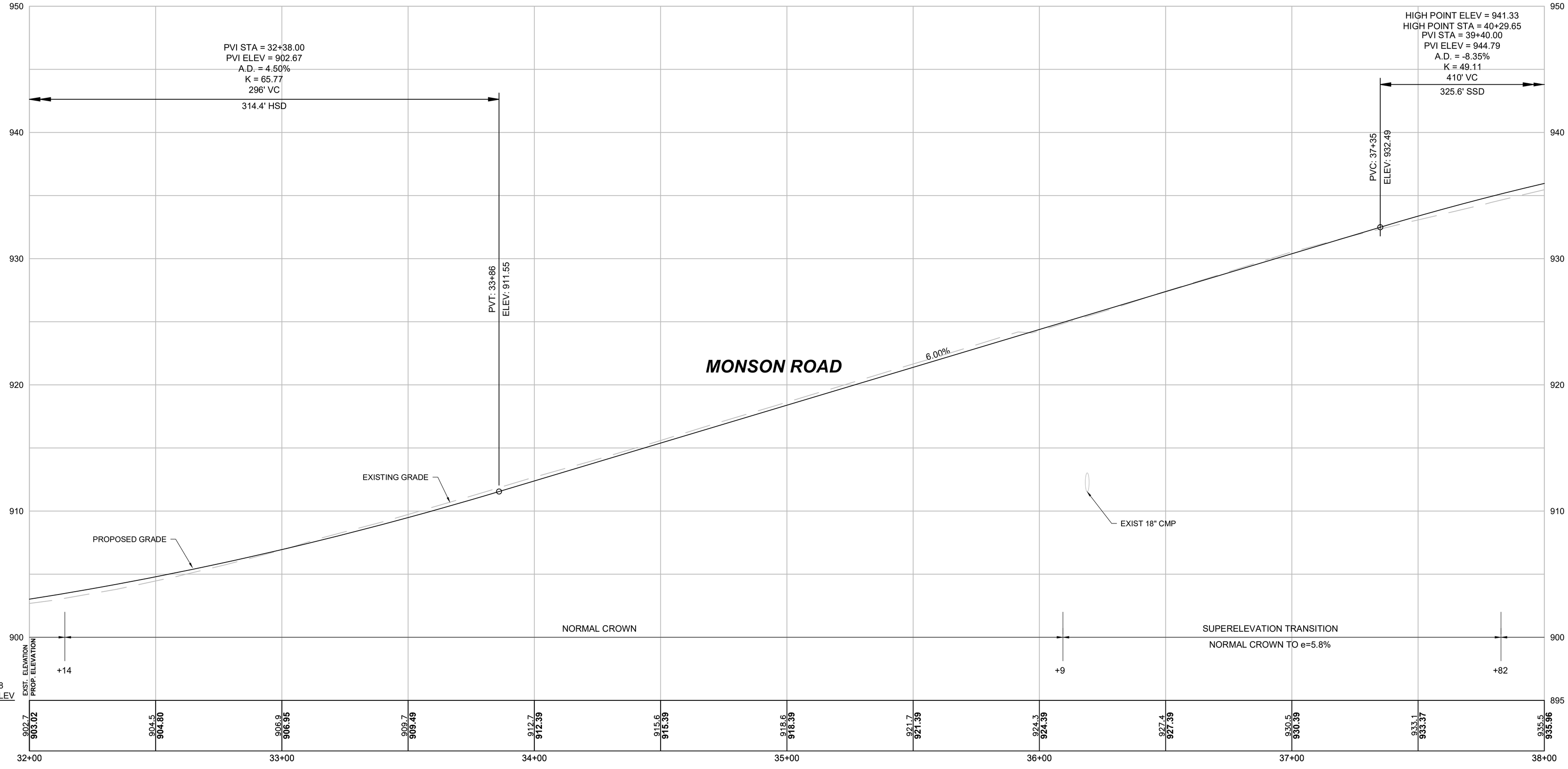
Proposal No. 608163-128112

A080609 - 428

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	25	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



CONTINUED ON SHEET NO. 24

CONTINUED ON SHEET NO. 26

HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

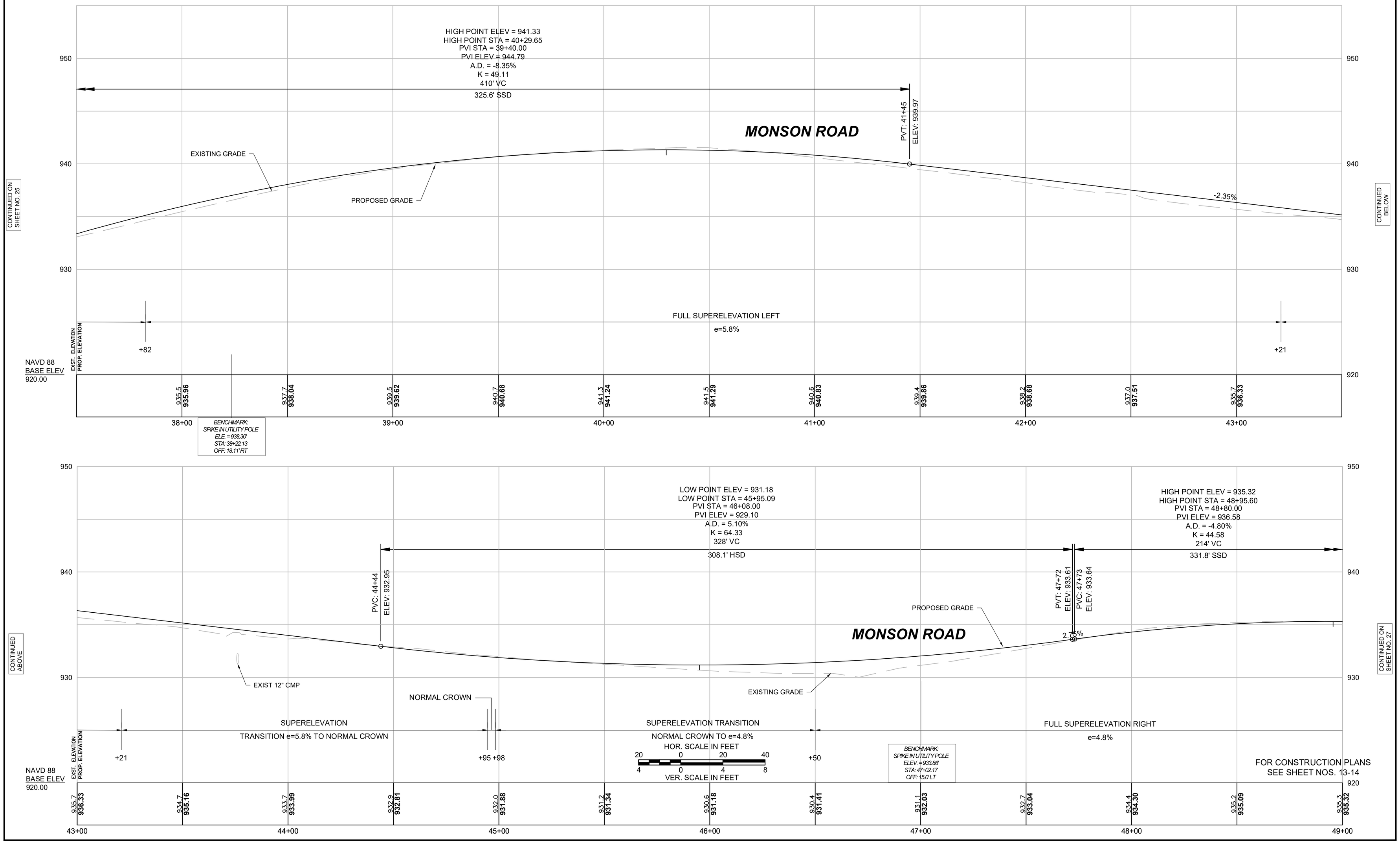
FOR CONSTRUCTION PLANS
SEE SHEET NO. 12

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:18 PM
Proposal No. 608163-128112
AM0809 - 429

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	26	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:19 PM

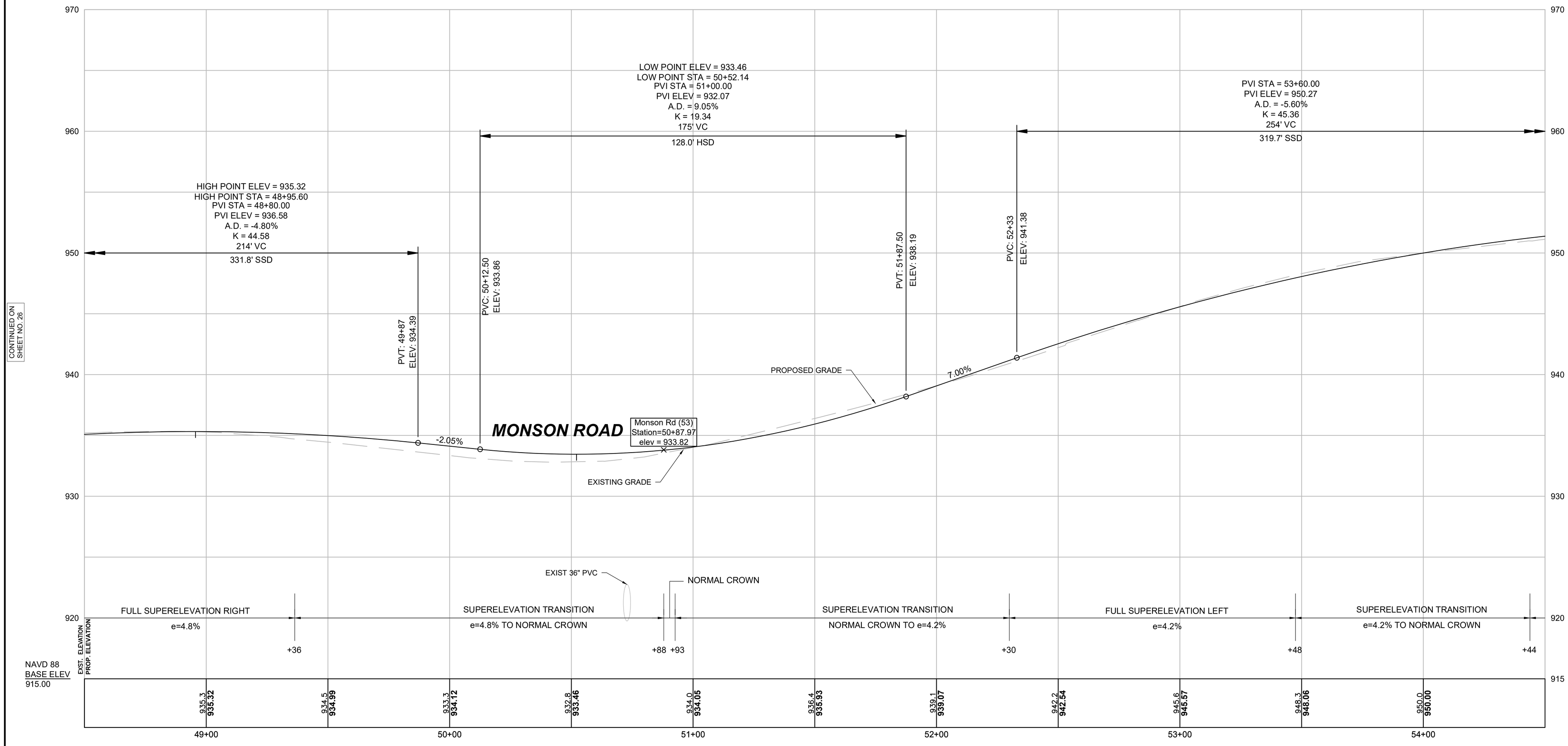
Proposal No. 608163-128112

A10860 - 430

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	27	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

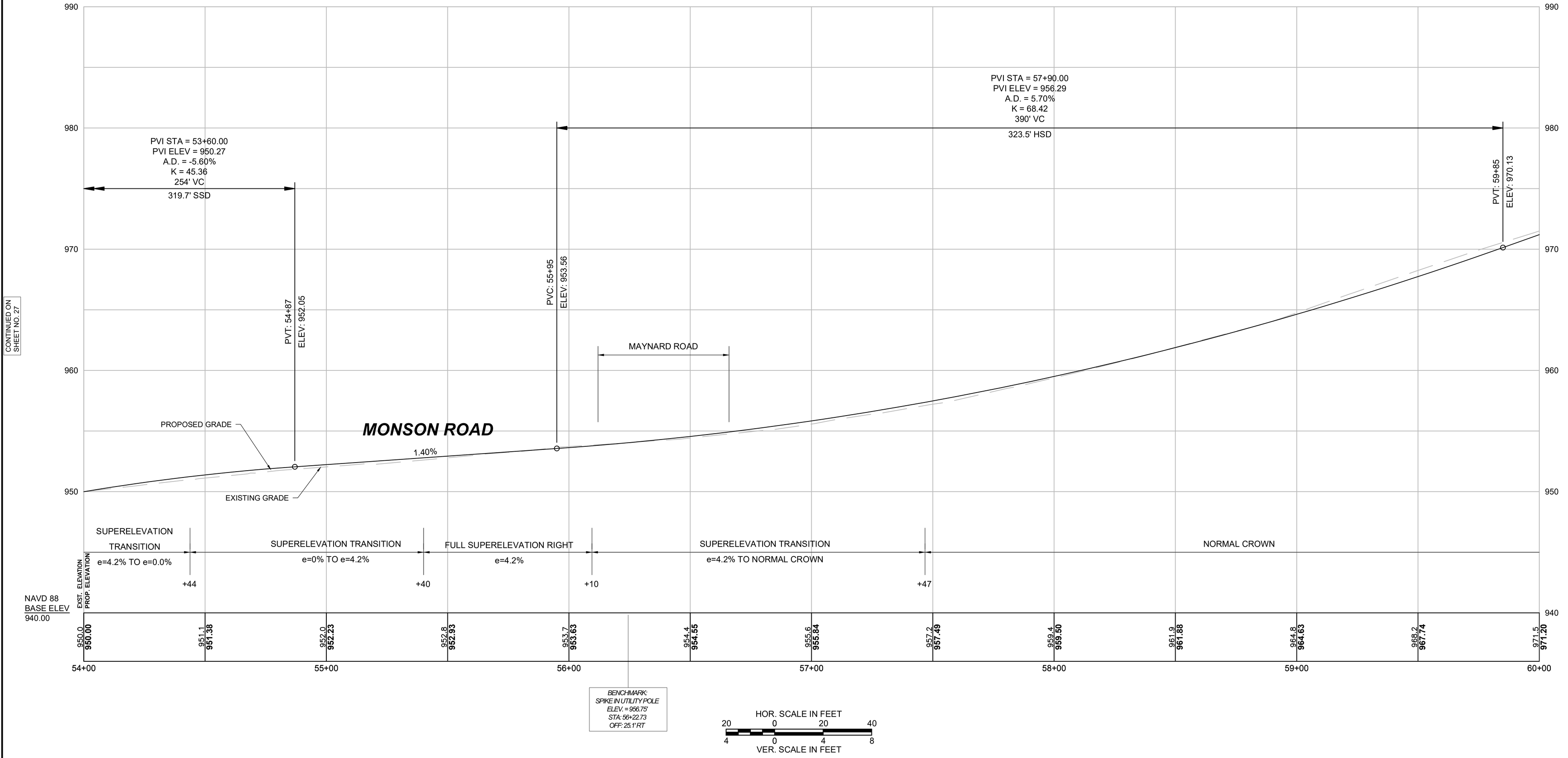
FOR CONSTRUCTION PLANS
SEE SHEET NO. 15

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:19 PM
Proposal No. 608163-128112
AM0869 - 431

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	28	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 16

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:20 PM

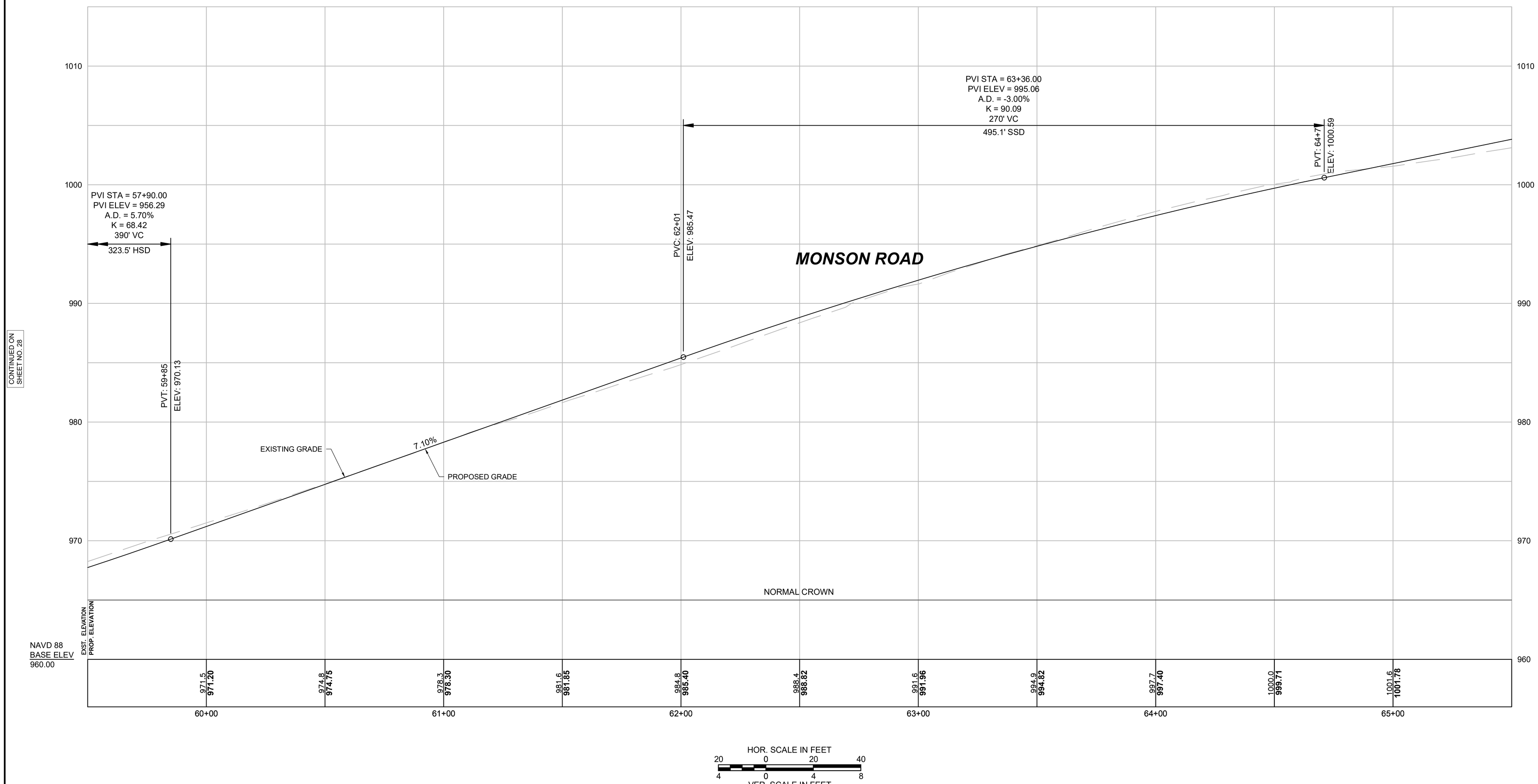
Proposal No. 608163-128112

A00060 - 432

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	29	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

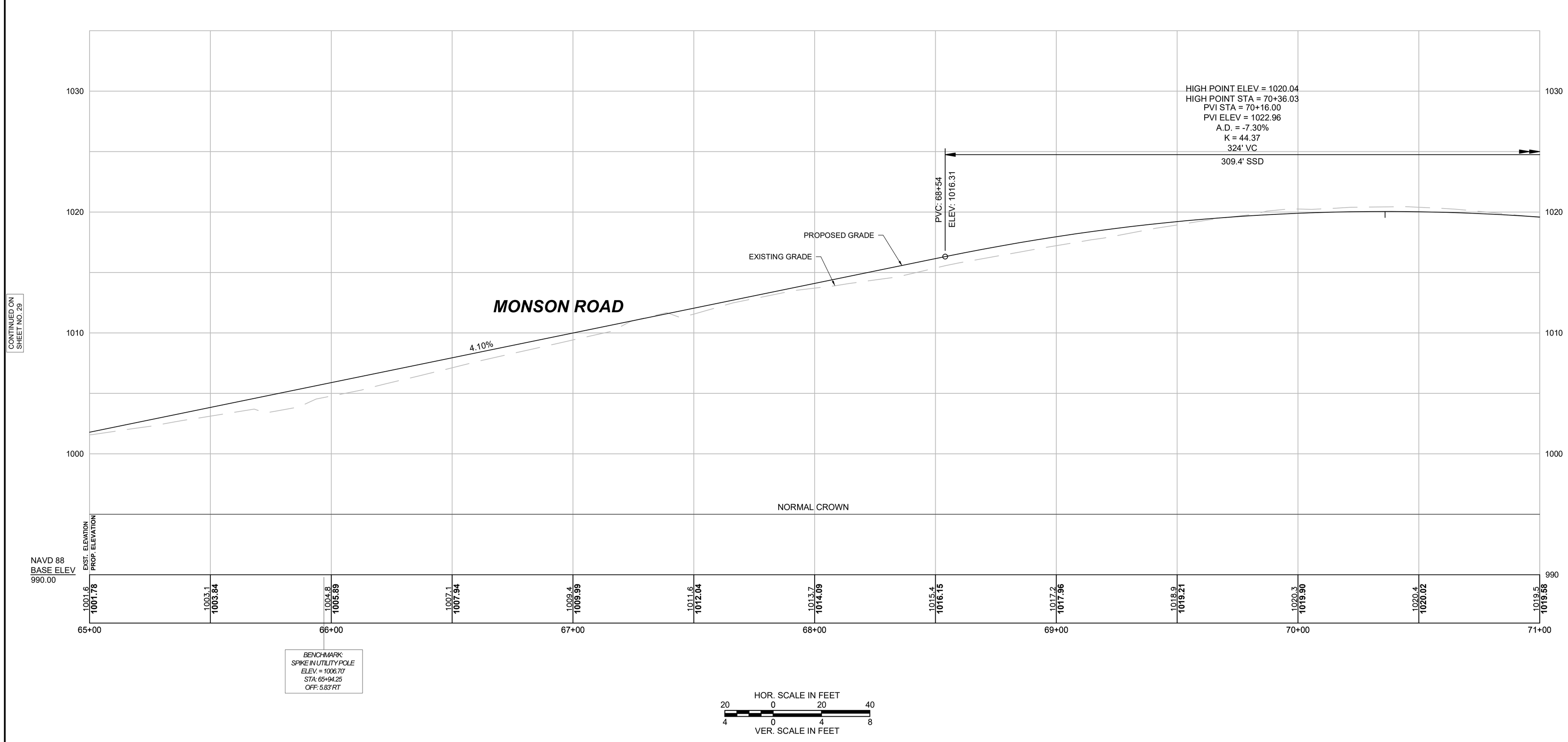
FOR CONSTRUCTION PLANS
SEE SHEET NO. 17

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:20 PM
Proposal No. 608163-120112
AN0696 - 433

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	30	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 18

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:21 PM

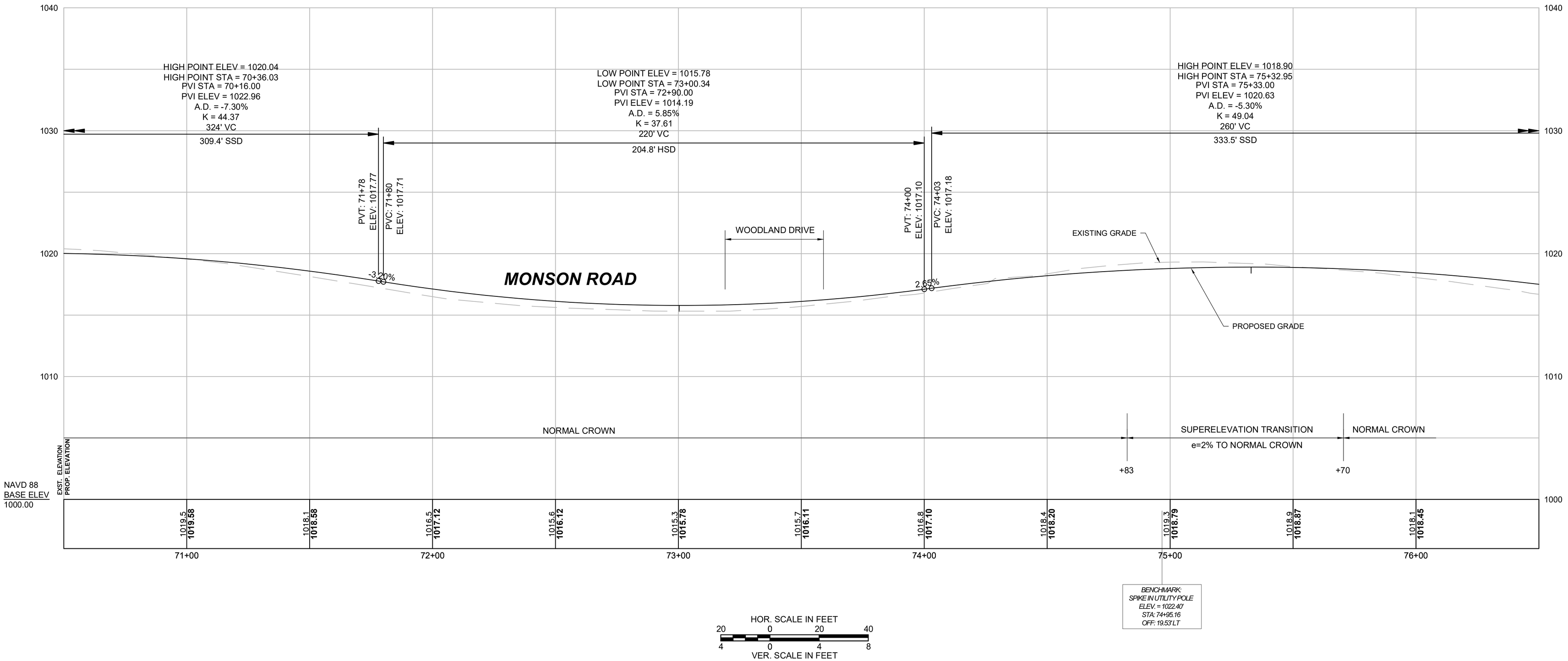
Proposal No. 608163-128112

A00809 - 434

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	31	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



FOR CONSTRUCTION PLANS
SEE SHEET NO. 19

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:21 PM

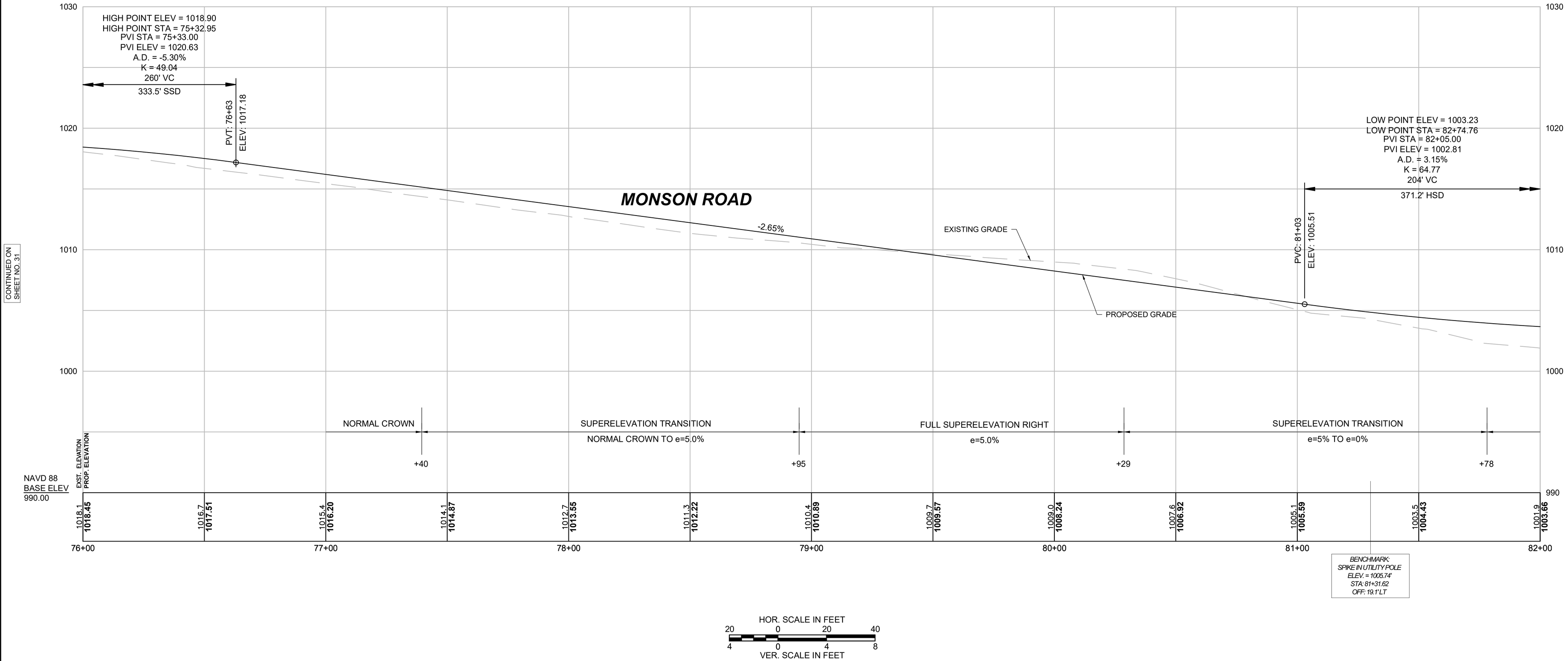
Proposal No. 608163-128112

A00060 - 435

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	180
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS
SEE SHEET NO. 20

608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:21 PM

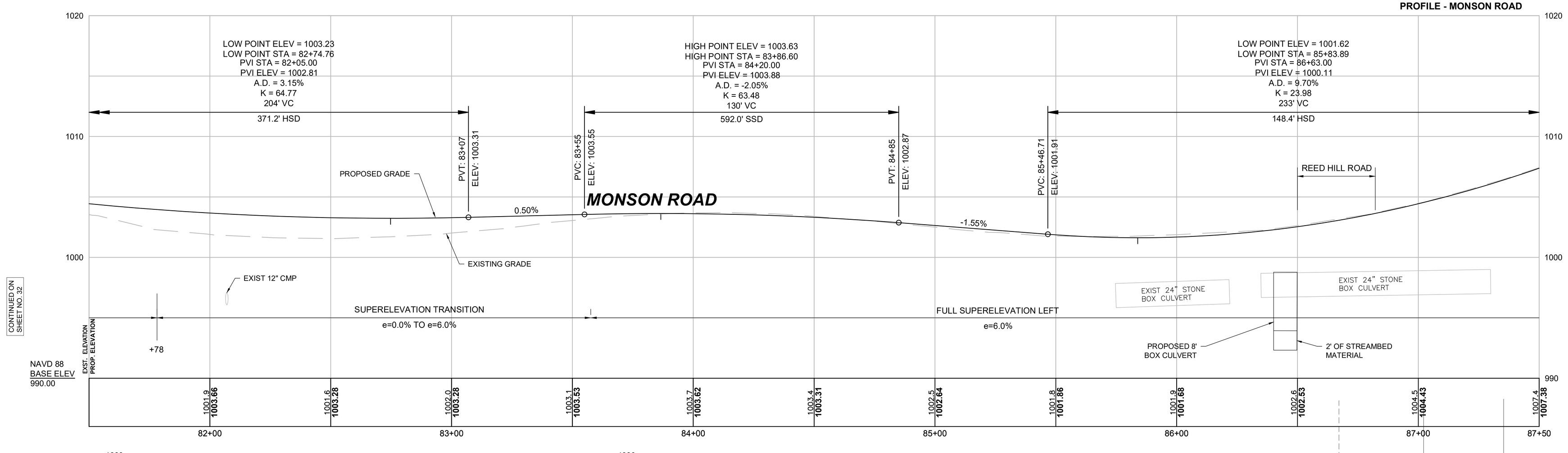
Proposal No. 608163-128112

A00860 - 436

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	180
PROJECT FILE NO.	608163		

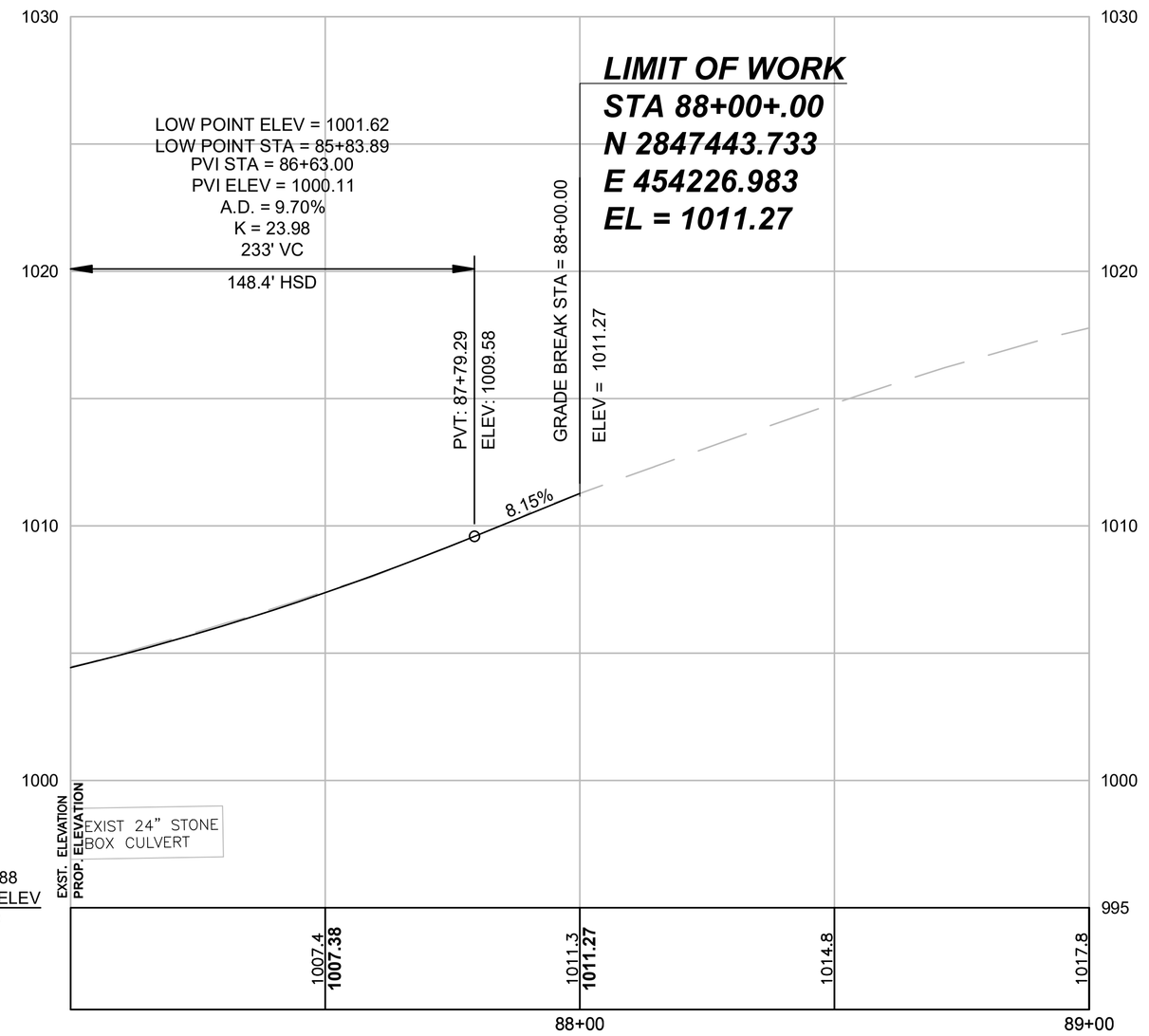
PROFILE - MONSON ROAD



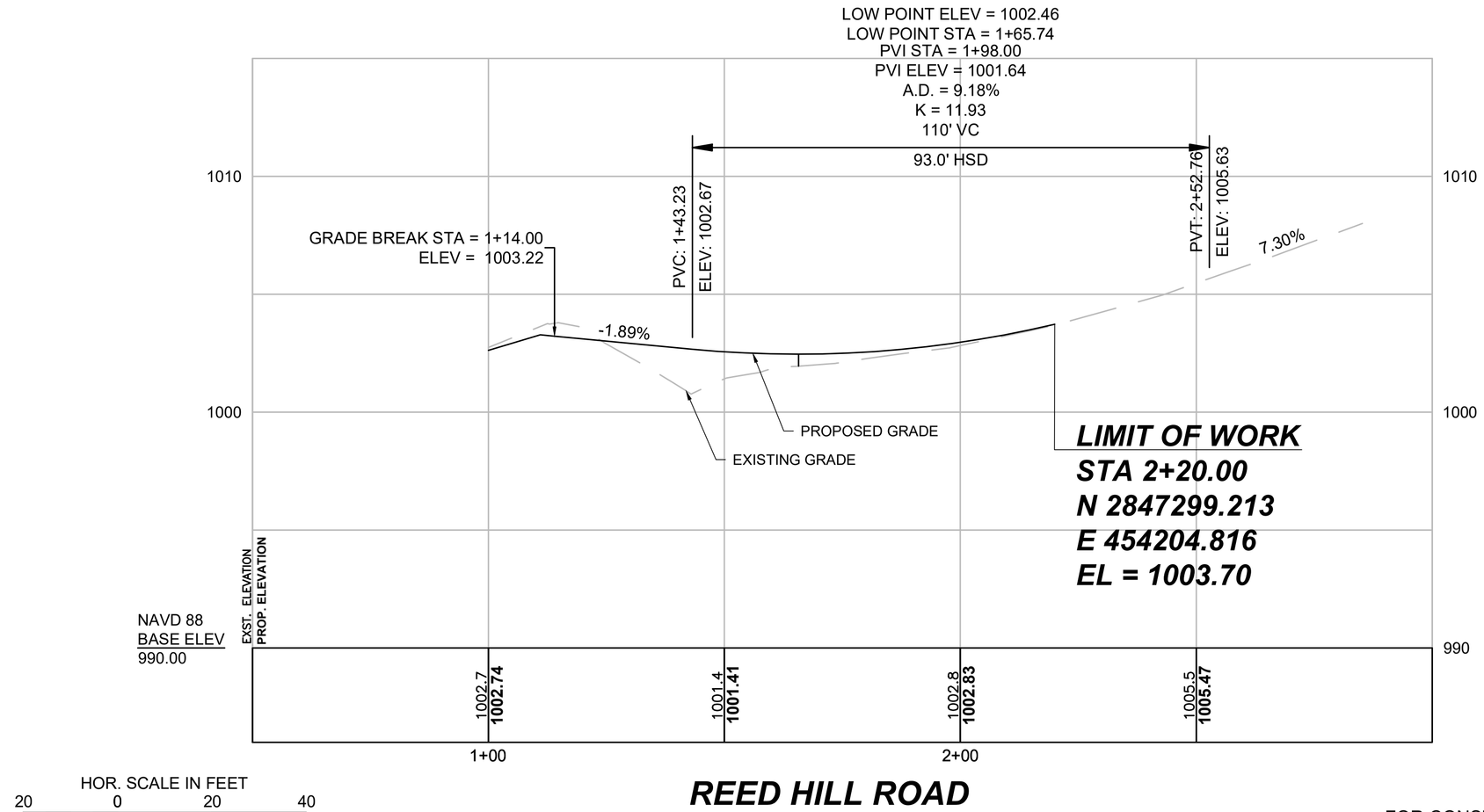
STA 86+63.21 MONSON RD ℄ =
STA 1+00.00 REED HILL RD ℄

BENCHMARK:
SPIKE IN UTILITY POLE
ELEV. = 1007.89'
STA: 87+05.97
OFF: 18.87' RT

BENCHMARK:
BRASS RIVET
ELEV. = 1001.17'
STA: 87+15.35
OFF: 41.26' LT



MONSON ROAD

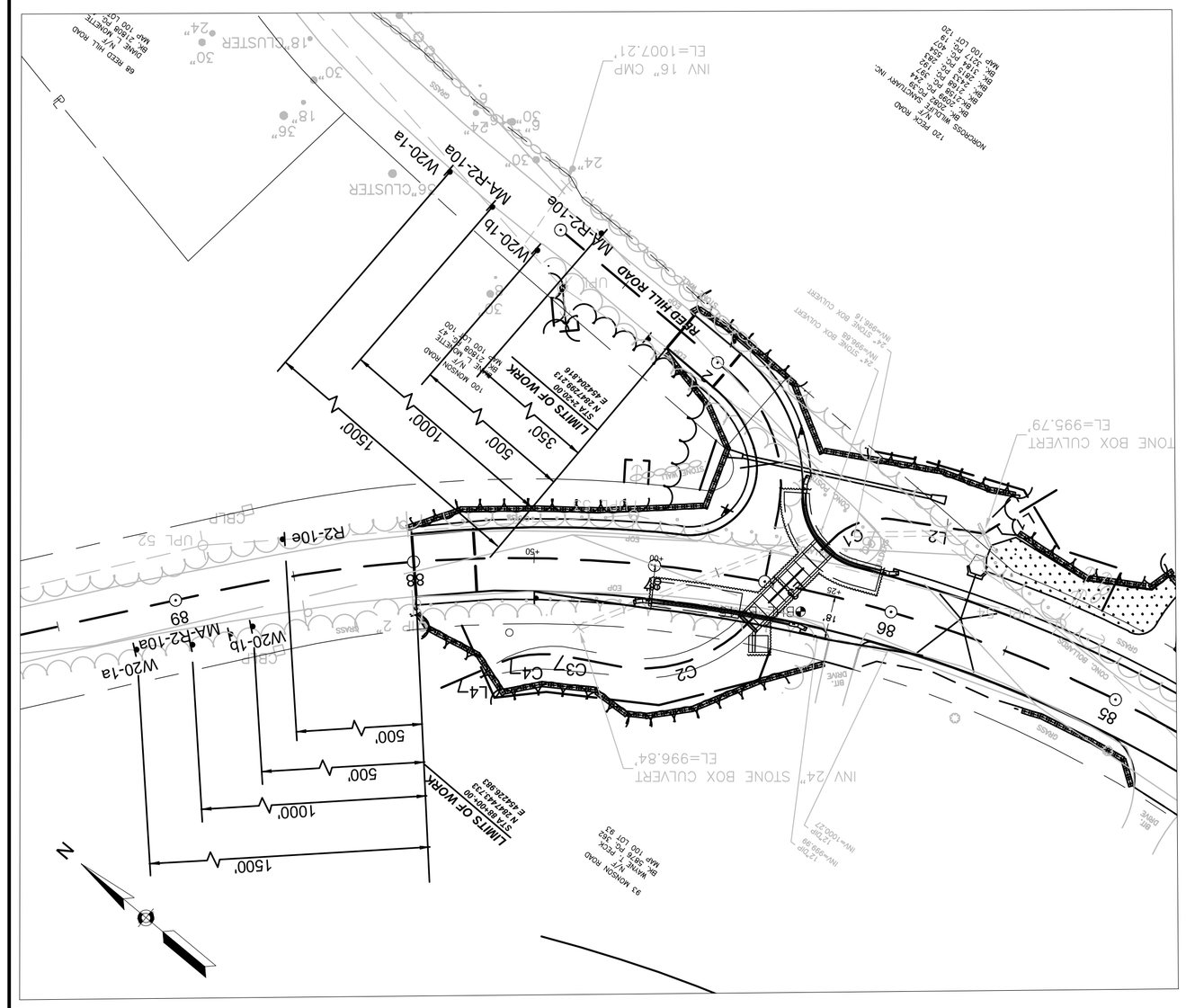


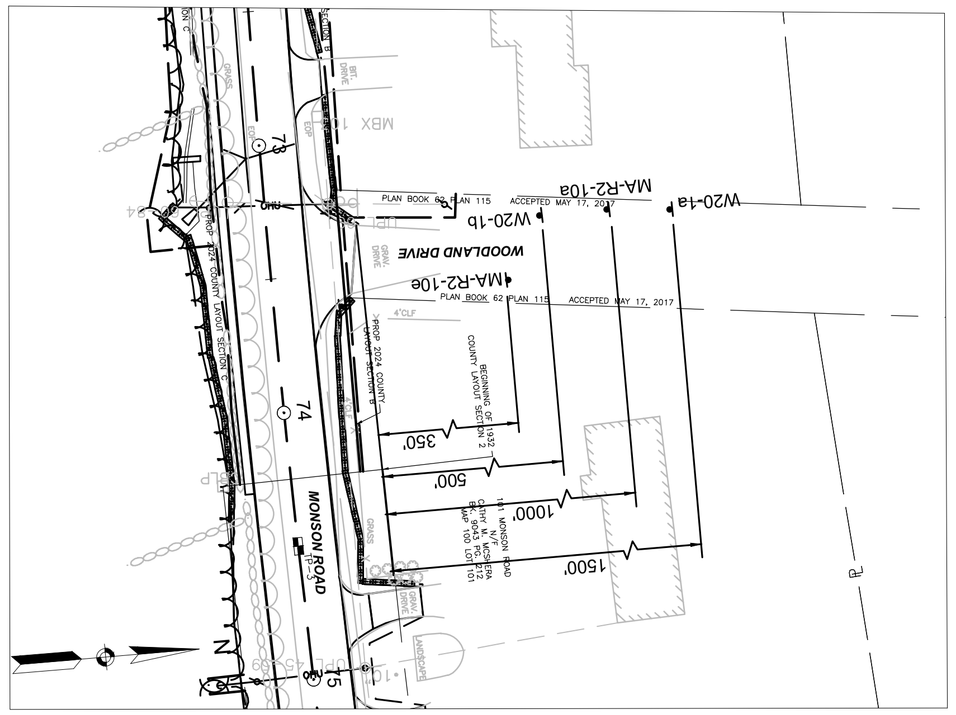
REED HILL ROAD

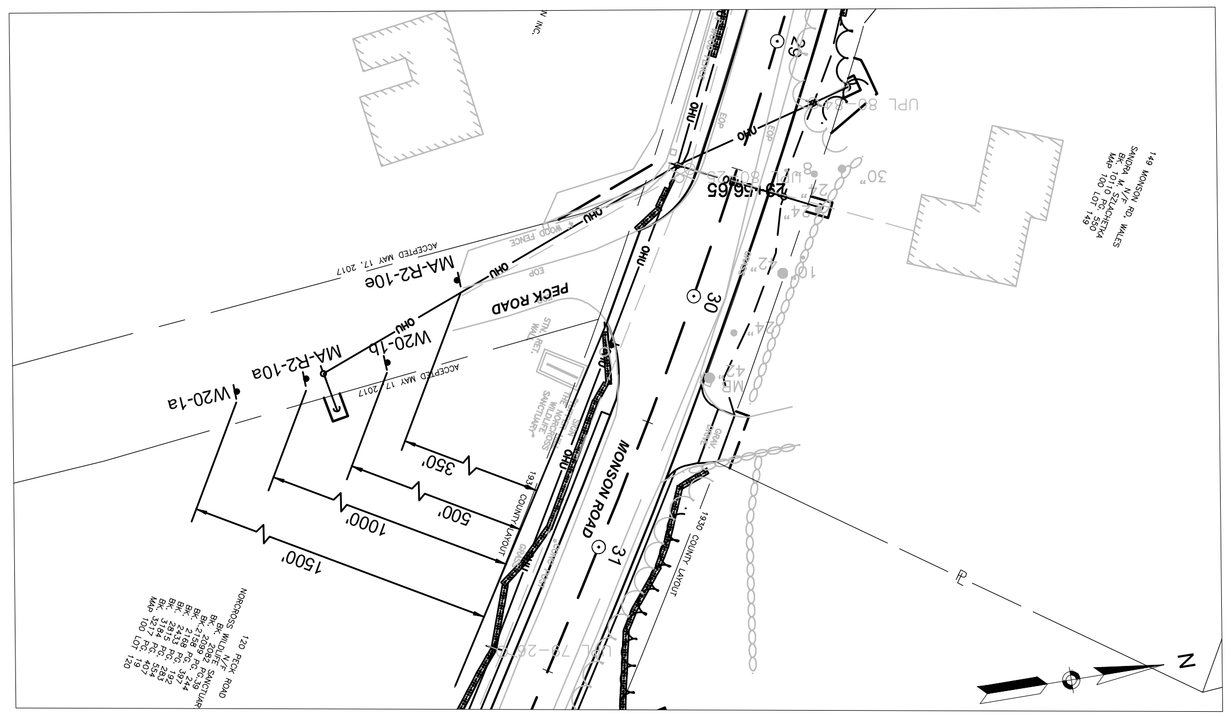
HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

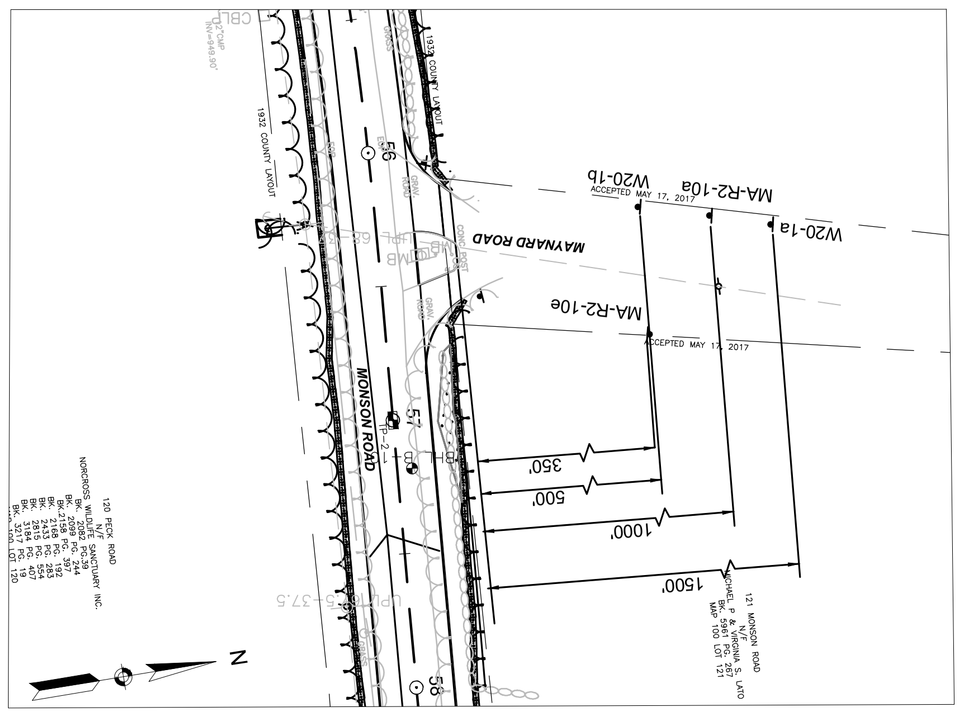
FOR CONSTRUCTION PLANS
SEE SHEET NO. 21

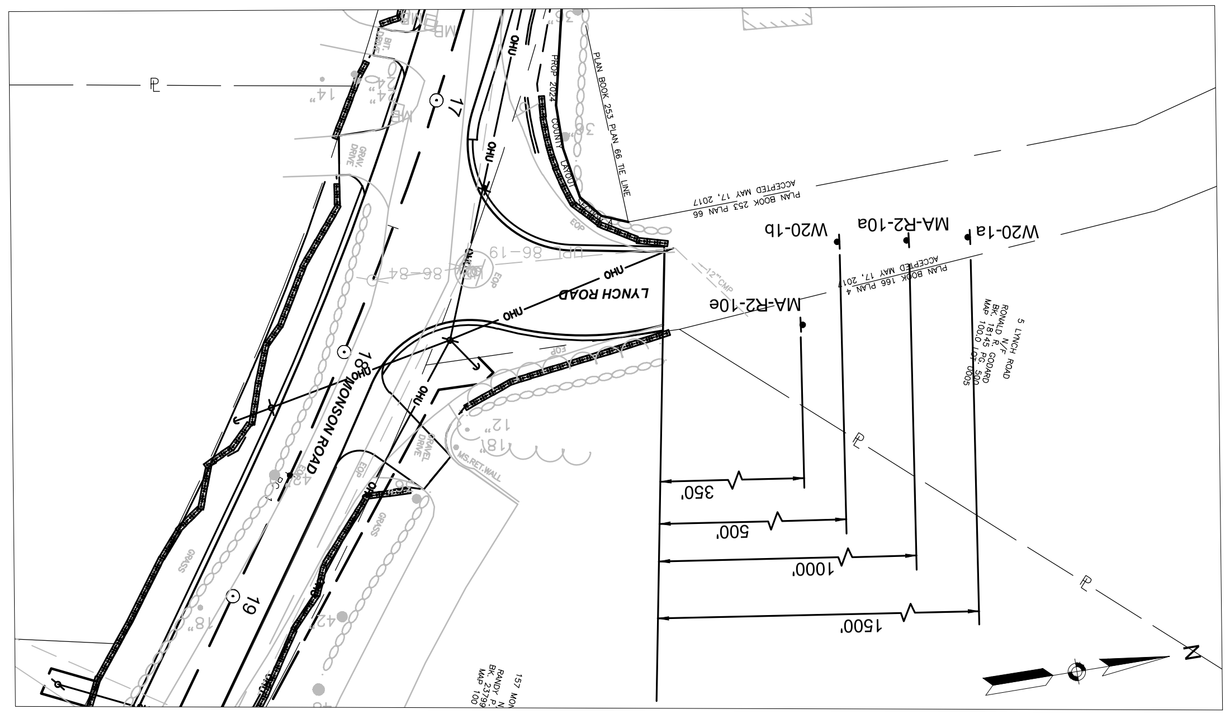
608163_HD4(PROFILE).DWG Plotted on 5-Jun-2024 1:22 PM
Proposal No. 608163-128112
A08060 - 437



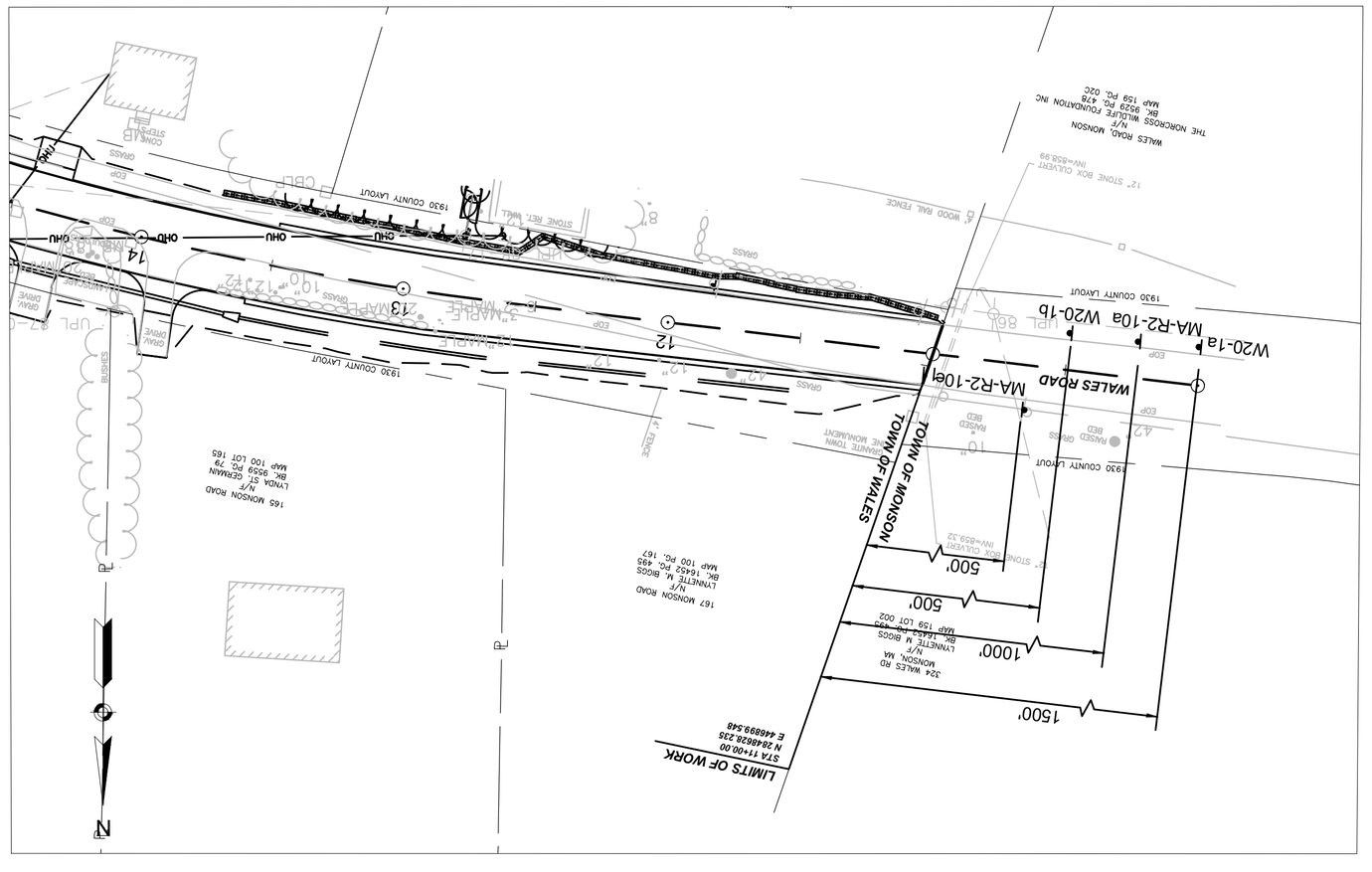








NOTE: ALL SIGNAGE SHOWN AT THE LIMITS SHALL BE ERECT FOR THE DURATION OF THE PROJECT



IDENTIFICATION NUMBER	SIZE OF SIGN		TEXT	TEXT DIMENSIONS (INCHES)			NUMBER OF SIGNS REQUIRED	COLOR			POST SIZE AND NUMBER REQUIRED	UNIT AREA (S.F.)	AREA IN SQUARE FEET
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.		BACK-GROUND	LEGEND	BORDER			
MA-R2-10a	48"	36"	WORK ZONE SPEEDING FINES DOUBLED	SEE MASSDOT'S STANDARD SIGN BOOK, LATEST EDITION			6	FLUOR-ESCENT ORANGE WHITE	BLACK	BLACK	4" WOOD POST (7)	12	84
MA-R2-10e	36"	48"	END ROAD WORK DOUBLE FINES END				5	FLUOR-ESCENT ORANGE WHITE	BLACK	BLACK	4" WOOD POST (7)	12	84
W20-1a	36"	36"	ROAD WORK 1500FT	SEE MUTCD AND STANDARD HIGHWAY SIGNS MANUAL, LATEST EDITIONS			7	FLUOR-ESCENT ORANGE	BLACK	BLACK	4" WOOD POST (7)	9	63
W20-1b	36"	36"	ROAD WORK 500FT				7	FLUOR-ESCENT ORANGE	BLACK	BLACK	4" WOOD POST (7)	9	63

WALES
MONSON ROAD

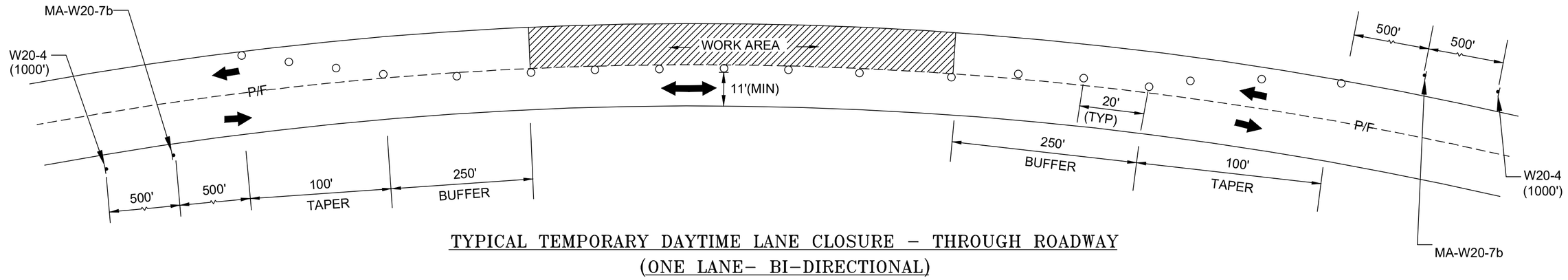
TEMPORARY TRAFFIC CONTROL & CONSTRUCTION SIGN SUMMARY

PROJECT FILE NO. 608163		
STATE	FED. AID PROJ. NO.	SHEET NO. / TOTAL SHEETS
MA	-	63 / 180

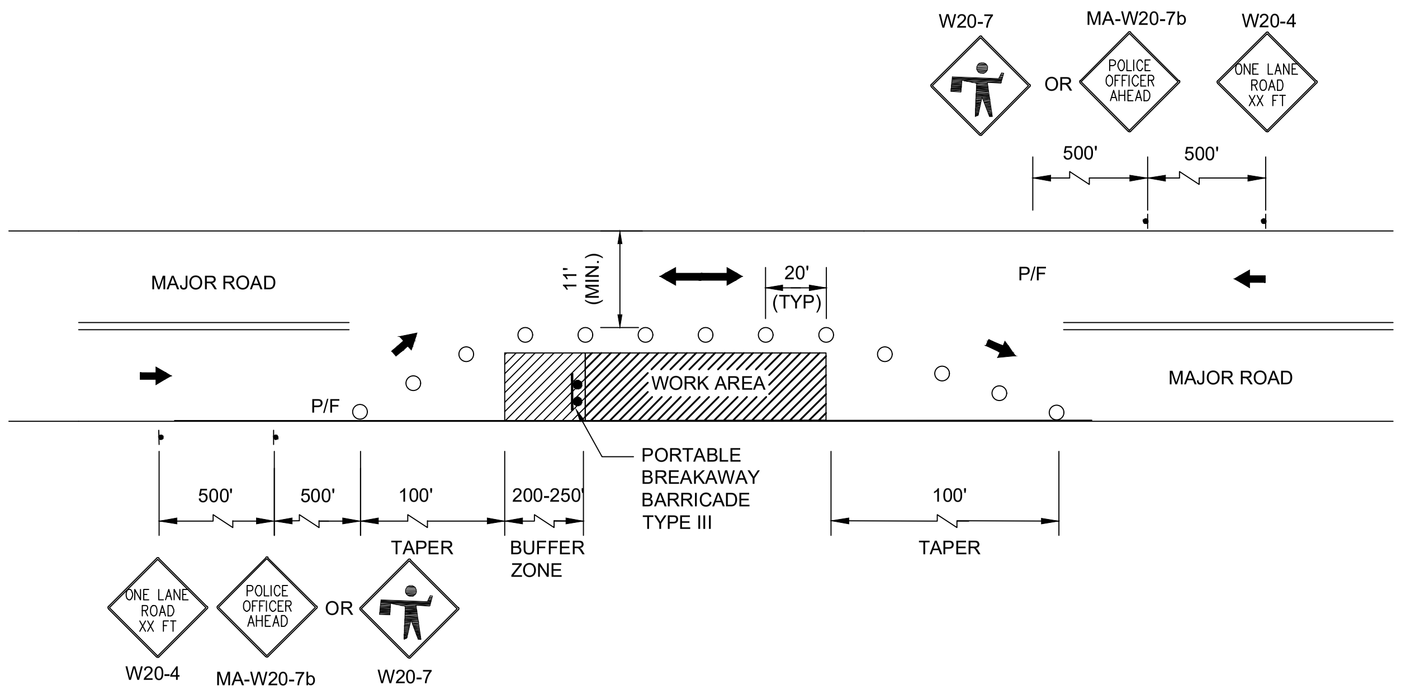
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	64	180
PROJECT FILE NO.	608163		

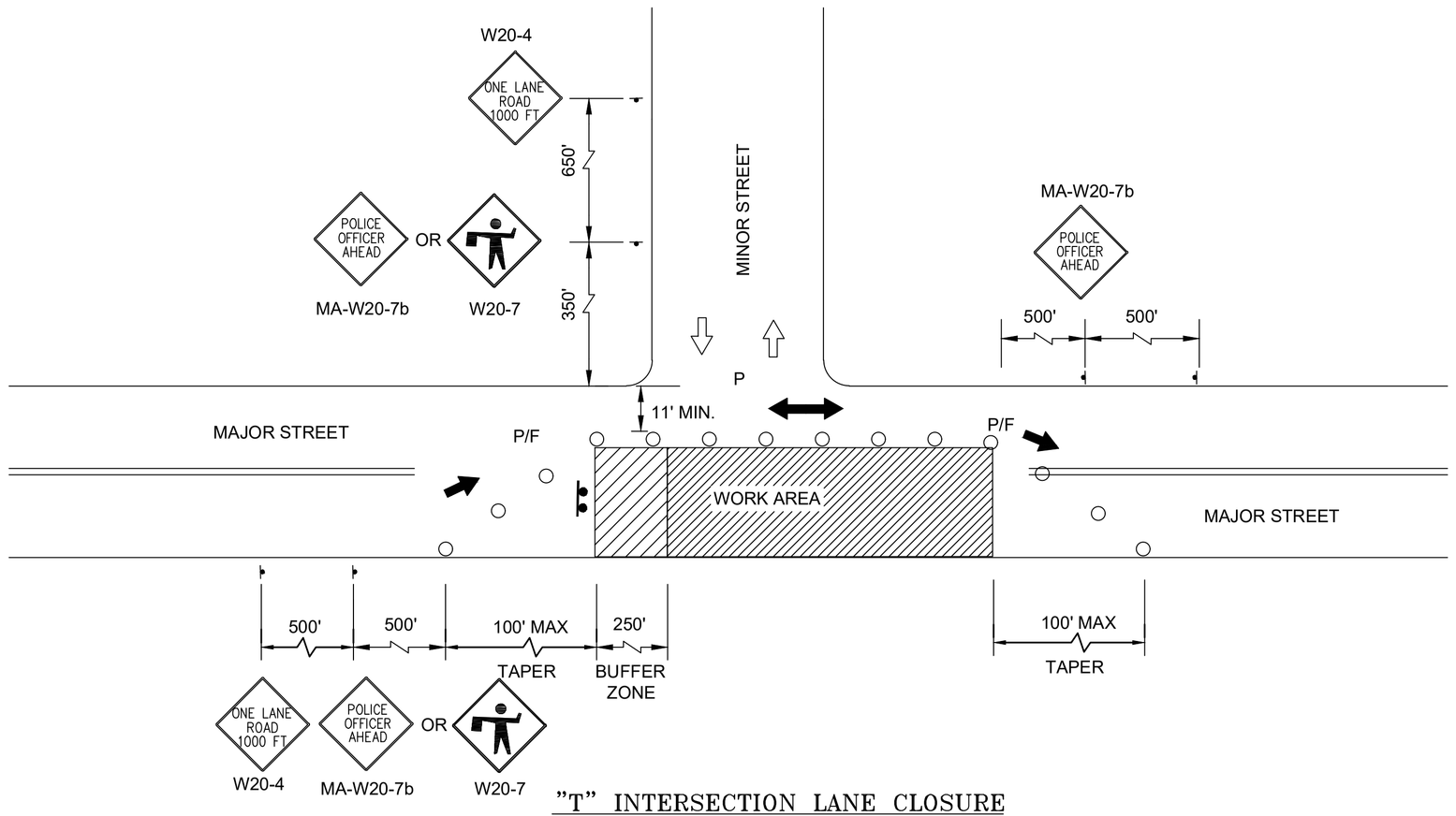
TEMPORARY TRAFFIC CONTROL DETAILS



TYPICAL TEMPORARY DAYTIME LANE CLOSURE – THROUGH ROADWAY
(ONE LANE– BI–DIRECTIONAL)
N.T.S.



LANE CLOSURE – TWO WAY ALTERNATING TRAFFIC
N.T.S.



"T" INTERSECTION LANE CLOSURE
N.T.S.

TEMPORARY TRAFFIC SIGN SUMMARY

IDENTIFICATION NUMBER	SIZE OF SIGN		TEXT	COLOR			NOTES
	WIDTH	HEIGHT		BACK-GROUND	LEGEND	BORDER	
W13-1p	24"	24"	XX M.P.H.	FLUOR-ESCENT ORANGE	BLACK	BLACK	ADVISORY SPEED LIMIT AS DETERMINED BY THE ENGINEER
W20-4	36"	36"	ONE LANE ROAD	FLUOR-ESCENT ORANGE	BLACK	BLACK	
W20-7	36"	36"		FLUOR-ESCENT ORANGE	BLACK	BLACK	
MA-W20-7b	36"	36"	POLICE OFFICER AHEAD	FLUOR-ESCENT ORANGE	BLACK	BLACK	

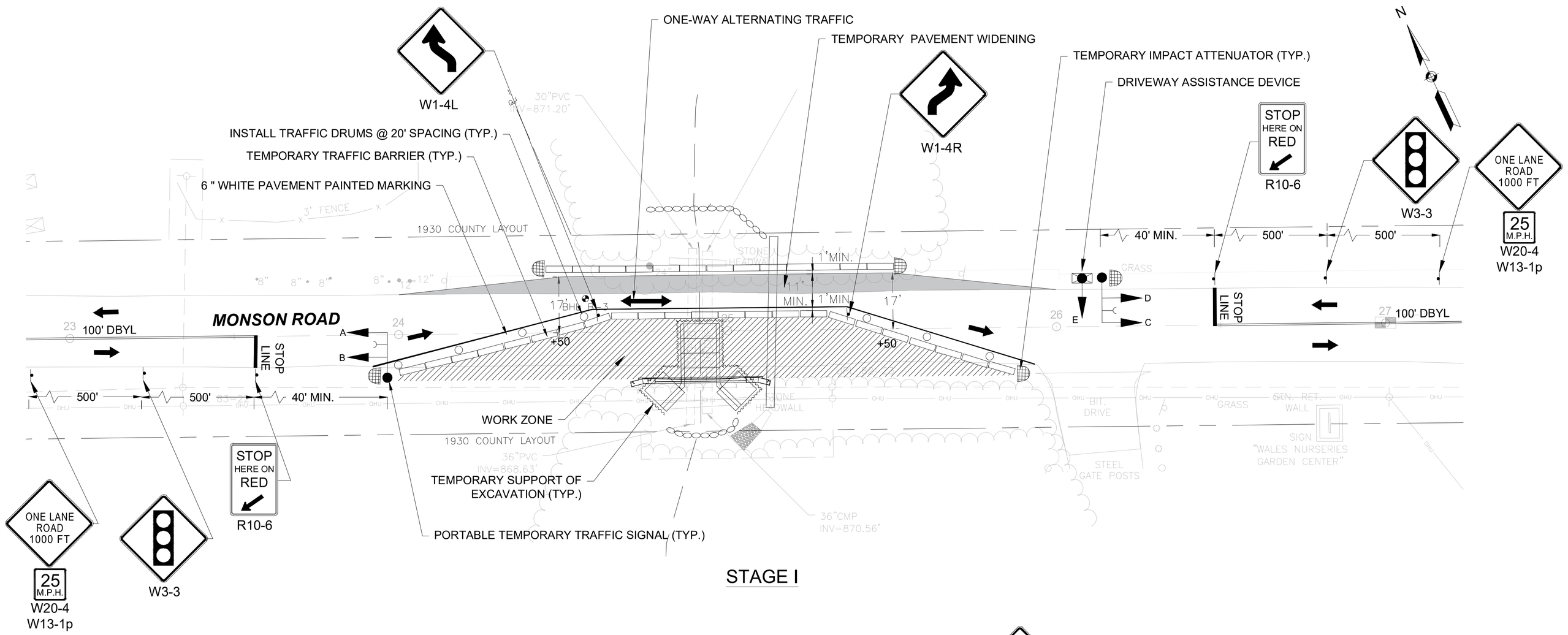
NOTES:

1. PLACEMENT OF ALL CONSTRUCTION SIGNS, DRUMS, BARRICADES, TRAFFIC DEVICES AND THE SHAPE, SIZE & COLOR OF ALL TEMPORARY TRAFFIC SIGNS SHALL CONFORM WITH THE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND ALL PREVISIONS.
2. ADVANCE WARNING SIGN PLACEMENT AND TAPER LENGTH SHALL BE ADJUSTED ACCORDING TO STREET CONDITIONS AND DRIVEWAY OPENINGS.
3. ALL DRUMS SHALL BE APPROXIMATELY PLACED AND RELOCATED AS NECESSARY TO MAINTAIN ADEQUATE ABUTTER ACCESS AT ALL TIMES.
4. THE CONTRACTOR SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF THE START OF ANY WORK THAT WILL REQUIRE THE TEMPORARY CLOSURE OF ACCESS, SUCH AS EXISTING PAVEMENT EXCAVATION, TEMPORARY DRIVEWAY PAVEMENT PLACEMENT AND SIMILAR OPERATIONS.
5. NONESSENTIAL TRAFFIC CONTROL DEVICES SHALL BE COVERED OR REMOVED DURING NON-WORKING HOURS.
6. PEDESTRIANS SHALL BE PROVIDED WITH ACCESS AND SAFE PASSAGE THROUGH THE TEMPORARY TRAFFIC CONTROL ZONE AT ALL TIMES.
7. ADVISORY SPEED PLATES (W13-1) SHALL BE USED IF APPLICABLE AND AS DIRECTED BY THE ENGINEER.
8. MA-R2-10a SIGN TO BE ERECTED BETWEEN W20-1 AND W20-4 SIGN.
9. MAINTAIN ONE LANE (MIN. 11' WIDTH) AT ALL TIMES DURING CONSTRUCTION.

LEGEND

□	REFLECTORIZED CHANNELIZING DEVICE		CONSTRUCTION SIGN
○	REFLECTORIZED DRUM		WORK AREA
⬅	TRAFFIC FLOW DURING CONSTRUCTION	N.T.S.	NOT TO SCALE
⇦	NORMAL TRAFFIC FLOW		ARROW BOARD
P/F	POLICE/FLAGGER DETAIL		TEMPORARY PRECAST PORTABLE CONCRETE BARRIER W/WARNING LIGHTS
	PORTABLE BREAKAWAY BARRICADE TYPE III		
	TEMPORARY IMPACT ATTENUATOR		

608163_HD7(TTCP).DWG Plotted on 5-Jun-2024 1:04 PM
Proposal No. 608163-128112
A080960 - 439



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	65	180
PROJECT FILE NO.		608163	

TEMPORARY TRAFFIC CONTROL DETAILS

CONSTRUCTION SEQUENCE

STAGE I

1. INSTALL SEDIMENT & EROSION CONTROLS..
2. INSTALL TEMPORARY BYPASS PIPE AND COFFERDAM. SEE TEMPORARY CONTROL OF WATER PLANS AND DETAILS.
3. REMOVE EXISTING 30" AND 36" DRAINAGE PIPES.
4. INSTALL TEMPORARY WIDENED ROADWAY.
5. INSTALL TEMPORARY SIGNAL & SIGNAGE.
6. INSTALL TEMPORARY PRECAST CONCRETE BARRIER CURB & TRAFFIC DRUMS.
7. ACTIVATE TEMPORARY SIGNAL AND ALTERNATING ONE-WAY TRAFFIC OPERATIONS.
8. EXCAVATE AS NEEDED & INSTALL TEMPORARY SUPPORT OF EXCAVATION.
9. INSTALL PRECAST CONCRETE BOX CULVERT AND DOWNSTREAM WESTERN WINGWALL AND PARAPET, CONSTRUCT WIDENED ROAD DRAINAGE PIPES AND FLARED ENDS WITHIN THE WORK ZONE.
10. INSTALL BRIDGE BARRIER AND TEMPORARY IMPACT ATTENUATOR AT PARAPET ENDS UNTIL GUIDERAIL IS INSTALLED.
11. BACKFILL CULVERT AND CONSTRUCT ROAD TO FINISH GRADE OF PAVEMENT BASE COURSE. INSTALL TEMPORARY WIDENED ROADWAY AS NEEDED DEPENDING ON STAGE OF ROADWAY IMPROVEMENTS.

STAGE II

1. RELOCATE TEMPORARY PRECAST TRAFFIC BARRIER CURB & TRAFFIC DRUMS.
2. INSTALL TEMPORARY SHORING AS NEEDED.
3. INSTALL REMAINING PRECAST CONCRETE CULVERT AND UPSTREAM WESTERN WINGWALL AND PARAPET, CONSTRUCT WIDENED ROAD.
4. INSTALL 2' OF NATURAL STREAMBED MATERIAL WITH A 6" LOW FLOW DEPRESSION IN CULVERT AS SHOWN ON THE STRUCTURAL PLANS AND DETAILS.
5. REMOVE COFFERDAM DIVERT FLOW INTO NEW CULVERT.
6. INSTALL BRIDGE BARRIER & GUARDRAIL AND EASTERN WINGWALLS FOLLOWING REMOVAL OF TEMPORARY BYPASS PIPE.
7. REMOVE TEMPORARY SUPPORT OF EXCAVATION.
8. BACKFILL CULVERT AND WINGWALLS AND CONSTRUCT ROAD TO FINISHED GRADE OF PAVEMENT BASE COURSE.
9. REMOVE ONE-WAY ALTERNATING TRAFFIC & SIGNAGE.
10. FINALIZE GRADING & SITE IMPROVEMENTS.
11. REMOVE SEDIMENT & EROSION CONTROLS.

LEGEND

- DIRECTION OF TRAFFIC
- CONSTRUCTION SIGN
- TRAFFIC OR PEDESTRIAN SIGNAL
- TEMPORARY IMPACT ATTENUATOR
- WORK AREA
- TEMPORARY TRAFFIC BARRIER
- REFLECTORIZED DRUM

0 20 50 100

SCALE: 1" = 20'

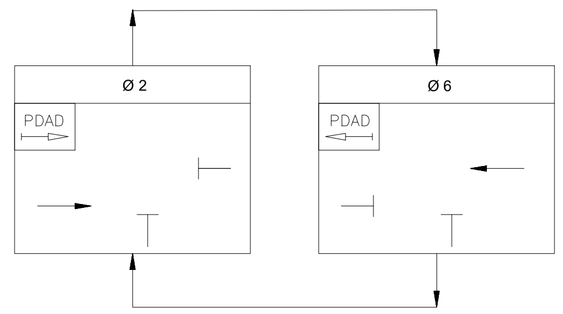
608163_HD7(TTCP).DWG Plotted on 5-Jun-2024 1:05 PM
Proposal No. 608163-128112
A00600 - 040

MONSON ROAD / 150 MONSON RD. DRIVEWAY			PHASE 1			PHASE 2			PHASE 3			PHASE 4			PHASE 5			PHASE 6			PHASE 7			PHASE 8			EMERGENCY ONLY
			NOT USED			PDAD			NOT USED			NOT USED			NOT USED			PDAD			NOT USED			NOT USED			
STREET	DIRECTION	HOUSINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	FLASH OPER.
MONSON ROAD	EB	A,B				G	Y	R										R	R	R							FR
MONSON ROAD	WB	C,D				R	R	R										G	Y	R							FR
PORTABLE DRIVEWAY ASSISTANCE DEVICE (PDAD)	N/A	E				FRA	R	R										FLA	R	R							FR
																											OFF
																											OFF
																											OFF

TIMING IN SECONDS

MINIMUM GREEN				10													10									
VEHICLE EXTENSION				3.0													3.0									
MAXIMUM I (WEEKDAYS)				35													35									
MAXIMUM II (ALL OTHER TIMES)				35													35									
YELLOW CLEARANCE					3.5													3.5								
RED CLEARANCE						12													12							
PEDESTRIAN WALK																										
PEDESTRIAN CLEARANCE																										
RECALL				SOFT													SOFT									
MEMORY				NON–LOCK													NON–LOCK									

PREFERENTIAL PHASING SEQUENCE



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	180
PROJECT FILE NO.		608163	

TEMPORARY TRAFFIC CONTROL DETAILS

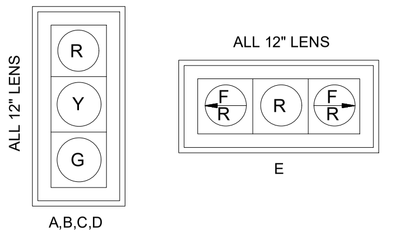
PRE-EMPTION PHASING AND PRIORITY

APPROACH	PREEMPTION PHASE	NEXT PHASE CALLED
EASTBOUND	2	6
WESTBOUND	6	2

TRAFFIC VOLUME DATA

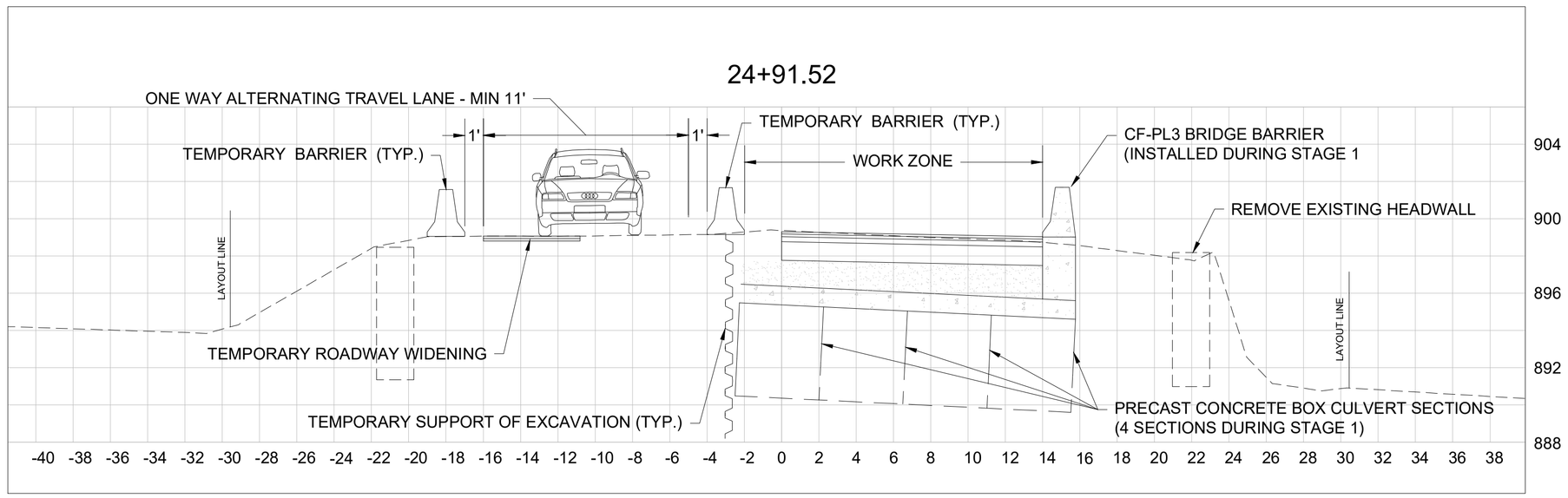
ADT (2019)	7641
PHV	683
PHV EB (D)	337 (49%)
PHV WB (D)	346 (51%)

SIGNAL IDENTIFICATION



NOTES:

1. ALL VEHICLE AND PEDESTRIAN LENSES SHALL BE LED TYPE.
2. ALL HOUSINGS TO BE PROVIDED WITH TUNNEL VISORS AND 5" RETRO-REFLECTIVE LOUVERED BACKPLATES.
3. ALL HOUSINGS TO BE FIXED MOUNTED.



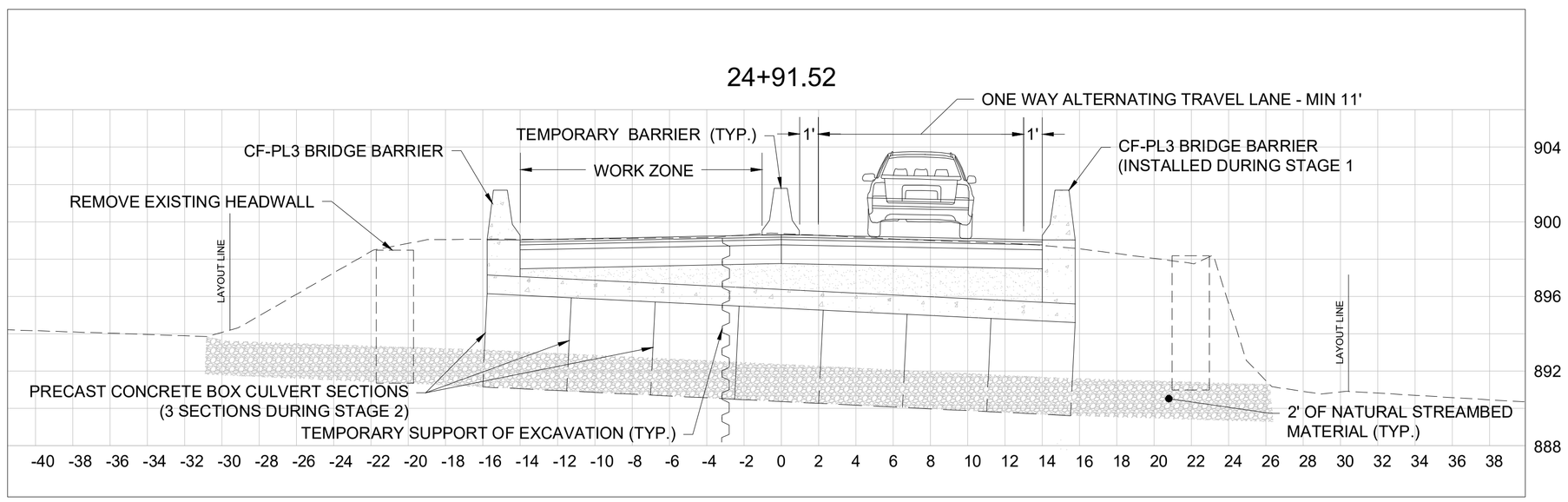
STAGE I

VIDEO DETECTION ZONES

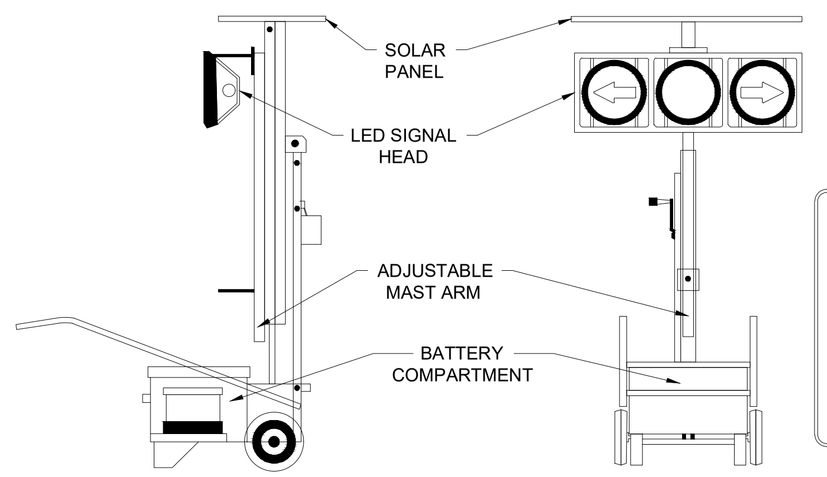
DETECTION NUMBER	DETECTION ZONE	Ø CALLED	Ø EXT.	MODE A = PULSE B = PRES.	DELAY TIME	EXT. TIME
1	12' x 20'	Ø2	Ø2	B	3	---
2	12' x 20'	Ø6	Ø6	B	3	---

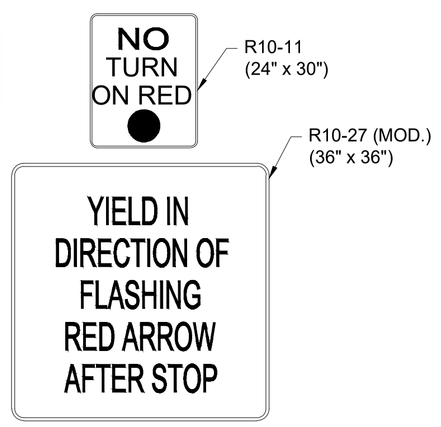
SEQUENCE & TIMING NOTES:

1. IF CALL EXIST ON ALL PHASES. THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
2. FLASHING OPERATION IS FOR EMERGENCY ONLY. THE SIGNAL SHALL PROVIDE STOP AND GO OPERATION 24 HOURS DAILY.
3. THE CONTRACTOR SHALL MONITOR TRAFFIC CONDITIONS DURING CONSTRUCTION AND ADJUST SIGNAL TIMINGS AS NECESSARY AND AS DIRECTED BY THE ENGINEER.



STAGE II



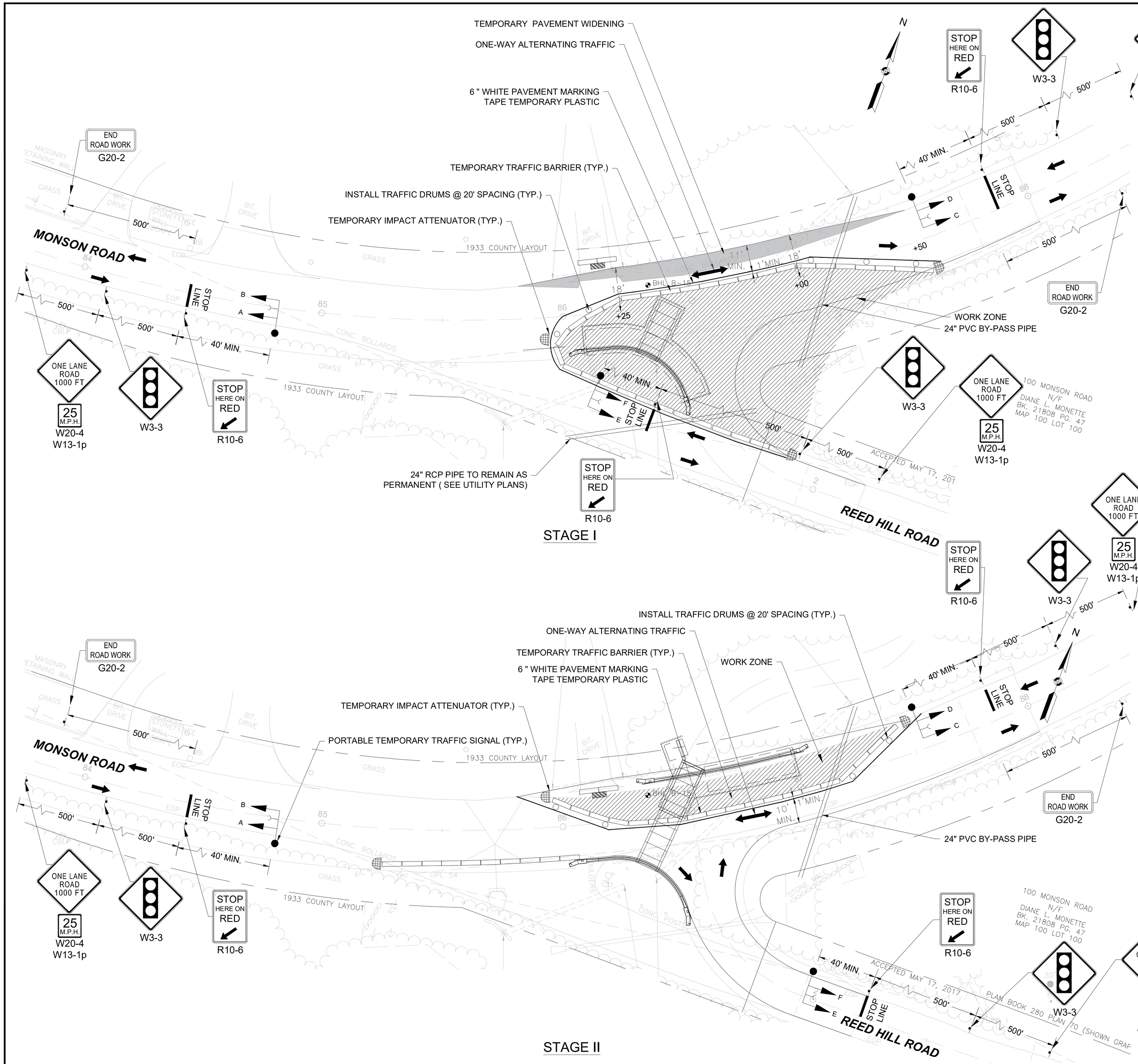


NOTES

PORTABLE DRIVEWAY ASSISTANCE DEVICES SHALL DISPLAY A FLASHING RED ARROW IN DIRECTION OF TRAFFIC DURING Ø2 & Ø6 GREEN AND YELLOW CLEARANCE INTERVALS. A SOLID RED BALL SHALL BE DISPLAYED DURING Ø4 AND ALL RED CLEARANCE INTERVALS.

1. AFFIX ONE (1) R10-11 AND ONE (1) R10-27(MOD) SIGN, FACING THE SAME DIRECTION AS THE LENSES, TO EACH PORTABLE DRIVEWAY ASSISTANCE DEVICE.
2. ANY SIGNS MOUNTED TO THE PORTABLE DRIVEWAY ASSISTANCE DEVICES SHALL BE CLEARLY VISIBLE TO THE INTENDED TARGET.

608163_HD7(TTCP).DWG Plotted on 5-Jun-2024 1:05 PM
Proposal No. 608163-128112
A00860 - 441



N

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	67	180
PROJECT FILE NO.		608163	

TEMPORARY TRAFFIC CONTROL DETAILS

CONSTRUCTION SEQUENCE

STAGE I

1. INSTALL SEDIMENT & EROSION CONTROLS.
2. REMOVE CONCRETE BOLLARD AS NEEDED.
3. INSTALL TEMPORARY BYPASS PIPES AND COFFERDAMS. SEE TEMPORARY CONTROL OF WATER PLANS AND DETAILS.
4. REMOVE EXISTING DRAINAGE PIPES,
5. INSTALL TEMPORARY WIDENED ROADWAY.
6. INSTALL TEMPORARY SIGNAL & SIGNAGE.
7. INSTALL TEMPORARY PRECAST CONCRETE BARRIER CURB & TRAFFIC DRUMS.
8. ACTIVATE TEMPORARY SIGNAL AND ALTERNATING ONE-WAY TRAFFIC OPERATIONS.
9. EXCAVATE AS NEEDED & INSTALL TEMPORARY SUPPORT OF EXCAVATION.
10. INSTALL PRECAST CONCRETE BOX CULVERT AND DOWNSTREAM ENDWALL, WINGWALLS, PARAPET AND CONSTRUCT NEW REED HILL ROAD INTERSECTION AND APPROACH, DRAINAGE PIPES, FLARED ENDS WITHIN THE WORK ZONE.
11. INSTALL BRIDGE BARRIER AND TEMPORARY IMPACT ATTENUATOR AT PARAPET ENDS UNTIL GUIDERAIL IS INSTALLED.
12. BACKFILL CULVERT AND CONSTRUCT ROAD TO FINISHED GRADE OF PAVEMENT BASE COURSE.

STAGE II

1. RELOCATE TEMPORARY PRECAST TRAFFIC BARRIER CURB & TRAFFIC DRUMS.
2. INSTALL TEMPORARY SUPPORT OF EXCAVATION AS SHOWN.
3. INSTALL REMAINING PRECAST CONCRETE CULVERT SECTIONS AND UPSTREAM WINGWALLS, PARAPET AND CHANNEL WITH 6" LOW FLOW DEPRESSION (SEE TYPICAL CHANNEL DETAIL), CONSTRUCT WIDENED ROAD.
4. INSTALL 2' OF NATURAL STREAMBED MATERIAL WITH A 6" LOW FLOW DEPRESSION IN CULVERT AS SHOWN ON THE STRUCTURAL PLANS AND DETAILS.
5. INSTALL BRIDGE BARRIER & GUARDRAIL ON UPSTREAM SIDE.
6. REMOVE TEMPORARY SUPPORT OF EXCAVATION.
7. REMOVE ONE-WAY ALTERNATING TRAFFIC & SIGNAGE.
8. BACKFILL CULVERT AND WINGWALLS AND CONSTRUCT ROAD TO FINISHED GRADE OF PAVEMENT BASE COURSE.
9. FINALIZE GRADING & SITE IMPROVEMENTS ON UPSTREAM SIDE.
10. REMOVE SEDIMENT & EROSION CONTROLS AFTER SITE STABILIZATION HAS OCCURRED.

STAGE III

1. RESTORE TWO-WAY TRAFFIC ON MONSON ROAD.
2. DIRECT TRAFFIC TO NEW INTERSECTION OF MONSON ROAD AT REED HILL ROAD.
3. EXCAVATE DOWNSTREAM CHANNEL, CREATE WETLAND REPLICATION AREA AND INSTALL DRAINAGE.
4. REMOVE COFFERDAM AND DIVERT FLOW INTO NEW CHANNEL AND CULVERT AT THE DIRECTION OF THE ENGINEER.
5. REMOVE TEMPORARY BYPASS PIPES.
6. FINALIZE GRADING AND SITE IMPROVEMENTS ON DOWNSTREAM SIDE
7. REMOVE SEDIMENT AND EROSION CONTROLS AFTER SITE STABILIZATION HAS OCCURRED TO THE SATISFACTION OF THE ENGINEER.

LEGEND

- DIRECTION OF TRAFFIC
- CONSTRUCTION SIGN
- TRAFFIC OR PEDESTRIAN SIGNAL
- TEMPORARY IMPACT ATTENUATOR
- WORK AREA
- TEMPORARY TRAFFIC BARRIER
- REFLECTORIZED DRUM

0 20 50 100

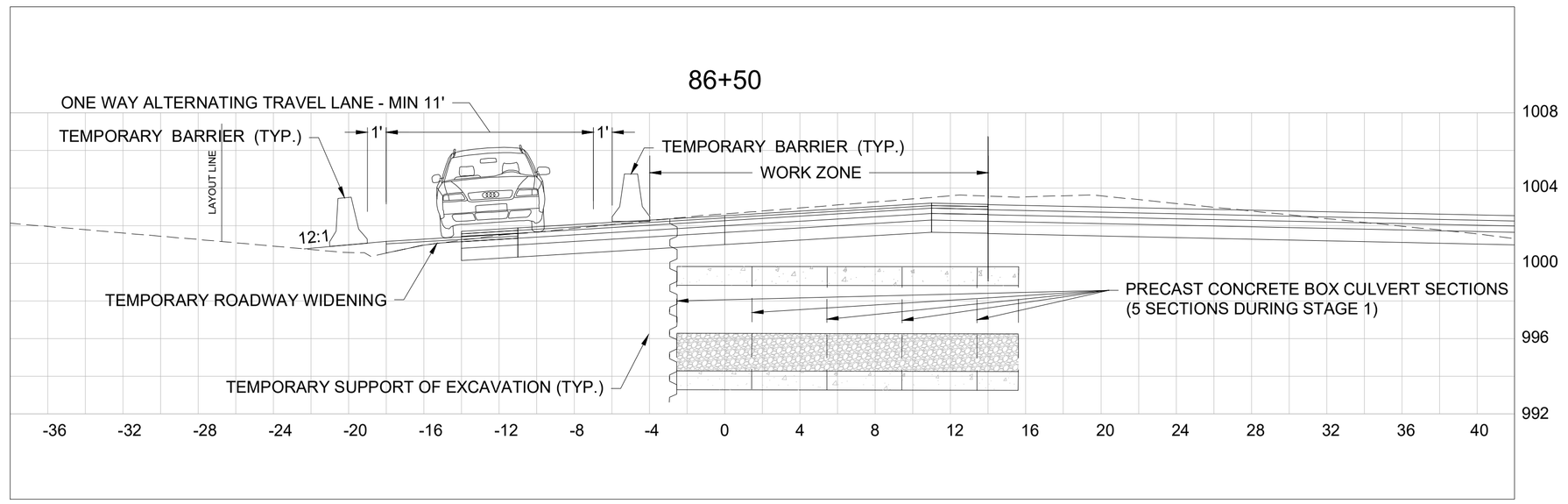
SCALE: 1" = 20'

608163_HD7(TTCP).DWG Plotted on 5-Jun-2024 1:05 PM
Proposal No. 608163-128112
A000860 - 442

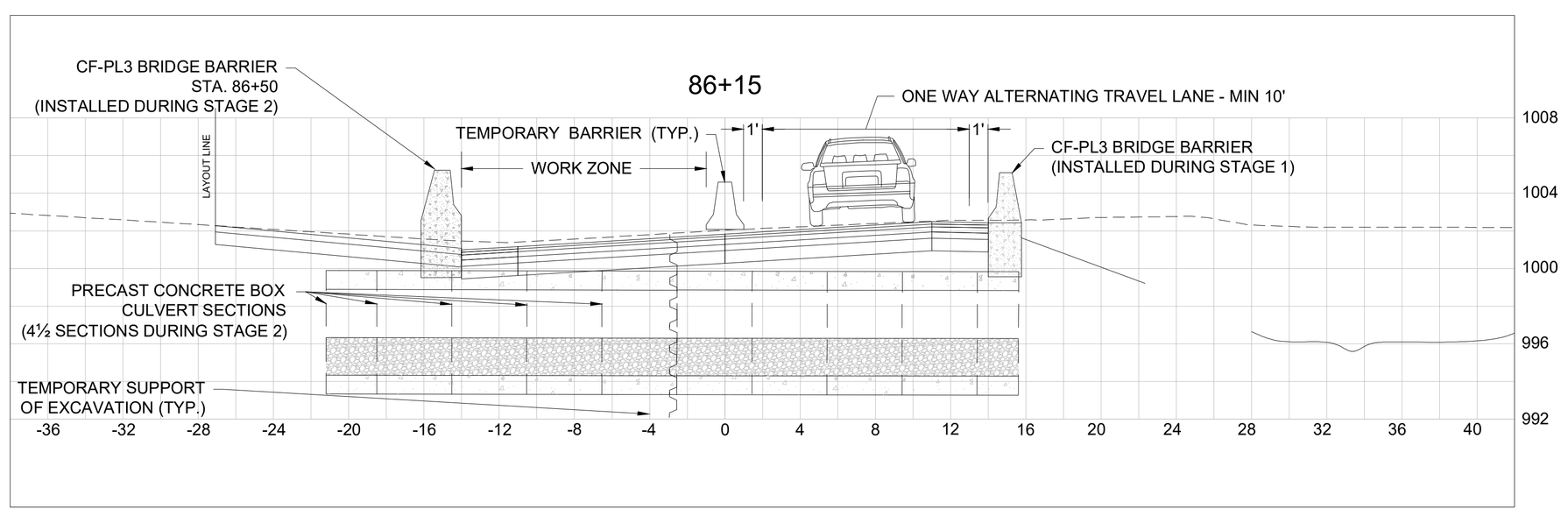
STREET	DIRECTION	HOUSINGS	PHASE 1			PHASE 2			PHASE 3			PHASE 4			PHASE 5			PHASE 6			PHASE 7			PHASE 8			EMERGENCY ONLY
			NOT USED						NOT USED						NOT USED						NOT USED			NOT USED			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	FLASH OPER.
MONSON ROAD	EB	A,B				G	Y	R				R	R	R				R	R	R							FR
MONSON ROAD	WB	C,D				R	R	R				G	Y	R				R	R	R							FR
REED HILL ROAD	EB	E,F				R	R	R				R	R	R				G	Y	R							FR
																											OFF
																											OFF
																											OFF
																											OFF

TIMING IN SECONDS

MINIMUM GREEN				10						10						10										
VEHICLE EXTENSION				3.0						3.0						3.0										
MAXIMUM I (WEEKDAYS)				35						35						35										
MAXIMUM II (ALL OTHER TIMES)				35						35						35										
YELLOW CLEARANCE					3.5						3.5						3.5									
RED CLEARANCE						12						12						12								
PEDESTRIAN WALK																										
PEDESTRIAN CLEARANCE																										
RECALL				SOFT						SOFT						SOFT										
MEMORY				NON–LOCK						NON–LOCK						NON–LOCK										

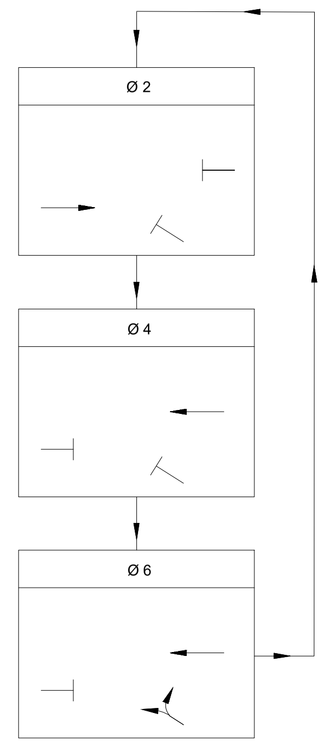


STAGE I



STAGE II

PREFERENTIAL PHASING SEQUENCE

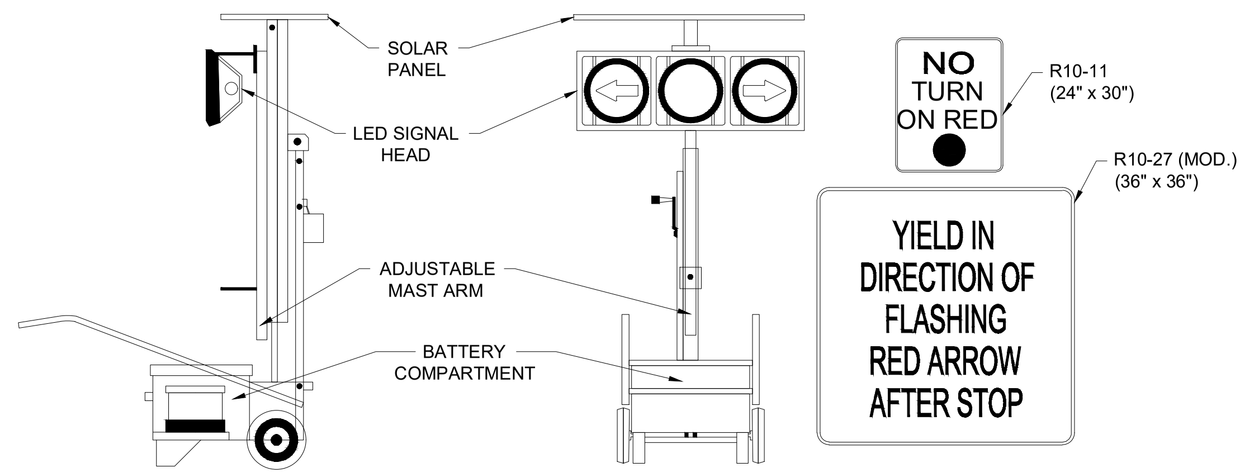


PRE-EMPTION PHASING AND PRIORITY

APPROACH	PREEMPTION PHASE	NEXT PHASE CALLED
EASTBOUND	2	6
WESTBOUND	4	6

VIDEO DETECTION ZONES

DETECTION NUMBER	DETECTION ZONE	Ø CALLED	Ø EXT.	MODE A = PULSE B = PRES.	DELAY TIME	EXT. TIME
1	12' x 20'	Ø2	Ø2	B	3	---
2	12' x 20'	Ø6	Ø6	B	3	---



NOTES

PORTABLE DRIVEWAY ASSISTANCE DEVICES SHALL DISPLAY A FLASHING RED ARROW IN DIRECTION OF TRAFFIC DURING Ø2 & Ø6 GREEN AND YELLOW CLEARANCE INTERVALS. A SOLID RED BALL SHALL BE DISPLAYED DURING Ø4 AND ALL RED CLEARANCE INTERVALS.

1. AFFIX ONE (1) R10-11 AND ONE (1) R10-27(MOD) SIGN, FACING THE SAME DIRECTION AS THE LENSES, TO EACH PORTABLE DRIVEWAY ASSISTANCE DEVICE.
2. ANY SIGNS MOUNTED TO THE PORTABLE DRIVEWAY ASSISTANCE DEVICES SHALL BE CLEARLY VISIBLE TO THE INTENDED TARGET.

WALES
MONSON ROAD

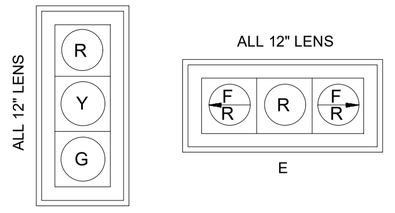
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	68	180
PROJECT FILE NO.	608163		

TEMPORARY TRAFFIC CONTROL DETAILS

TRAFFIC VOLUME DATA

ADT (2019)	XXXX
PHV	XXX
PHV EB (D)	XXX (49%)
PHV WB (D)	XXX (51%)

SIGNAL IDENTIFICATION



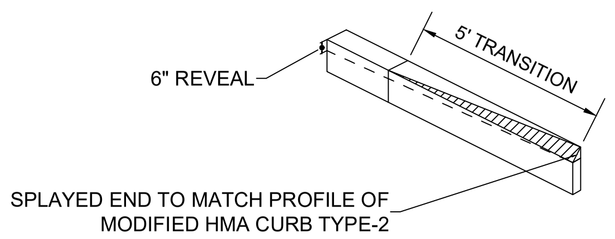
NOTES:

1. ALL VEHICLE AND PEDESTRIAN LENSES SHALL BE LED TYPE.
2. ALL HOUSINGS TO BE PROVIDED WITH TUNNEL VISORS AND 5" RETRO-REFLECTIVE LOUVERED BACKPLATES.
3. ALL HOUSINGS TO BE FIXED MOUNTED.

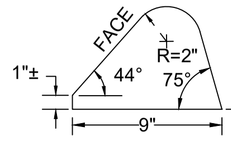
SEQUENCE & TIMING NOTES:

1. IF CALL EXIST ON ALL PHASES. THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
2. FLASHING OPERATION IS FOR EMERGENCY ONLY. THE SIGNAL SHALL PROVIDE STOP AND GO OPERATION 24 HOURS DAILY.
3. THE CONTRACTOR SHALL MONITOR TRAFFIC CONDITIONS DURING CONSTRUCTION AND ADJUST SIGNAL TIMINGS AS NECESSARY AND AS DIRECTED BY THE ENGINEER.

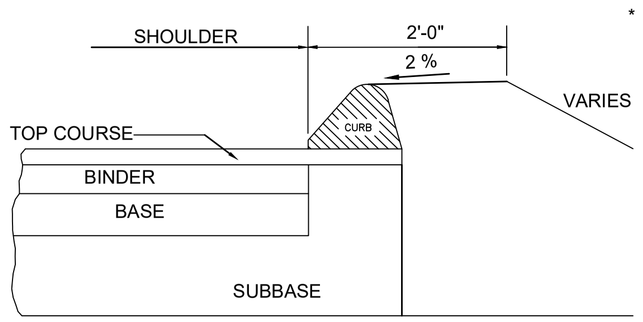
608163_HD7(TTCP).DWG Plotted on 5-Jun-2024 1:06 PM
Proposal No. 608163-128112
A00860 - 443



GRANITE CURB - SPLAYED END
NOT TO SCALE

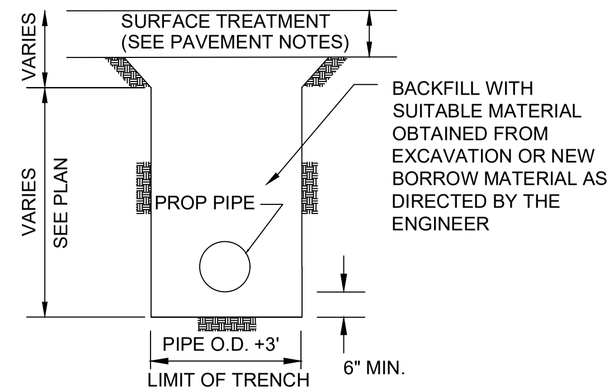


TYPE - 2

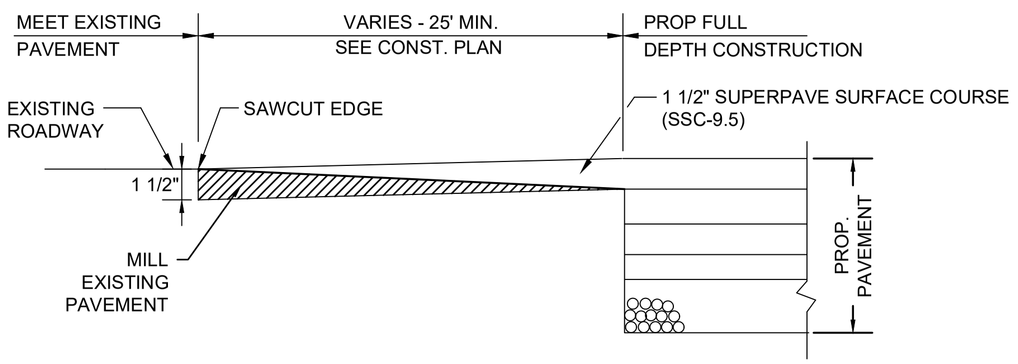


NOTE:
* SEE TYPICAL SECTIONS FOR PROJECT.

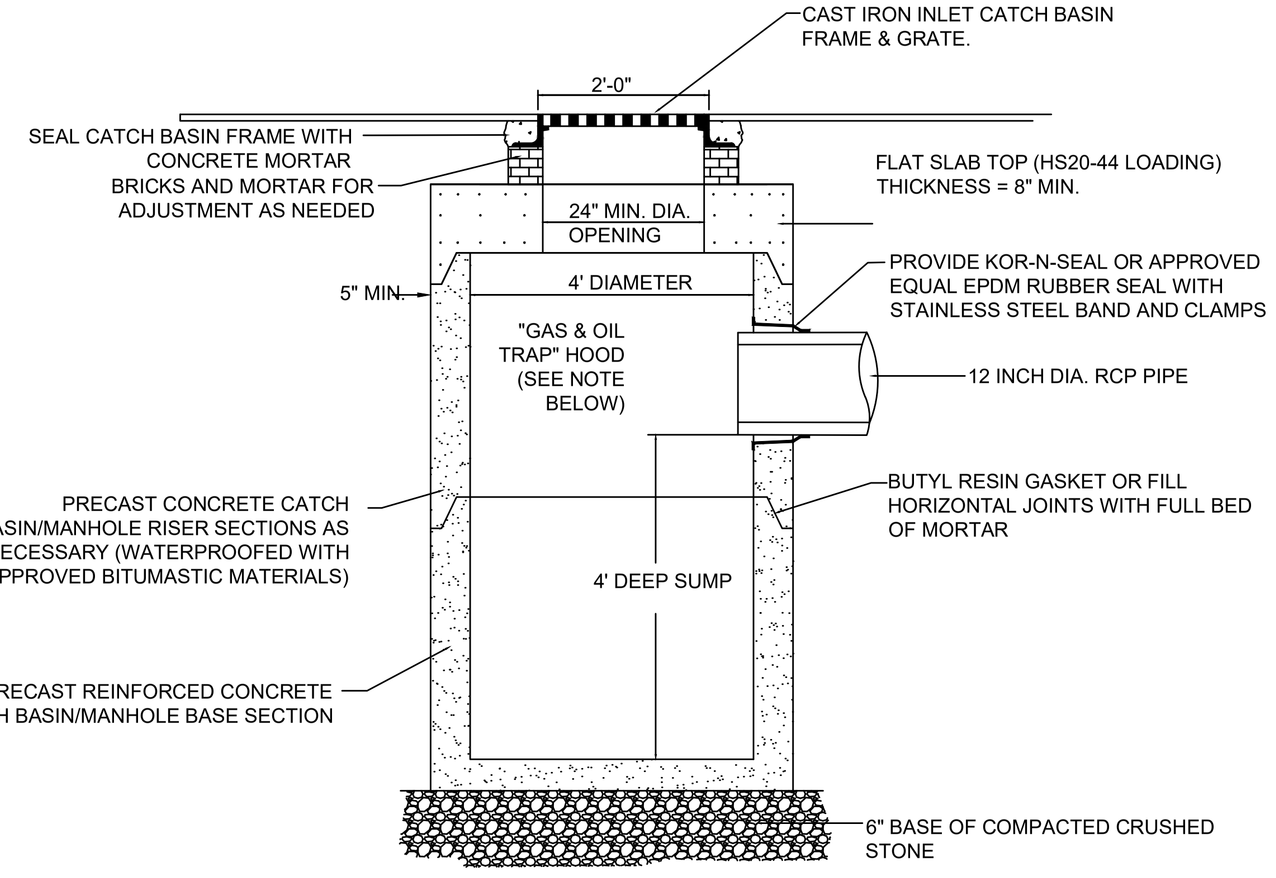
HOT MIX ASPHALT CURB
NOT TO SCALE



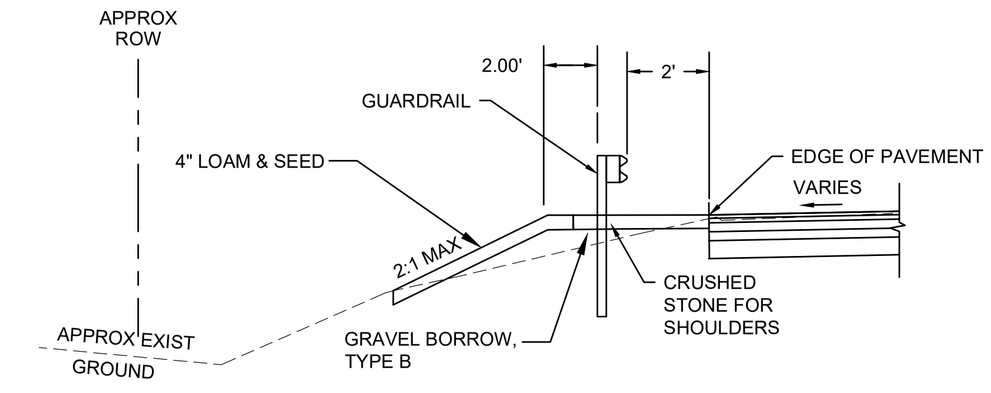
DRAINAGE TRENCH
NOT TO SCALE



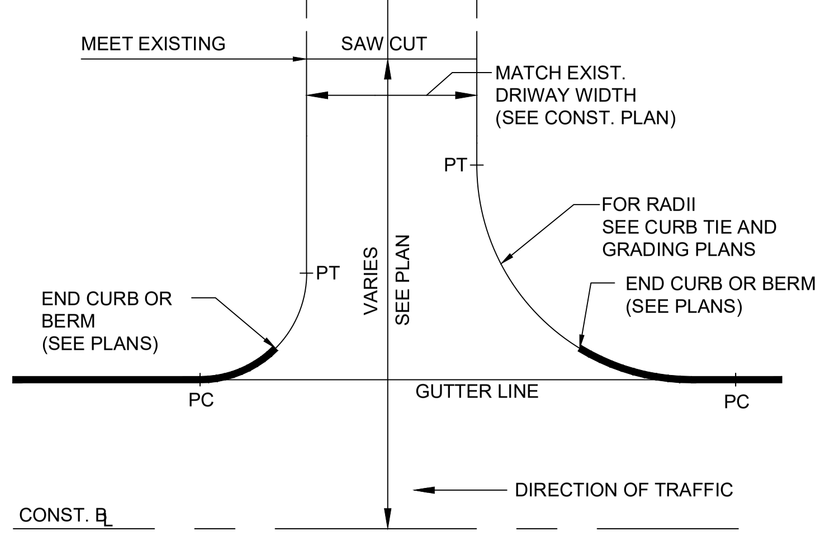
PROPOSED PAVEMENT TRANSITION
(LONGITUDINAL SECTION)
NOT TO SCALE



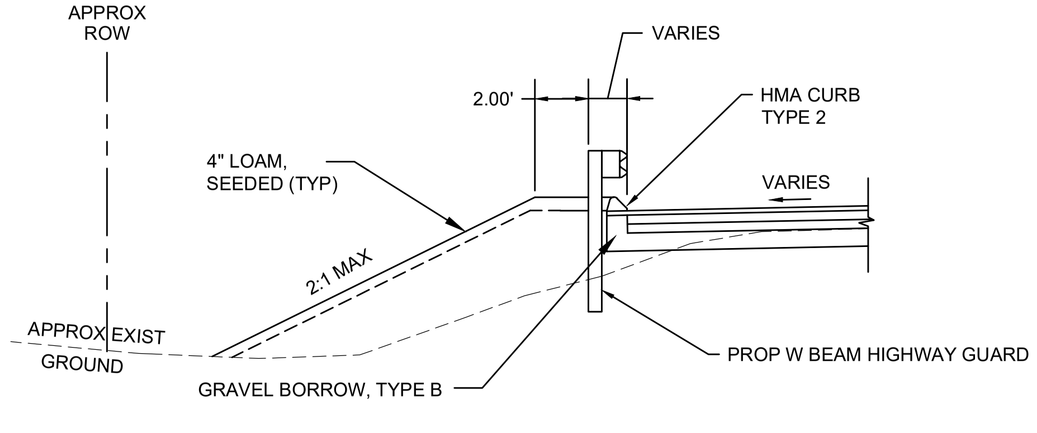
DEEP SUMP CATCH BASIN
NOT TO SCALE



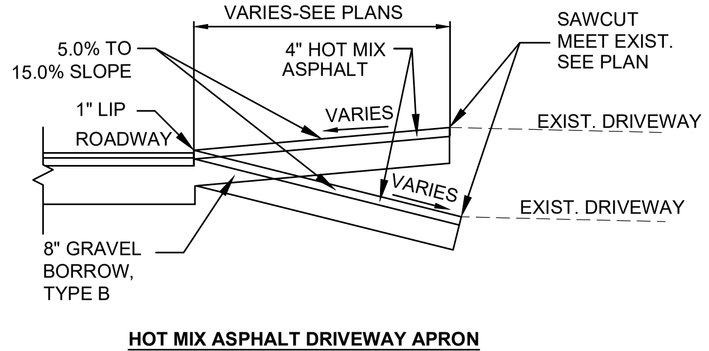
HIGHWAY GUARD INSTALLATION DETAIL
(WITHOUT CURB OR BERM)
NOT TO SCALE



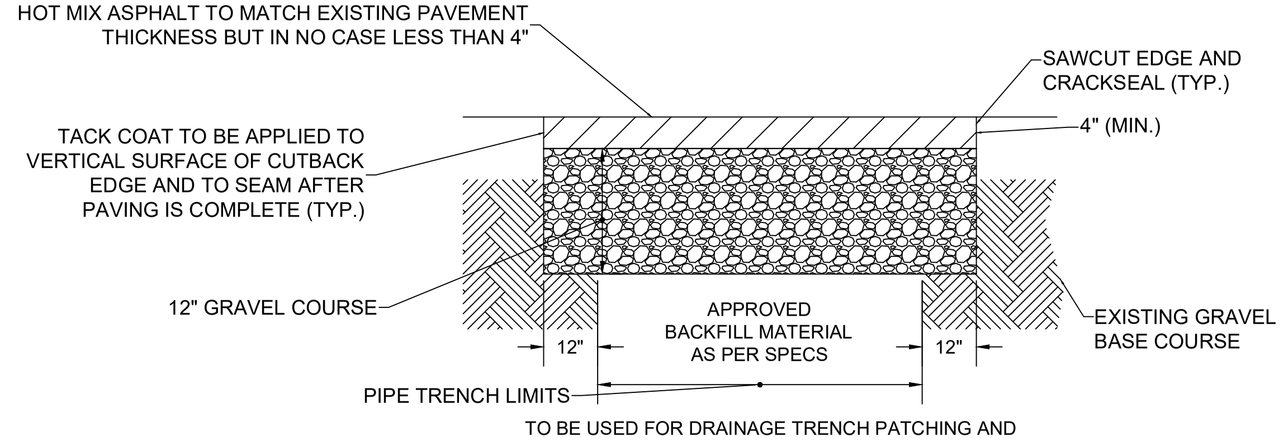
TYPICAL HMA OR GRAVEL DRIVE ENTRANCE
NOT TO SCALE



HIGHWAY GUARD INSTALLATION DETAIL
(WITH HMA CURB TYPE 2)
NOT TO SCALE



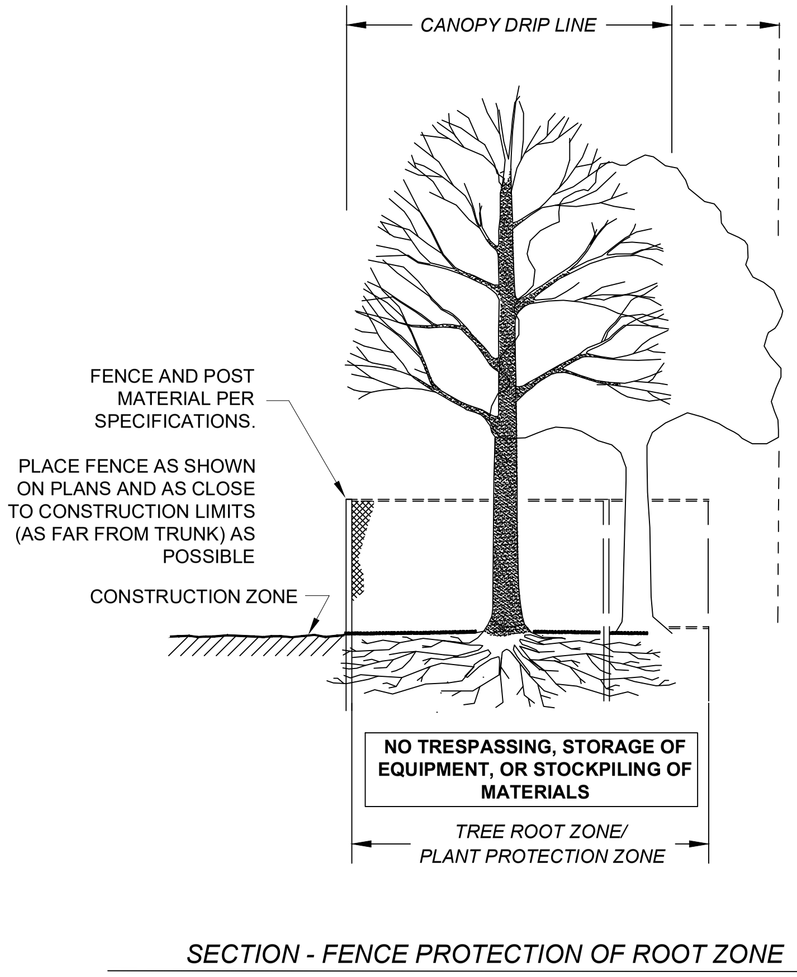
HOT MIX ASPHALT DRIVEWAY APRON
NOT TO SCALE



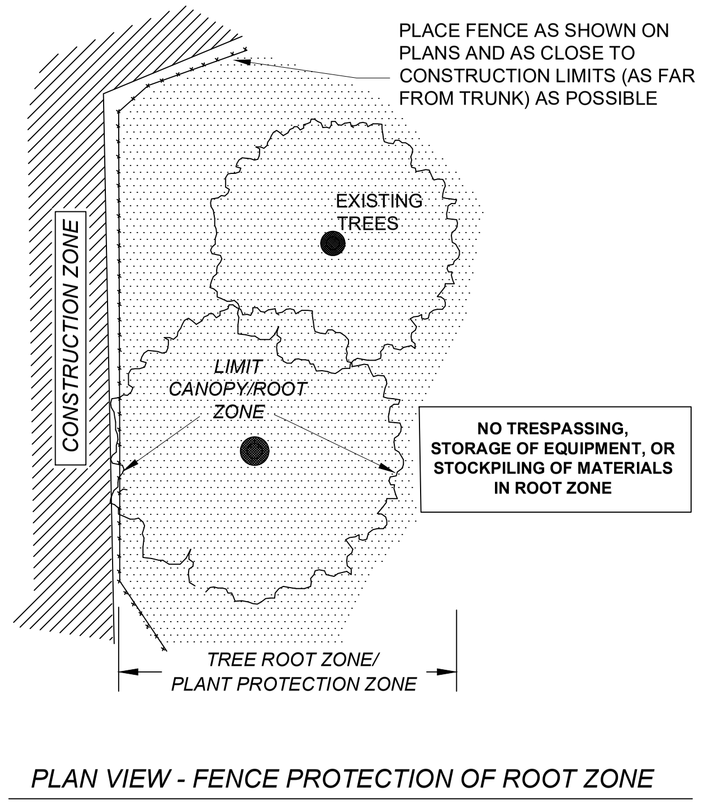
TO BE USED FOR DRAINAGE TRENCH PATCHING AND
TEMPORARY PAVEMENT WIDEINING

TEMPORARY ASPHALT PATCHING
NOT TO SCALE

608163_HD9(CONSTRUCTION DETAILS).DWG Plotted on 5-Jun-2024 12:52 PM
Proposal No. 608163-128112
A00860 - 444



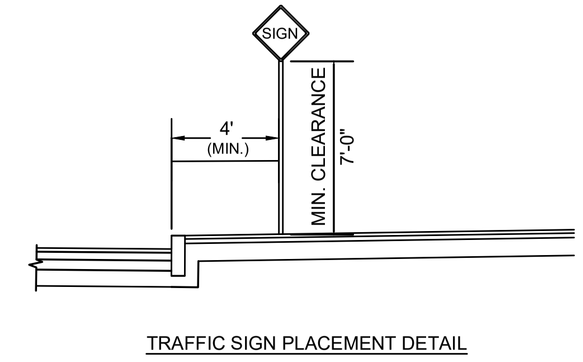
SECTION - FENCE PROTECTION OF ROOT ZONE



PLAN VIEW - FENCE PROTECTION OF ROOT ZONE

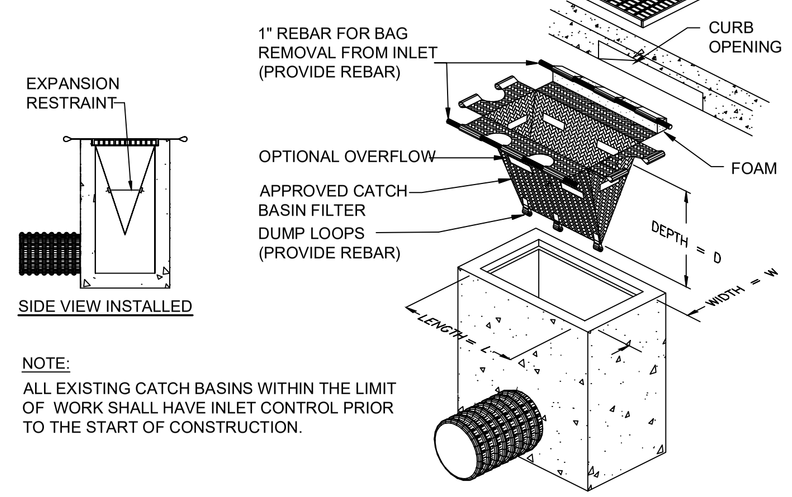
TREE PROTECTION - ROOT ZONE

NOT TO SCALE



TRAFFIC SIGN PLACEMENT DETAIL

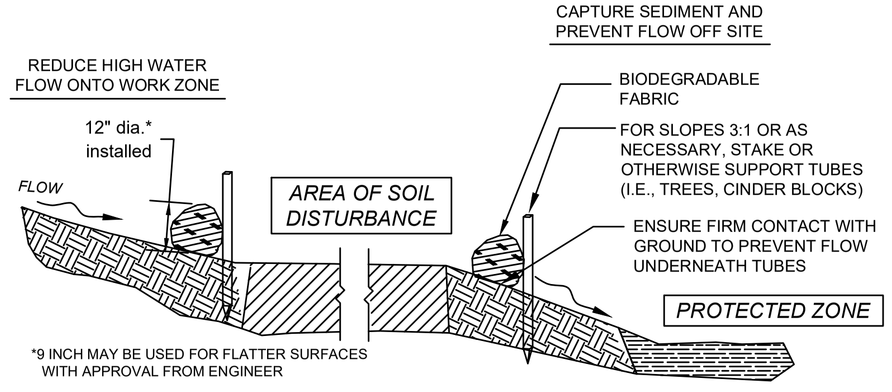
N.T.S.



NOTE:
ALL EXISTING CATCH BASINS WITHIN THE LIMIT OF WORK SHALL HAVE INLET CONTROL PRIOR TO THE START OF CONSTRUCTION.

INLET SEDIMENT CONTROL

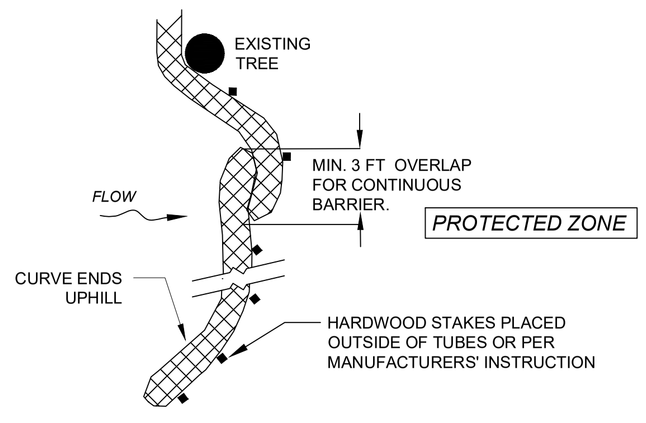
NOT TO SCALE



SECTION

SEDIMENT BARRIER - COMPOST FILTER TUBE

NOT TO SCALE



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

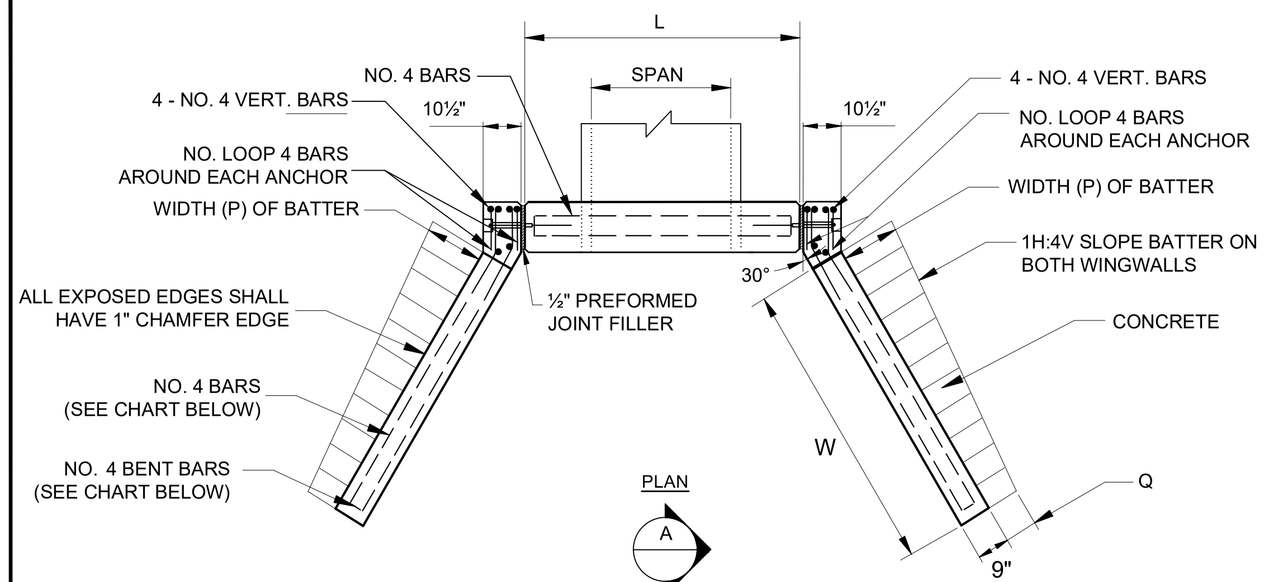
ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

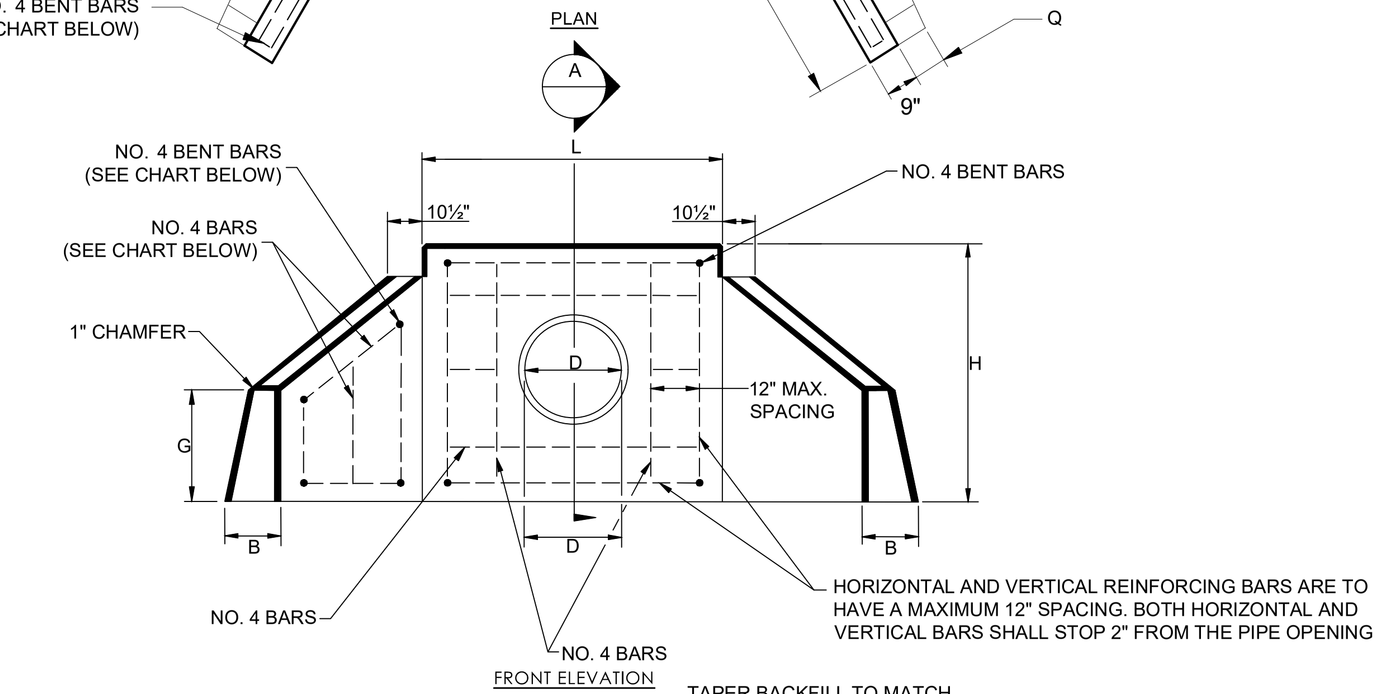
PLAN VIEW

CONSTRUCTION SPECIFICATIONS ON SILTATION & EROSION CONTROL

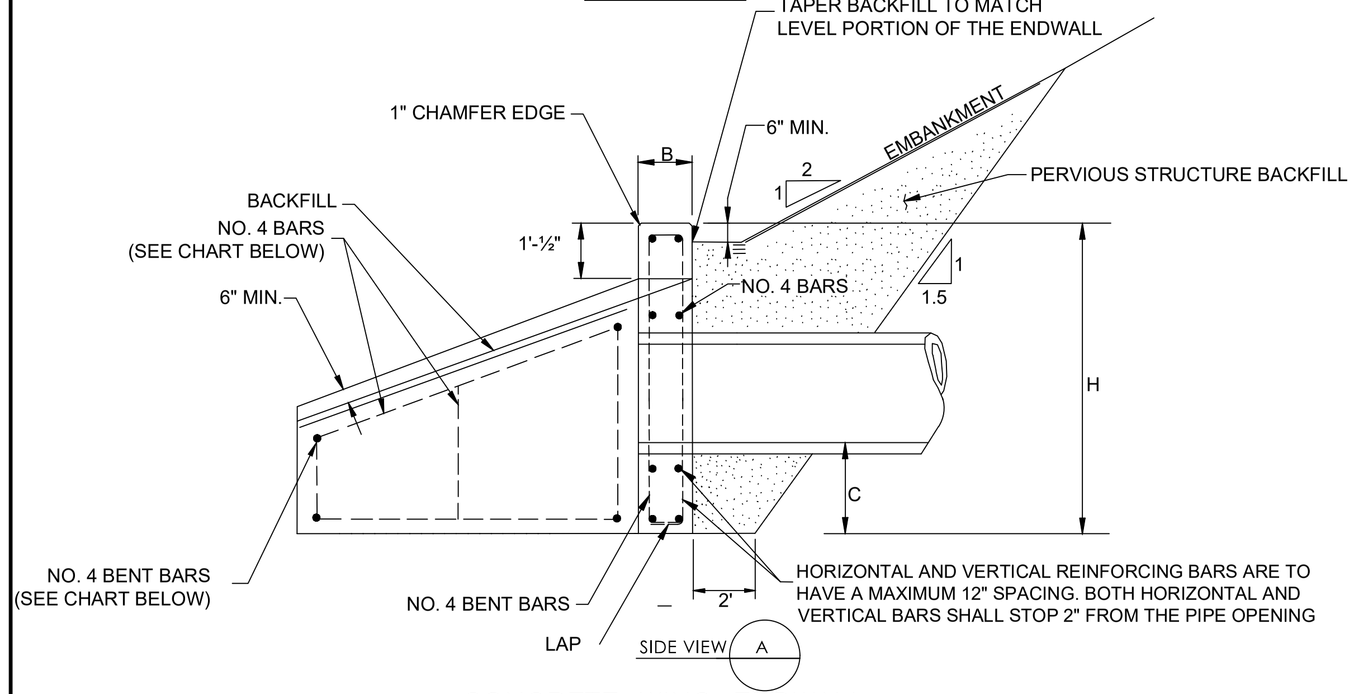
1. EROSION CONTROL MEASURES SHALL BE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. AREAS SUBJECT TO EROSION SHALL BE MINIMIZED IN TERMS OF TIME AND AREA.
3. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
4. DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE PROPOSED LIMIT OF EROSION CONTROL BARRIERS (MULCH TUBE) ACTIVITIES.
5. TEMPORARY SILT CONTROLS SHALL BE PLACED AS SHOWN ON THE PLAN. PERMANENTLY STABILIZE EACH COMPLETED SEGMENT OF CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE TEMPORARY SILT CONTROLS AND ALL ACCUMULATED SILT AND DEBRIS AFTER COMPLETION OF CONSTRUCTION OPERATIONS.
7. SILT CONTROLS SHALL BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
8. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL SILT AND DEBRIS FROM EACH DRAINAGE STRUCTURE UPON COMPLETION OF THE PROJECT.
9. OBJECTS AND/OR AREAS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
10. ALL DISTURBED AREAS SHALL BE RESTORED TO EXISTING GRADE. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED.
11. SILT CONTROLS SHALL BE REMOVED UPON THE SATISFACTORY COMPLETION OF ALL WORK SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
12. SITE PERIMETER SHALL HAVE COMPOST FILTER TUBES INSTALLED AT THE LIMIT OF WORK.

608163_HD9(CONSTRUCTION DETAILS).DWG Plotted on 5-Jun-2024 12:52 PM
Proposal No. 608163-128112
A00060 - 445





FRONT ELEVATION



CONCRETE WING ENDWALL

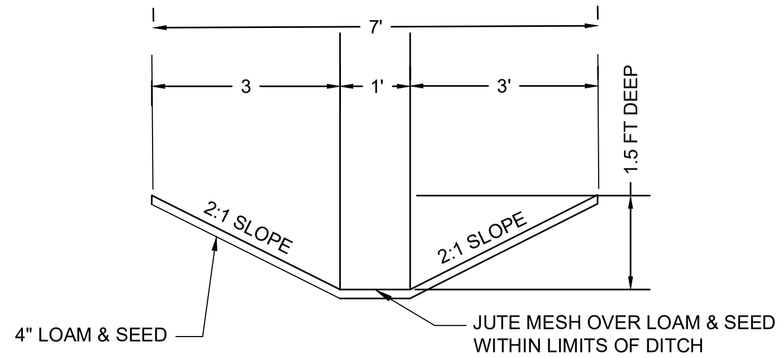
N.T.S.

WING ENDWALL DIMENSIONS ONLY (SEE NOTE # 4 FOR STRAIGHT ENDWALL COMPONENT INFORMATION)									
CONCRETE									
		DEPTH OF CUTOFF WALL	HEIGHT OF	TOTAL	LENGTH OF	WIDTH OF	WIDTH OF BATTER	TAPERED WINGWALL	VOLUME
DIAMETER	BASE	TO INVERT	WINGWALL	HEIGHT	ENDWALL	BATTER	AT ENDPOINT	LENGTH	
(D)	(B)	(C)	(G)	(H)	(L)	(P)	(Q)	(W)	
IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	C.Y.
12"	1'-3"	2'-0"	2'-0"	4'-6"	4'-6"	0'-10¾"	0'-6"	2'-11"	1.8

	WINGWALL STEEL REINFORCEMENT		
DIAMETER (D)	NO. 4 BENT BARS	NO. 4 BARS	THREADED ROD CONNECTIONS PER WINGWALL
IN.	EA.	EA.	EA.
12"	4	8	3

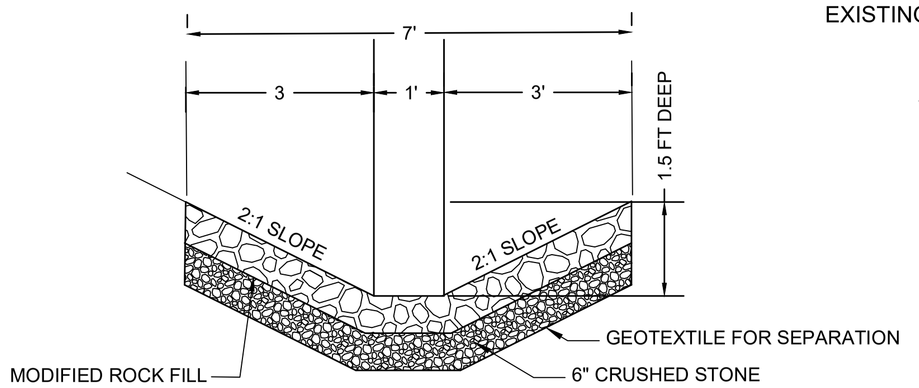
GENERAL NOTES:

1. ALL REINFORCING BARS SHALL HAVE 2" COVER MIN.
2. ALL REINFORCING BARS ARE TO BE TIED AND NOT WELDED.
3. WET SETTING OF ANY STEEL IS NOT PERMITTED.
4. REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615, GRADE 60 AND SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A767, CLASS 1.
5. WHEN USING PRECAST ALL PORTIONS OF LIFTING AND SEATING DEVICES THAT EXTEND TO OR BEYOND THE FINISHED CONCRETE SURFACE SHALL BE REMOVED. ALL FIXTURES OR HOLES CAST INTO THE SECTIONS FOR LIFTING OR SEATING SHALL BE COMPLETELY FILLED WITH NON-SHRINK GROUT AND FINISHED SMOOTH AND FLUSH WITH THE ADJACENT CONCRETE SURFACE.
6. NON-SHRINK GROUT SHALL CONFORM TO SECTION M4. THE NON-SHRINK GROUT SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI PRIOR TO ALLOWING THE PASSAGE OF WATER OVER THE GROUT.



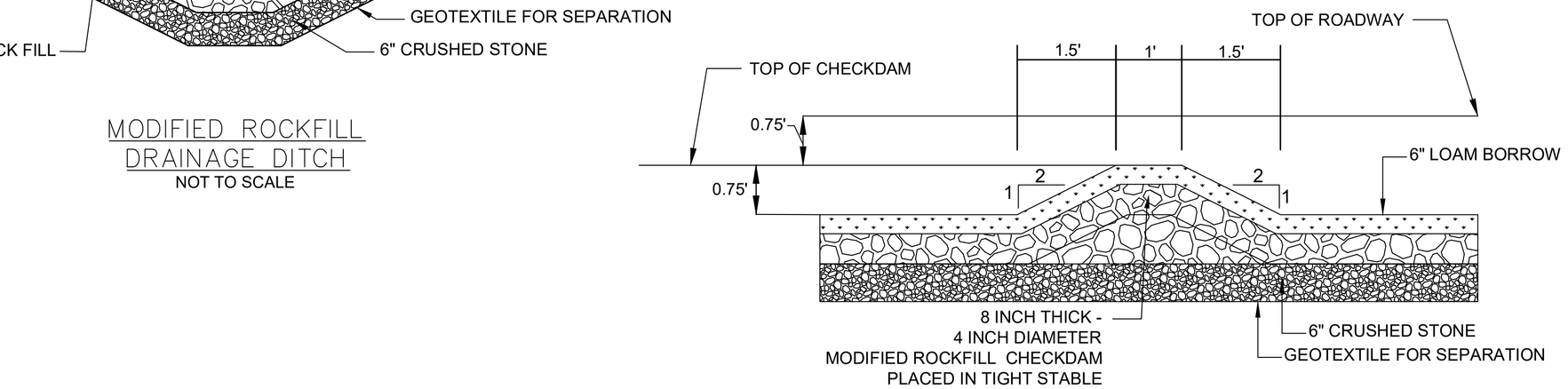
GRASS DRAINAGE DITCH

NOT TO SCALE

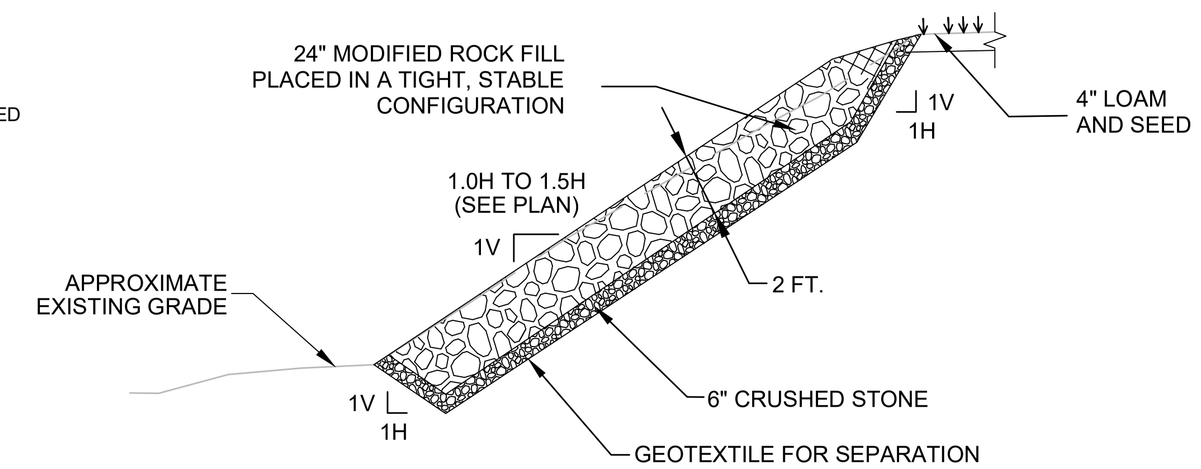


MODIFIED ROCKFILL DRAINAGE DITCH

NOT TO SCALE

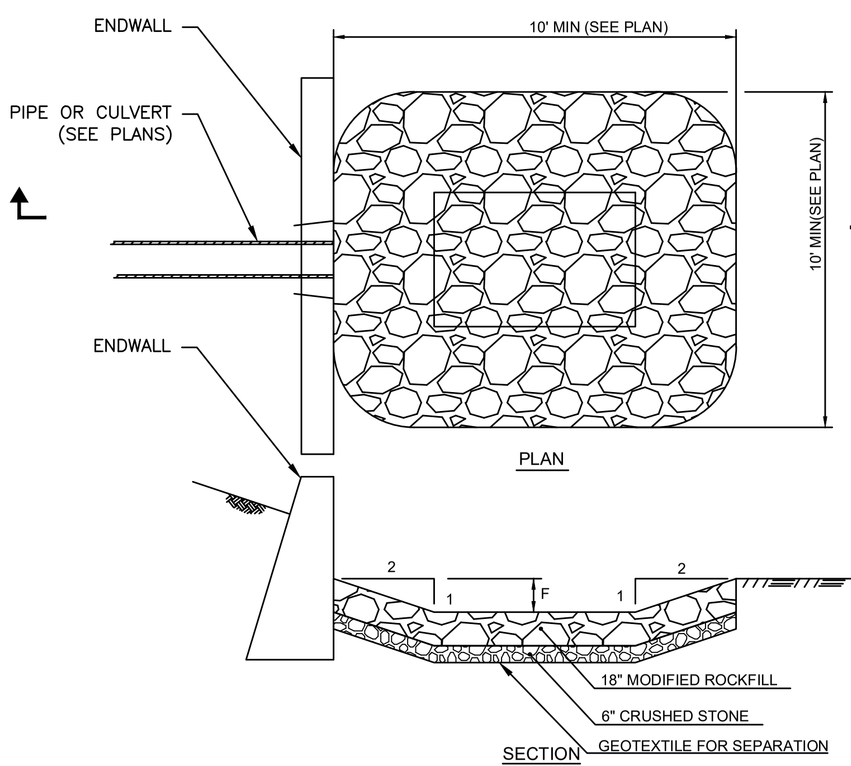


CHECKDAM



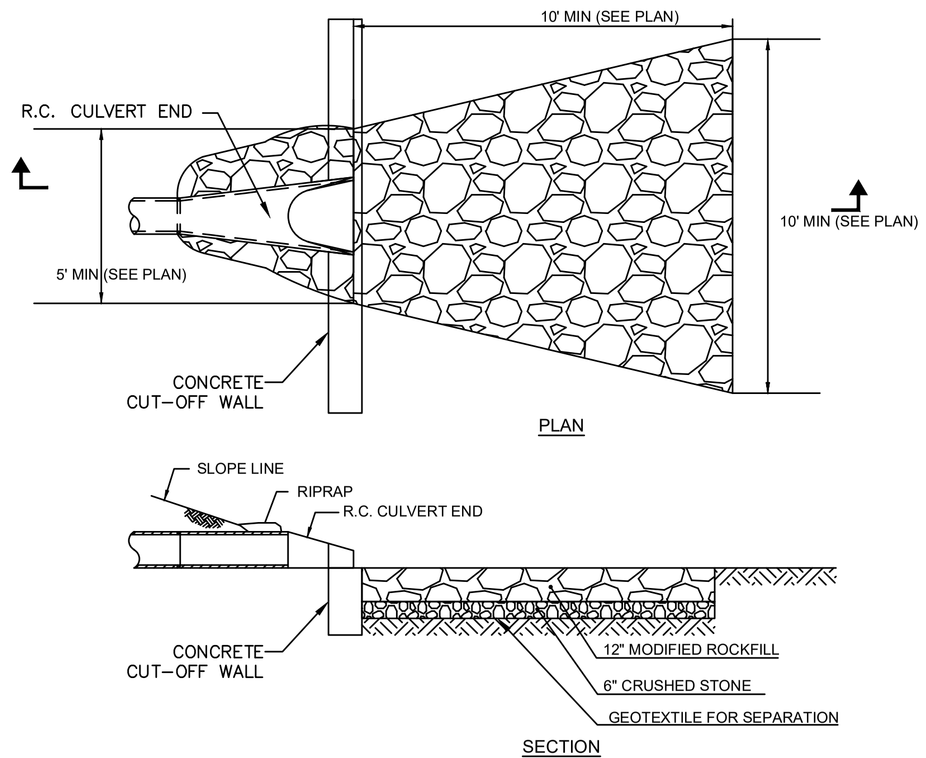
STEEP SLOPE WITH MODIFIED ROCK FILL

NOT TO SCALE



PREFORMED MODIFIED ROCK FILL SCOUR HOLE

N.T.S.



MODIFIED ROCK FILL APRON

N.T.S

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	85	180
PROJECT FILE NO.	608163		

CONSTRUCTION DETAILS

608163_HD9(CONSTRUCTION DETAILS).DWG Plotted on 5-Jun-2024 12:52 PM
Proposal No. 608163-128112
A080960 - 446

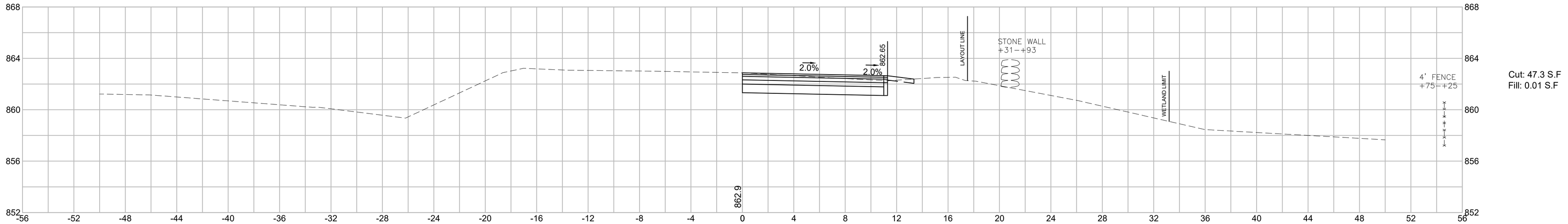
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	86	180
PROJECT FILE NO.	608163		

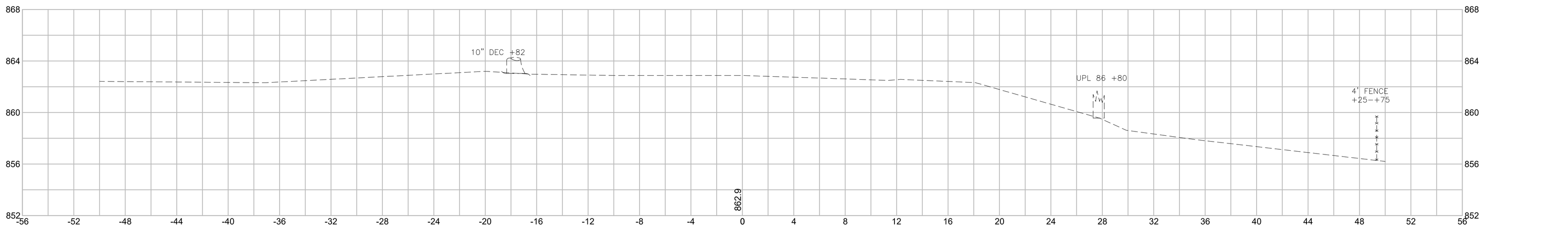
CROSS SECTIONS

11+00

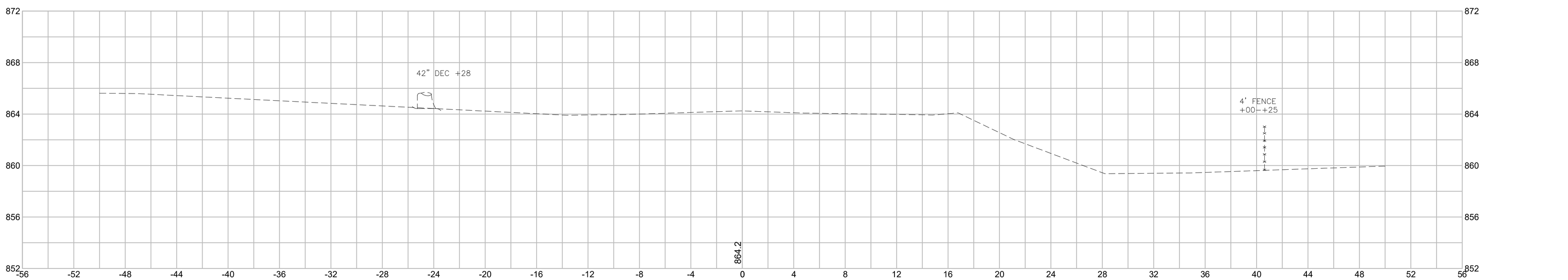


Cut: 47.3 S.F
Fill: 0.01 S.F

10+50



10+00



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:28 AM
Proposal No. 608163-128112
A00860 - 447

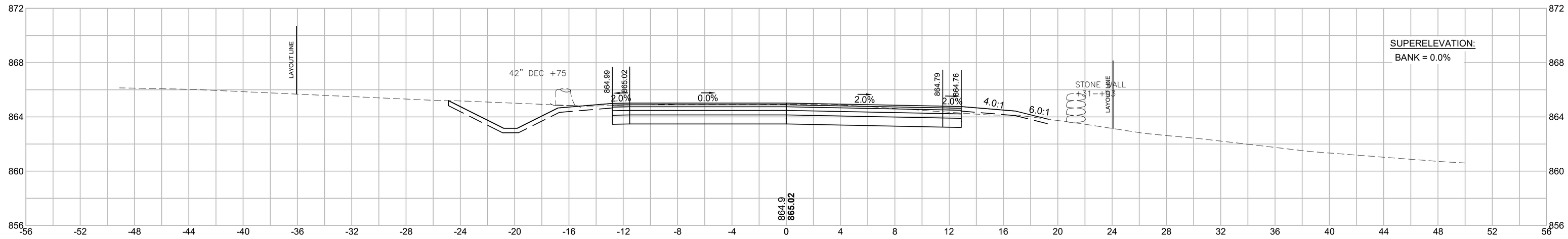
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	87	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

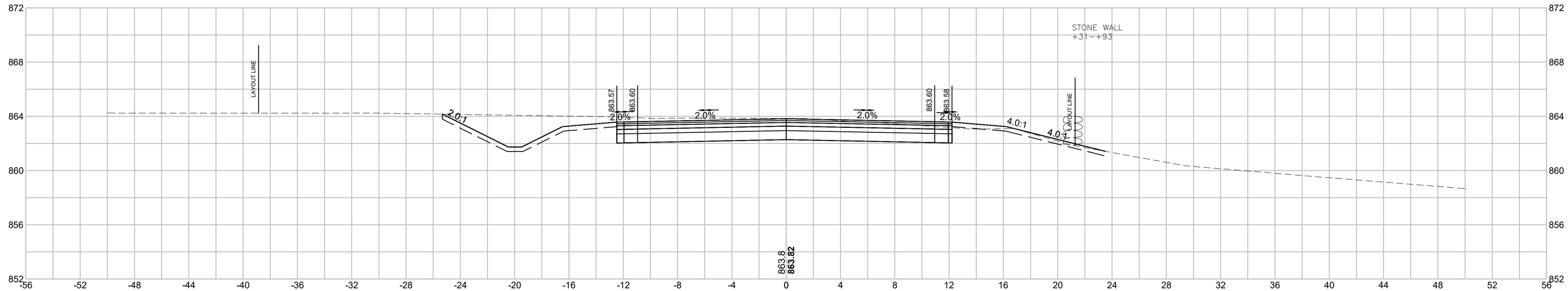
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

11+97.22



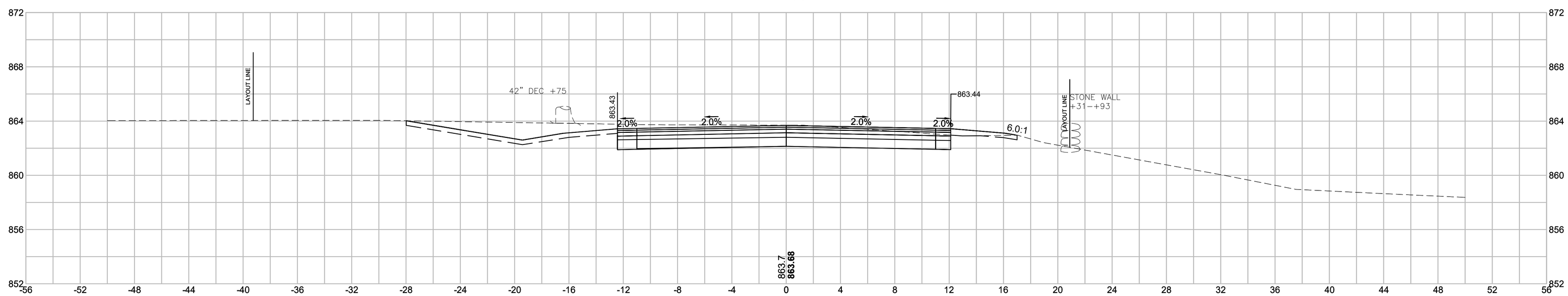
Cut: 49.30
Fill: 2.03

11+55.85



Cut: 59.99
Fill: 1.92

11+50



Cut: 54.0
Fill: 1.45

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:29 AM
Proposal No. 608163-128112
A008(0) - 848

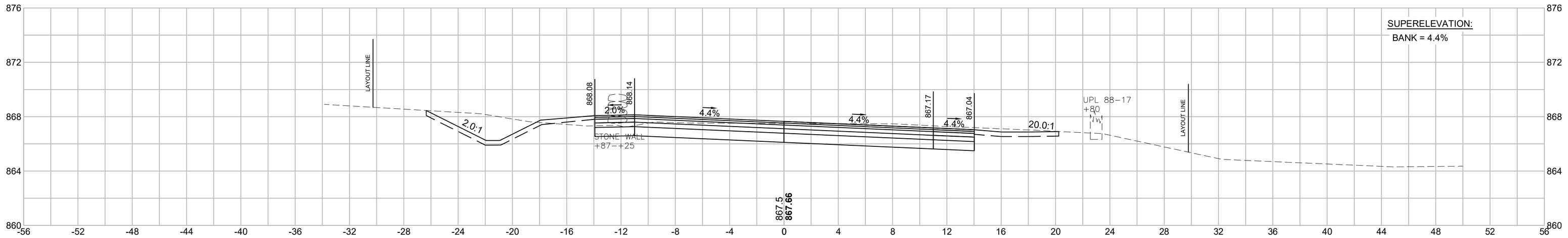
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

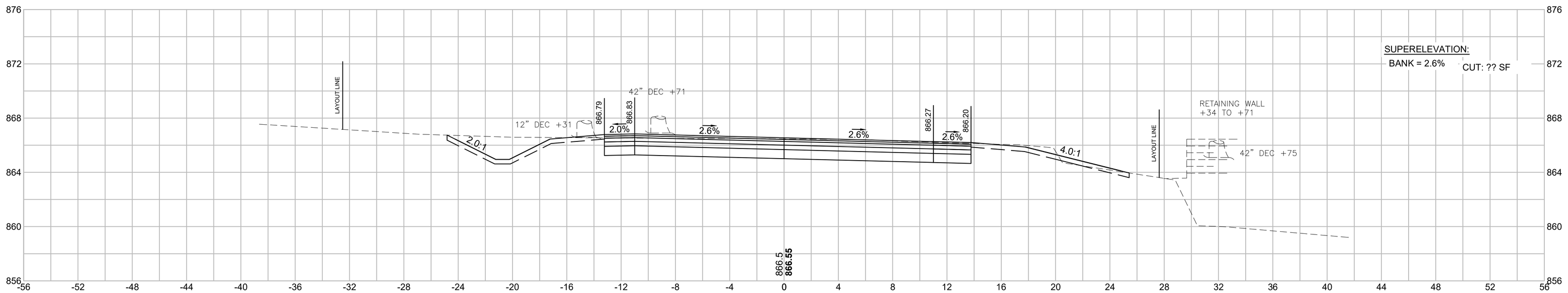
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	88	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

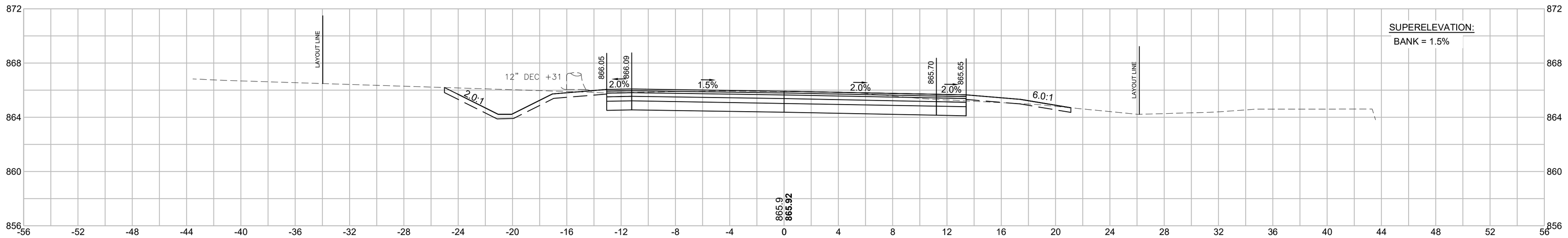
12+88.22



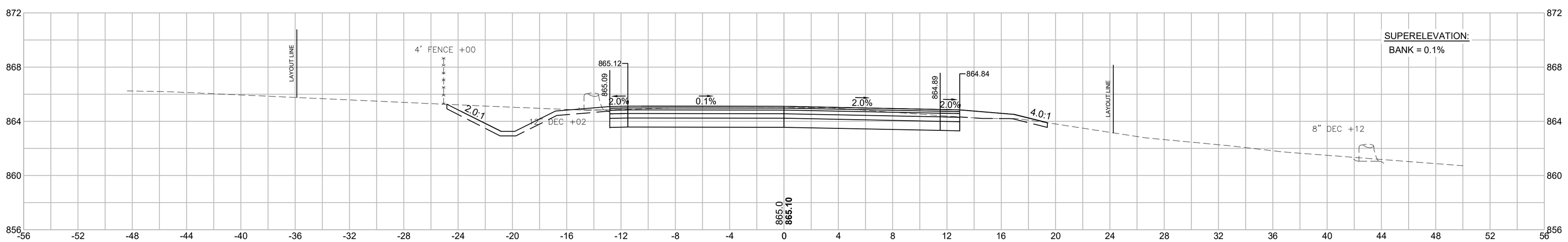
12+50



12+28.28



12+00



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:30 AM
Proposal No. 608163-128112
AM0600 - 449

AV08060 - 450

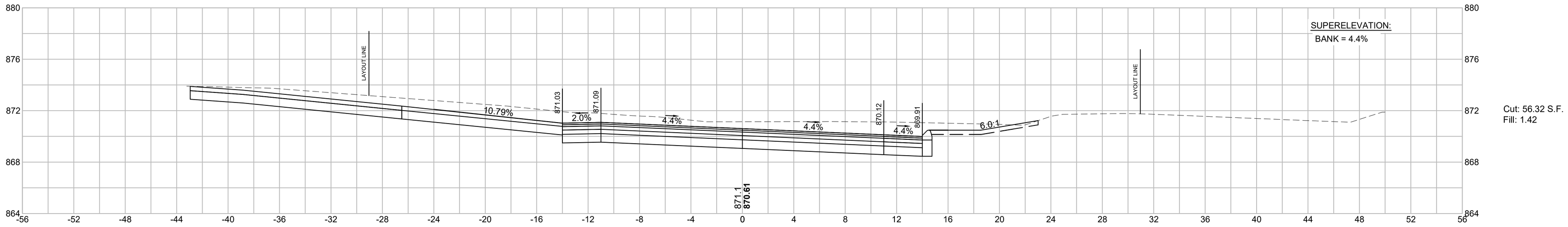
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	88	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

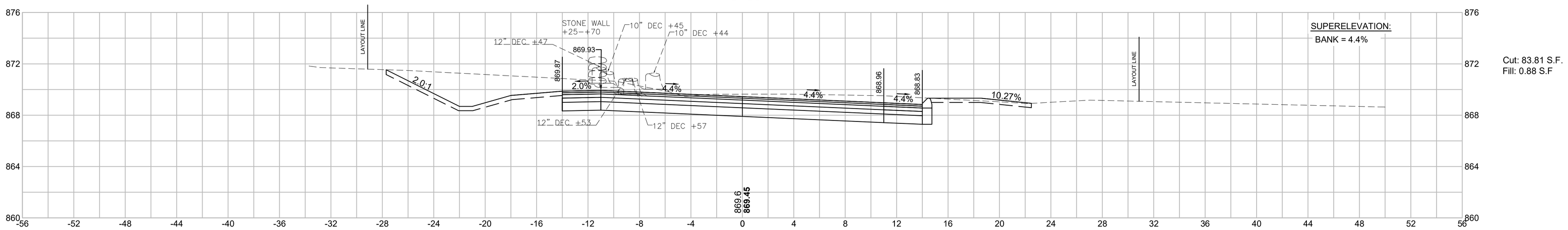
CROSS SECTIONS

13+90



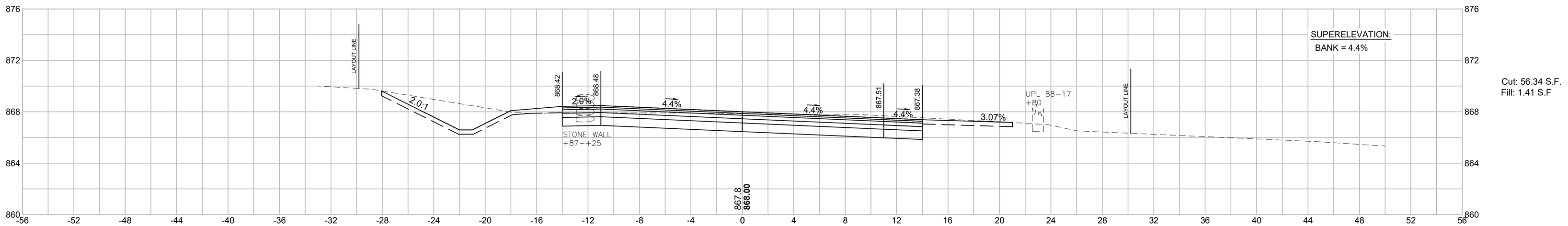
Cut: 56.32 S.F.
Fill: 1.42

13+50



Cut: 83.81 S.F.
Fill: 0.88 S.F

13+00



Cut: 56.34 S.F.
Fill: 1.41 S.F

Plotted on 5-Jun-2024 11:30 AM
608163_HD10(XSC_GRADINGCALC).DWG
Proposal No. 608163-128112

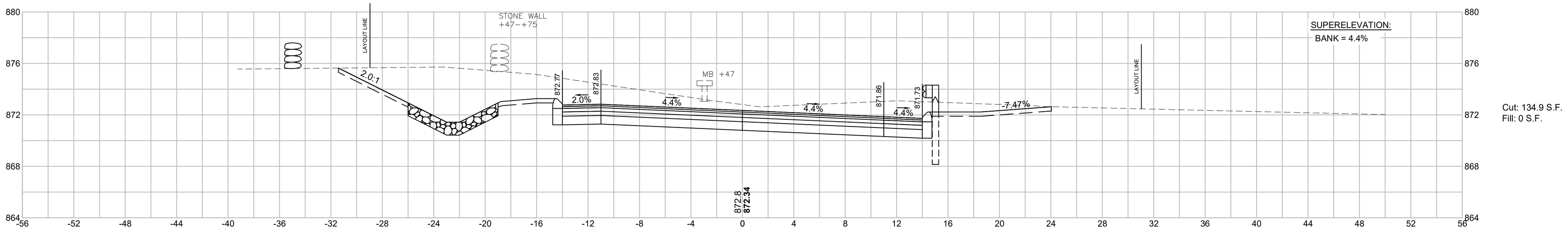
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	90	180
PROJECT FILE NO.	608163		

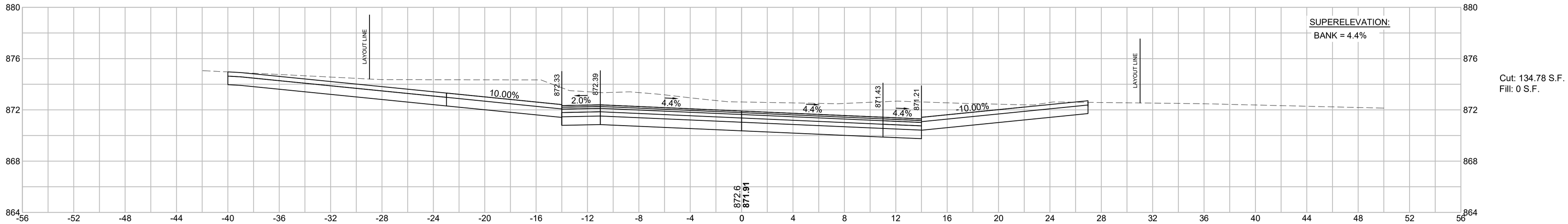
CROSS SECTIONS

14+50



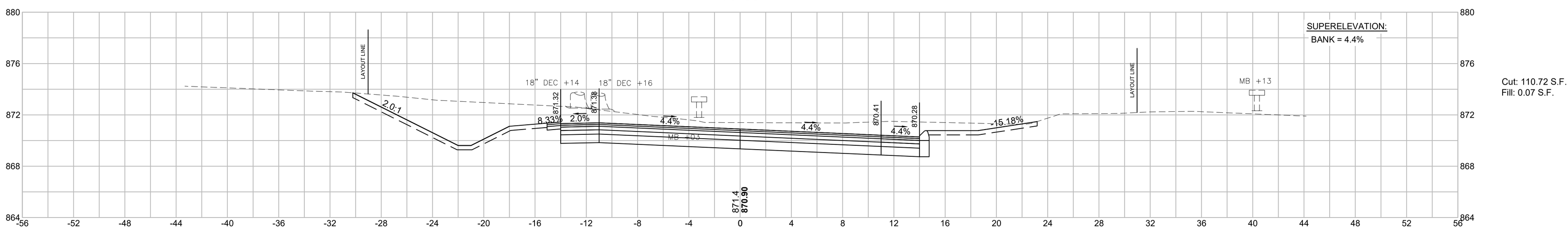
Cut: 134.9 S.F.
Fill: 0 S.F.

14+35



Cut: 134.78 S.F.
Fill: 0 S.F.

14+00



Cut: 110.72 S.F.
Fill: 0.07 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:31 AM
Proposal No. 608163-128112
A00809 - 451

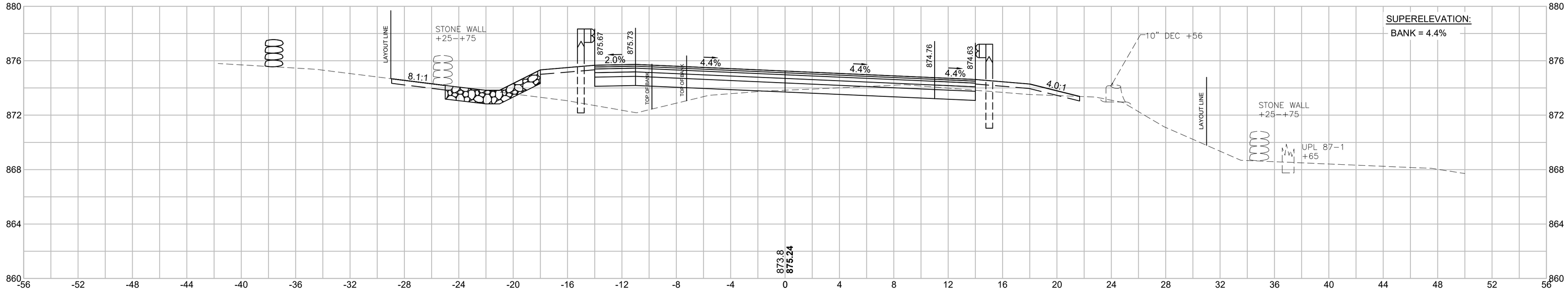
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	91	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

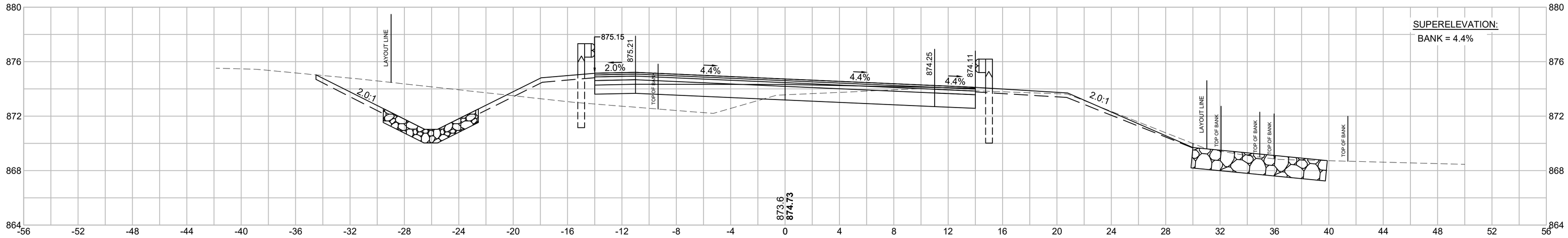
CROSS SECTIONS

15+50



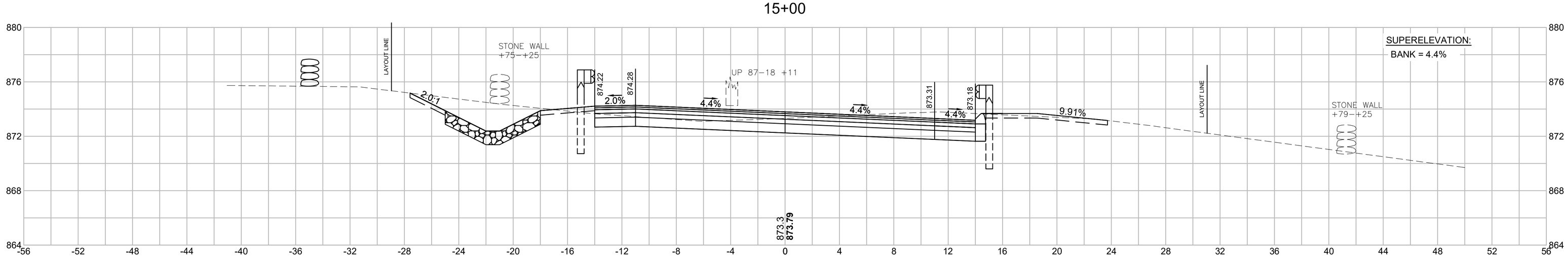
Cut: 15.21 S.F.
Fill: 30.65 S.F.

15+32.35



Cut: 64.35 S.F.
Fill: 22.57 S.F.

15+00



Cut: 57.30 S.F.
Fill: 1.74 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:32 AM
Proposal No. 608163-128112
AM08(09)-452

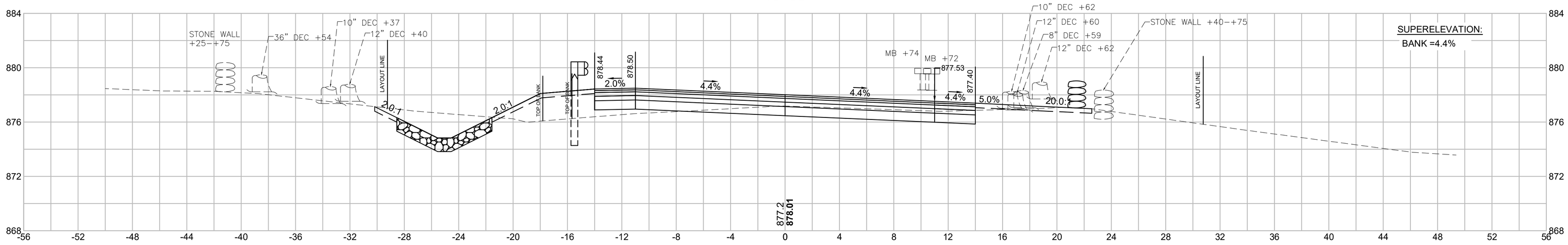
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	92	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

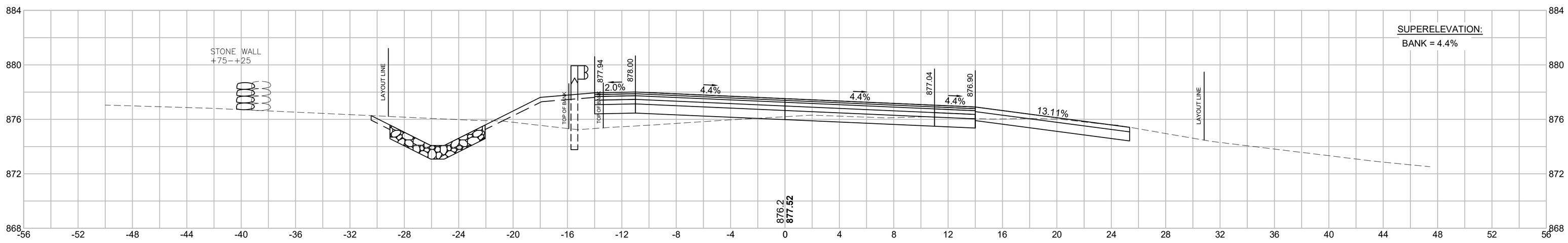
CROSS SECTIONS

16+50



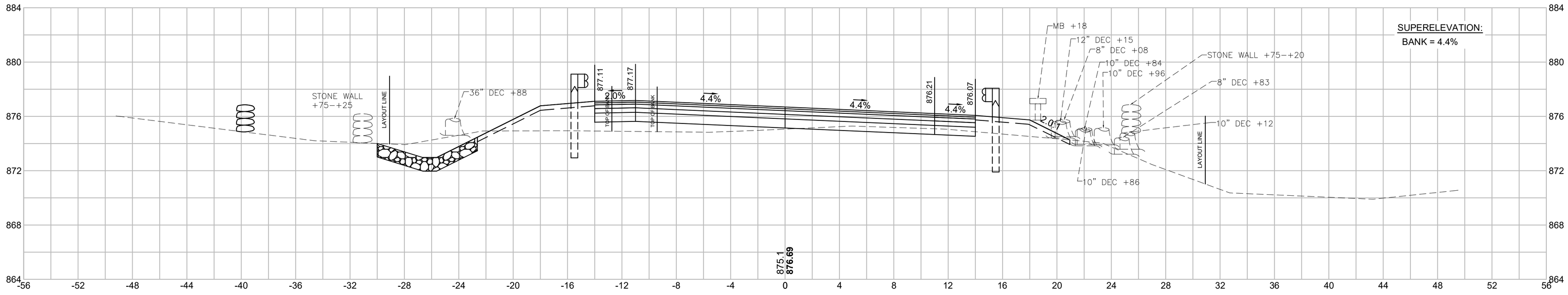
Cut: 31.49 S.F.
Fill: 15.48 S.F.

16+30



Cut: 33.24S.F.
Fill: 23.47 S.F.

16+00



Cut: 18.04 S.F.
Fill: 25.61 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:33 AM
Proposal No. 608163-128112
A008060 - 453

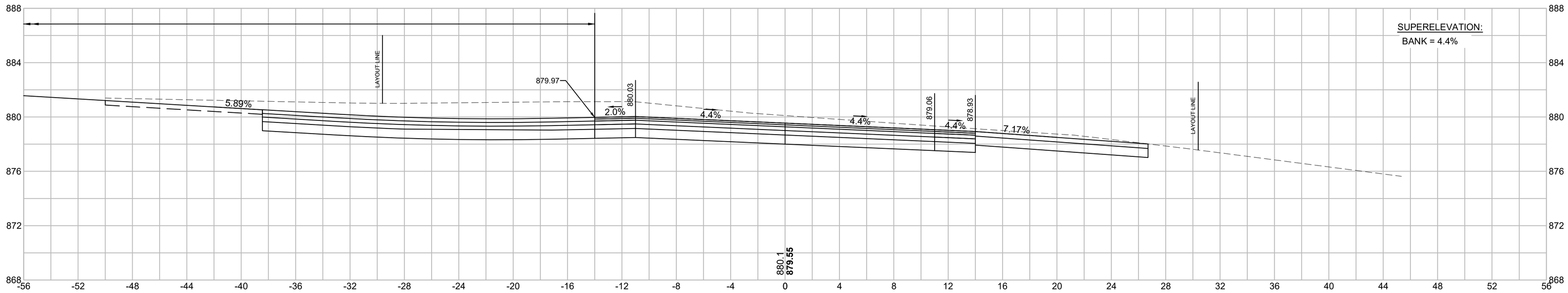
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	93	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

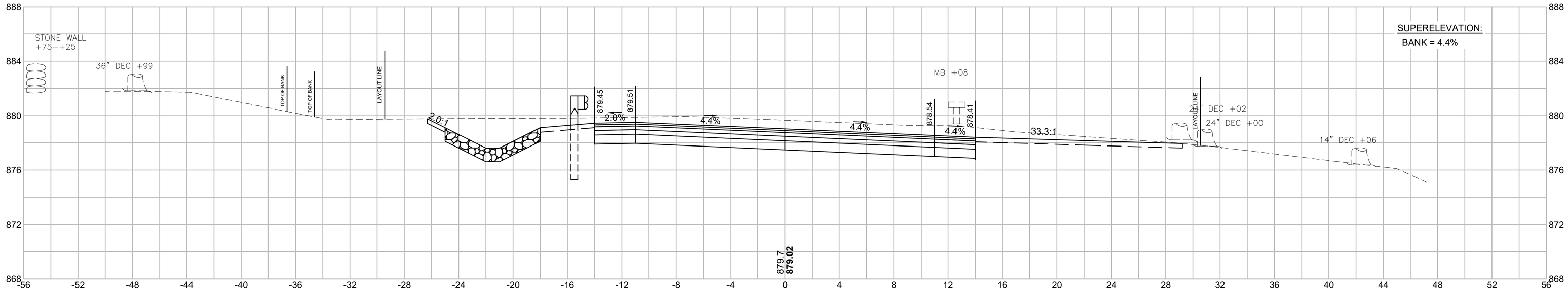
CROSS SECTIONS

17+35



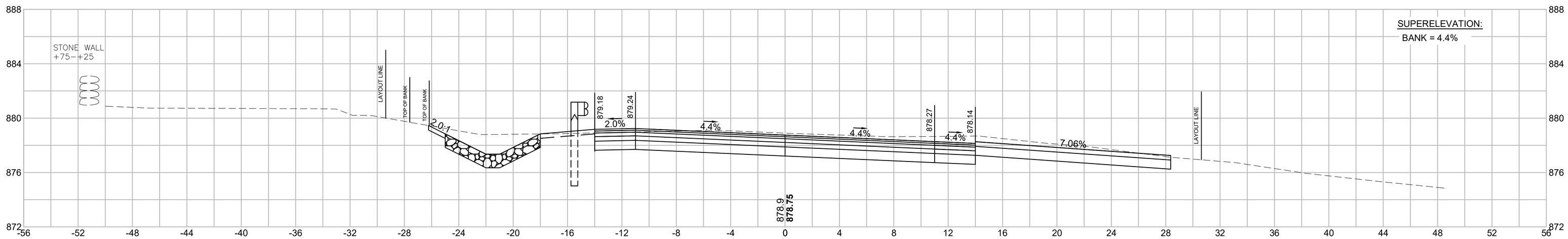
Cut: 143.04 S.F.
Fill: 0 S.F.

17+00



Cut: 92.25 S.F.
Fill: 0 S.F.

16+85



Cut: 78.67 S.F.
Fill: 0.56 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:33 AM
Proposal No. 608163-128112
A108860 - 454

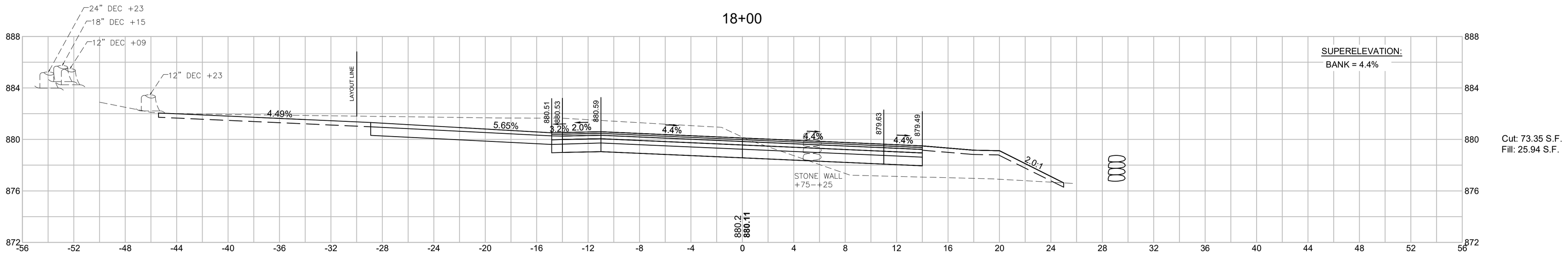
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	94	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

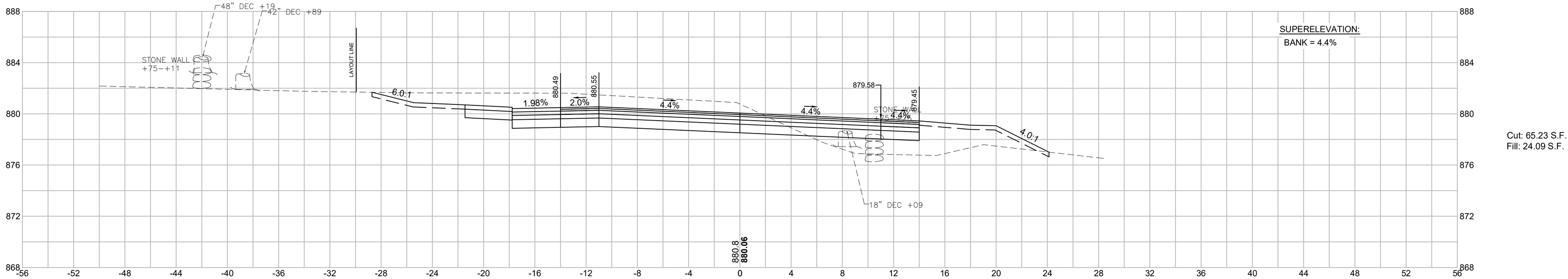
CROSS SECTIONS

18+00



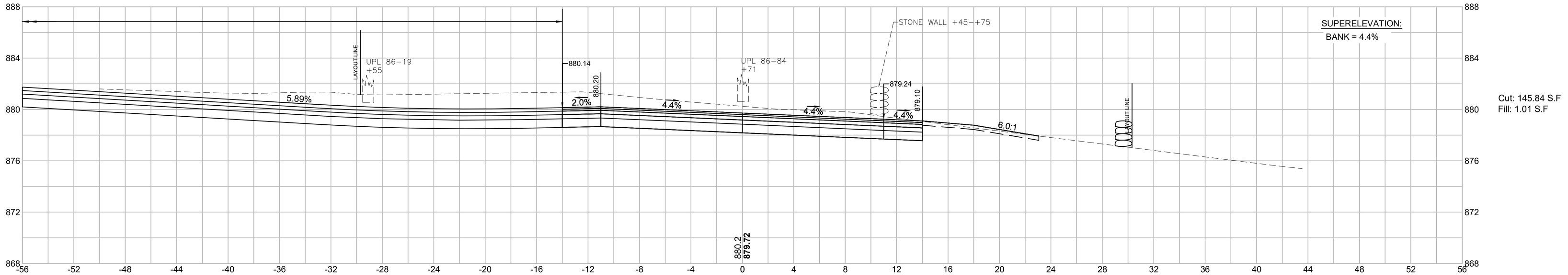
Cut: 73.35 S.F.
Fill: 25.94 S.F.

17+91



Cut: 65.23 S.F.
Fill: 24.09 S.F.

17+50



Cut: 145.84 S.F
Fill: 1.01 S.F

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:34 AM
Proposal No. 608163-128112
AM0860 - 455

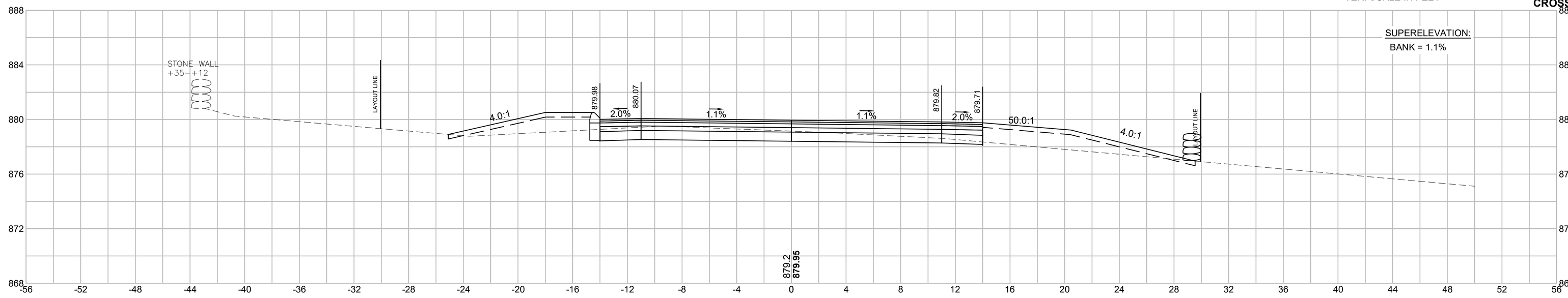
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	95	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

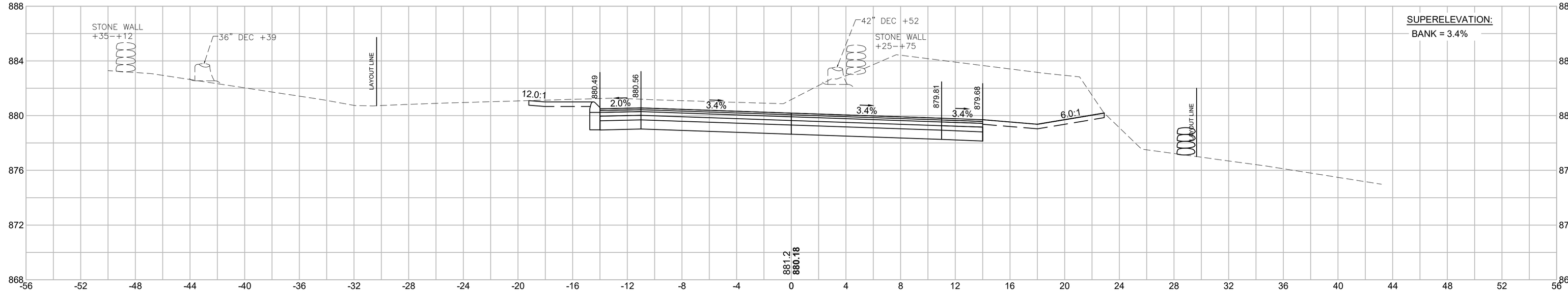
CROSS SECTIONS

19+00



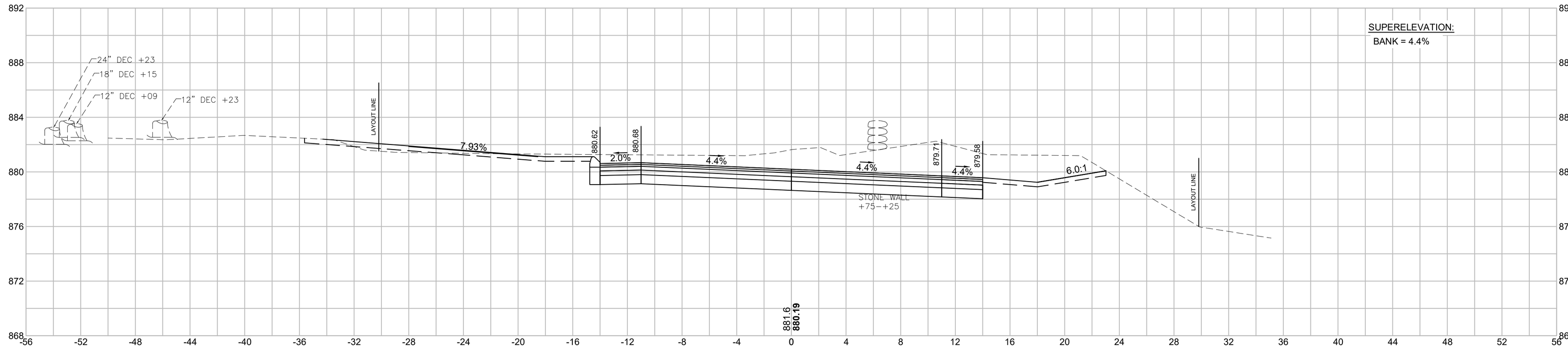
Cut: 20.39 S.F.
Fill: 26.01 S.F.

18+50



Cut: 90.33 S.F.
Fill: 0 S.F.

18+29.03



Cut: 103.64 S.F.
Fill: 3.61 S.F.

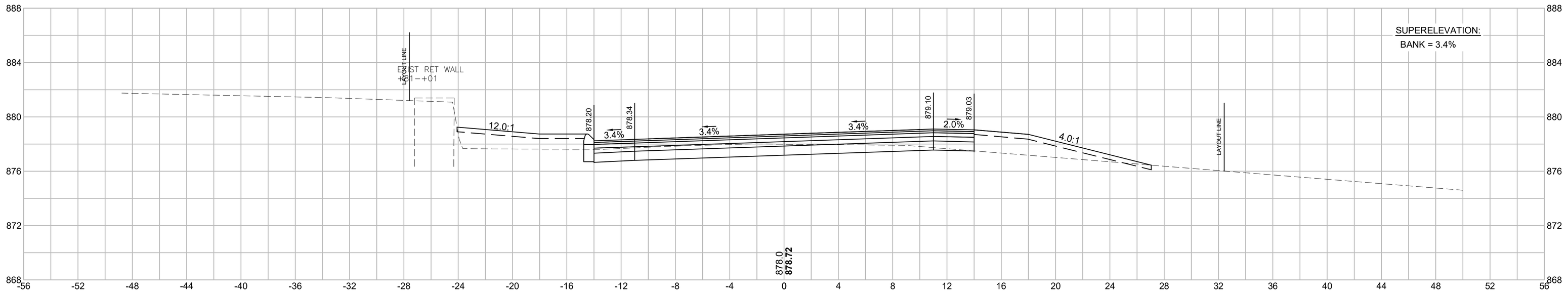
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:35 AM
Proposal No. 608163-128112
AV08080 - 45°

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	96	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

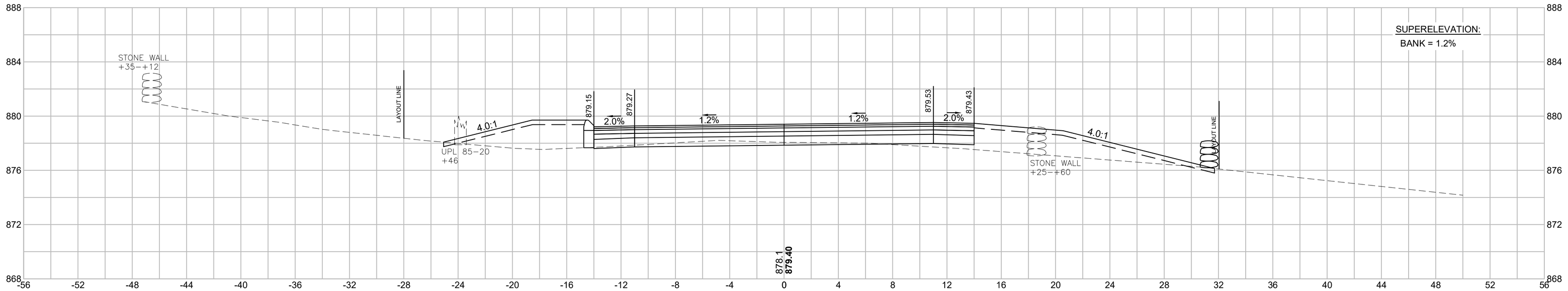
CROSS SECTIONS

20+00



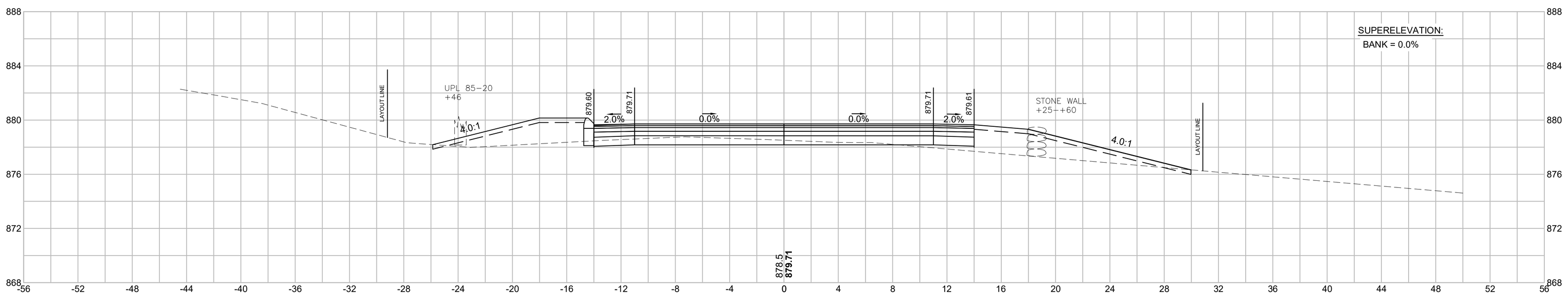
Cut: 20.22 S.F.
Fill: 24.66 S.F.

19+50



Cut: 4.97 S.F.
Fill: 39.52 S.F.

19+24.84



Cut: 8.99 S.F.
Fill: 36.15 S.F.

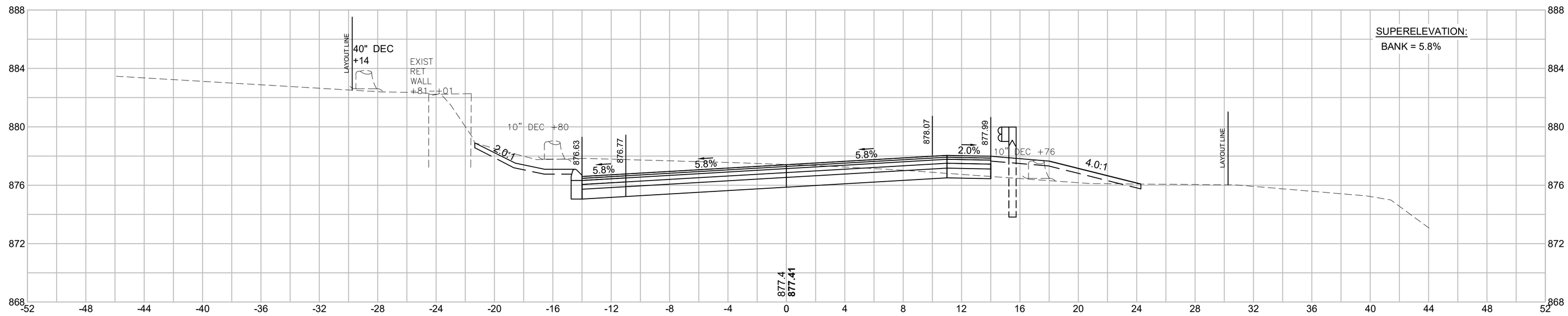
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:36 AM
Proposal No. 608163-128112
A00960 - 457

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	97	180
PROJECT FILE NO.	608163		

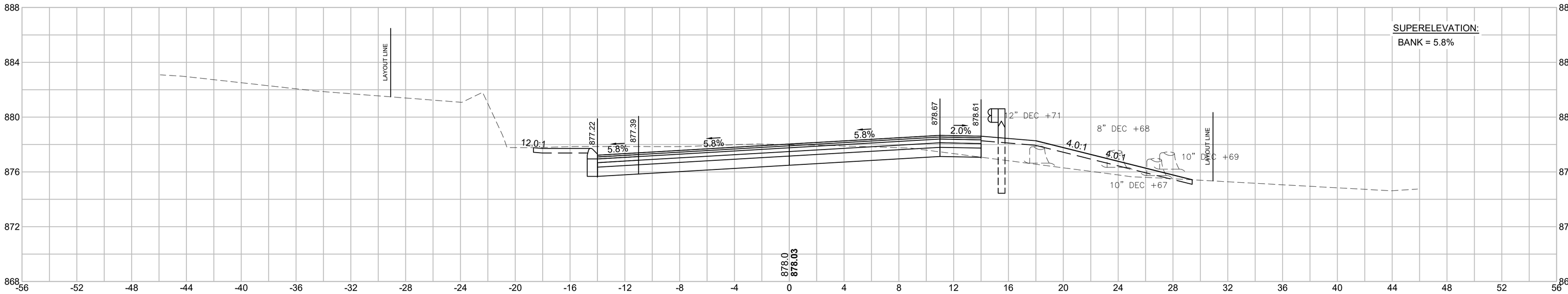
CROSS SECTIONS

20+97.43



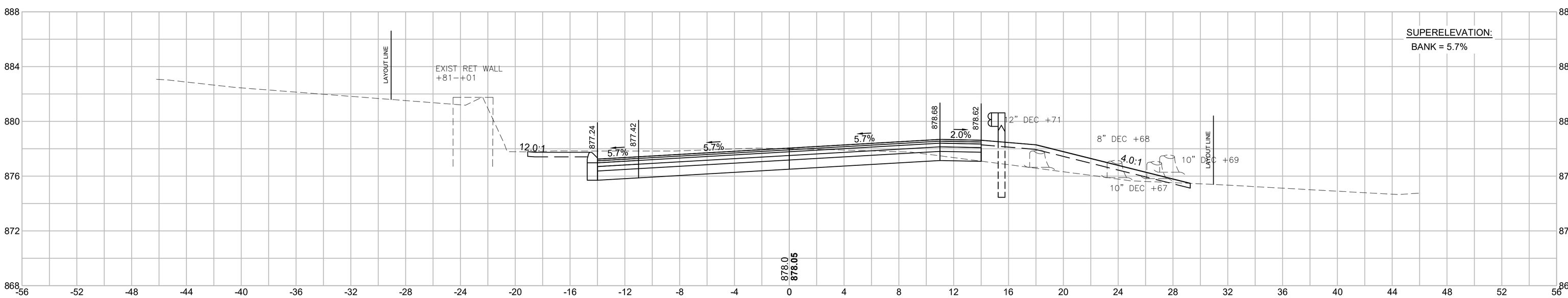
Cut: 49.78 S.F.
Fill: 9.96 S.F.

20+51.40



Cut: 41.11 S.F.
Fill: 17.54 S.F.

20+50



Cut: 40.62 S.F.
Fill: 17.44 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:36 AM
Proposal No. 608163-128112
AV0800 - 458

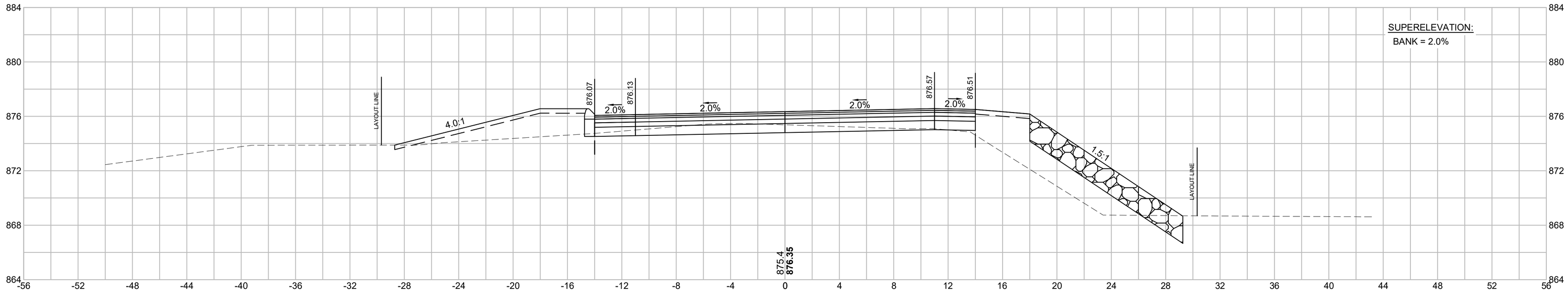
WALES
MONSON ROAD

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	98	180
PROJECT FILE NO.	608163		

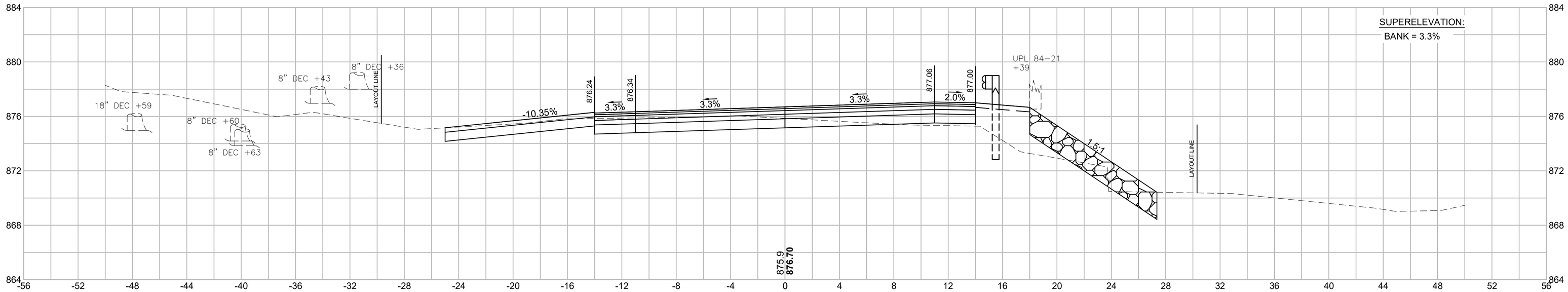
CROSS SECTIONS

21+76.05



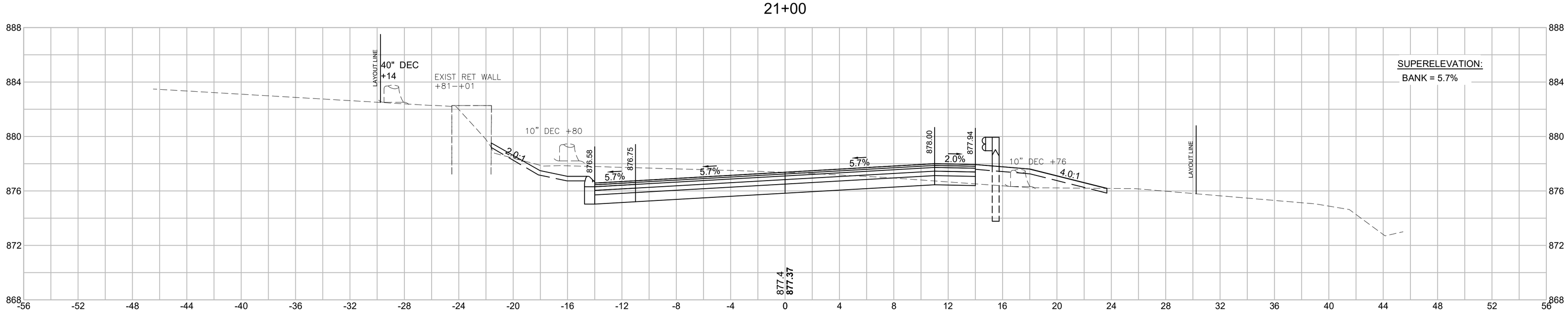
Cut: 14.76 S.F.
Fill: 44.34 S.F.

21+50



Cut: 30.73 S.F
Fill: 13.17 S.F

21+00



Cut: 47.40 S.F.
Fill: 10.22 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:37 AM

Proposal No. 608163-128112

AV0980 - 459

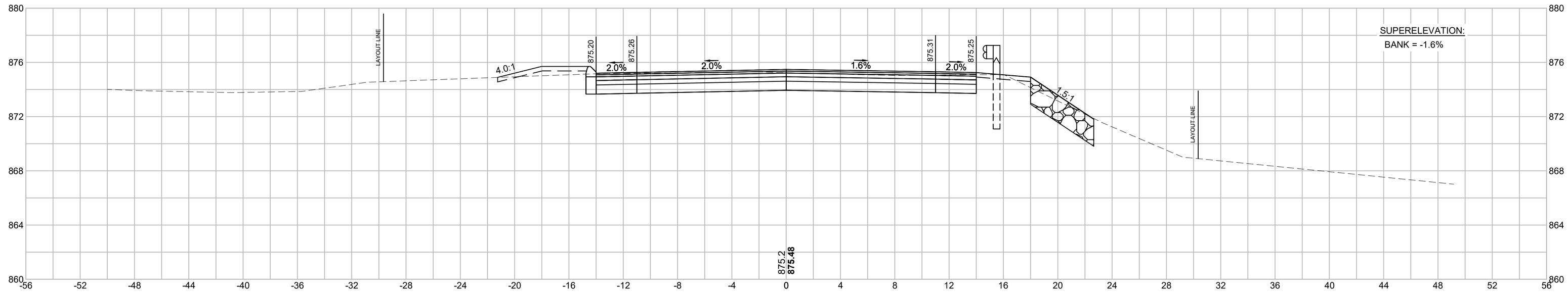
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	99	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

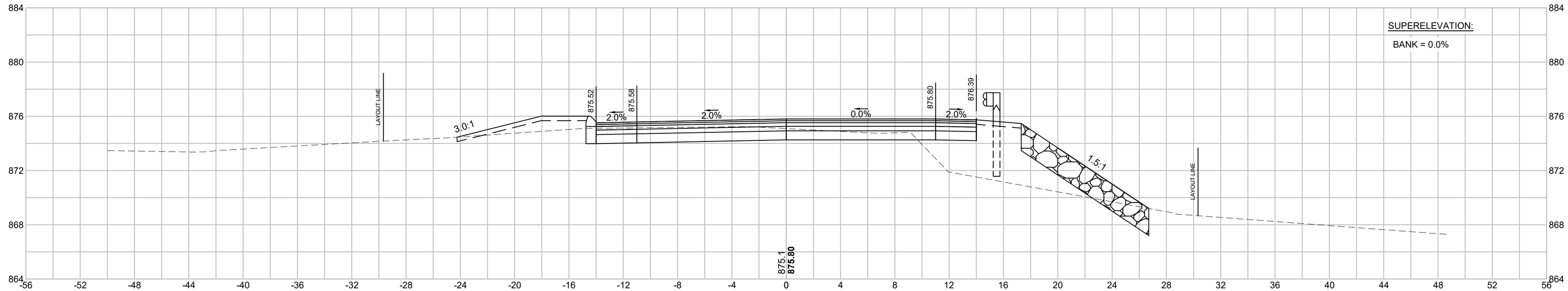
CROSS SECTIONS

22+50



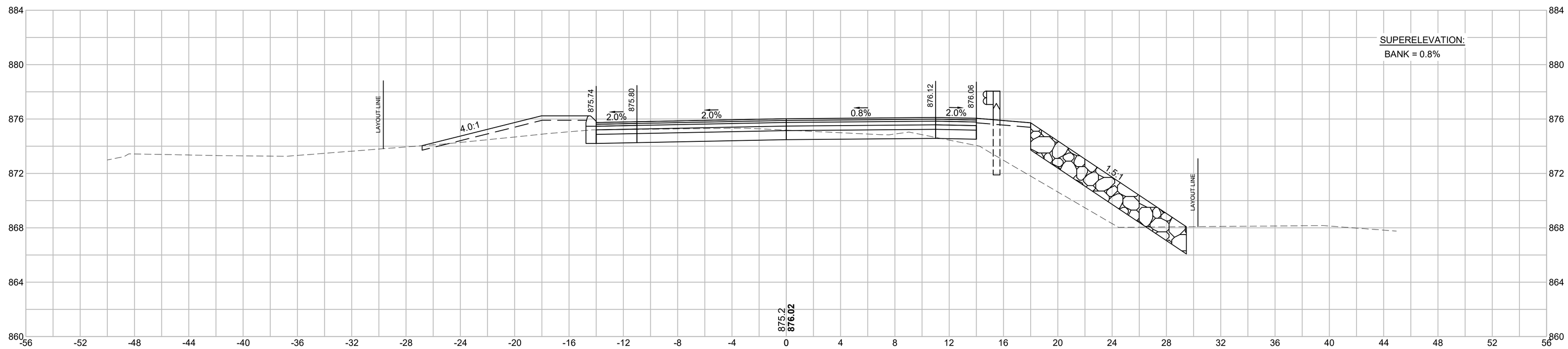
Cut: 47.53 S.F.
Fill: 4.10 S.F.

22+17.43



Cut: 25.94 S.F.
Fill: 36.73 S.F.

22+00



Cut: 21.81 S.F.
Fill: 34.46 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:38 AM
Proposal No. 608163-128112
AM0809 - 490

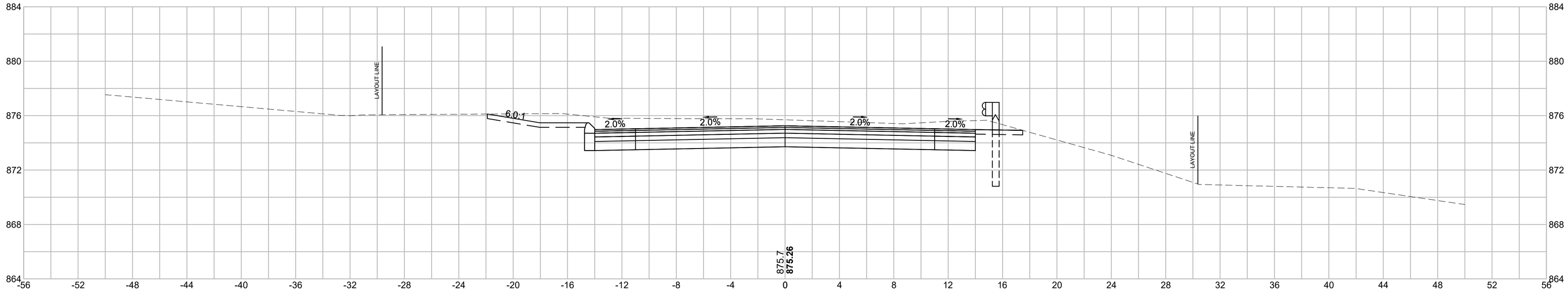
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	100	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

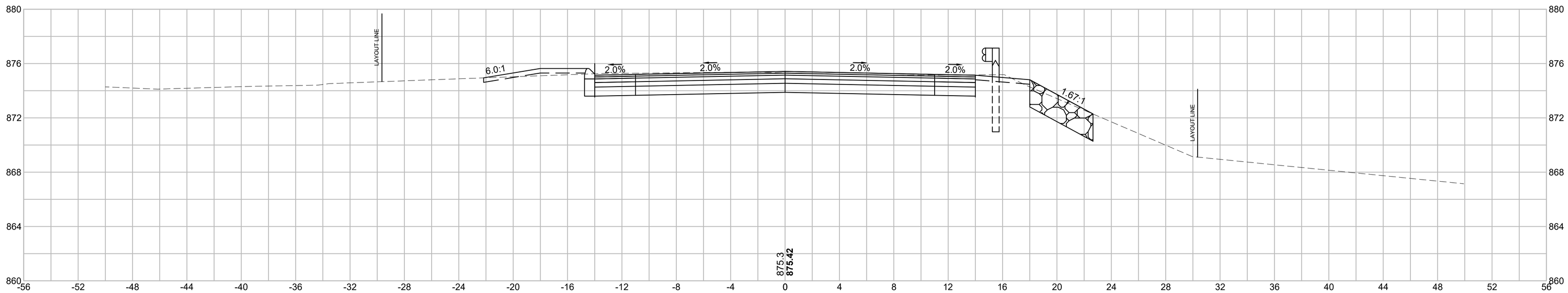
CROSS SECTIONS

23+00



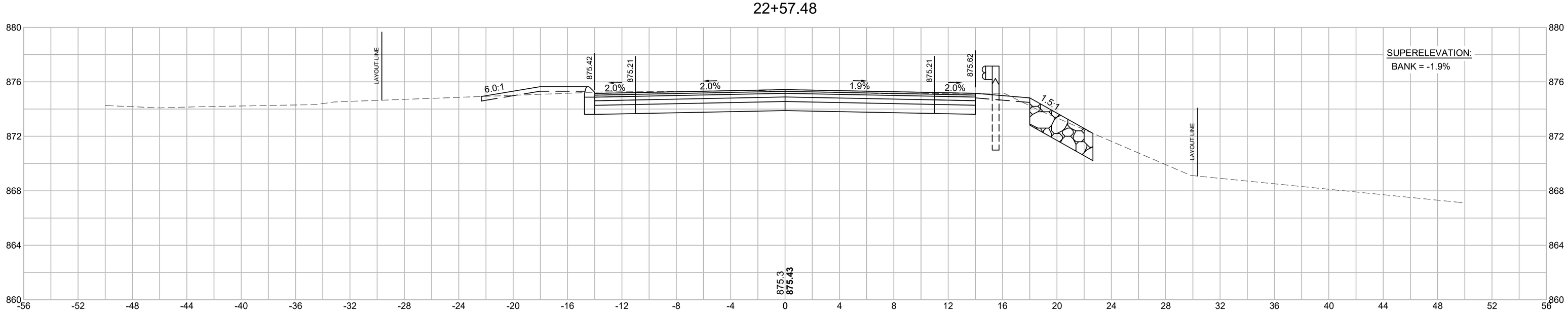
Cut: 68.97 S.F.
Fill: 0.0 S.F.

22+58.81



Cut: 45.96 S.F.
Fill: 4.28 S.F.

22+57.48



Cut: 49.08 S.F.
Fill: 3.68 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:38 AM
Proposal No. 608163-128112
A000060 - 461

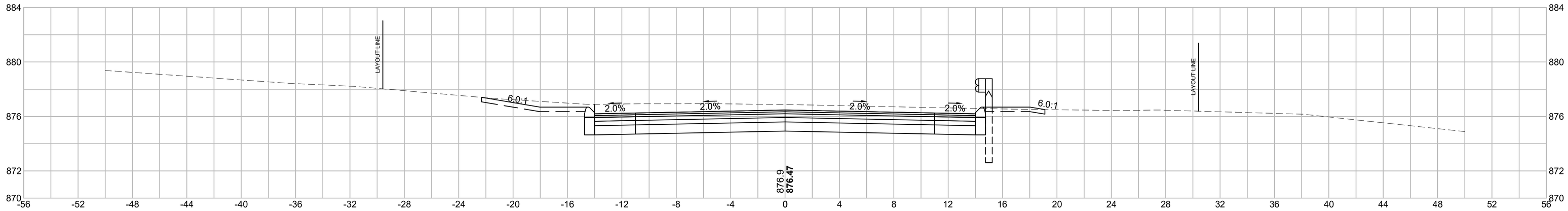
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	101	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

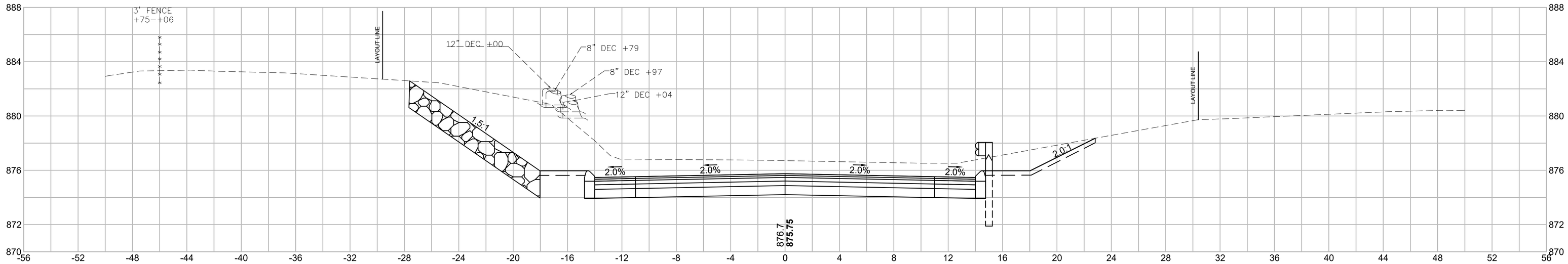
CROSS SECTIONS

24+50



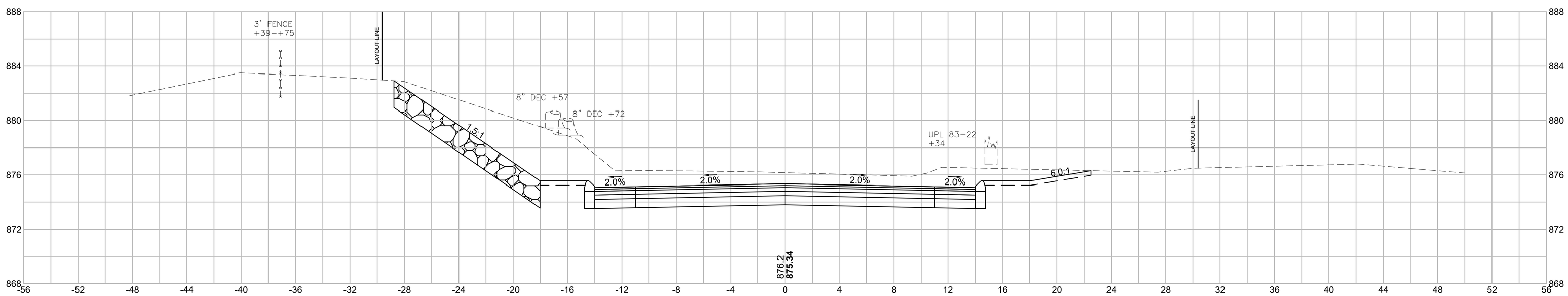
Cut: 65.40 S.F.
Fill: 0.57 S.F.

24+00



Cut: 150.34 S.F.
Fill: 0.0 S.F.

23+50



Cut: 141.07 S.F.
Fill: 0.0 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:39 AM
Proposal No. 608163-128112
A0080940 - 462

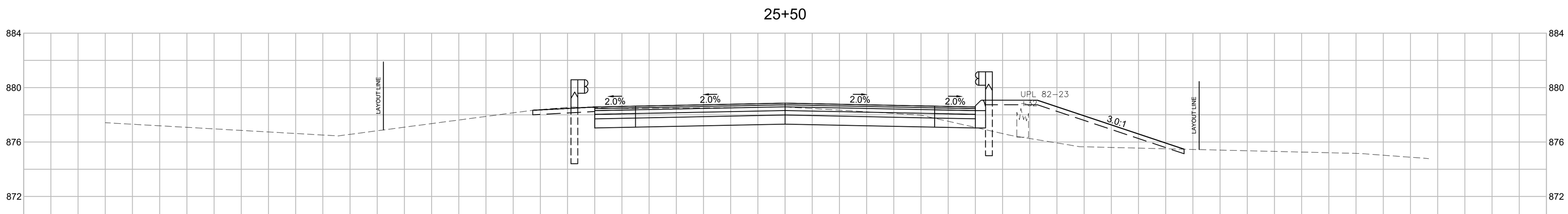
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	102	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

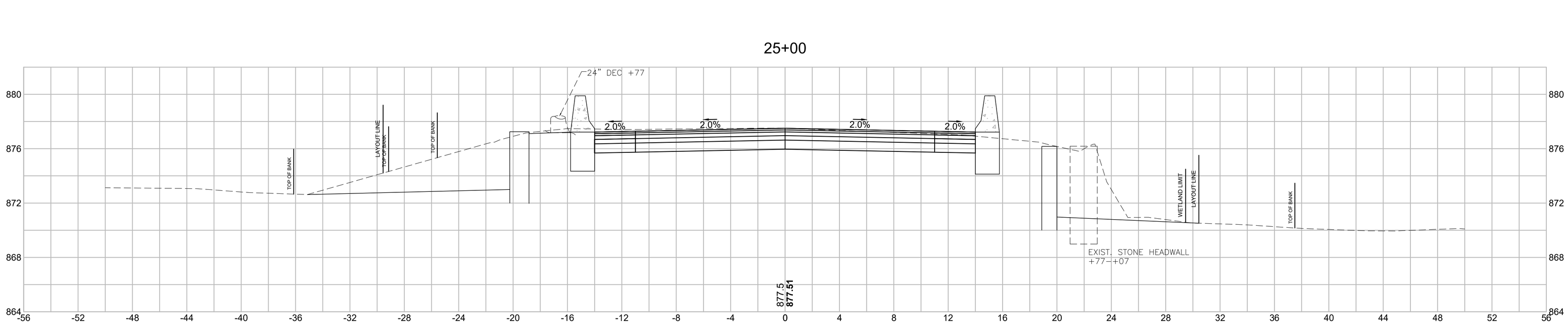
CROSS SECTIONS

25+50



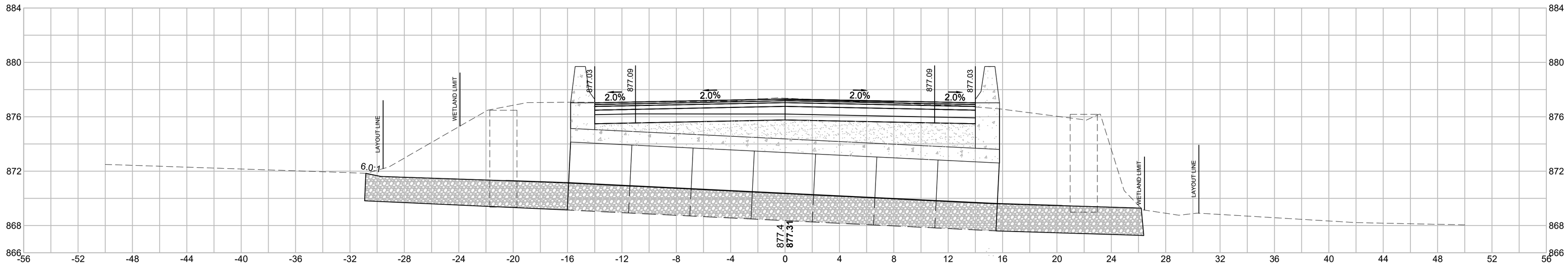
Cut: 33.06 S.F.
Fill: 27.18 S.F.

25+00



Cut: 121.15 S.F.
Fill: 0.00 S.F

24+91.52



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:40 AM
Proposal No. 608163-128112
AV8080-346

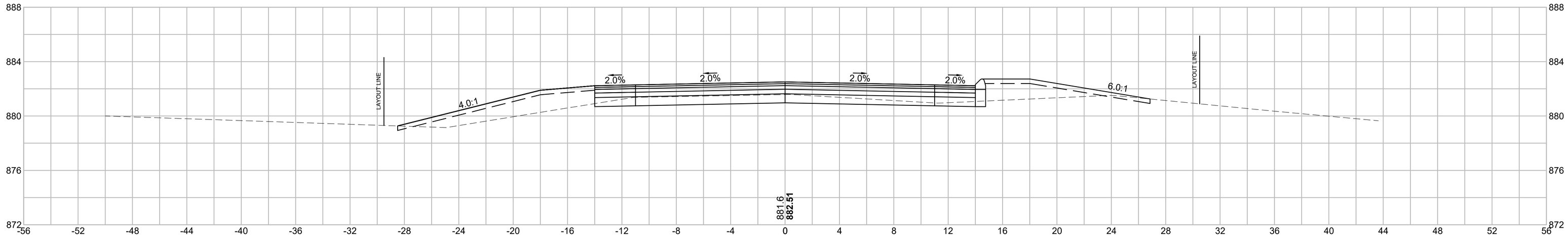
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	103	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

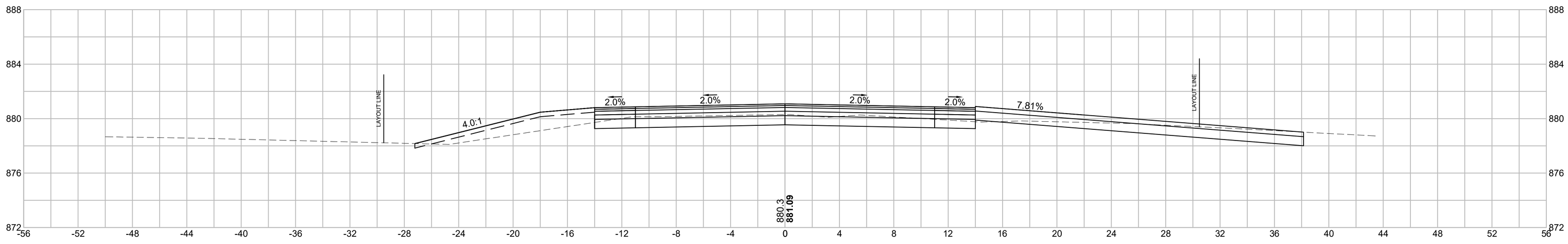
CROSS SECTIONS

26+50



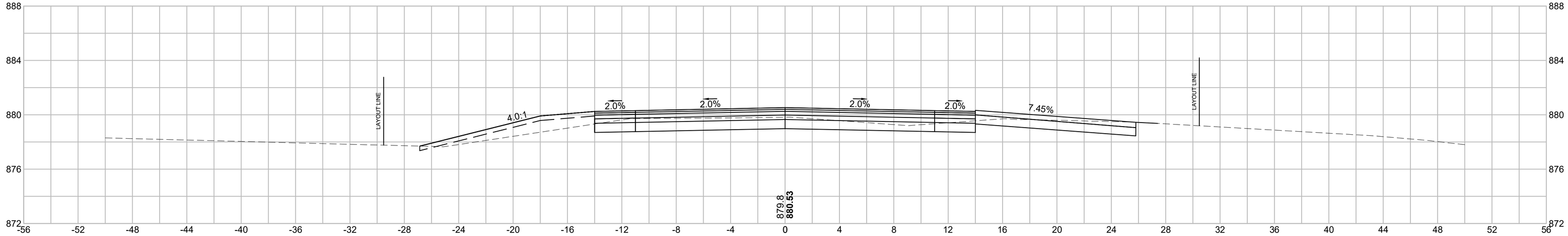
Cut: 14.82 S.F.
Fill: 27.26 S.F.

26+15



Cut: 34.24 S.F.
Fill: 22.86 S.F.

26+00



Cut: 29.54 S.F.
Fill: 10.10 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:40 AM

Proposal No. 608163-128112

AV08040 - 464

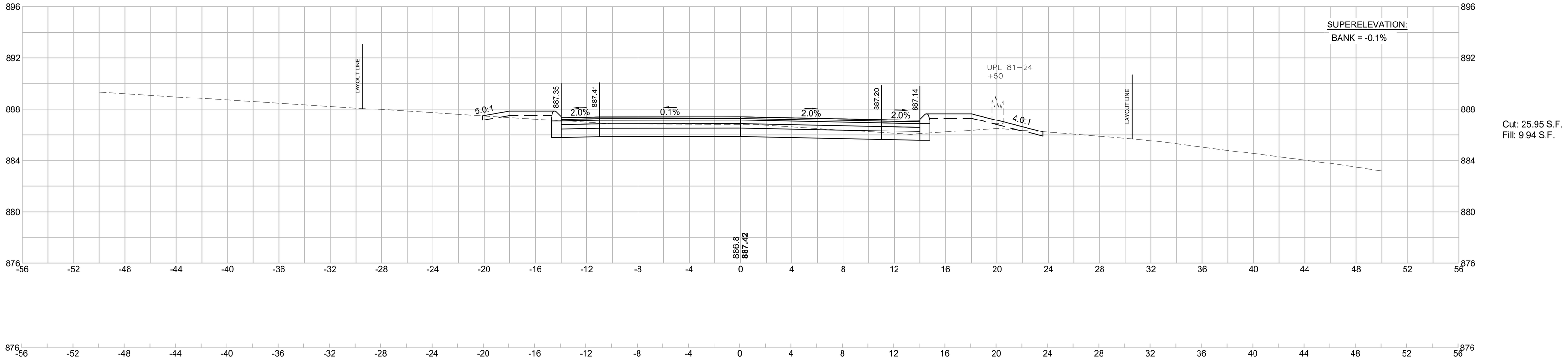
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	104	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

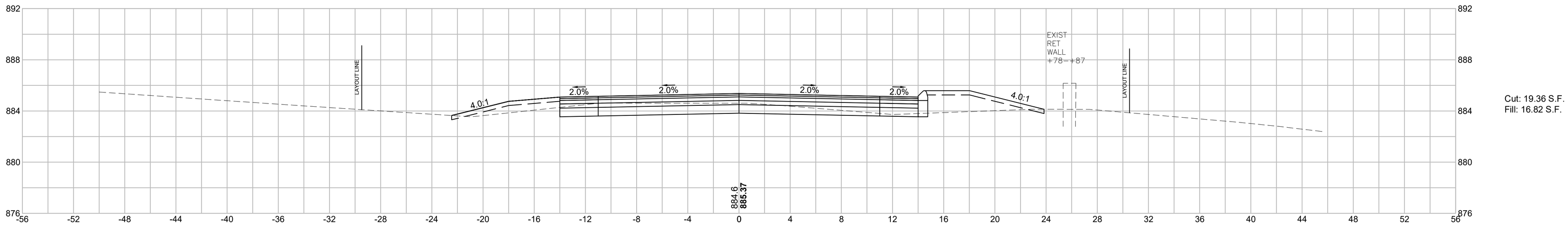
CROSS SECTIONS

27+50



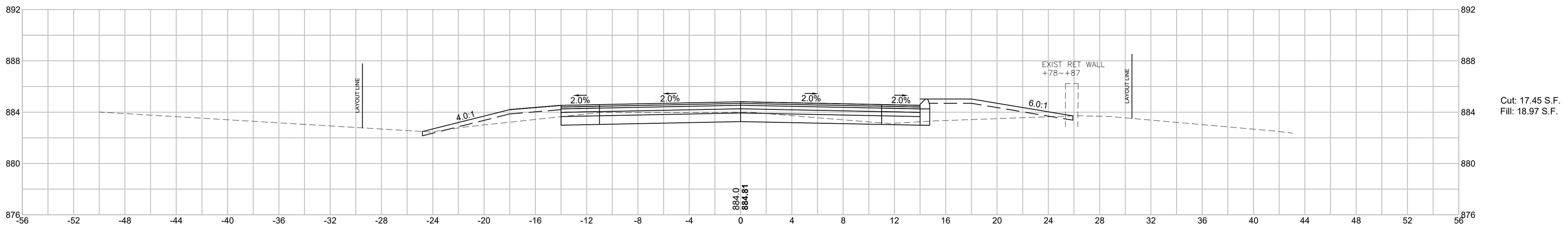
Cut: 25.95 S.F.
Fill: 9.94 S.F.

27+11.25



Cut: 19.36 S.F.
Fill: 16.82 S.F.

27+00



Cut: 17.45 S.F.
Fill: 18.97 S.F.

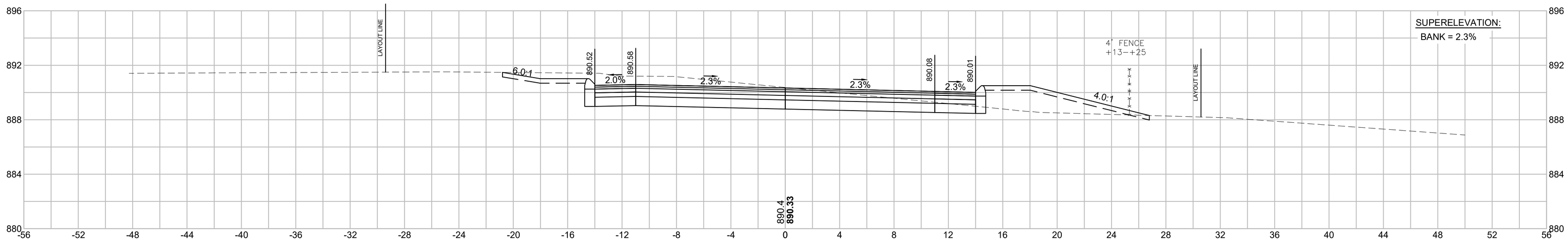
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:41 AM
Proposal No. 608163-120112
AV0980 - 455

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	105	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

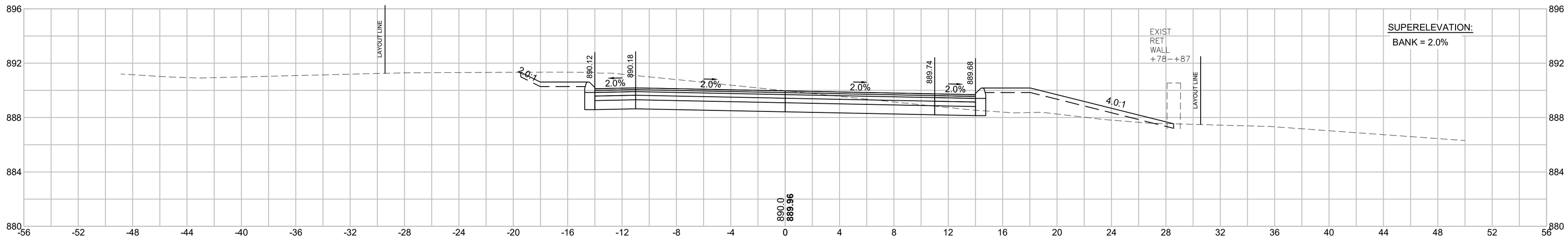
CROSS SECTIONS

28+00



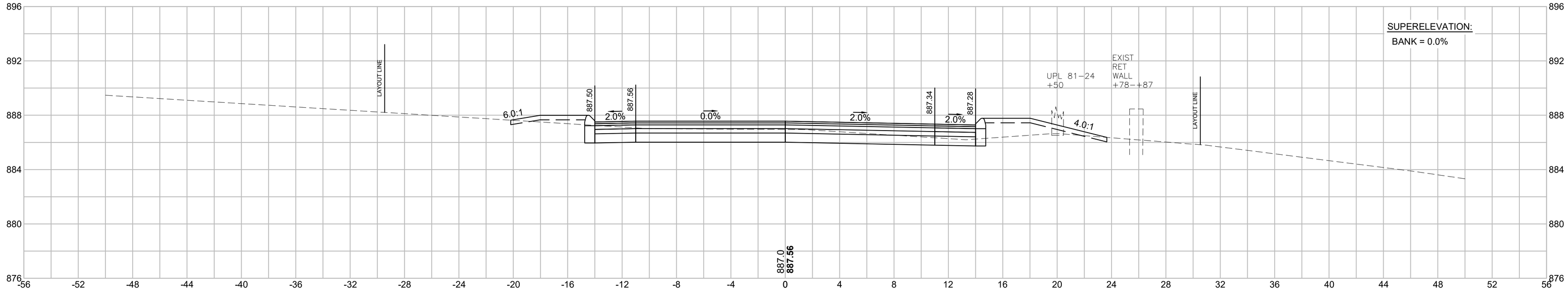
Cut: 49.78 S.F.
Fill: 14.22 S.F.

27+93.75



Cut: 50.91 S.F.
Fill: 17.04 S.F.

27+52.50



Cut: 26.12 S.F.
Fill: 10.96 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:42 AM
Proposal No. 608163-128112
AUV0860 - 466

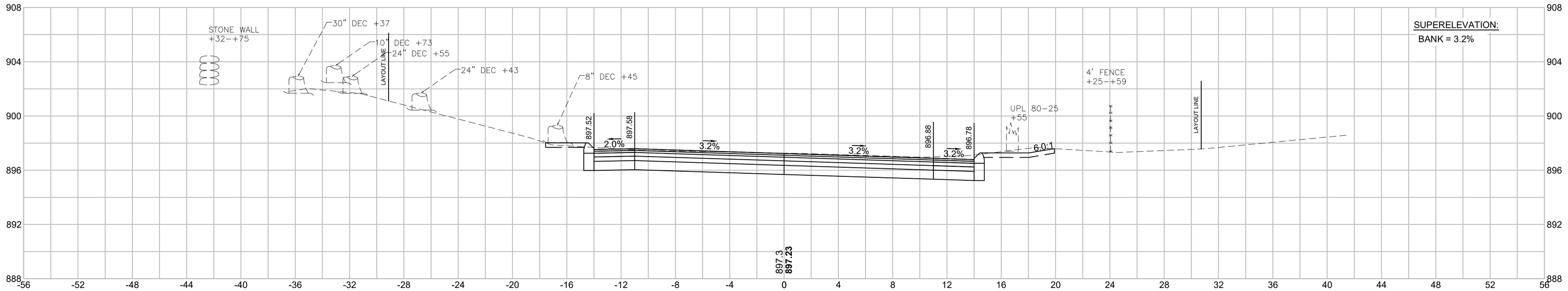
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	106	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

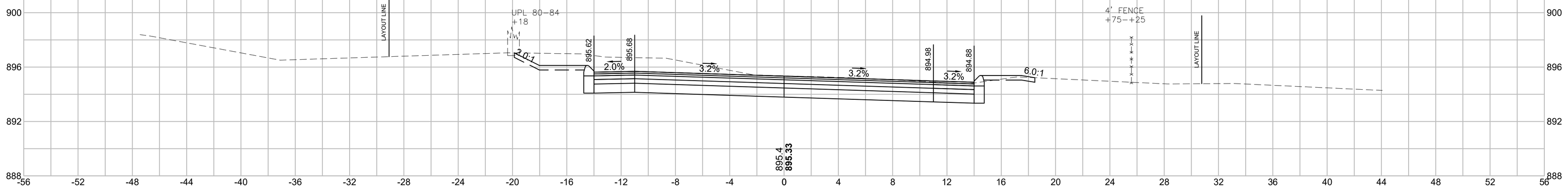
CROSS SECTIONS

29+50



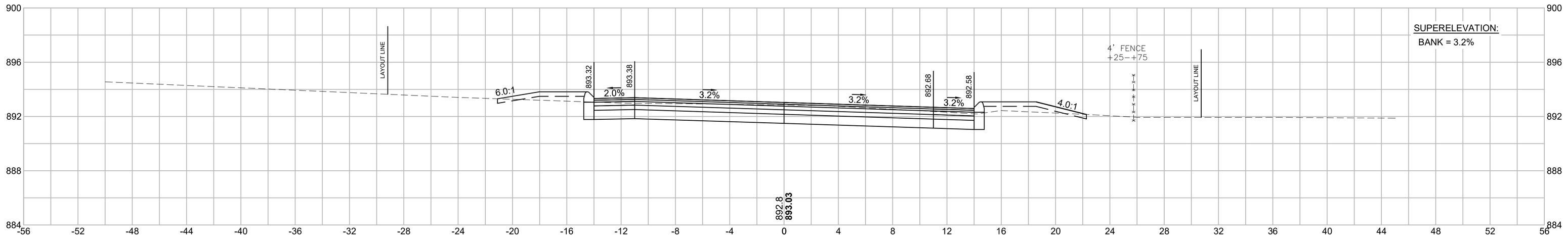
Cut: 49.87 S.F.
Fill: 0.62 S.F.

29+00



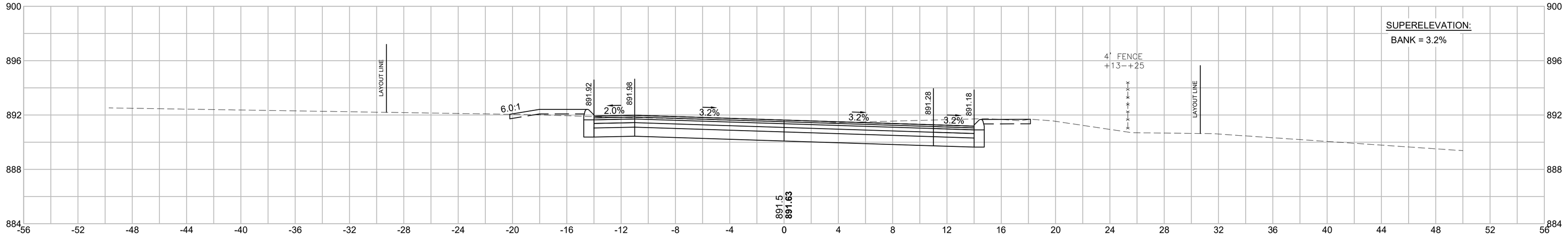
Cut: 61.10 S.F.
Fill: 0.80 S.F.

28+50



Cut: 37.95 S.F.
Fill: 7.36 S.F.

28+23.16



Cut: 47.26 S.F.
Fill: 2.25 S.F.

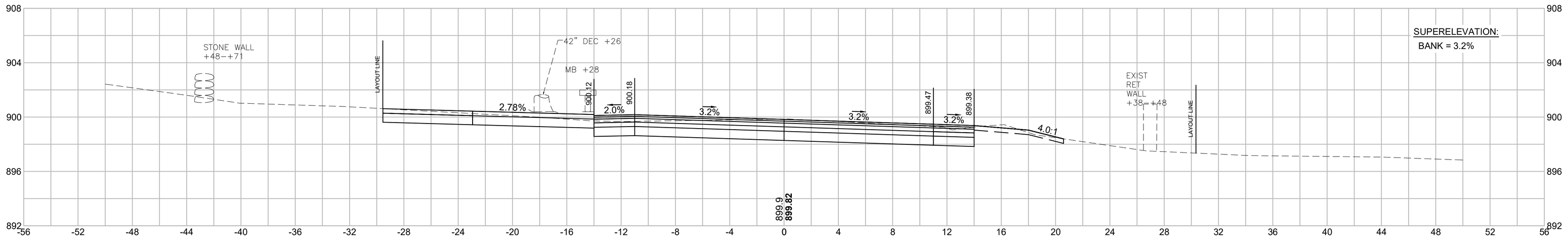
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:43 AM
Proposal No. 608163-128112
A08069 - 467

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	107	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

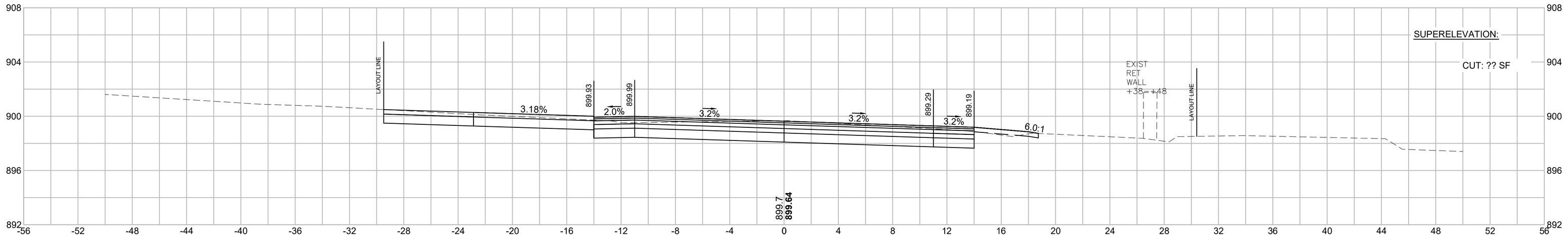
CROSS SECTIONS

30+50



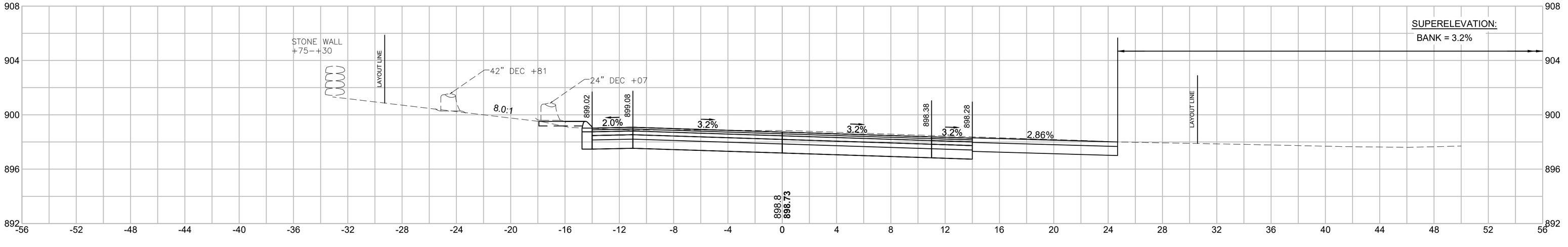
Cut: 52.20 S.F.
Fill: 0.40 S.F.

30+40



Cut: 59.13 S.F.
Fill: 1.47 S.F.

30+00



Cut: 57.0 S.F.
Fill: 0.94 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:43 AM
Proposal No. 608163-128112
A000690 - 488

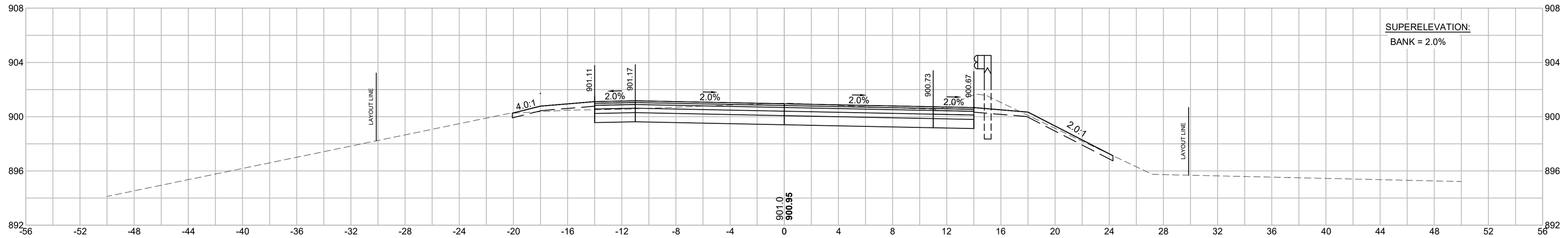
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	108	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

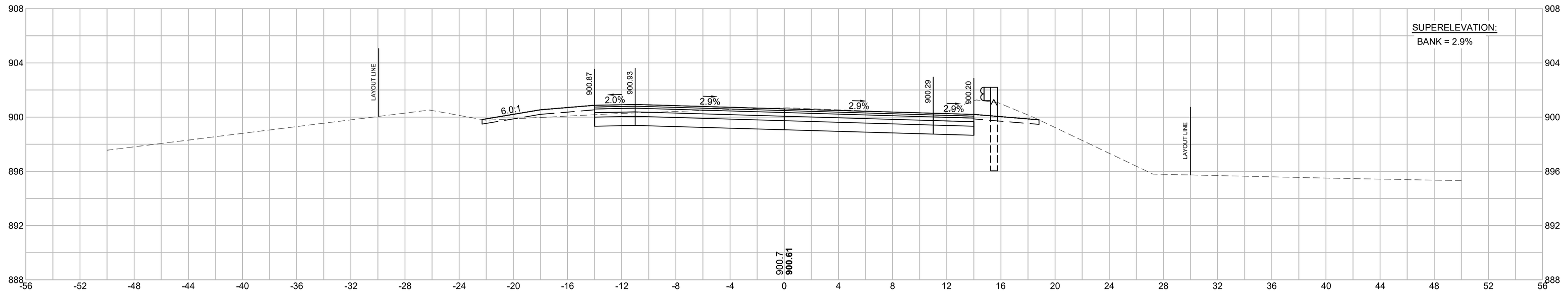
CROSS SECTIONS

31+18.99



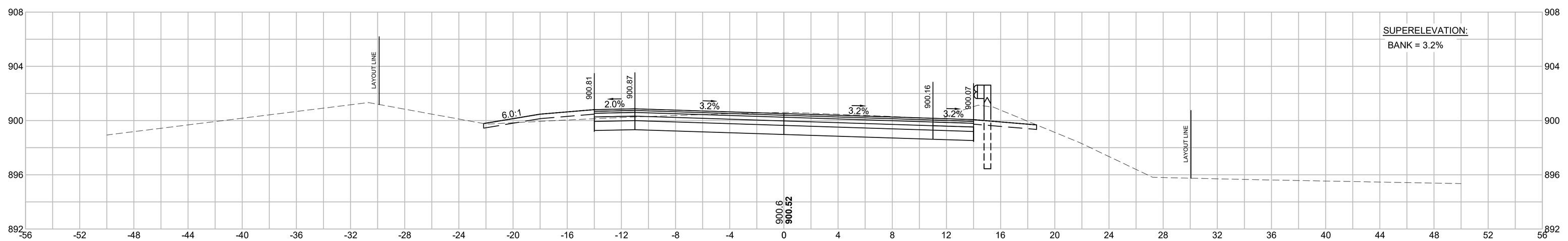
Cut: 43.84 S.F.
Fill: 3.21 S.F.

31+00



Cut: 45.0 S.F.
Fill: 3.86 S.F.

30+94.24



Cut: 45.54 S.F.
Fill: 3.63 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:44 AM
Proposal No. 608163-128112
AM0809 - 469

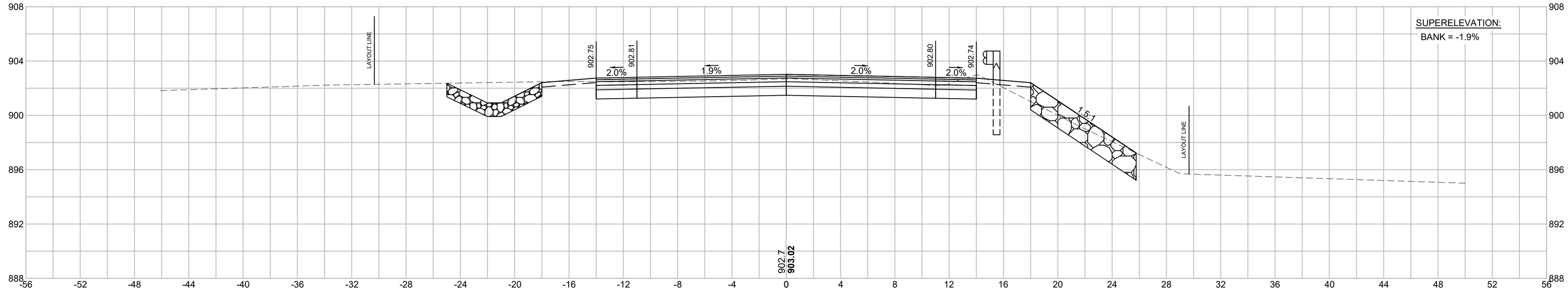
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	109	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

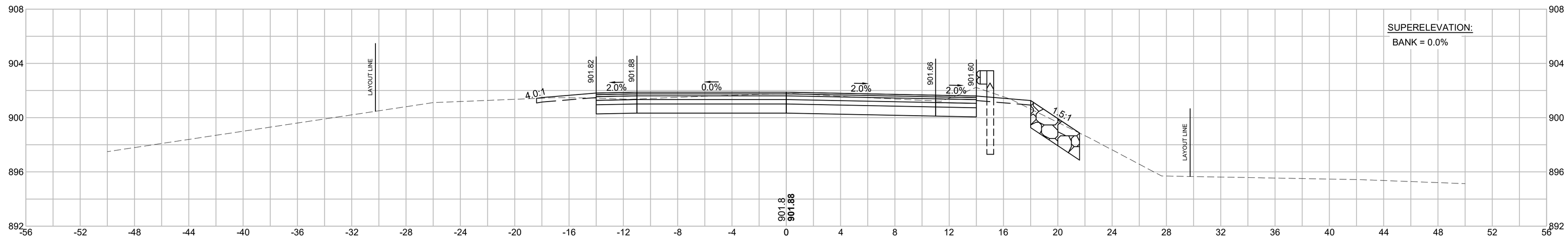
CROSS SECTIONS

32+00



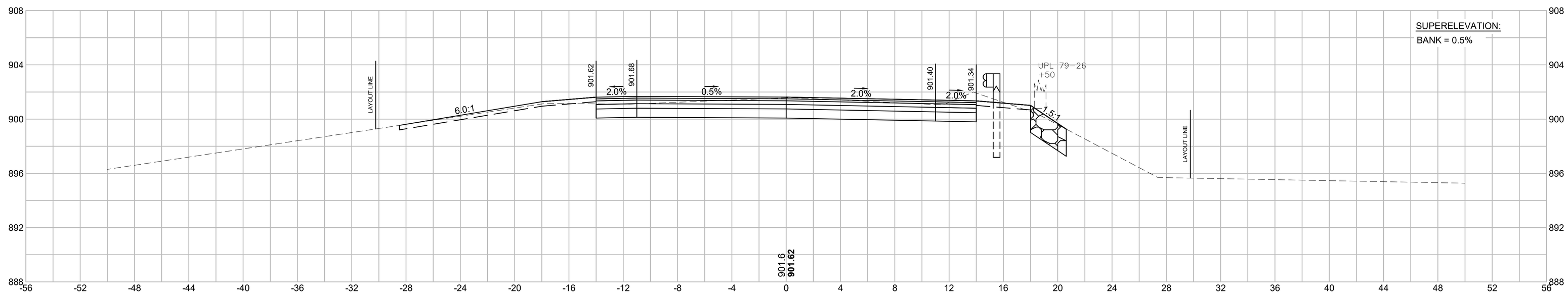
Cut: 57.0 S.F.
Fill: 2.66 S.F.

31+60.24



Cut: 44.26 S.F.
Fill: 1.26 S.F.

31+50



Cut: 45.9 S.F.
Fill: 2.51 S.F.

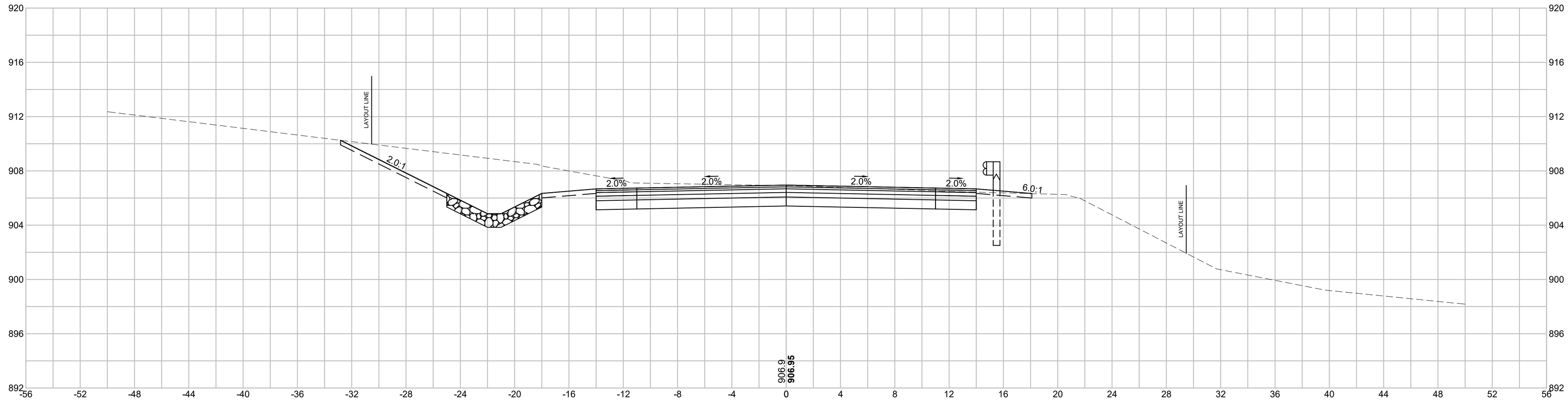
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:45 AM
Proposal No. 608163-128112
MW0980 - 470

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	110	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

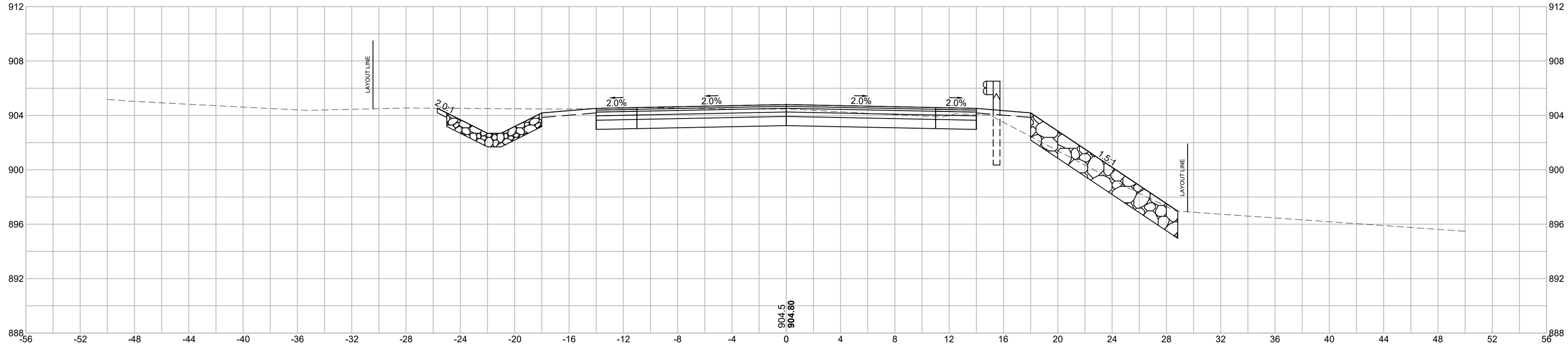
CROSS SECTIONS

33+00



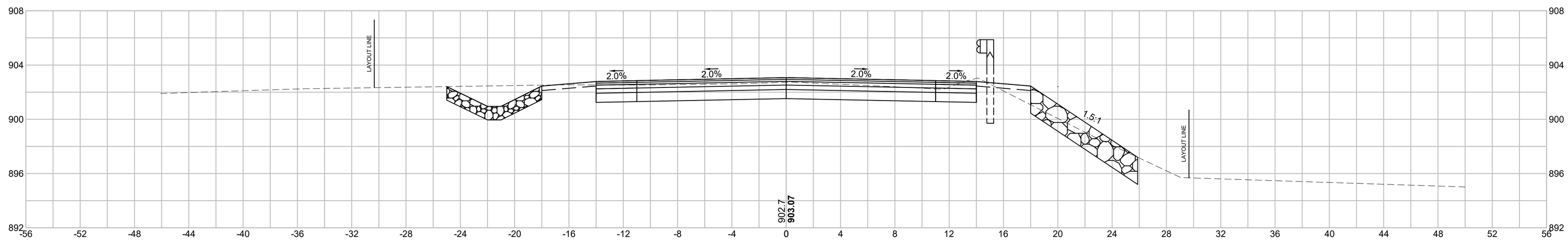
Cut: 98.3 S.F.
Fill: 0.51 S.F.

32+50



Cut: 63.2 S.F.
Fill: 3.65 S.F.

32+01.49



Cut: 57.32 S.F.
Fill: 2.62 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:45 AM
A00860 - 471
Proposal No. 608163-128112

A00860 - 272

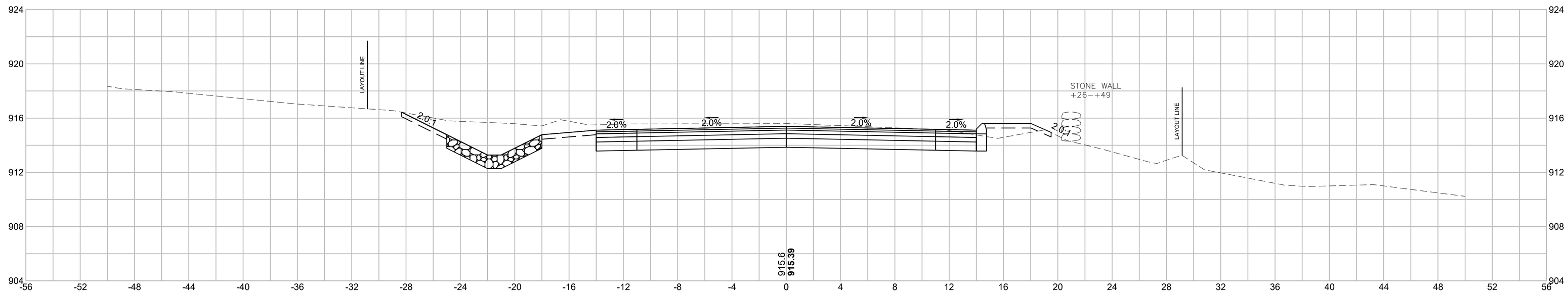
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	111	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

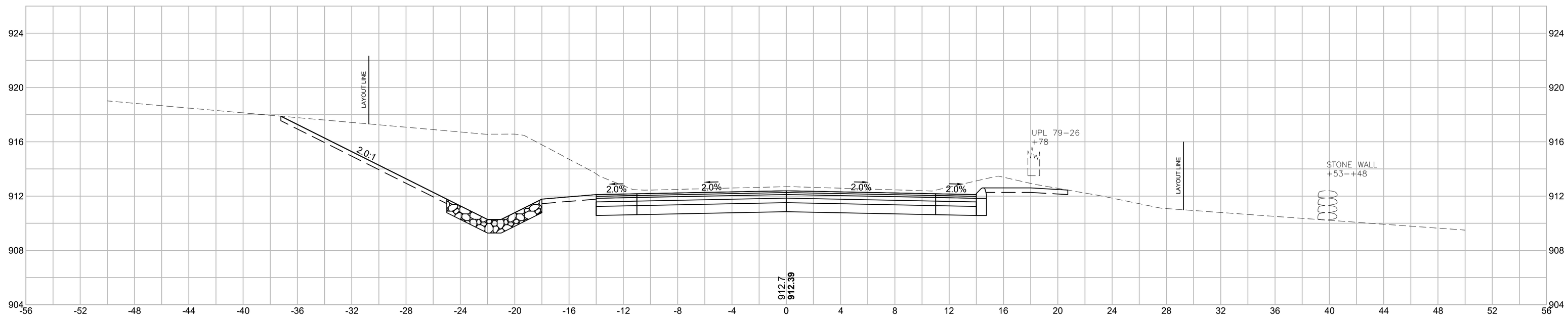
CROSS SECTIONS

34+50



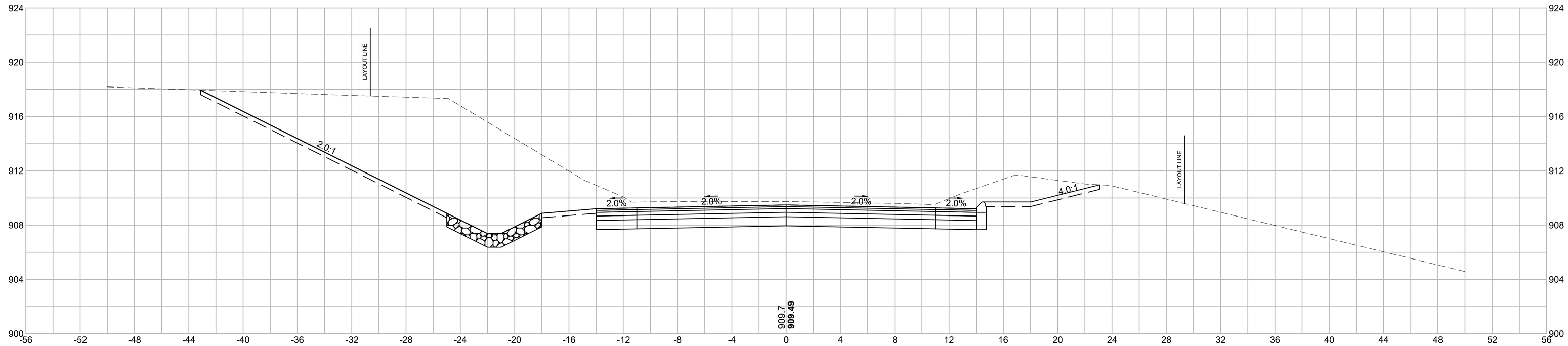
Cut: 75.62 S.F.
Fill: 3.38 S.F.

34+00



Cut: 153.5 S.F.
Fill: 0.0 S.F.

33+50



Cut: 224.7 S.F.
Fill: 0.0 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:46 AM
Proposal No. 608163-128112

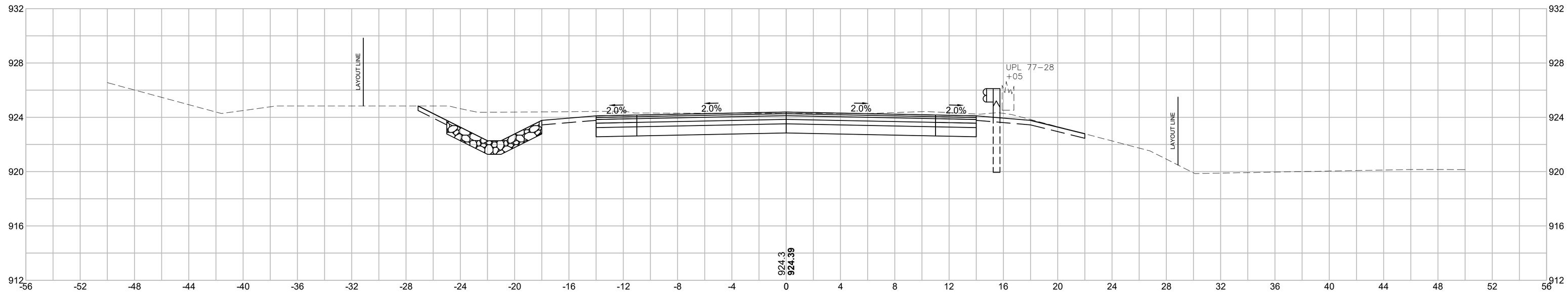
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	112	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

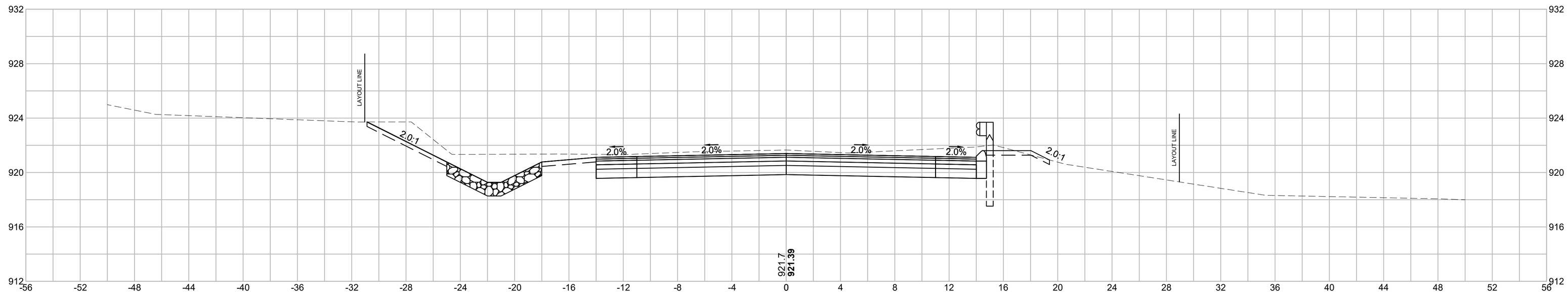
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

36+00



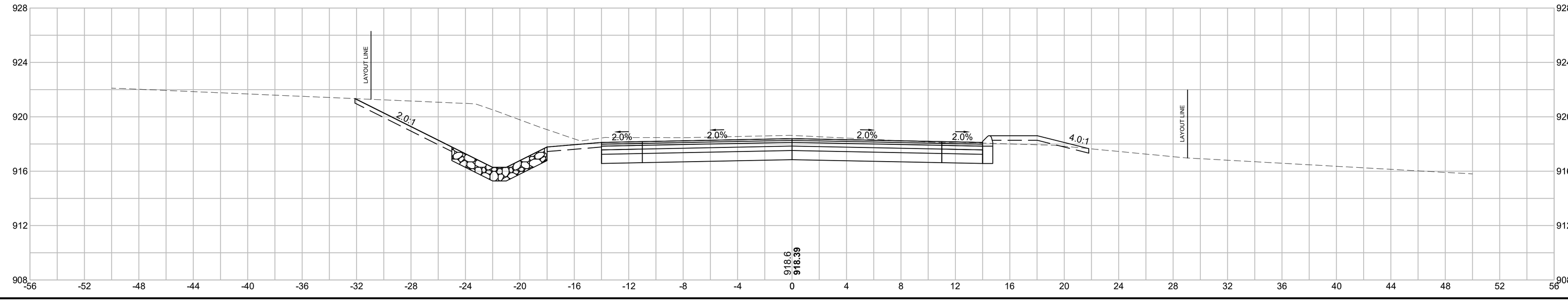
Cut: 71.9 S.F.
Fill: 0.0 S.F.

35+50



Cut: 83.19 S.F.
Fill: 0.41 S.F.

35+00



Cut: 97.26 S.F.
Fill: 3.20 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:47 AM
Proposal No. 608163-128112
AM0860 - 473

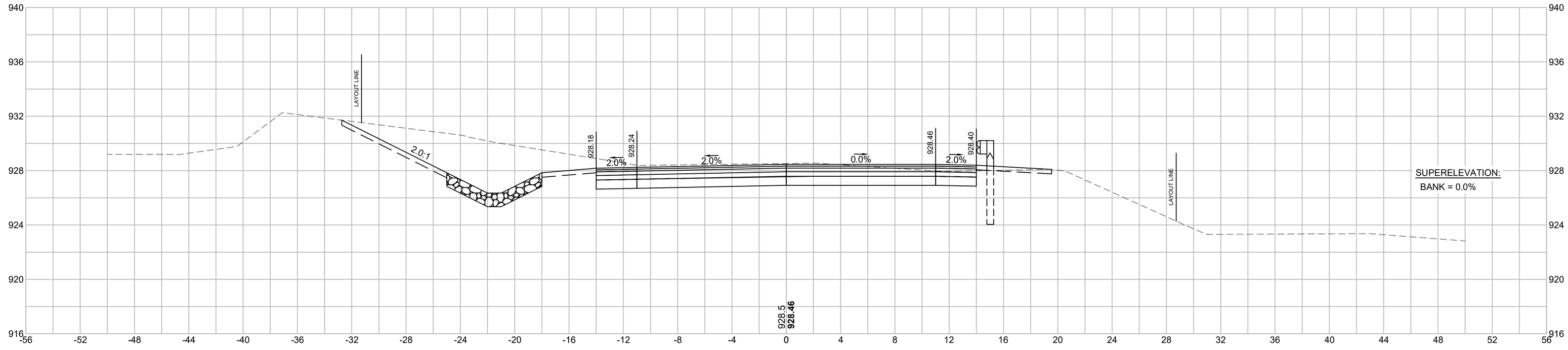
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	113	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

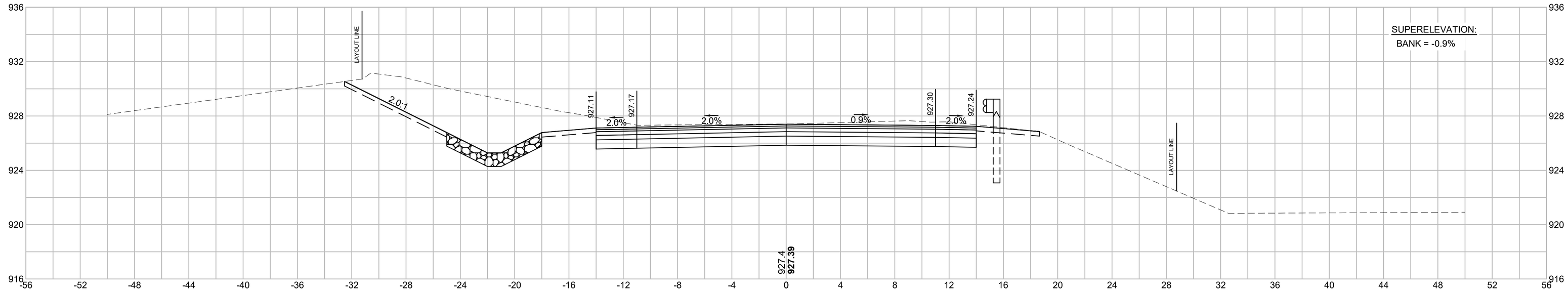
HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

36+67.83



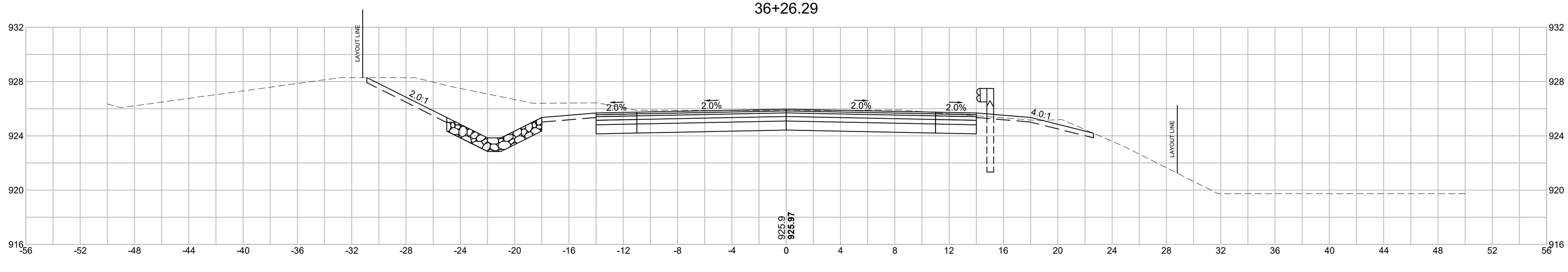
Cut: 92.62 S.F.
Fill: 1.13 S.F.

36+50



Cut: 105.3 S.F.
Fill: 0.0 S.F.

36+26.29



Cut: 86.86 S.F.
Fill: 0.92 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:48 AM
Proposal No. 608163-128112

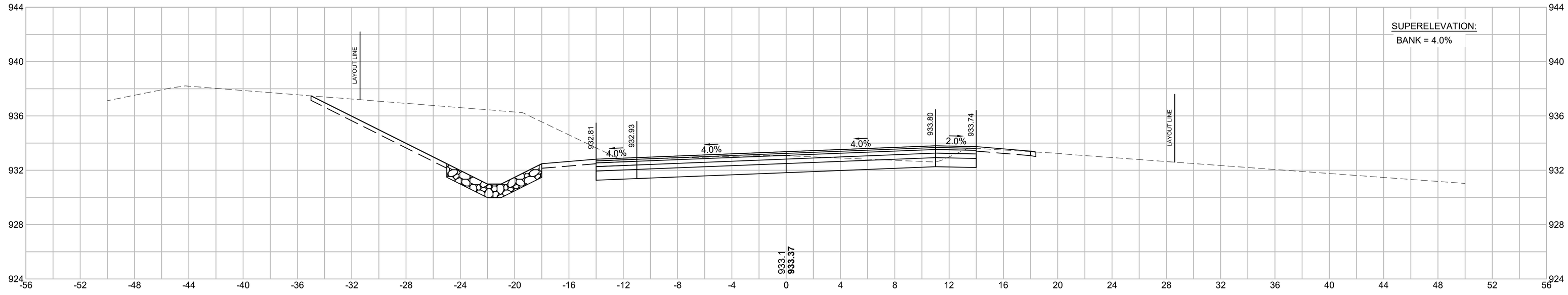
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	114	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

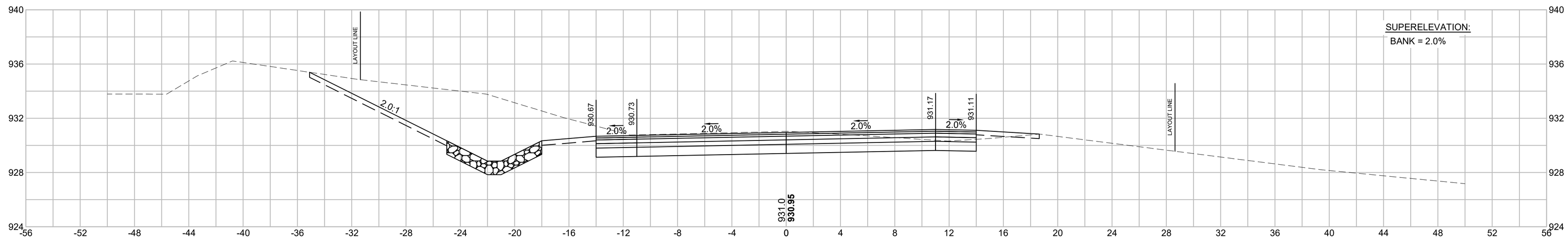
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

37+50



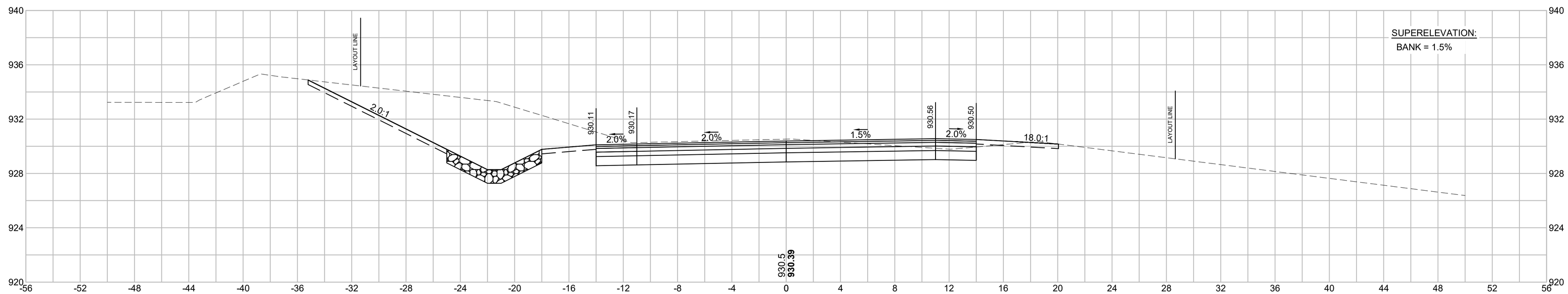
Cut: 106.50 S.F.
Fill: 0.35 S.F.

37+09.37



Cut: 104.00 S.F.
Fill: 1.59 S.F.

37+00



Cut: 110.57 S.F.
Fill: 1.06 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:48 AM
Proposal No. 608163-128112
A008690 - 475

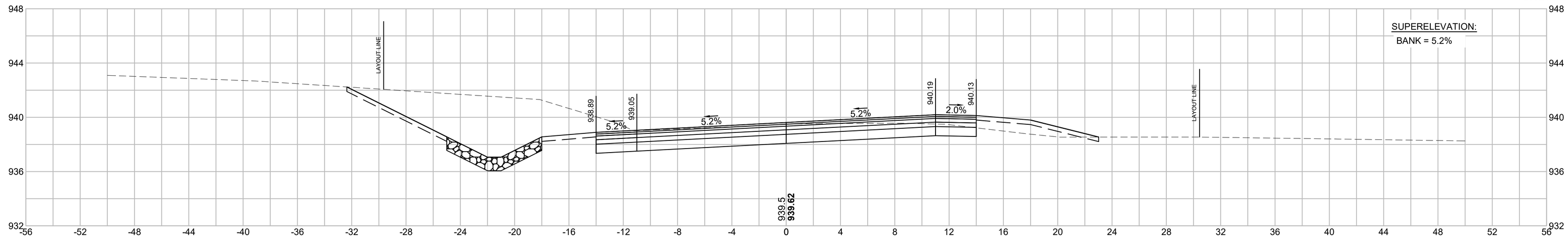
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	115	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

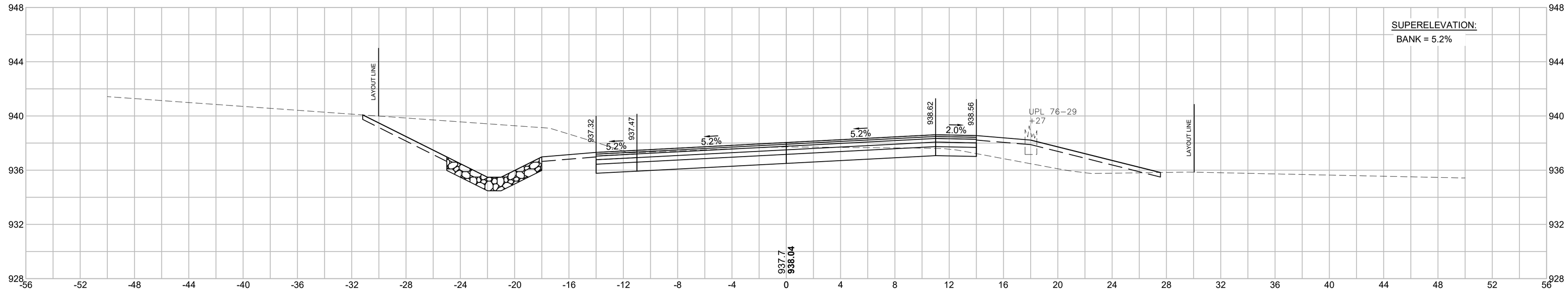
CROSS SECTIONS

39+00



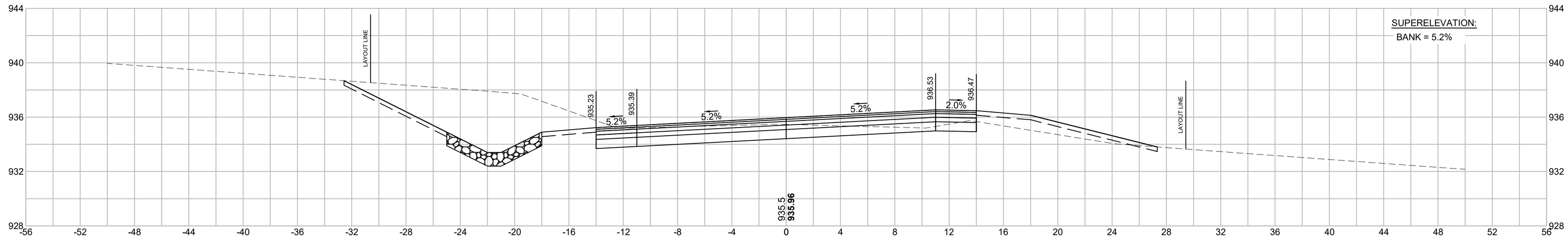
Cut: 94.97 S.F.
Fill: 6.82 S.F.

38+50



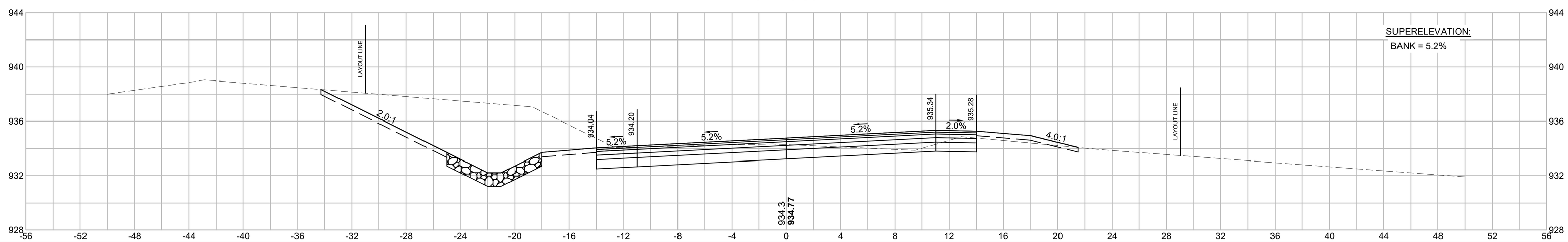
Cut: 78.10 S.F.
Fill: 16.61 S.F.

38+00



Cut: 82.00 S.F.
Fill: 9.78 S.F.

37+75.83



Cut: 96.57 S.F.
Fill: 3.07 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:49 AM
Proposal No. 608163-128112
A0808000 - 476

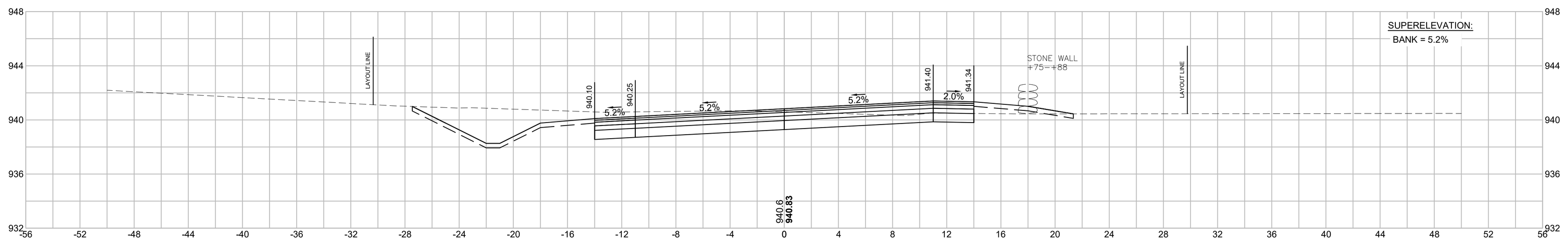
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	116	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

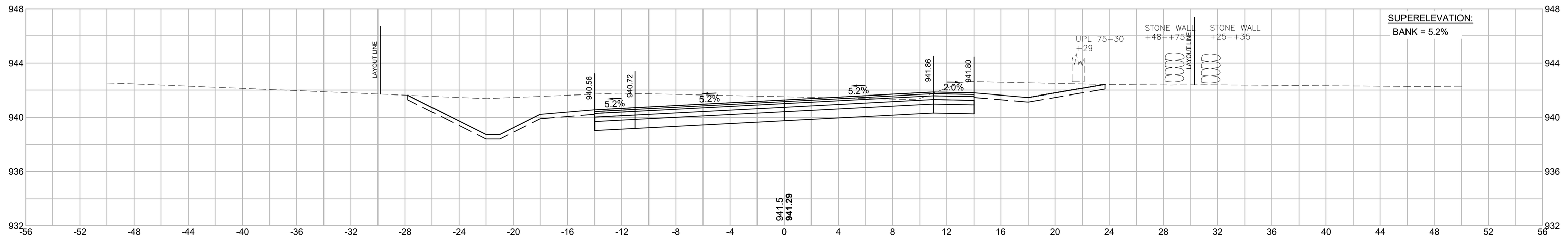
CROSS SECTIONS

41+00



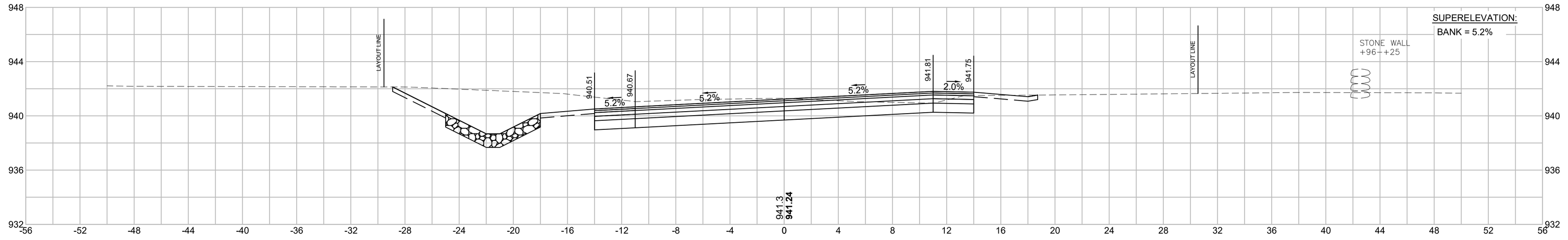
Cut: 58.20 S.F.
Fill: 3.80 S.F.

40+50



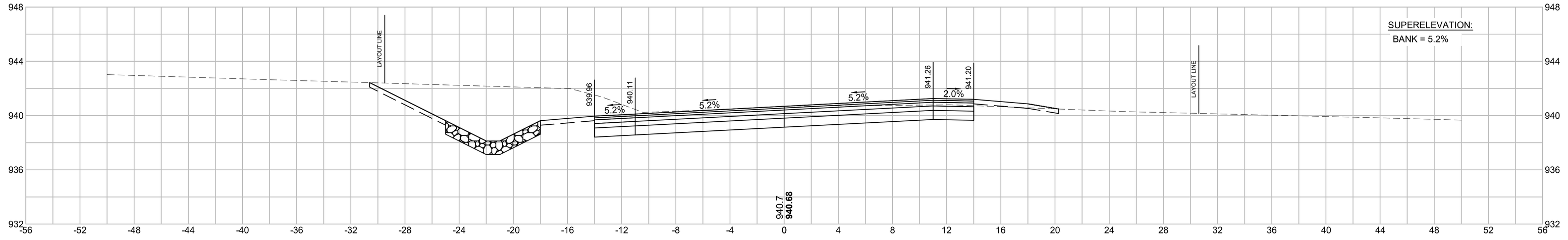
Cut: 89.25 S.F.
Fill: 0.0 S.F.

40+00



Cut: 78.80 S.F.
Fill: 0.34 S.F.

39+50



Cut: 92.8 S.F.
Fill: 1.84 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:50 AM
Proposal No. 608163-128112
A00860 - 477

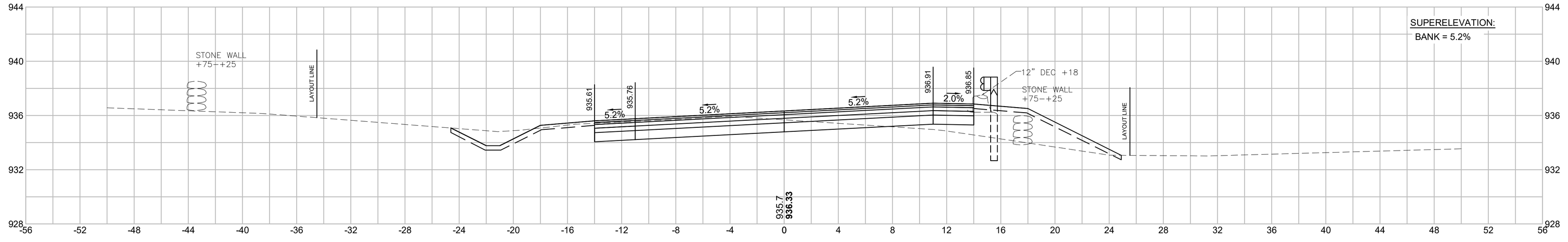
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	117	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

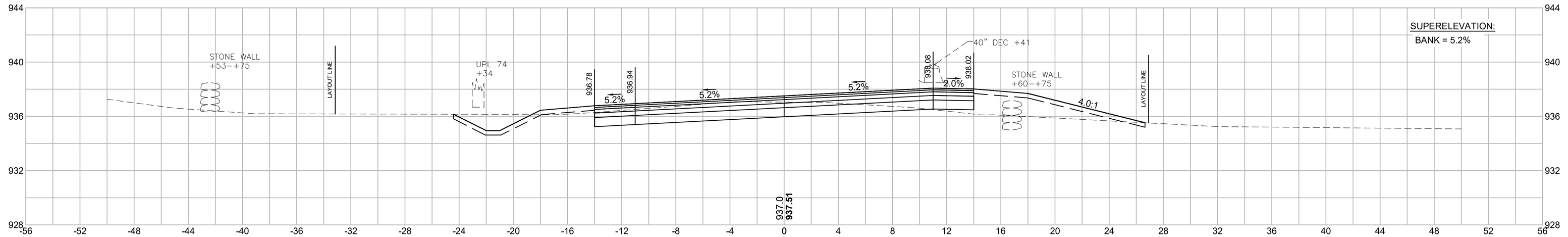
CROSS SECTIONS

43+00



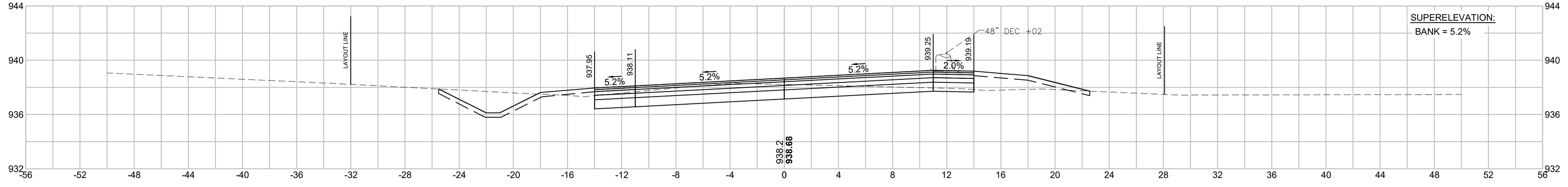
Cut: 28.10 S.F.
Fill: 21.77 S.F.

42+50



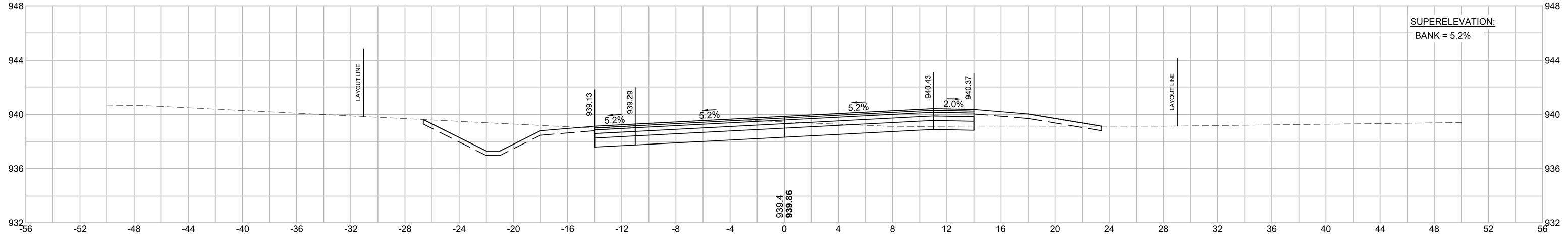
Cut: 29.63 S.F.
Fill: 16.88 S.F.

42+00



Cut: 34.1 S.F.
Fill: 8.58 S.F.

41+50



Cut:42.73 S.F.
Fill: 6.74 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:51 AM
Proposal No. 608163-128112
A009860 - 478

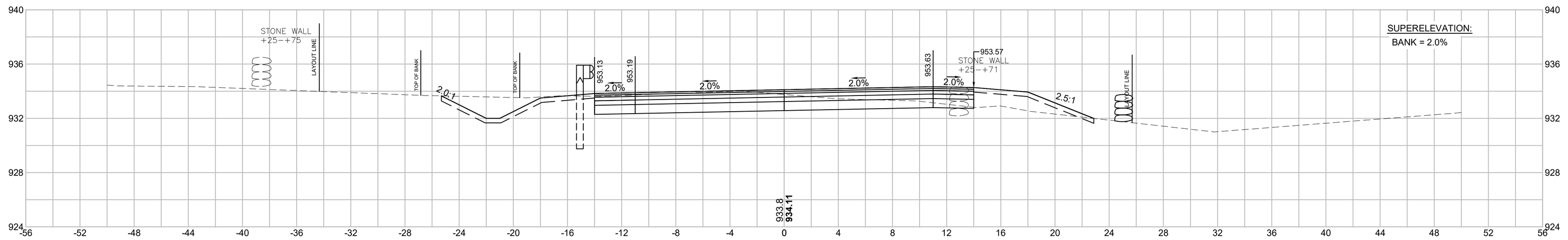
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	118	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

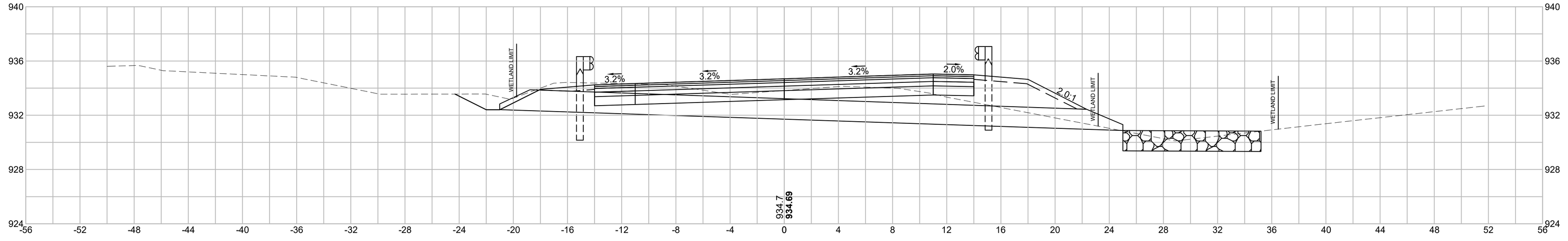
CROSS SECTIONS

43+94.64



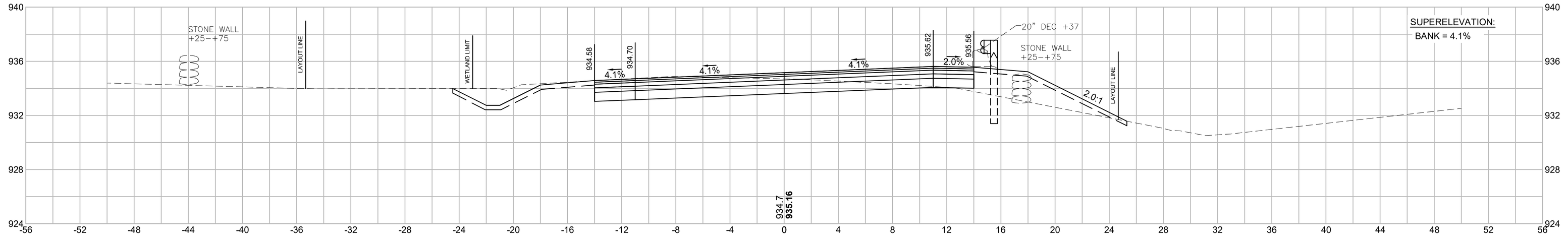
Cut: 39.15 S.F.
Fill: 8.87 S.F.

43+70 (SECTION CUT ALONG CENTERLINE OF PROPOSED CULVERT)



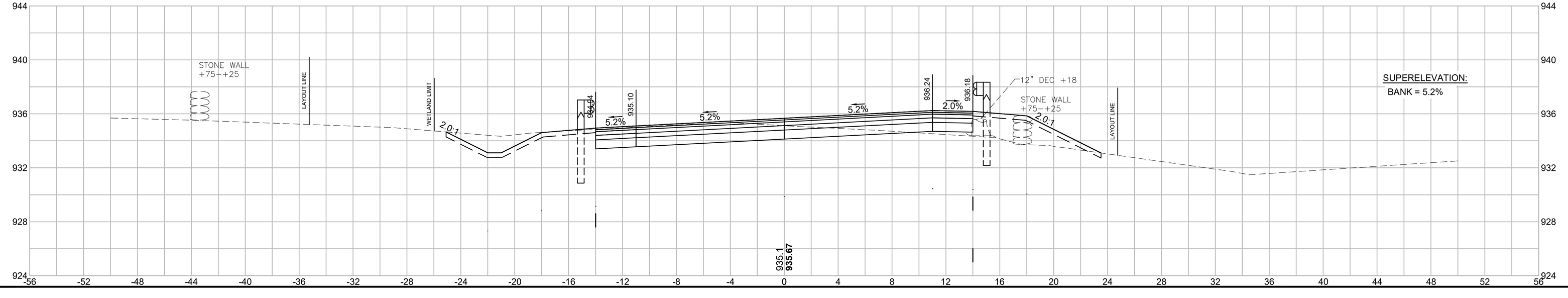
Cut: 96.36 S.F.
Fill: 12.89 S.F.

43+50



Cut: 35.54 S.F.
Fill: 16.37 S.F.

43+28.17



Cut: 33.29 S.F.
Fill: 14.32 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:52 AM
Proposal No. 608163-128112
A00860 - 479

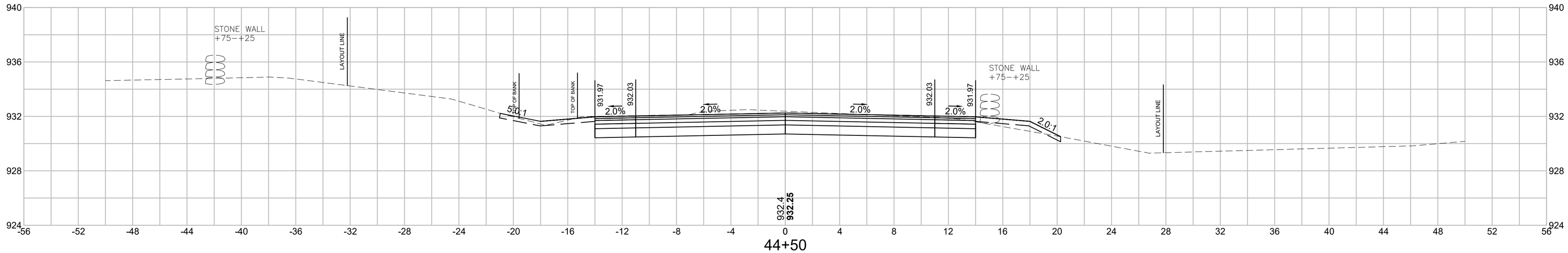
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	119	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

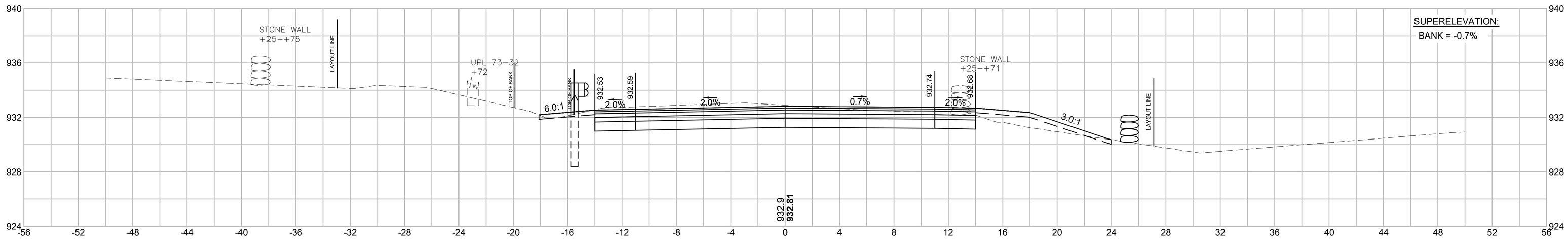
CROSS SECTIONS

44+77.71



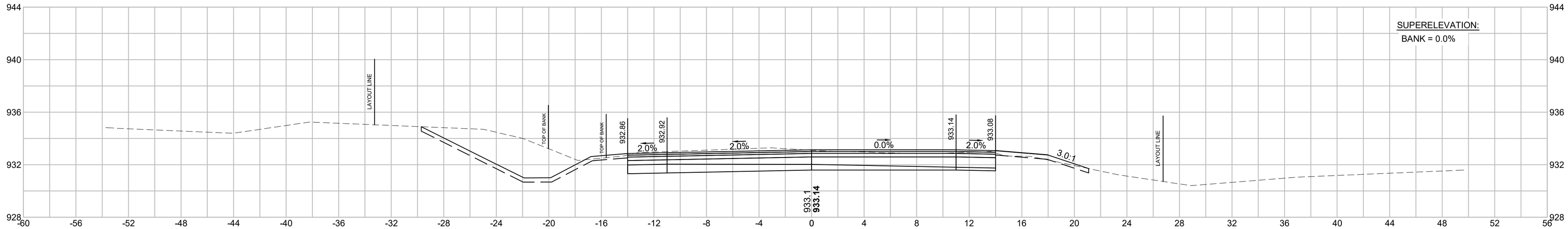
Cut: 46.50 S.F.
Fill: 3.76 S.F.

44+50



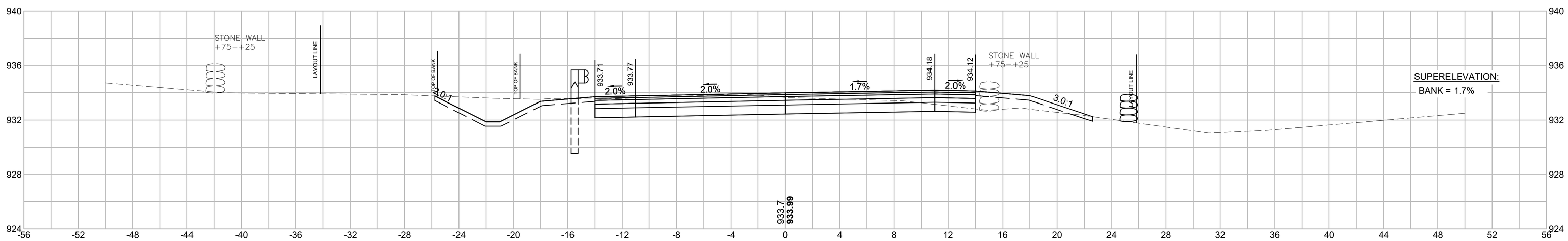
Cut: 44.21 S.F.
Fill: 7.53 S.F.

44+36.17



Cut: 68.48 S.F.
Fill: 2.27 S.F.

44+00



Cut: 43.43 S.F.
Fill: 7.01 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:53 AM
Proposal No. 608163-128112
A080969 - 490

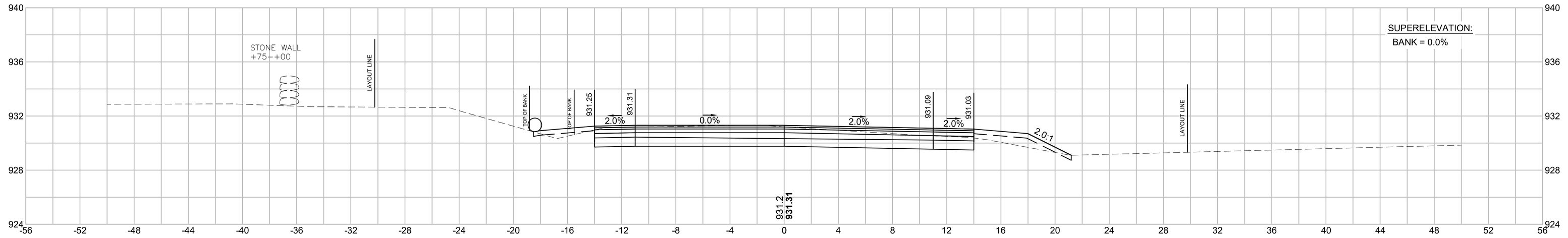
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	120	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

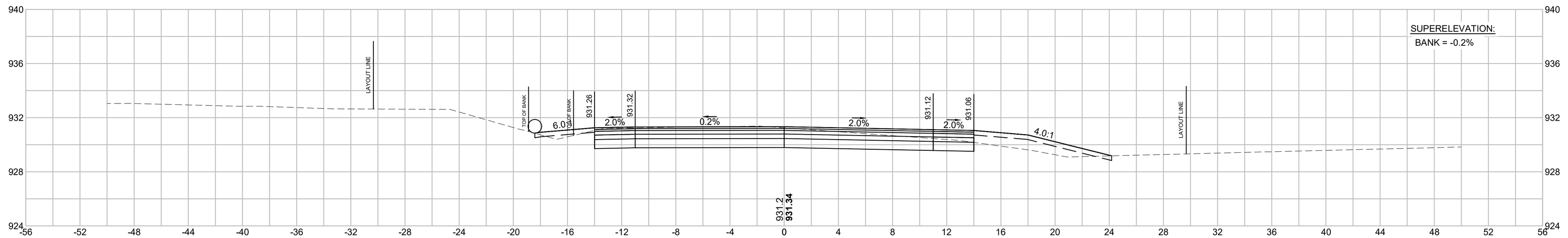
CROSS SECTIONS

45+53.68



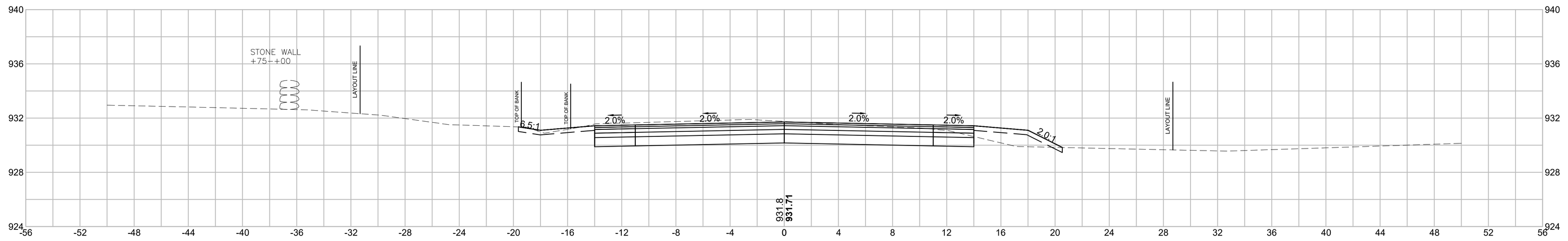
Cut: 36.97 S.F.
Fill: 6.85 S.F.

45+50



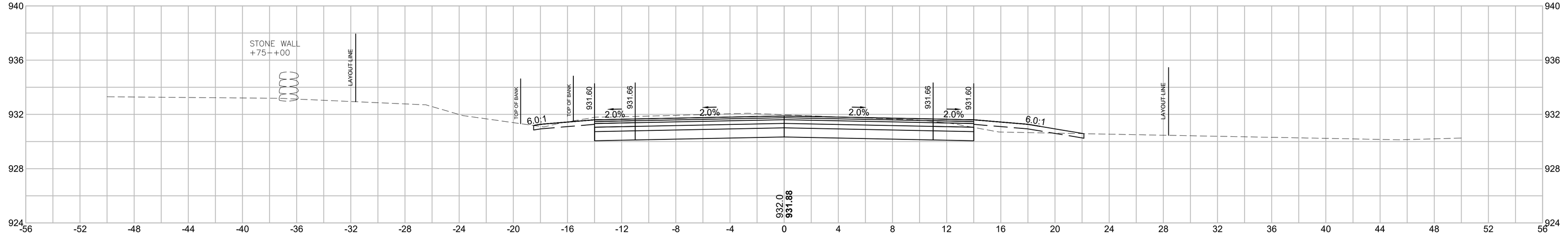
Cut: 36.74 S.F.
Fill: 10.03 S.F.

45+12.31



Cut: 44.45 S.F.
Fill: 6.26 S.F.

45+00



Cut: 46.70 S.F.
Fill: 4.16 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:54 AM
Proposal No. 608163-128112
A080069 - 481

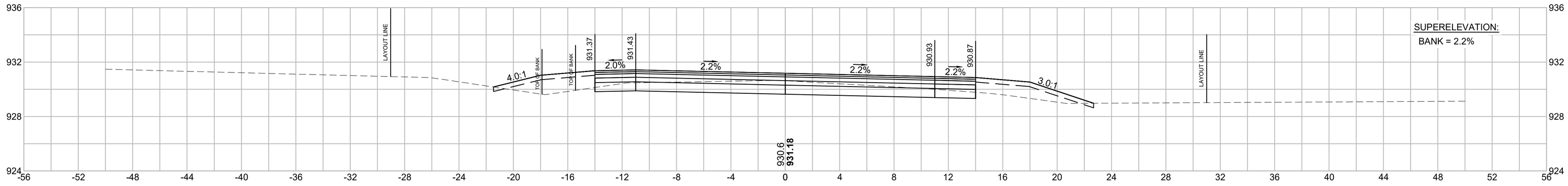
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	121	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

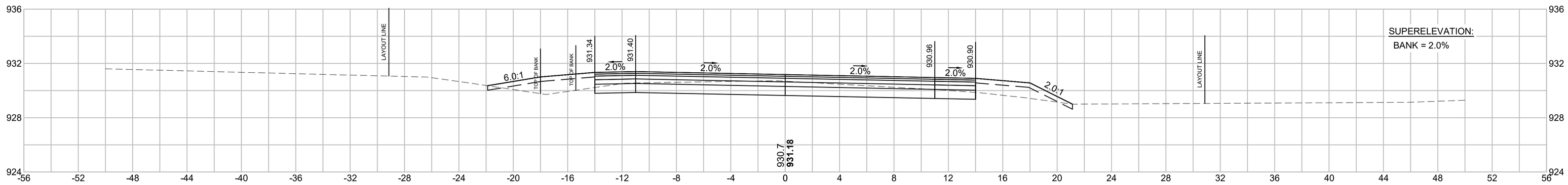
CROSS SECTIONS

46+00



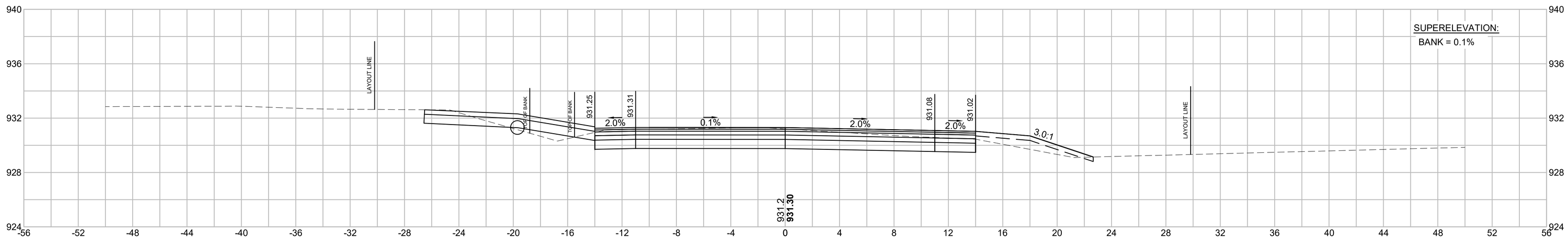
Cut: 21.13 S.F.
Fill: 15.44 S.F.

45+95.04



Cut: 23.29 S.F.
Fill: 13.40 S.F.

45+55



Cut: 41.69 S.F.
Fill: 7.24 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:55 AM
Proposal No. 608163-128112
A00060 - 482

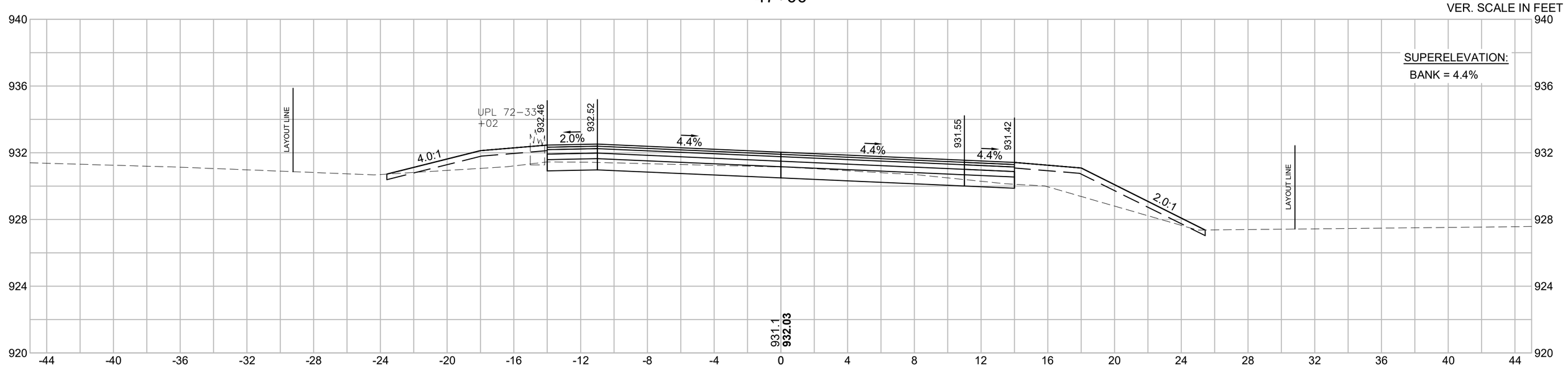
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	122	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

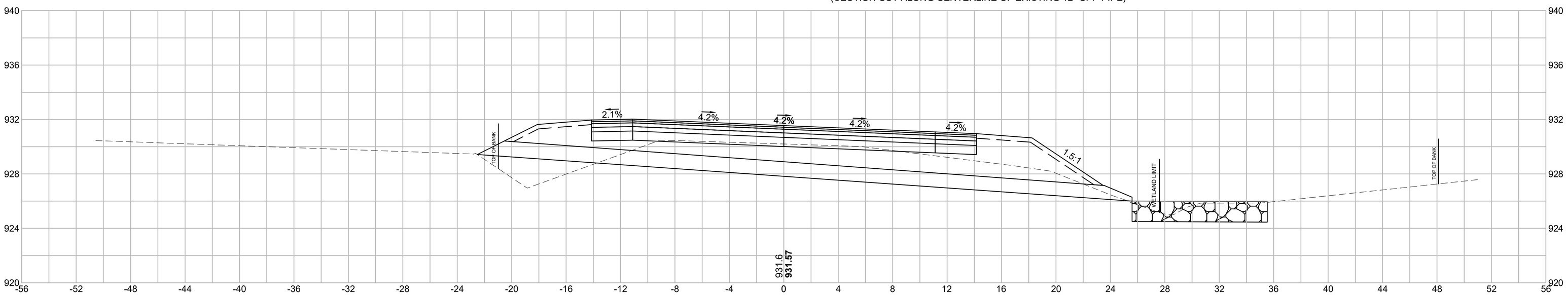
47+00



Cut: 15.09 S.F.
Fill: 19.53 S.F.

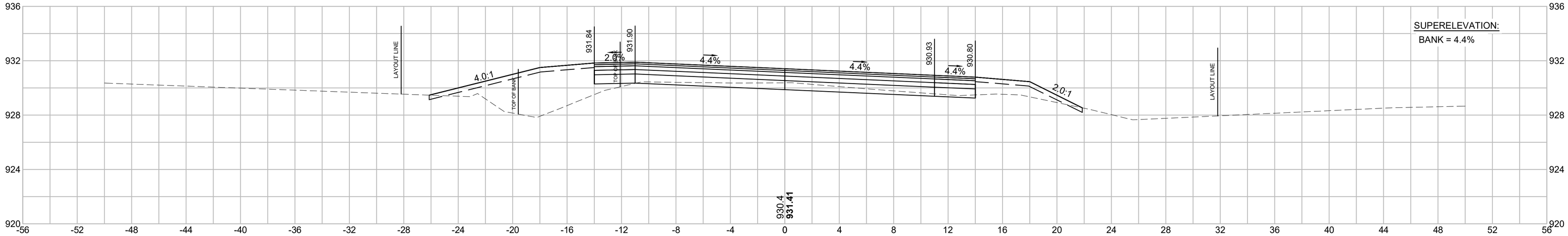
46+64.76

(SECTION CUT ALONG CENTERLINE OF EXISTING 12" CPP PIPE)



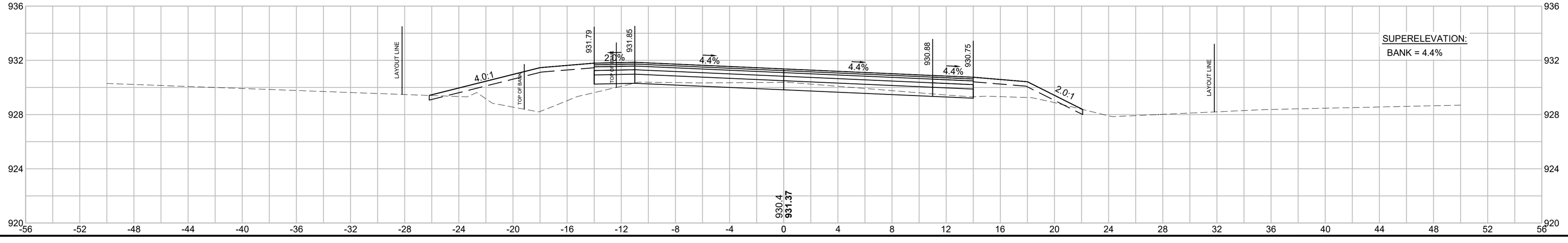
Cut: 85.75 S.F.
Fill: 36.70 S.F.

46+50



Cut: 7.89 S.F.
Fill: 32.80 S.F.

46+44.68



Cut: 8.27 S.F.
Fill: 30.60 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:56 AM
Proposal No. 608163-128112
A00060 - 483

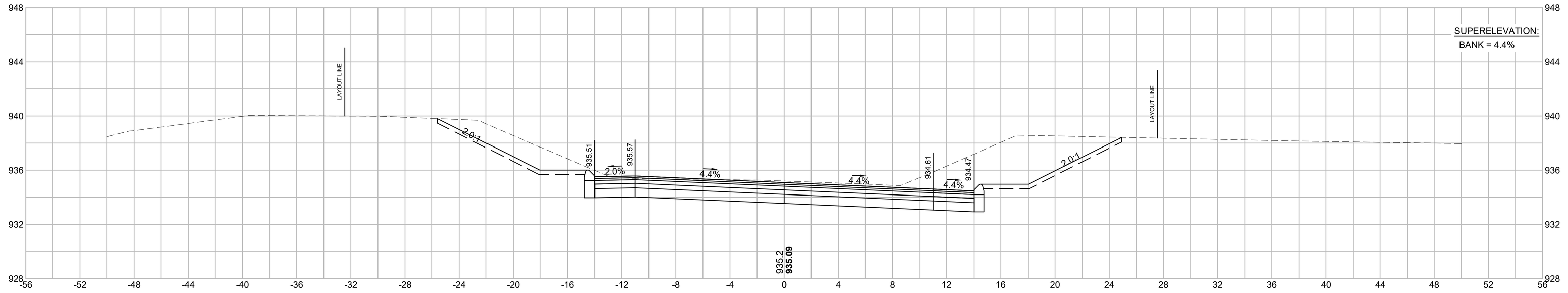
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	123	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

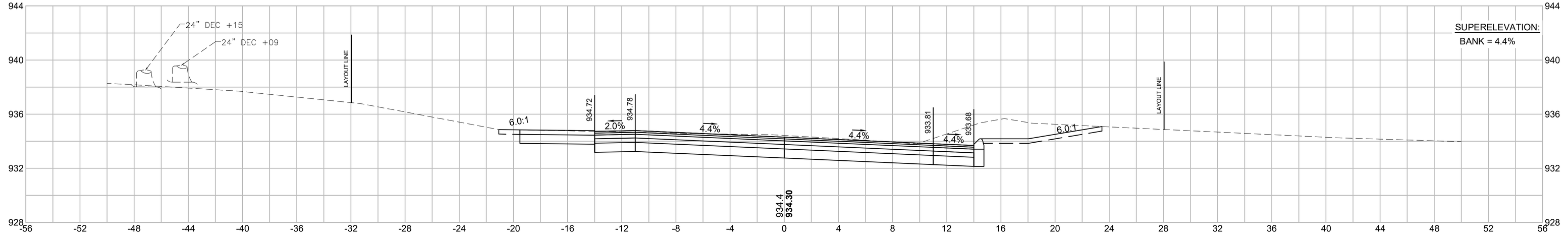
CROSS SECTIONS

48+50



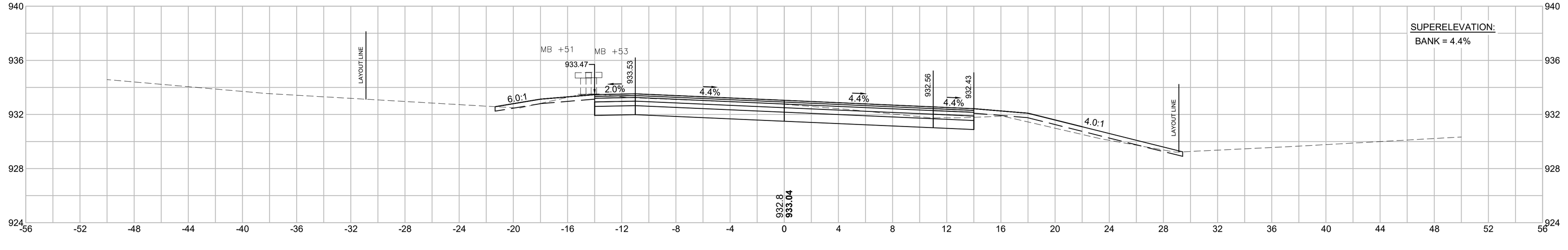
Cut: 99.45 S.F.
Fill: 0.0 S.F.

48+00



Cut: 65.42 S.F.
Fill: 0.0 S.F.

47+50



Cut: 33.23 S.F.
Fill: 8.51 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:57 AM

Proposal No. 608163-128112

V:\608000 - 609000\608163\Design\Roadway\Grading\608163_HD10(XSC_GRADINGCALC).DWG

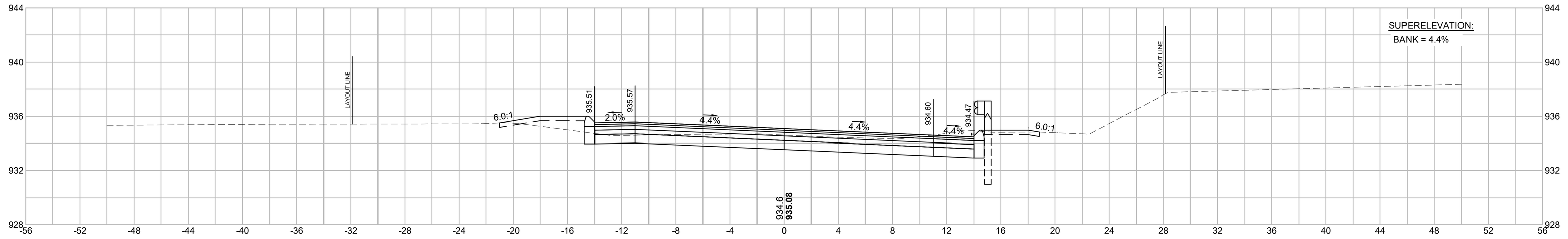
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	124	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

CROSS SECTIONS

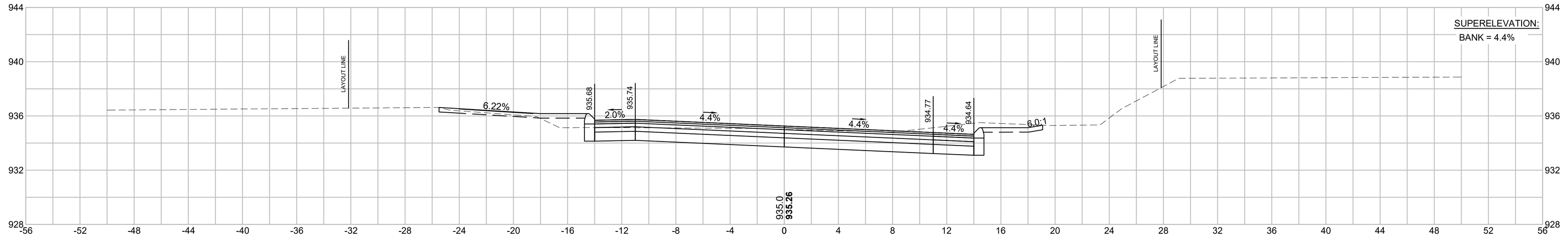
49+41.72



Cut: 32.76 S.F.
Fill: 4.71 S.F.

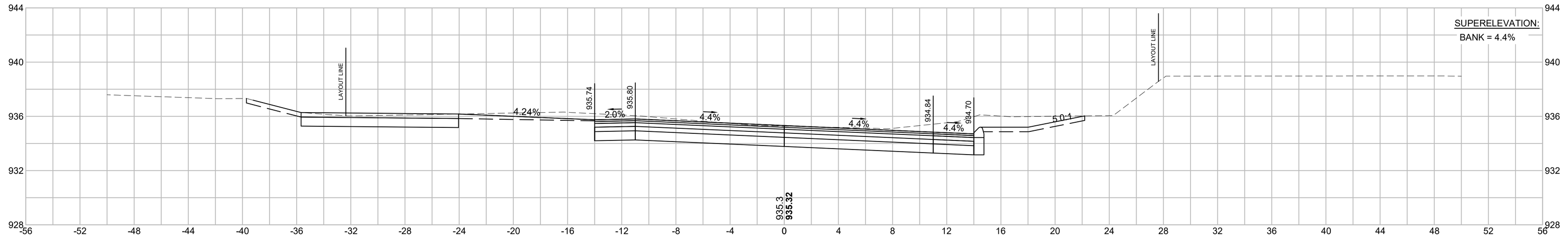
46+44.68

49+20



Cut: 43.69 S.F.
Fill: 4.33 S.F.

49+00



Cut: 74.36 S.F.
Fill: 0.0 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:58 AM
Proposal No. 608163-128112
AV08600 - 485

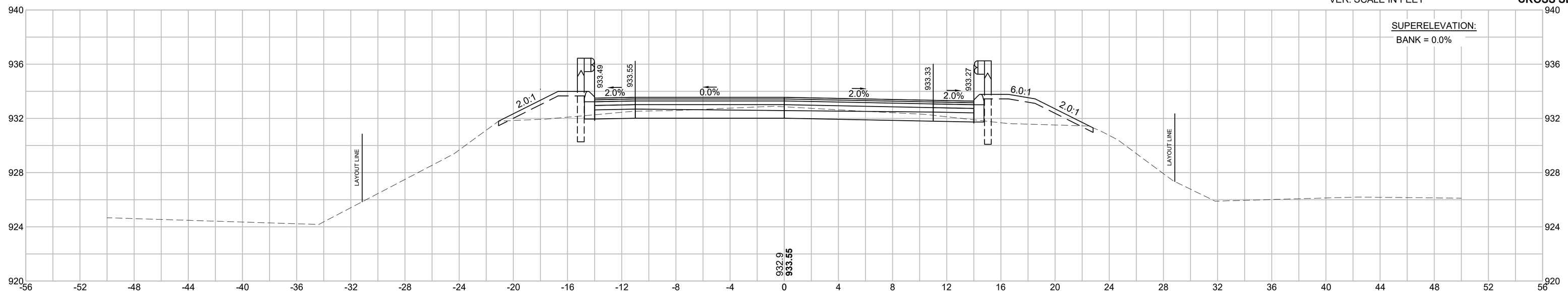
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	125	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

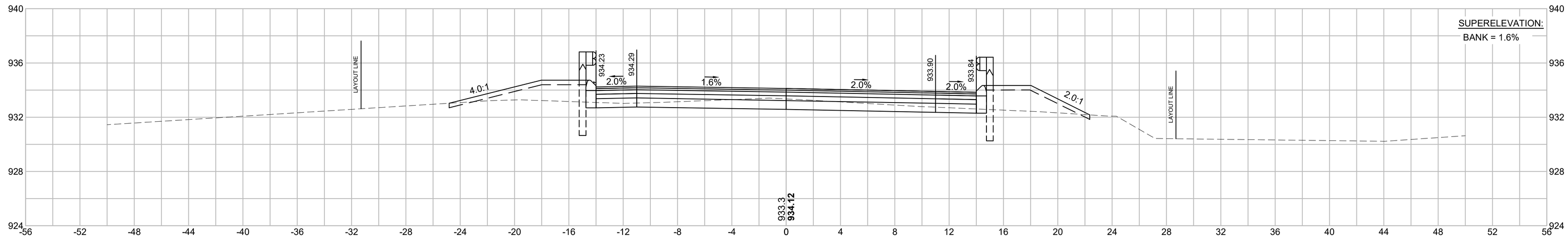
CROSS SECTIONS

50+32.72



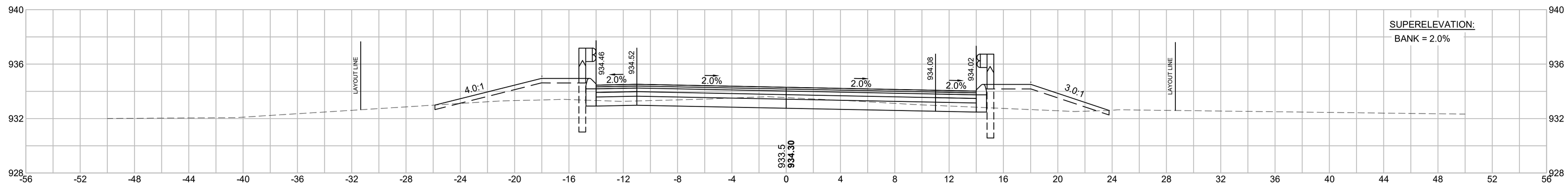
Cut: 17.50 S.F.
Fill: 19.59 S.F.

50+00



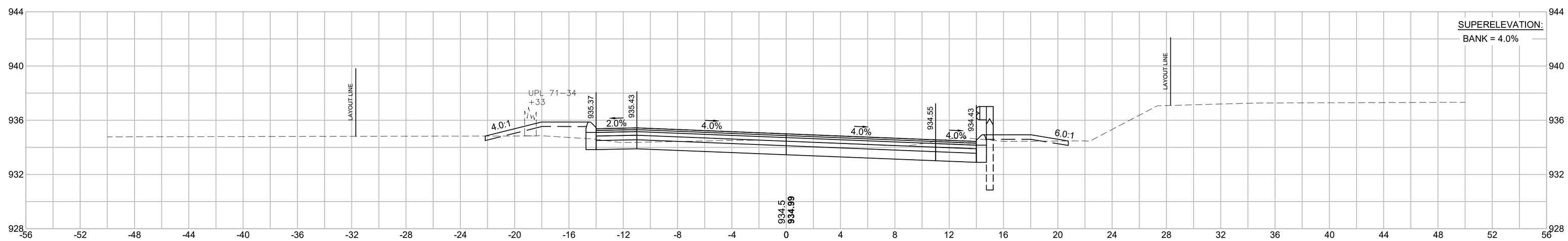
Cut: 15.56 S.F.
Fill: 19.90 S.F.

49+91.35



Cut: 16.43 S.F.
Fill: 22.60 S.F.

49+50



Cut: 29.22 S.F.
Fill: 8.02 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:58 AM

Proposal No. 608163-128112

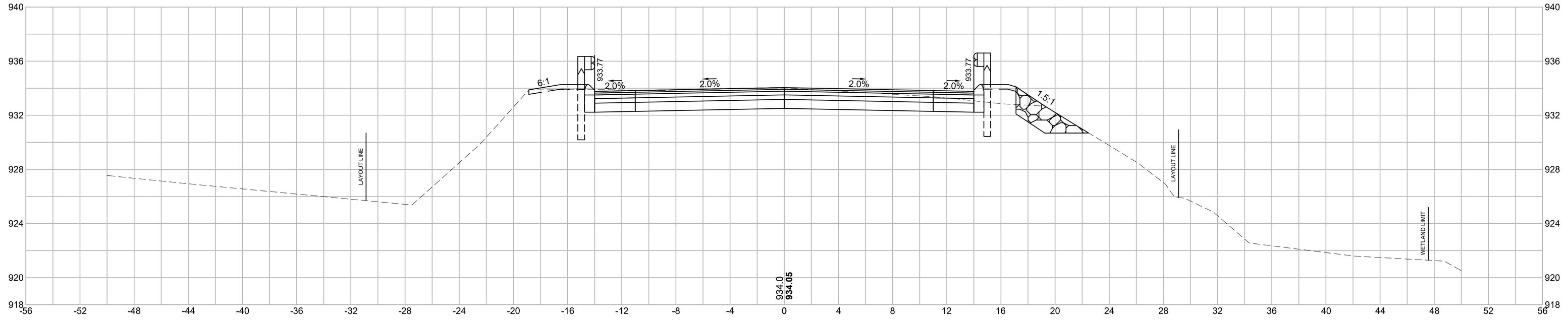
AV08080 - 486

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	126	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

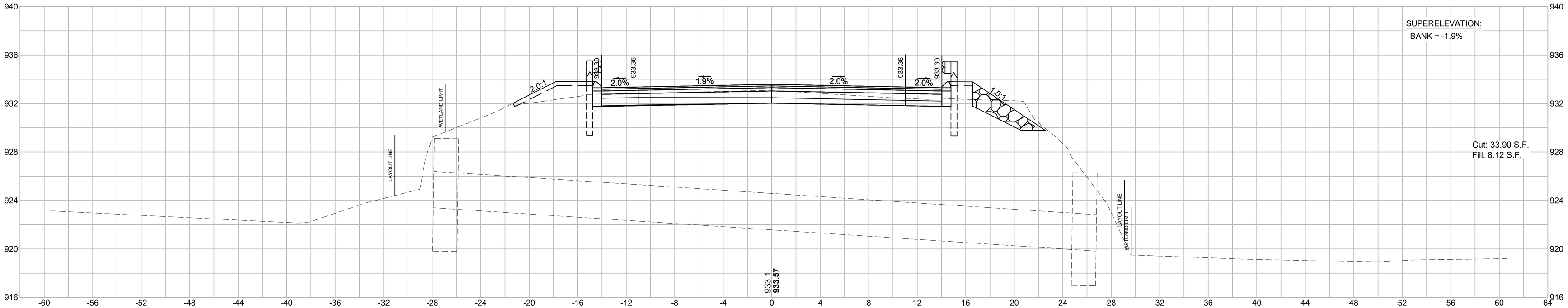
CROSS SECTIONS

51+00



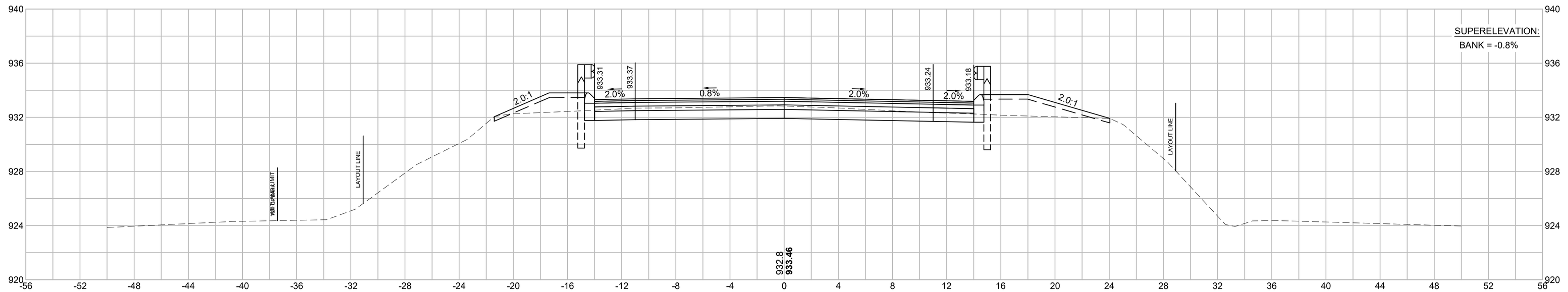
Cut: 47.14 S.F.
Fill: 4.41 S.F.

50+72.94 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)



Cut: 33.90 S.F.
Fill: 8.12 S.F.

50+50



Cut: 24.21 S.F.
Fill: 16.09 S.F.

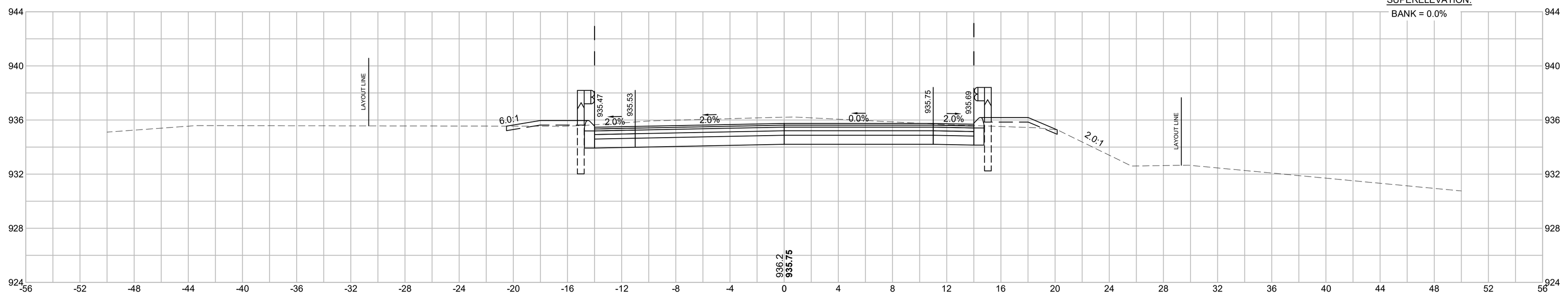
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 11:59 AM
Proposal No. 608163-128112
AUG0840 - 487

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	127	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

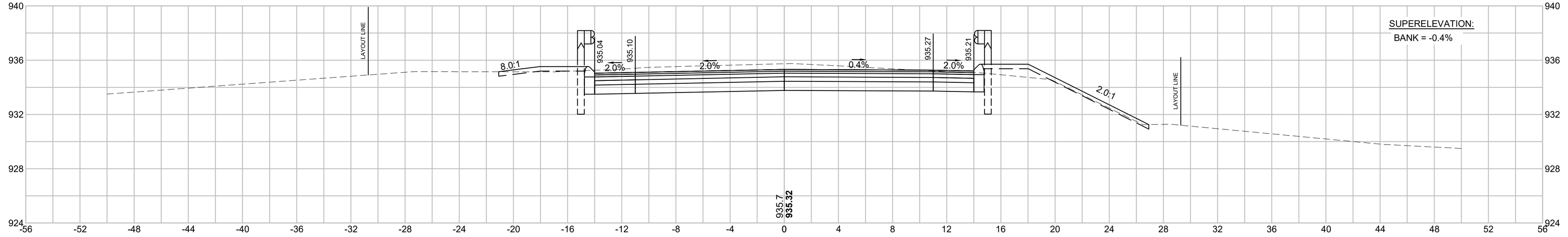
CROSS SECTIONS

51+46.26



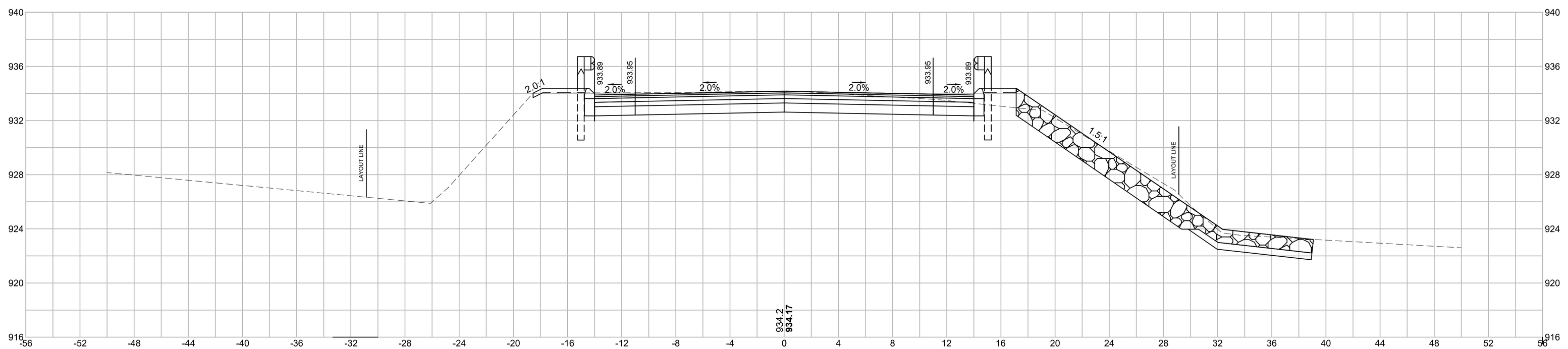
Cut: 53.78.F.
Fill: 4.89 S.F.

51+36.93



Cut: 53.16 S.F.
Fill: 7.35 S.F.

51+04.68



Cut: 76.43 S.F.
Fill: 4.20 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:00 PM
Proposal No. 608163-128112
A0008AD - 486

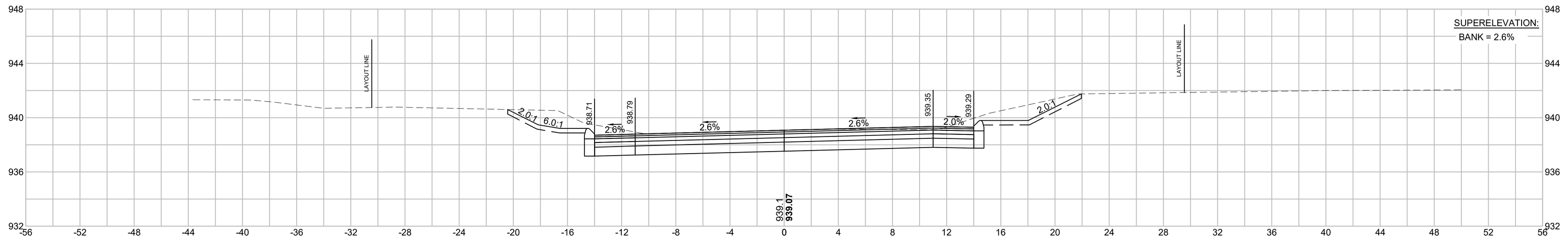
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	128	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

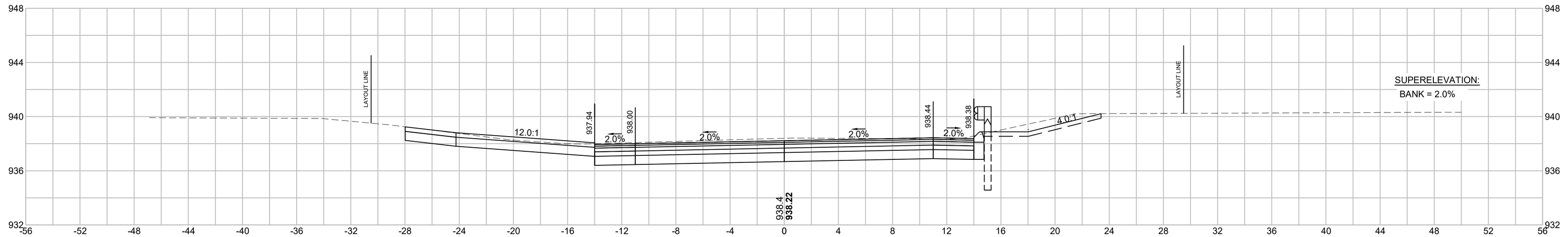
CROSS SECTIONS

52+00



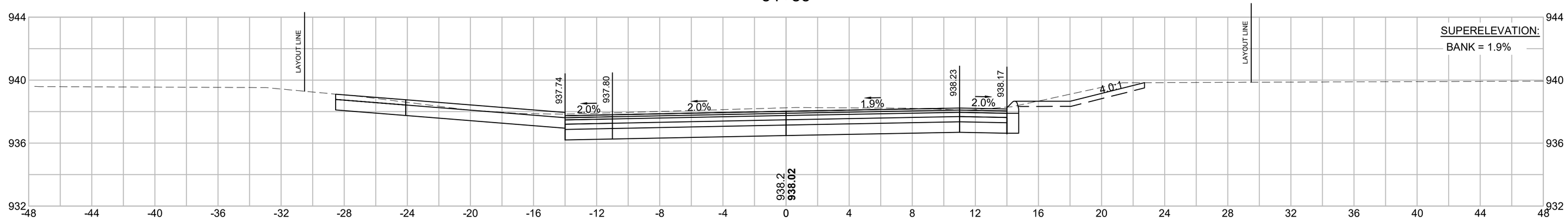
Cut: 61.59 S.F.
Fill: 0.0 S.F.

51+87.84



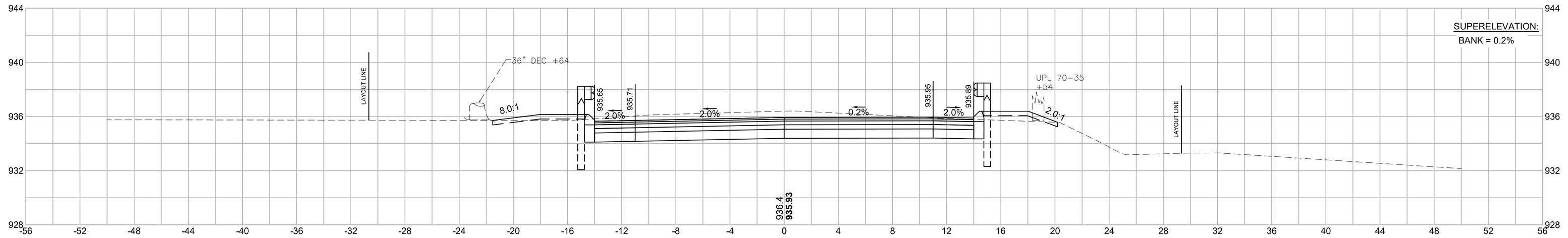
Cut: 64.63 S.F.
Fill: 0.06 S.F.

51+85



Cut: 63.86 S.F.
Fill: 0.19 S.F.

51+50



Cut: 53.71 S.F.
Fill: 5.29 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:01 PM
Proposal No. 608163-128112
AW0809 - 489

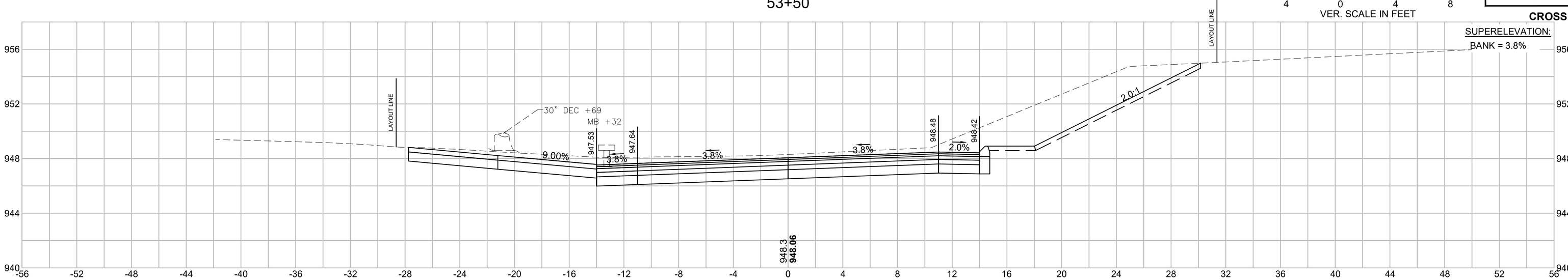
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	129	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

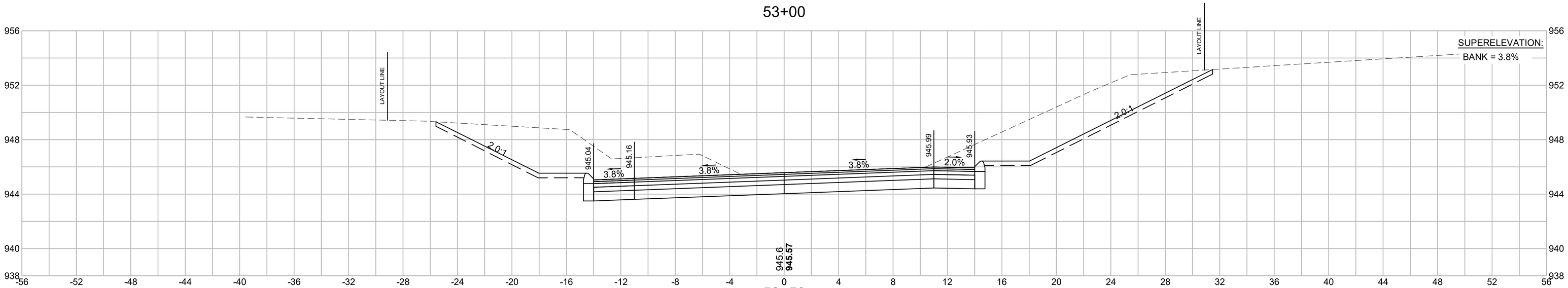
CROSS SECTIONS

53+50



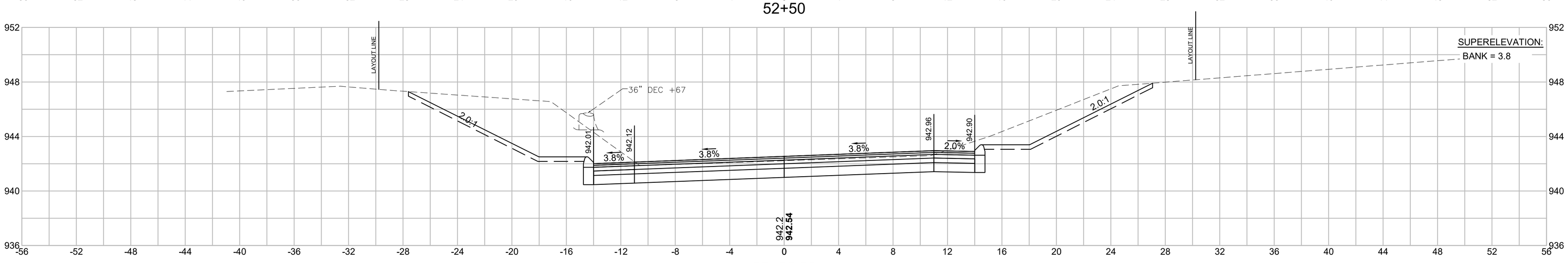
Cut: 113.21 S.F.
Fill: 0.0 S.F.

53+00



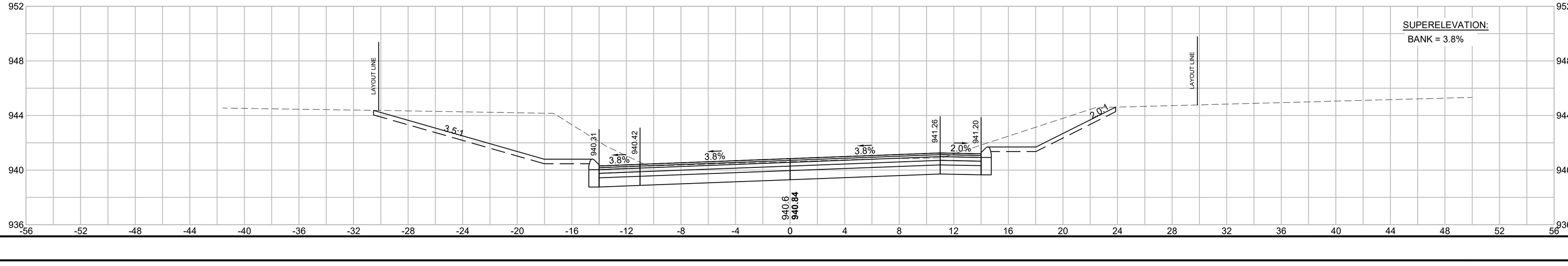
Cut: 136.50 S.F.
Fill: 0.0 S.F.

52+50



Cut: 99.13 S.F.
Fill: 0.0 S.F.

52+25.26



Cut: 92.26 S.F.
Fill: 0.0 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:02 PM
Proposal No. 608163-128112
AN08060 - 490

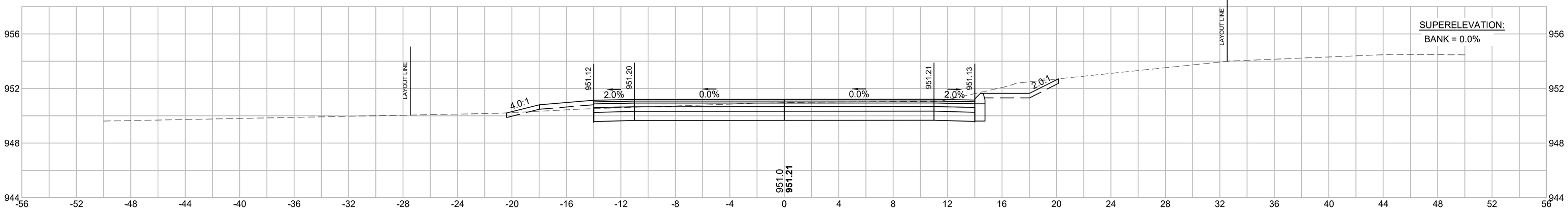
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	130	180
PROJECT FILE NO.	608163		

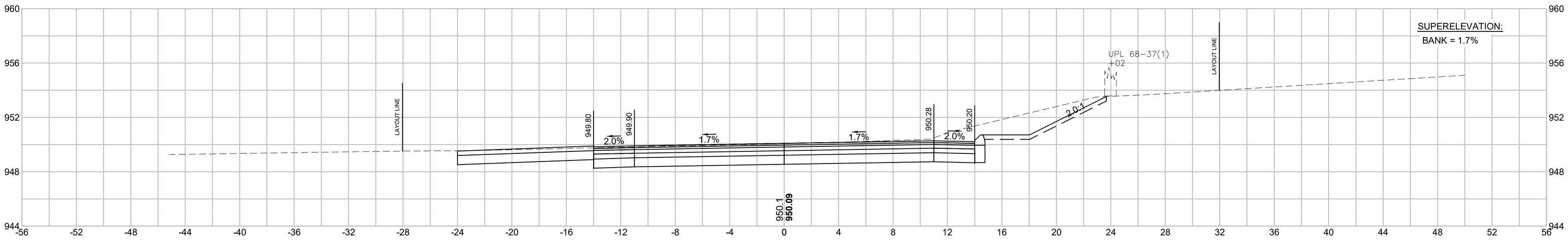
CROSS SECTIONS

54+42.60



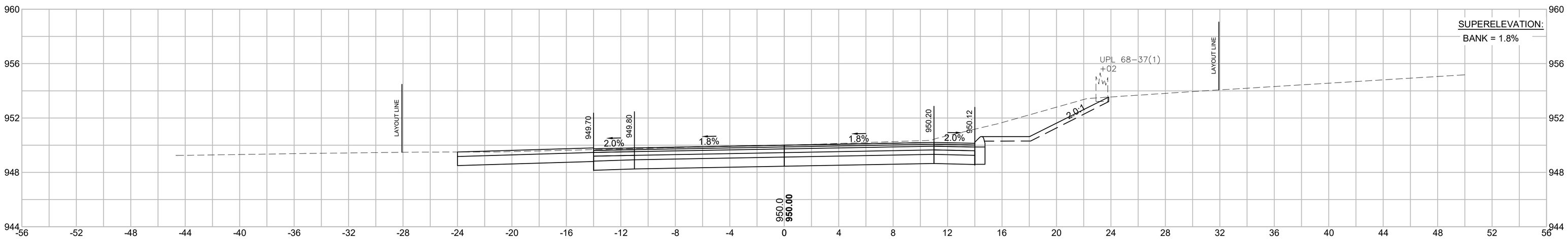
Cut: 41.4 S.F.
Fill: 2.74 S.F.

54+02.82



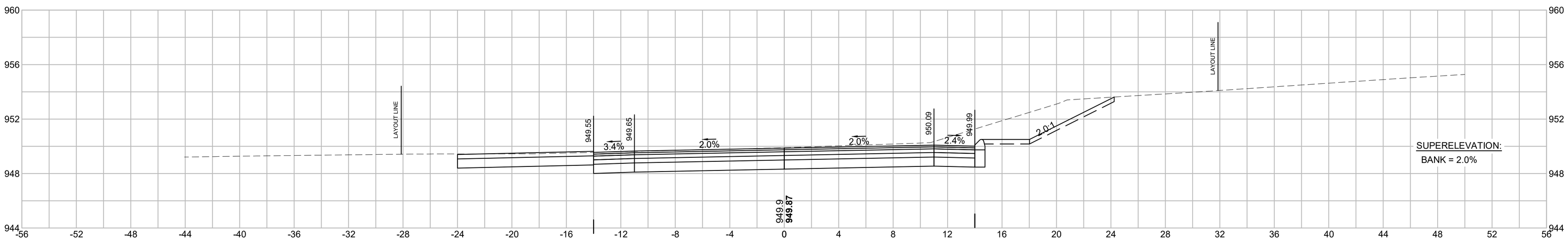
Cut: 68.48 S.F.
Fill: 0.0 S.F.

54+00



Cut: 69.10 S.F.
Fill: 0.0 S.F.

53+96.21



Cut: 74.18 S.F.
Fill: 0.0 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:03 PM
Proposal No. 608163-128112
A080609 - 491

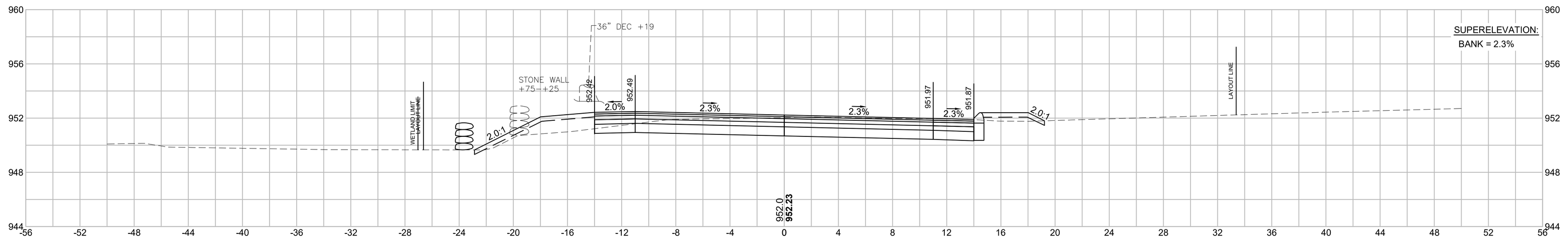
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	131	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

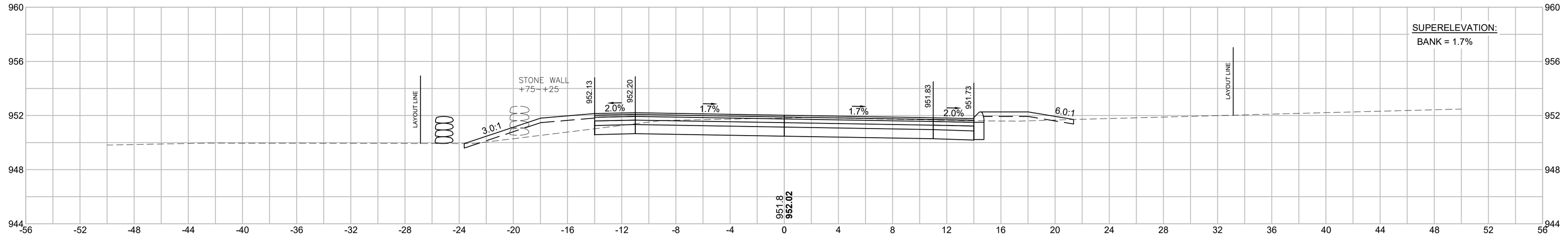
CROSS SECTIONS

55+00



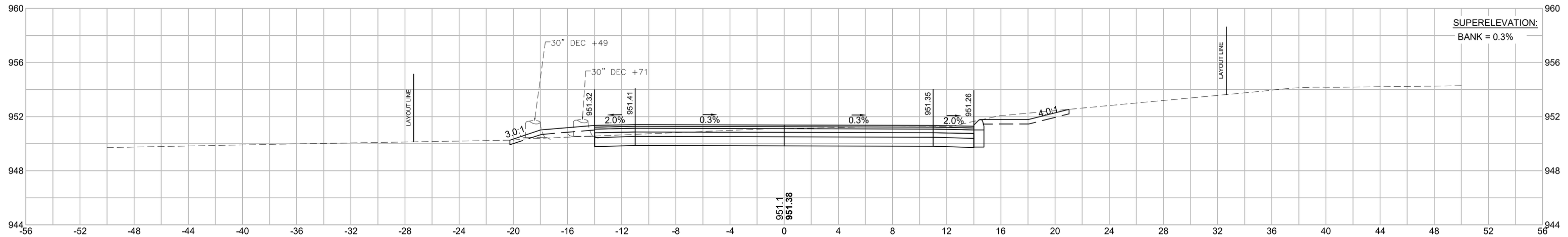
Cut: 35.75 S.F.
Fill: 10.35 S.F.

54+84.79



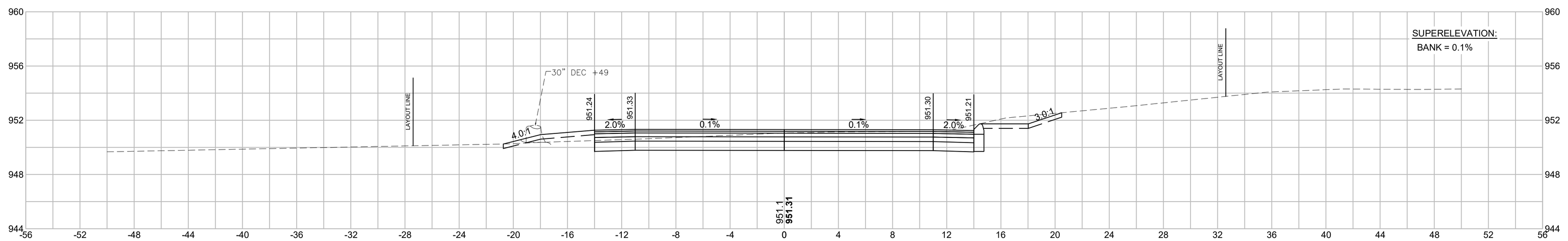
Cut: 35.3 S.F.
Fill: 11.90 S.F.

54+50



Cut: 39.68 S.F.
Fill: 3.47 S.F.

54+47.11



Cut: 39.59 S.F.
Fill: 3.46 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:04 PM
Proposal No. 608163-128112
A080809 - 492

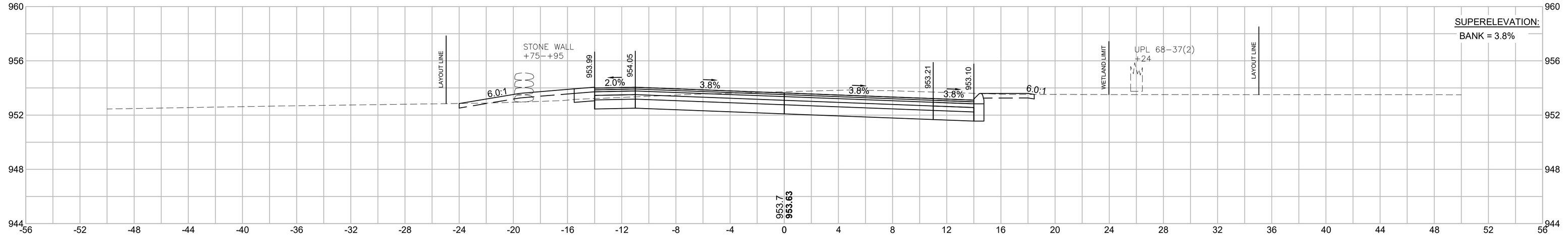
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	132	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

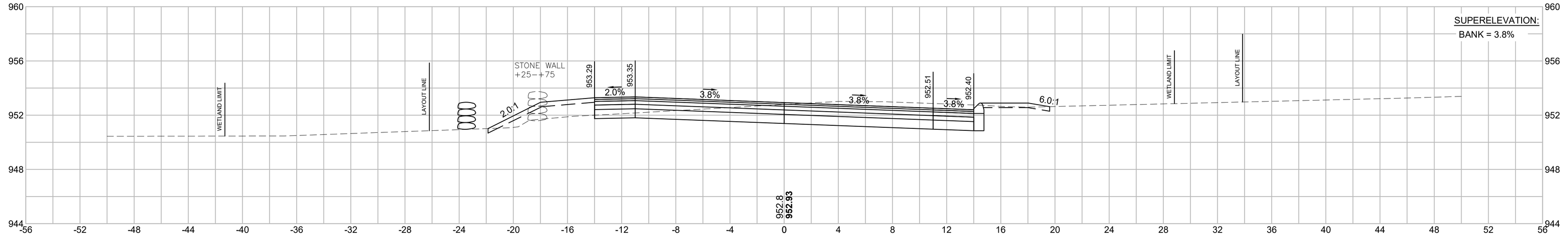
CROSS SECTIONS

56+00



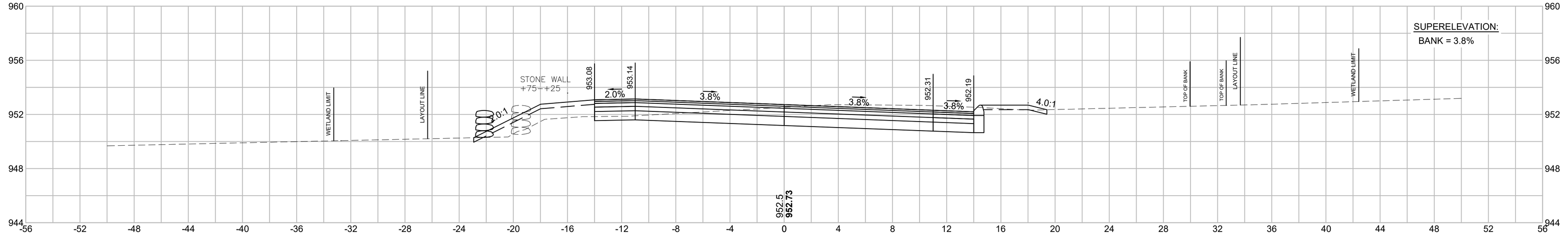
Cut: 46.20 S.F.
Fill: 4.56 S.F.

55+50



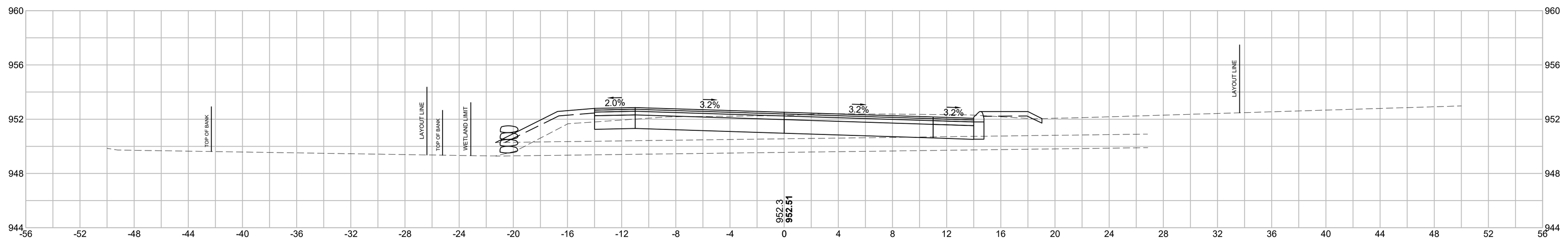
Cut: 37.71 S.F.
Fill: 8.90 S.F.

55+35.44



Cut: 36.3 S.F.
Fill: 10.40 S.F.

55+20



Cut: 36.90 S.F.
Fill: 8.64 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:05 PM
Proposal No. 608163-128112
A00060 - 493

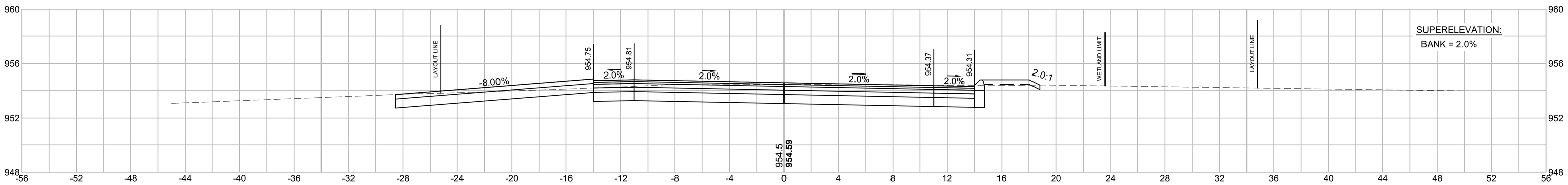
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	133	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

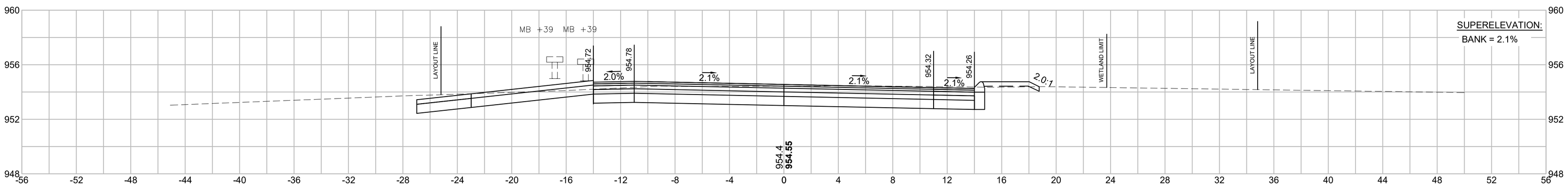
CROSS SECTIONS

56+51.60



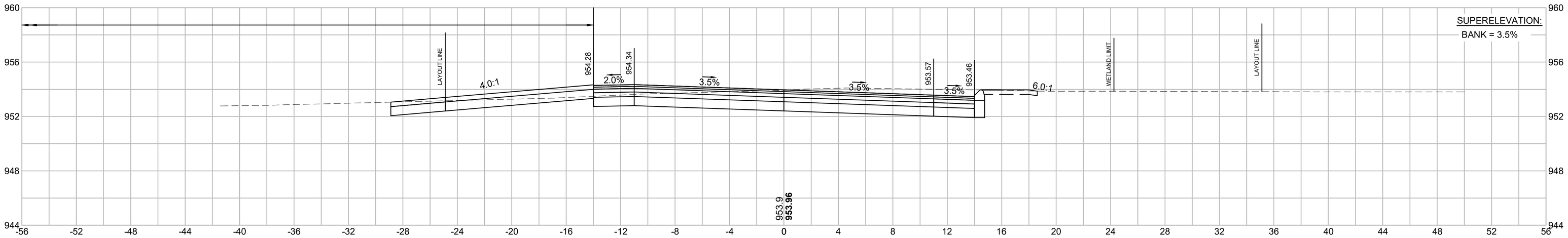
Cut: 49.56 S.F.
Fill: 1.53 S.F.

56+50



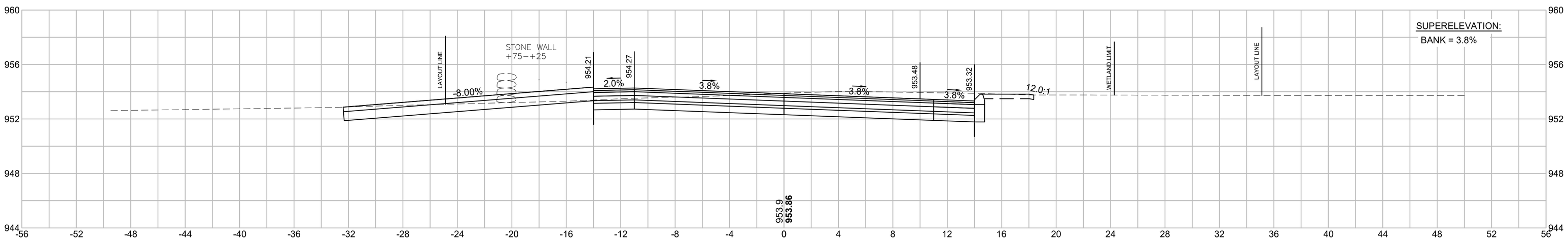
Cut: 51.20 S.F.
Fill: 1.46 S.F.

56+20



Cut: 52.22 S.F.
Fill: 0.16 S.F.

56+14.18



Cut: 54.10 S.F.
Fill: 0.06 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:06 PM
Proposal No. 608163-128112
A00060 - 494

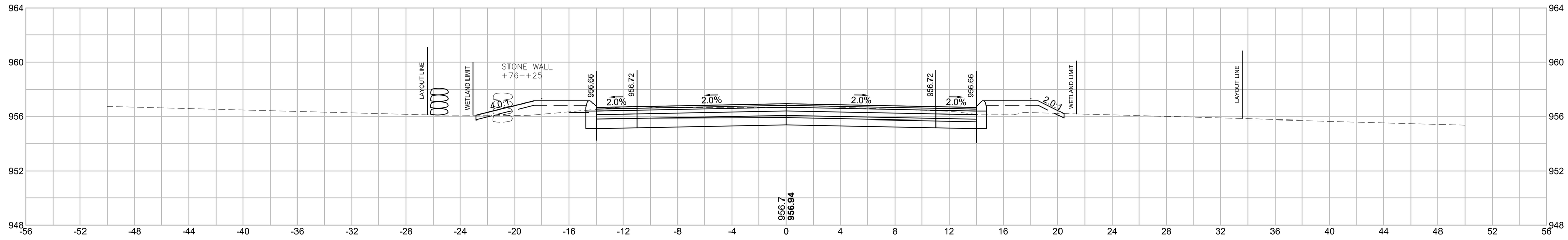
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	134	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

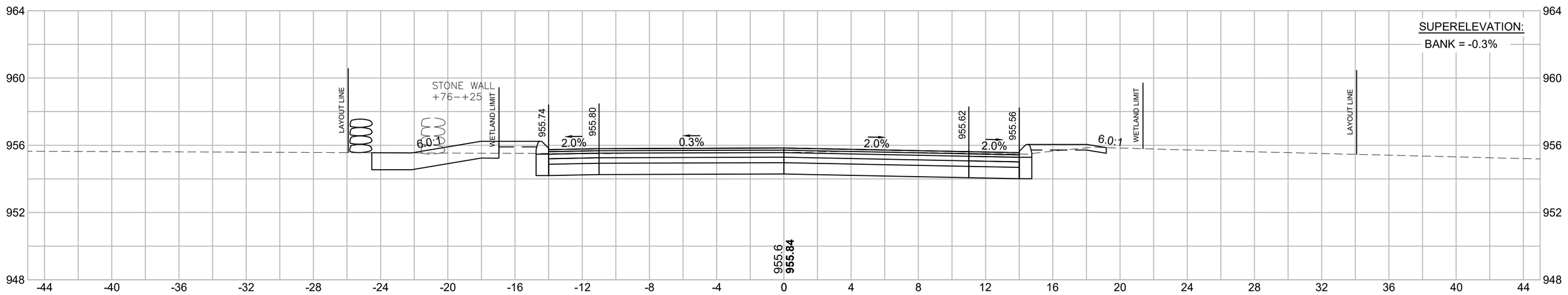
CROSS SECTIONS

57+34.75



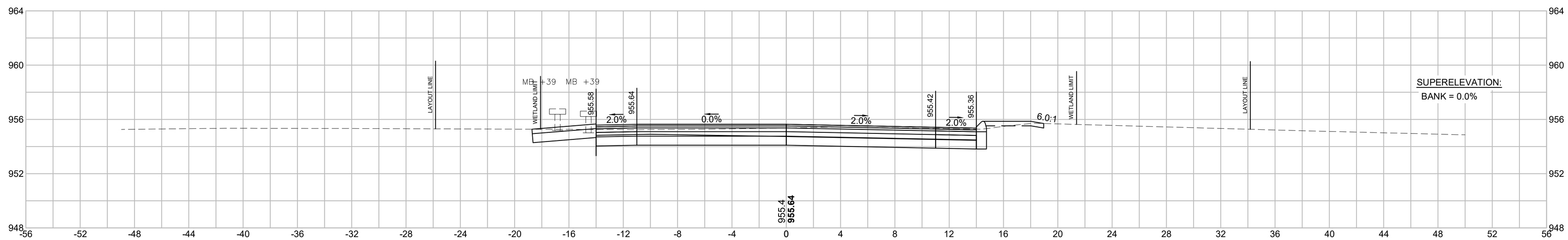
Cut: 39.6 S.F.
Fill: 10.37 S.F.

57+00



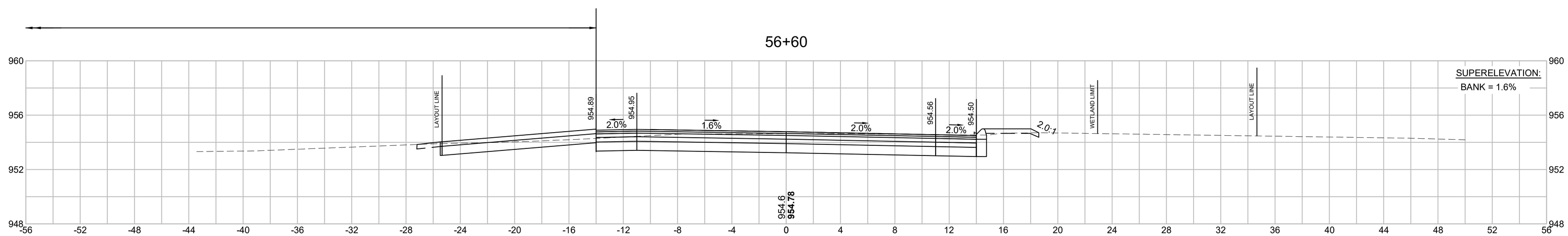
Cut: 40.32 S.F.
Fill: 5.17 S.F.

56+93.18



Cut: 41.77 S.F.
Fill: 1.19 S.F.

56+60



Cut: 46.38 S.F.
Fill: 1.33 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:07 PM
Proposal No. 608163-128112
A0980 - 495

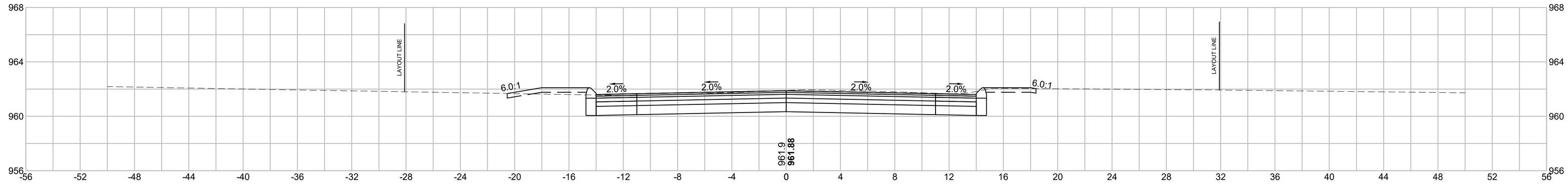
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	135	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

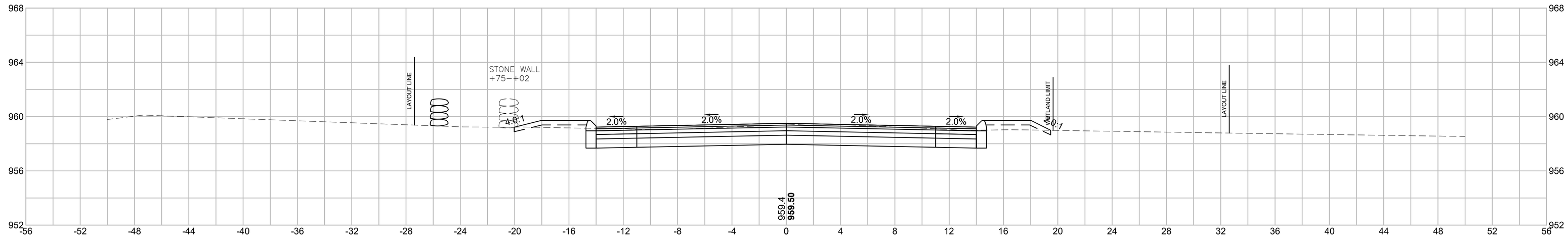
CROSS SECTIONS

58+50



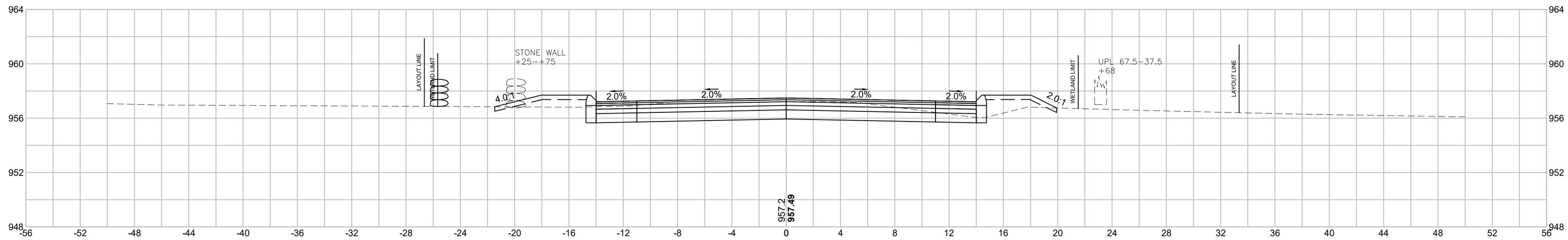
Cut: 47.05 S.F.
Fill: 2.44 S.F.

58+00



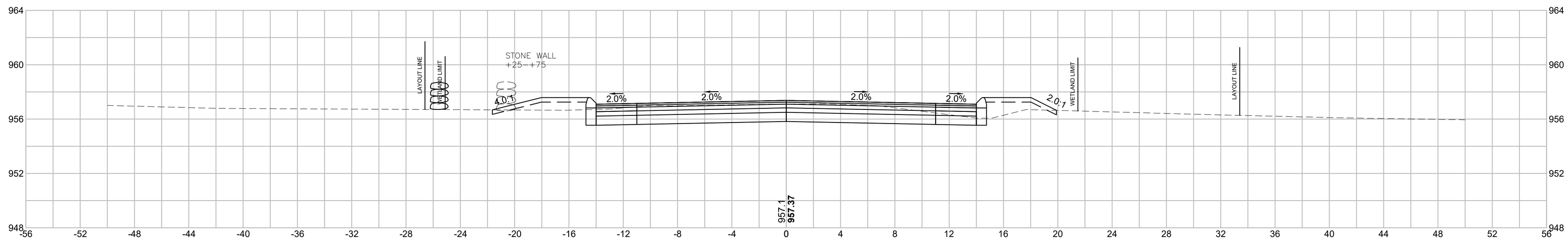
Cut: 41.36 S.F.
Fill: 5.13 S.F.

57+50



Cut: 33.54 S.F.
Fill: 9.34 S.F.

57+46.79



Cut: 35.16 S.F.
Fill: 9.52 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:08 PM
Proposal No. 608163-128112
AM0809 - 49

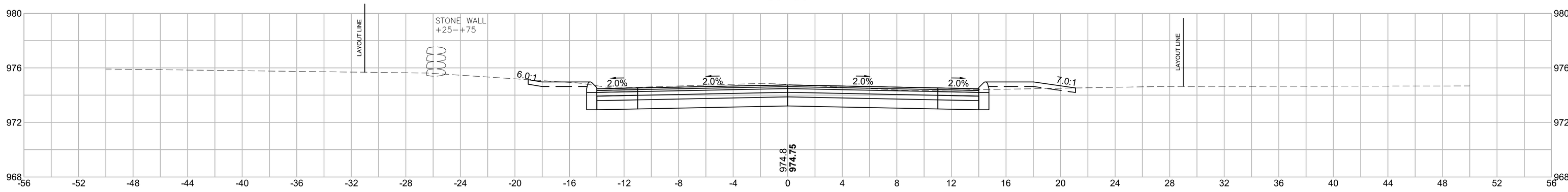
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	136	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

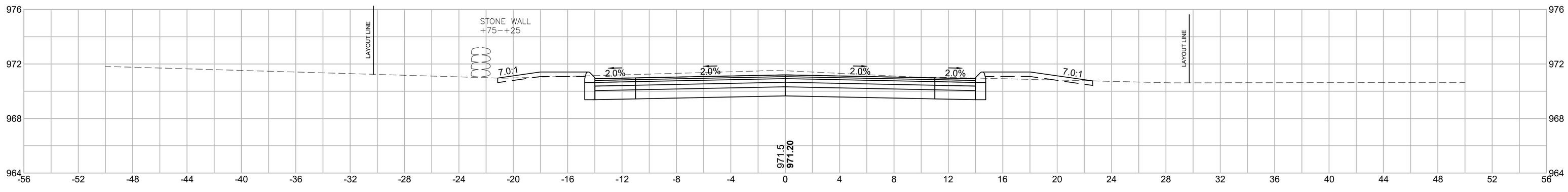
CROSS SECTIONS

60+50



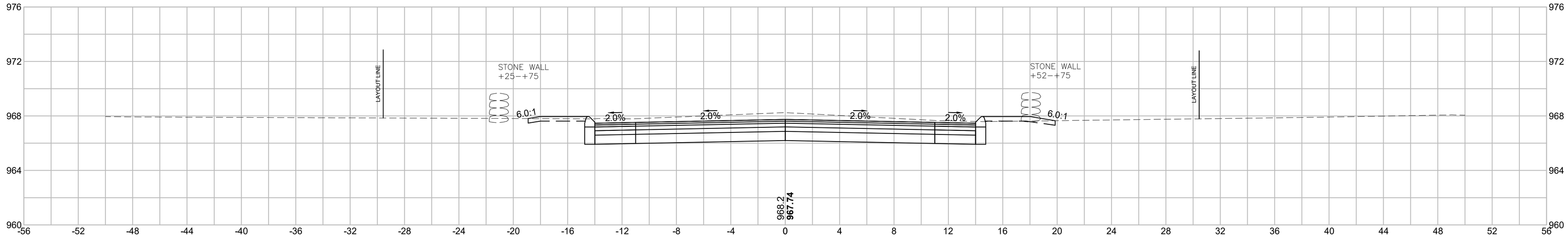
Cut: 47.05 S.F.
Fill: 2.63 S.F.

60+00



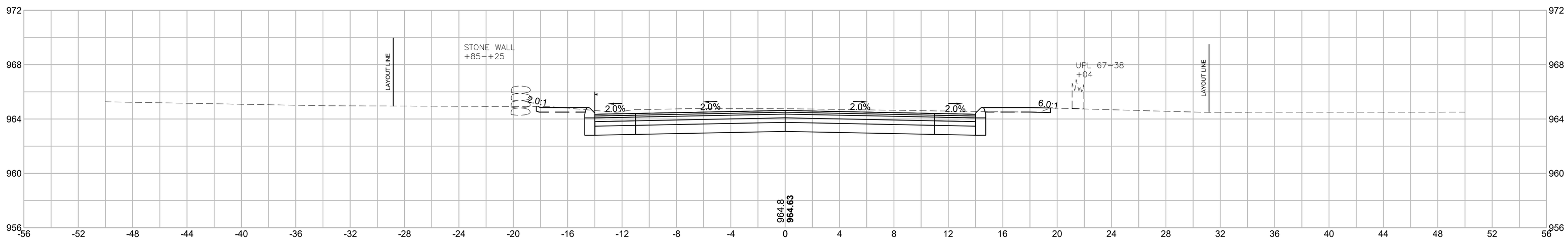
Cut: 52.37 S.F.
Fill: 4.69 S.F.

59+50



Cut: 56.17 S.F.
Fill: 2.10 S.F.

59+00



Cut: 52.50 S.F.
Fill: 1.55 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:19 PM
Proposal No. 608163-128112
AM0060 - 497

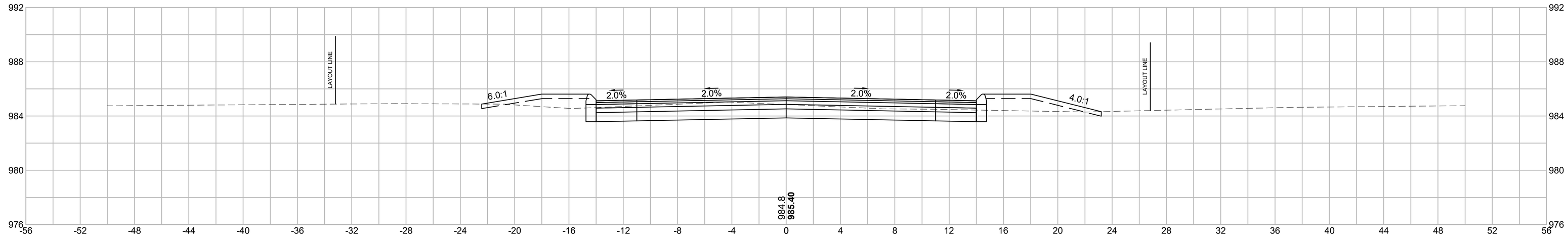
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	137	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

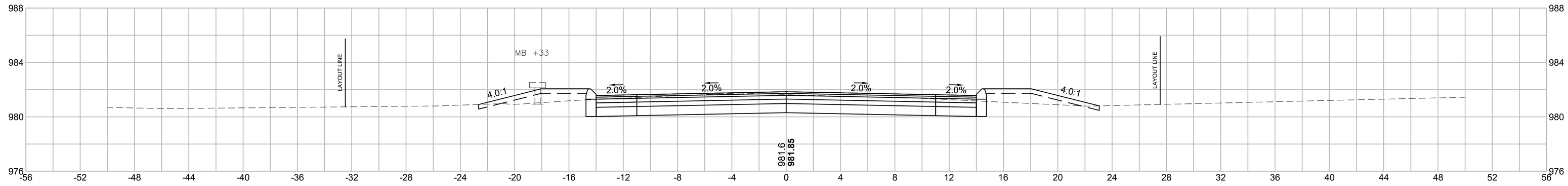
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

62+00



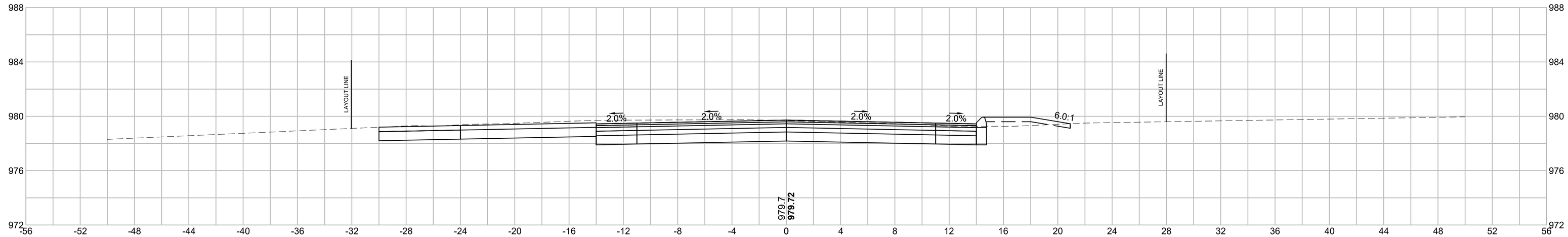
Cut: 30.14 S.F.
Fill: 12.60 S.F.

61+50



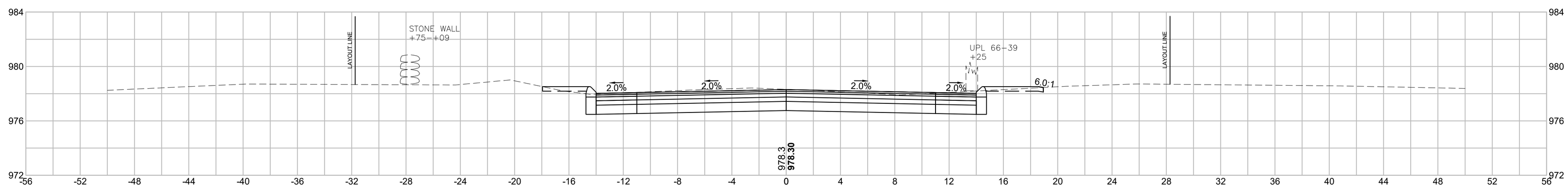
Cut: 39.32 S.F.
Fill: 11.66 S.F.

61+20



Cut: 62.25 S.F.
Fill: 3.10 S.F.

61+00



Cut: 46.67 S.F.
Fill: 1.72 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:20 PM
Proposal No. 608163-128112
AV00850 - 458

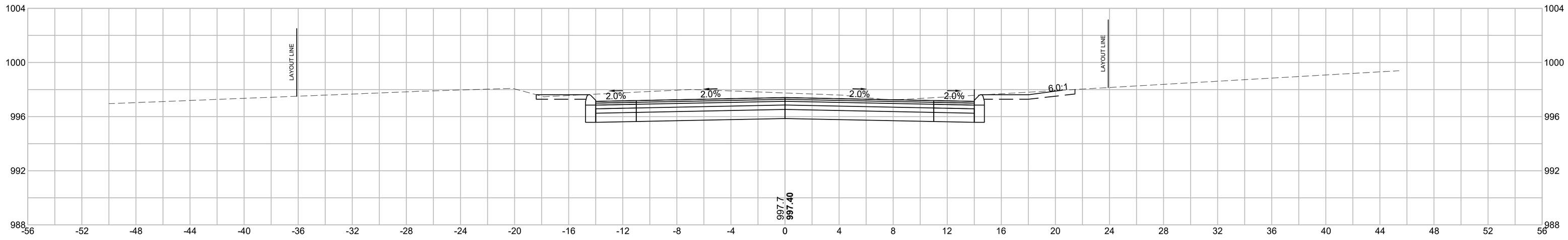
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	138	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

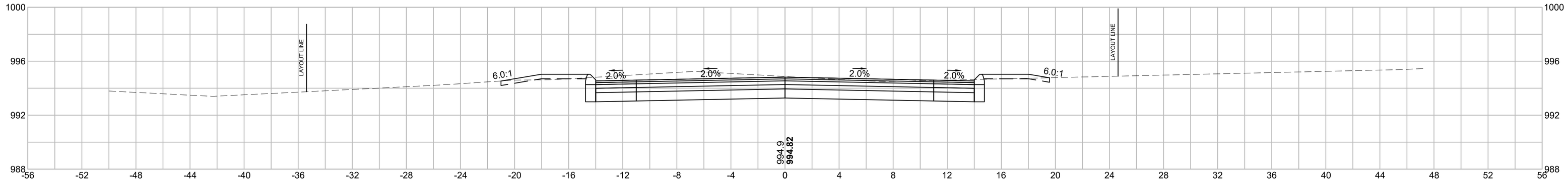
CROSS SECTIONS

64+00



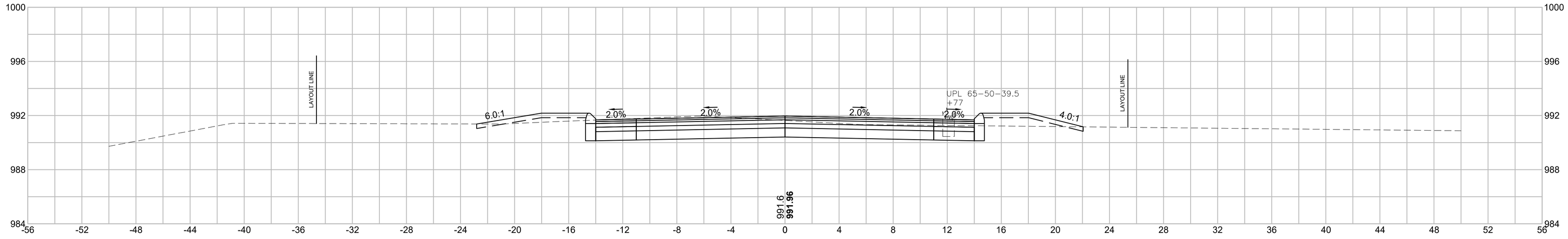
Cut: 61.35 S.F.
Fill: 0.27 S.F.

63+50



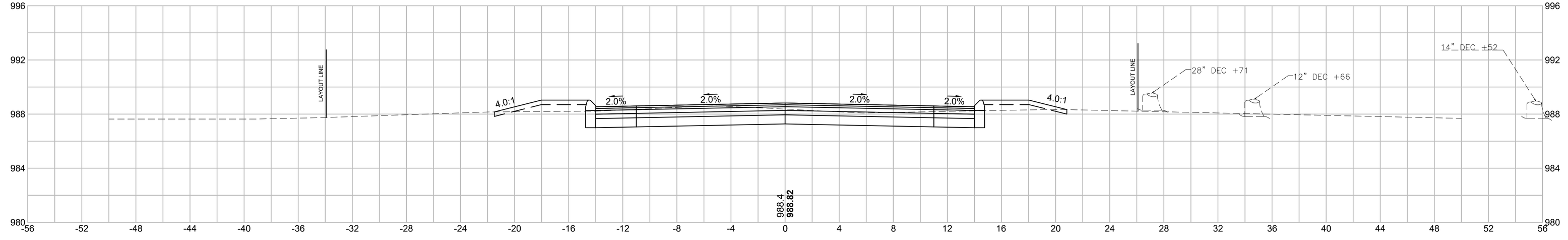
Cut: 50.9 S.F.
Fill: 3.02 S.F.

63+00



Cut: 39.10 S.F.
Fill: 8.85 S.F.

62+50



Cut: 35.31 S.F.
Fill: 7.73 S.F.

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:21 PM

Proposal No. 608163-128112

A080609 - 499

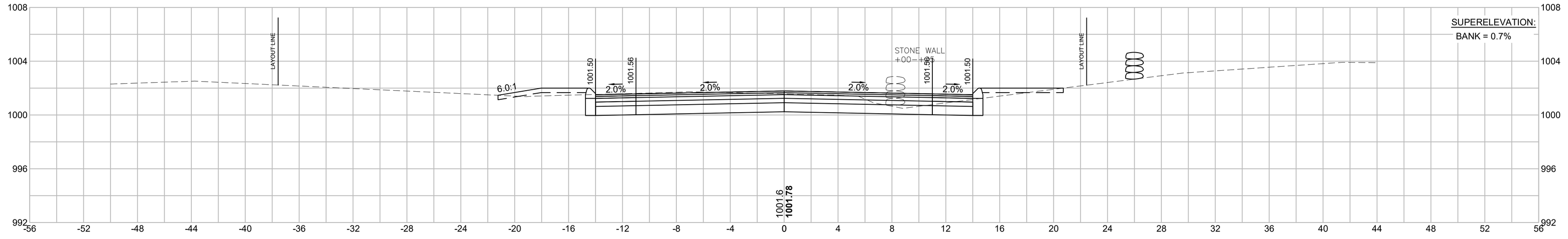
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	139	180
PROJECT FILE NO.	608163		

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

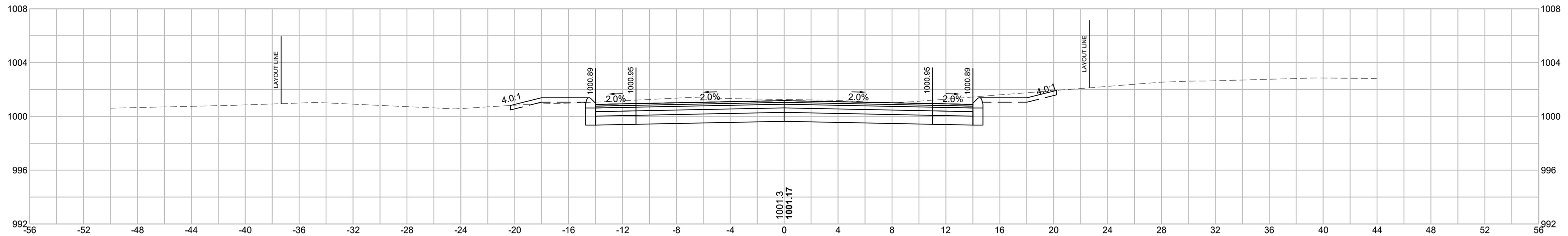
CROSS SECTIONS

65+00



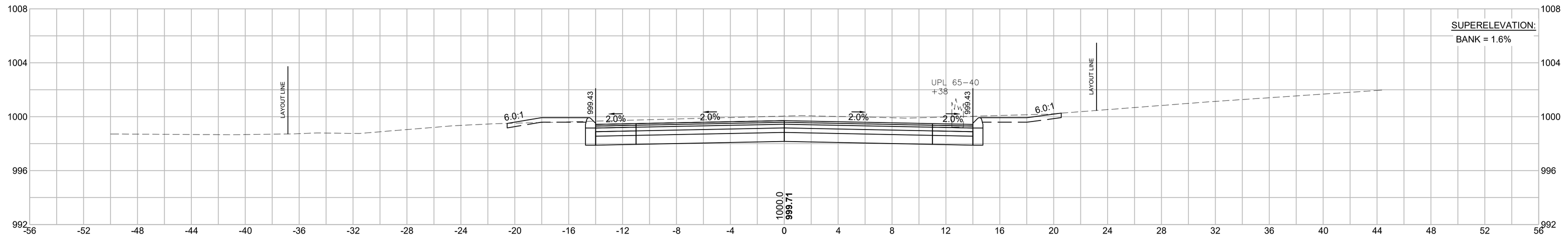
Cut: 38.10 S.F.
Fill: 5.02 S.F.

64+85.04



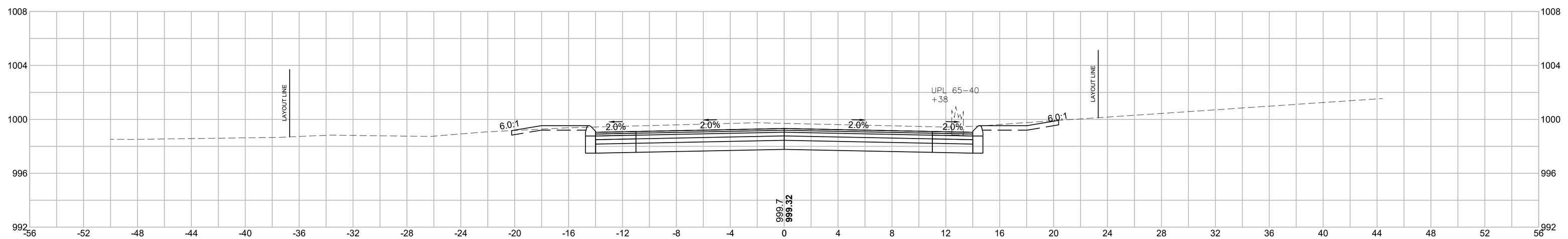
Cut: 55.0 S.F.
Fill: 1.88 S.F.

64+50



Cut: 59.20 S.F.
Fill: 1.51 S.F.

64+41.04



Cut: 60.90 S.F.
Fill: 0.89 S.F.

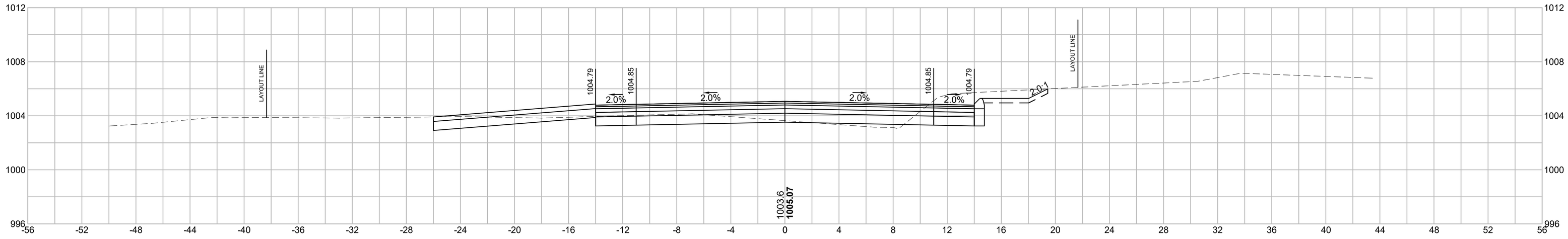
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:22 PM
Proposal No. 608163-128112
AM860 - 500

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	140	179
PROJECT FILE NO.	608163		

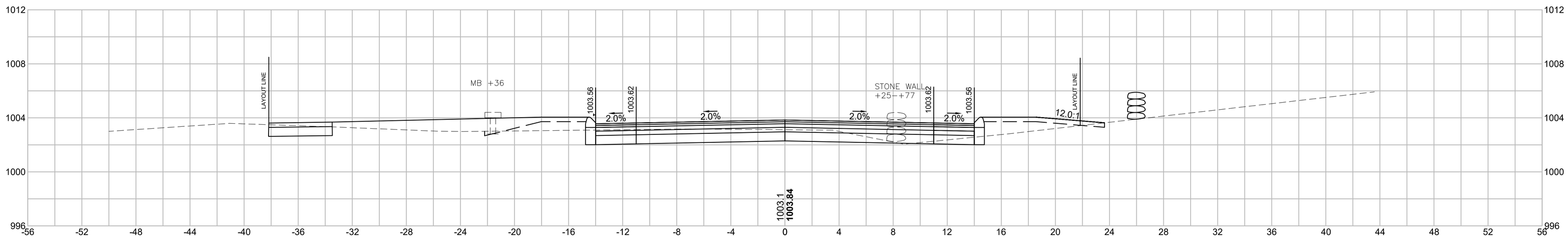
CROSS SECTIONS

65+80



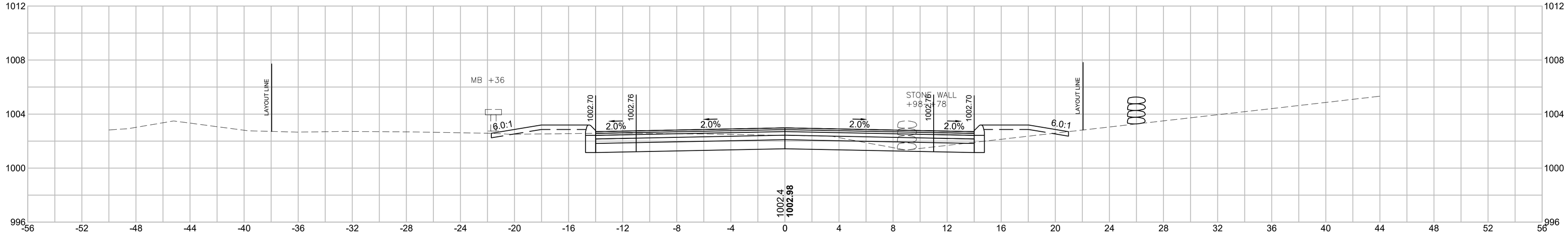
Cut: 29.94 S.F.
Fill: 0.00 S.F.

65+50



Cut: 21.92 S.F.
Fill: 12.58 S.F.

65+29.04



Cut: 27.83 S.F.
Fill: 8.04 S.F.

A00860 - 501

608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:22 PM
Proposal No. 608163-128112

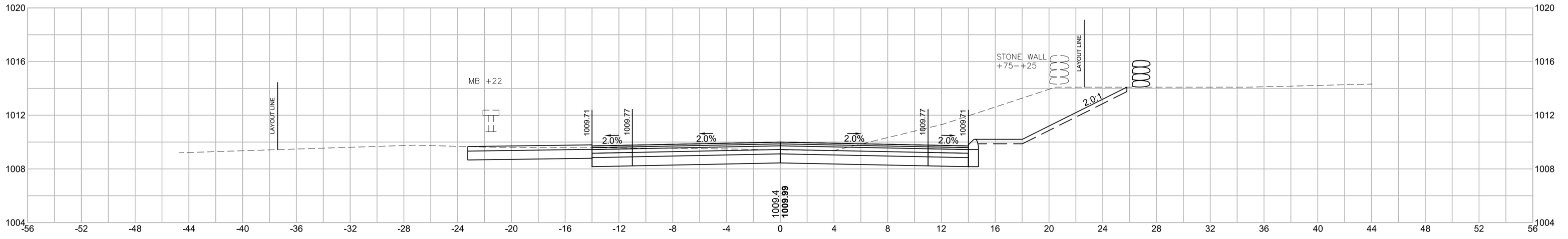
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	141	179
PROJECT FILE NO.	608163		

CROSS SECTIONS

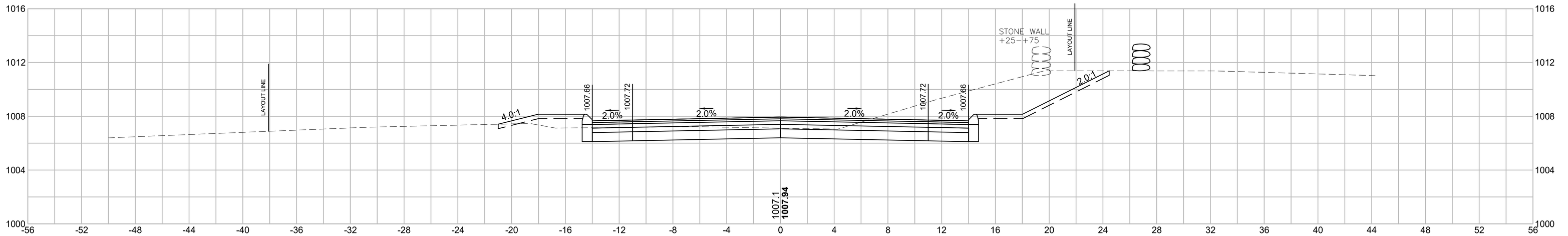
Plotted on 5-Jun-2024 12:23 PM
608163_HD10(XSC_GRADINGCALC).DWG
Proposal No. 608163-128112
AM98000 - 202

67+00



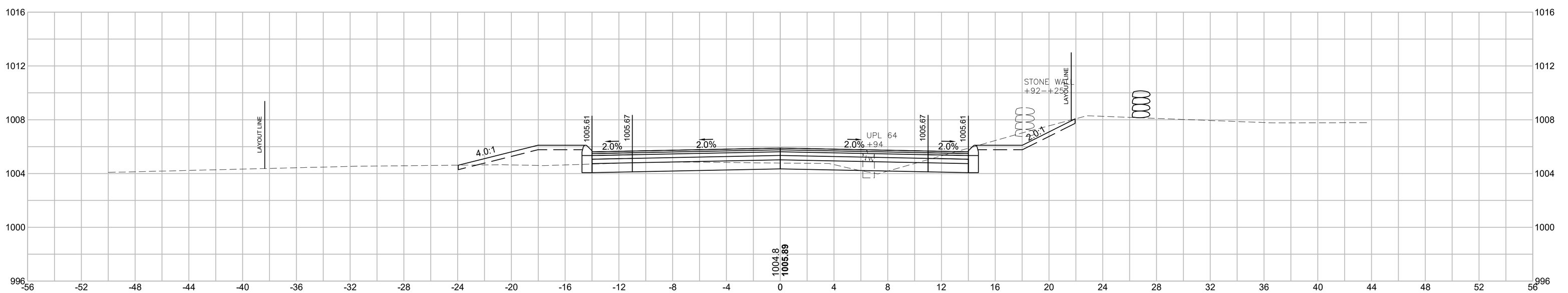
Cut: 81.16 S.F.
Fill: 0.00 S.F.

66+50



Cut: 63.05 S.F.
Fill: 4.29 S.F.

66+00



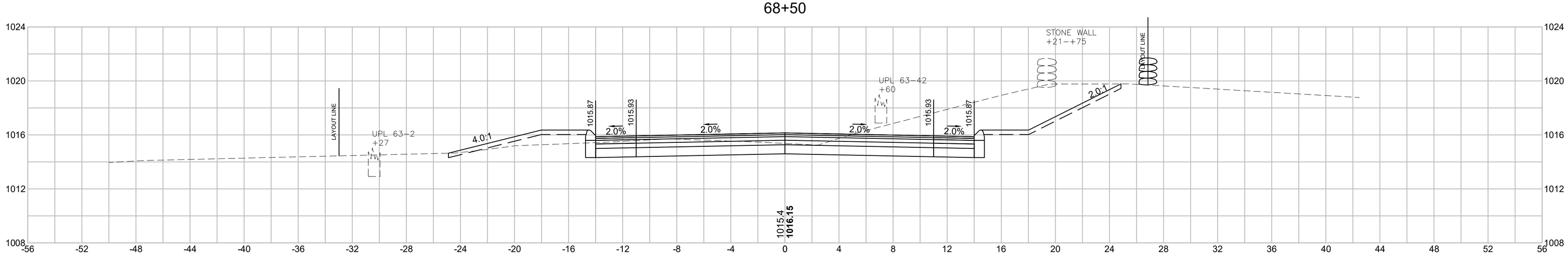
Cut: 23.70 S.F.
Fill: 9.34 S.F.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	142	179
PROJECT FILE NO.	608163		

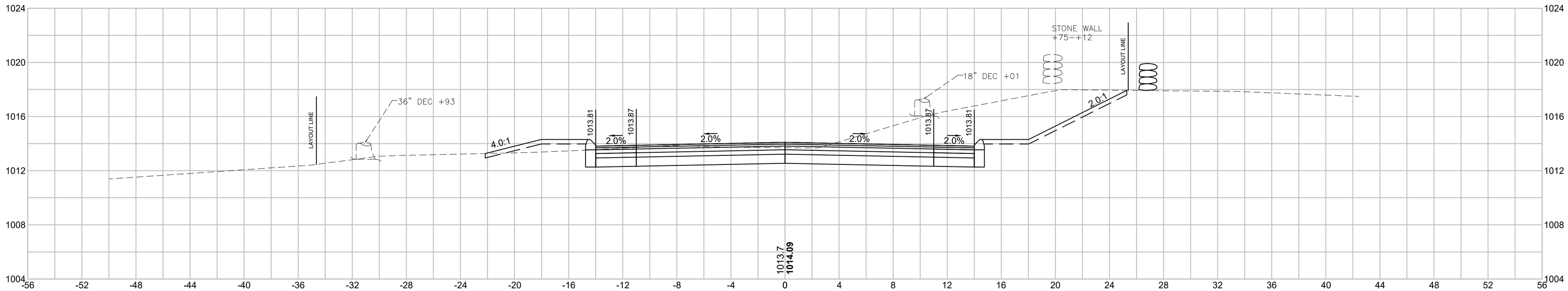
CROSS SECTIONS

68+50



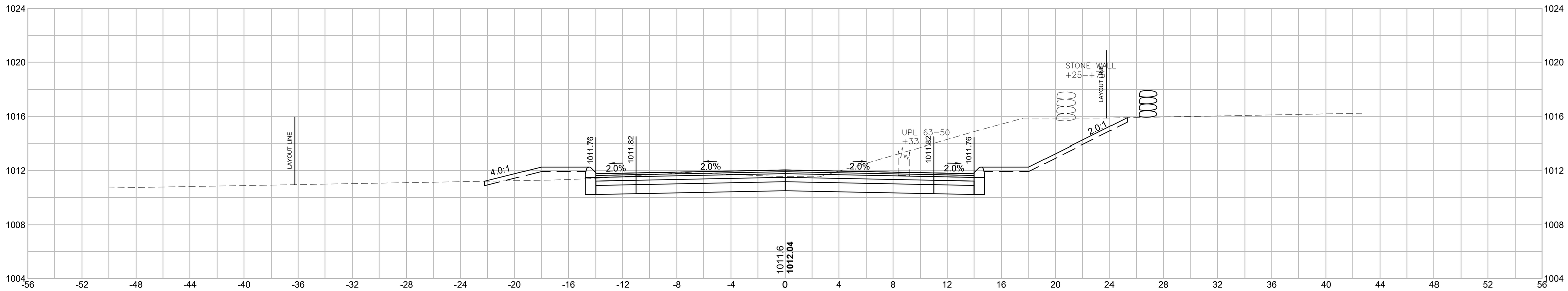
Cut: 72.80 S.F.
Fill: 6.95 S.F.

68+00



Cut: 86.11 S.F.
Fill: 4.79 S.F.

67+50



Cut: 85.80 S.F.
Fill: 5.14 S.F.

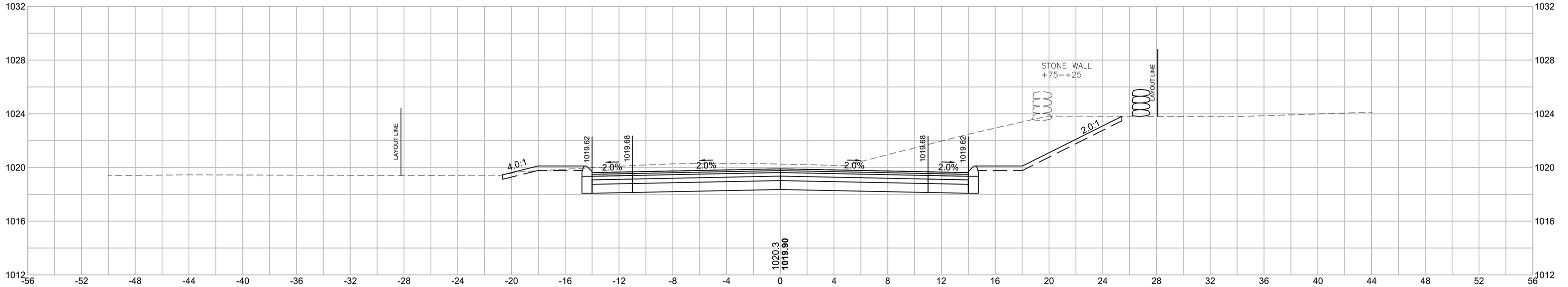
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:24 PM
Proposal No. 608163-128112
A000960 - 103

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	143	179
PROJECT FILE NO.	608163		

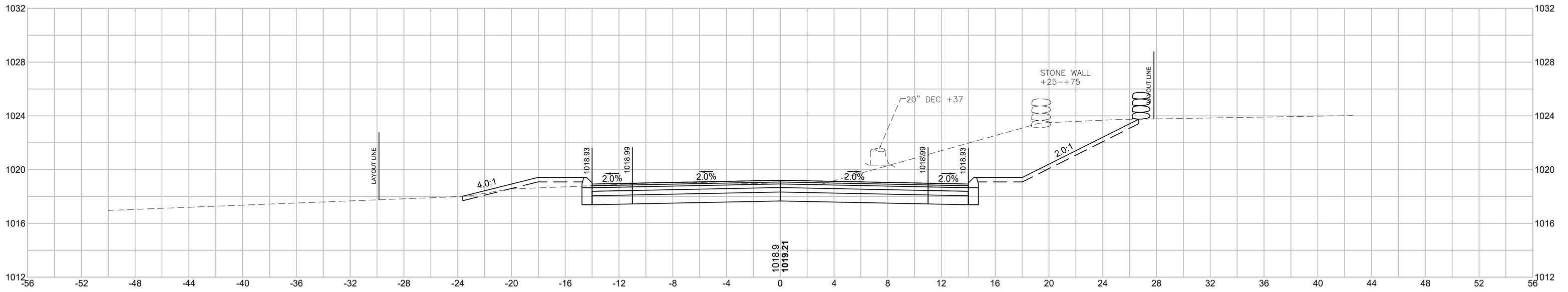
CROSS SECTIONS

70+00



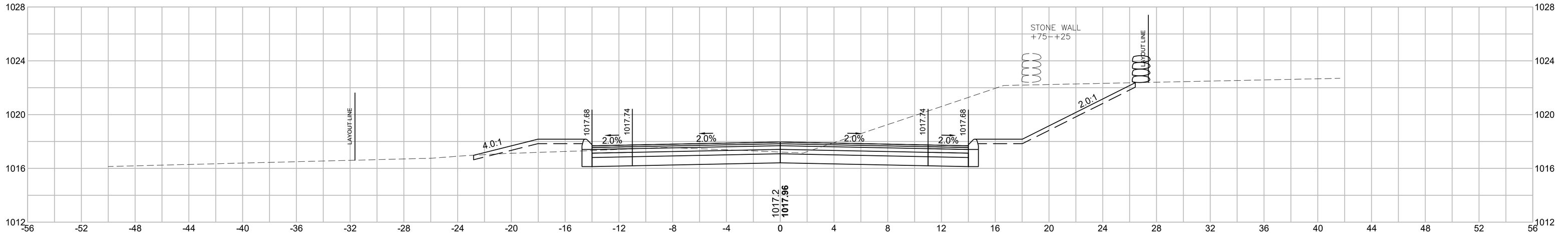
Cut: 98.06 S.F.
Fill: 1.25 S.F.

69+50



Cut: 93.16 S.F.
Fill: 4.26 S.F.

69+00



Cut: 91.73 S.F.
Fill: 5.36 S.F.

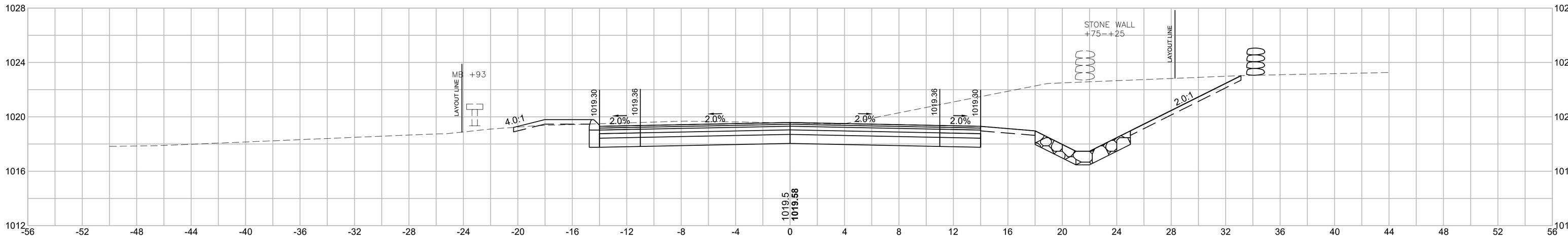
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:25 PM
Proposal No. 608163-128112
A008069 504

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	144	179
PROJECT FILE NO.	608163		

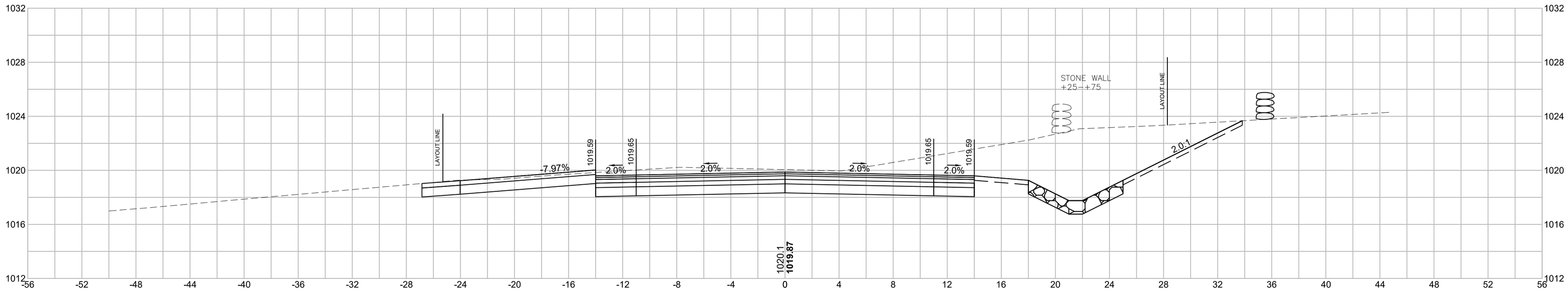
CROSS SECTIONS

71+00



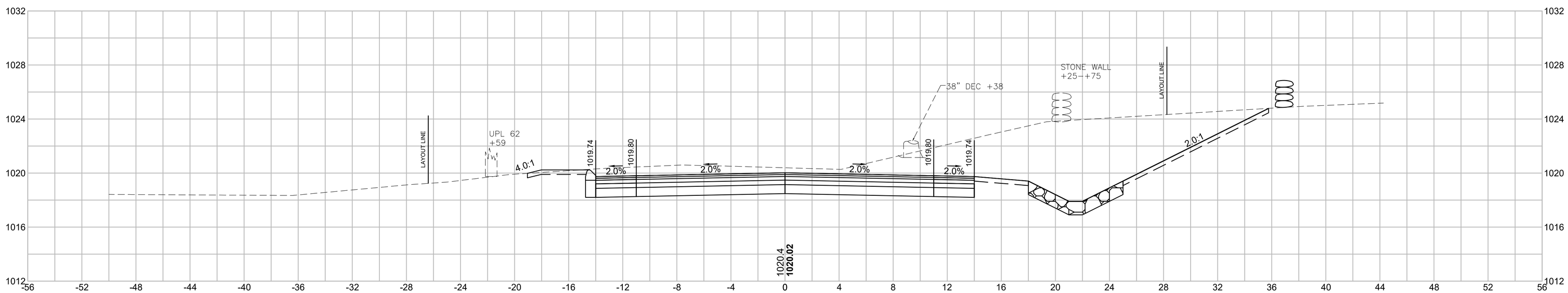
Cut: 126.30 S.F.
Fill: 1.73 S.F.

70+75



Cut: 141.04 S.F.
Fill: 0.00 S.F.

70+50



Cut: 160.04 S.F.
Fill: 0.38 S.F.

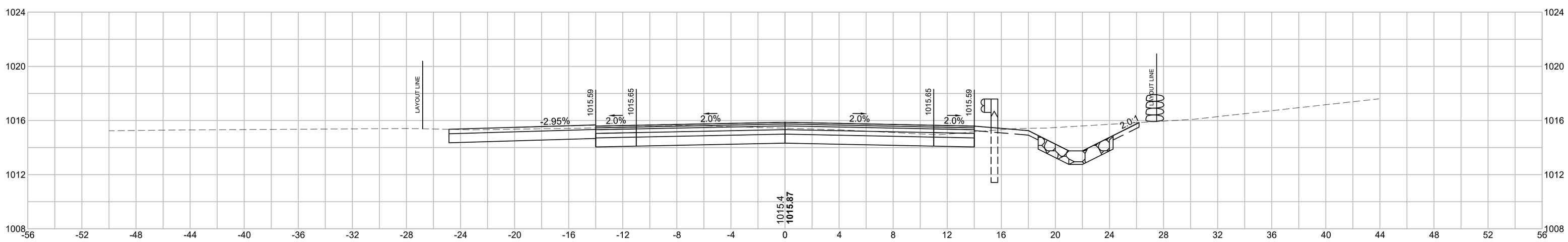
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:26 PM
Proposal No. 608163-128112
AV0860 - 505

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	145	179
PROJECT FILE NO.	608163		

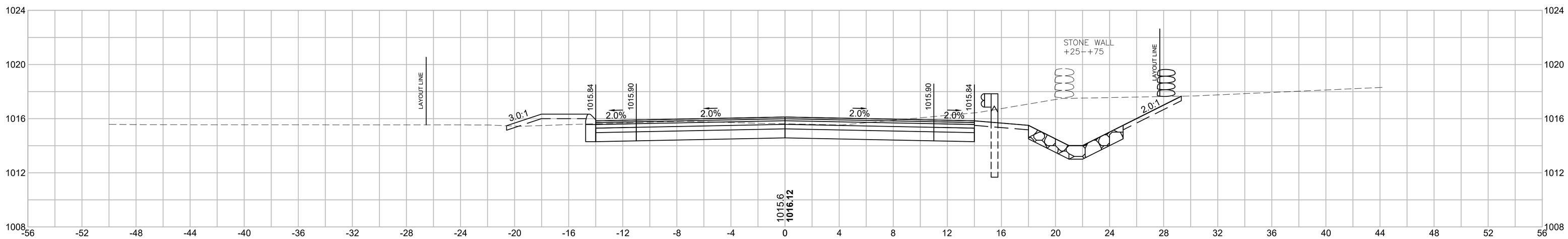
CROSS SECTIONS

72+75



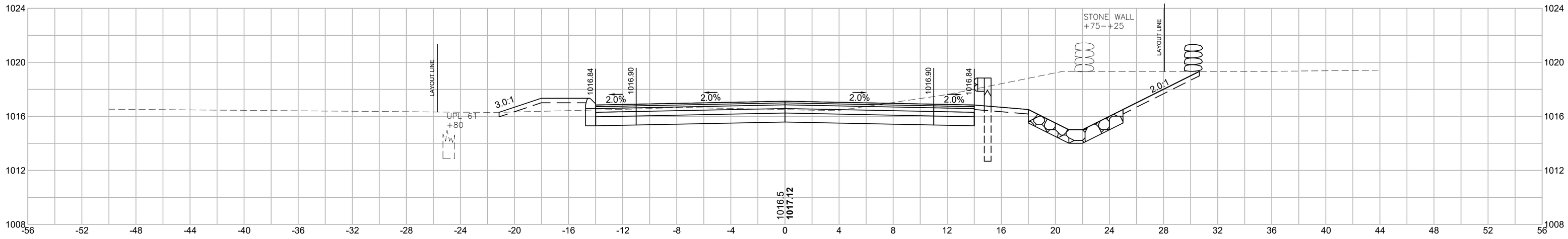
Cut: 58.24 S.F.
Fill: 0.56 S.F.

72+50



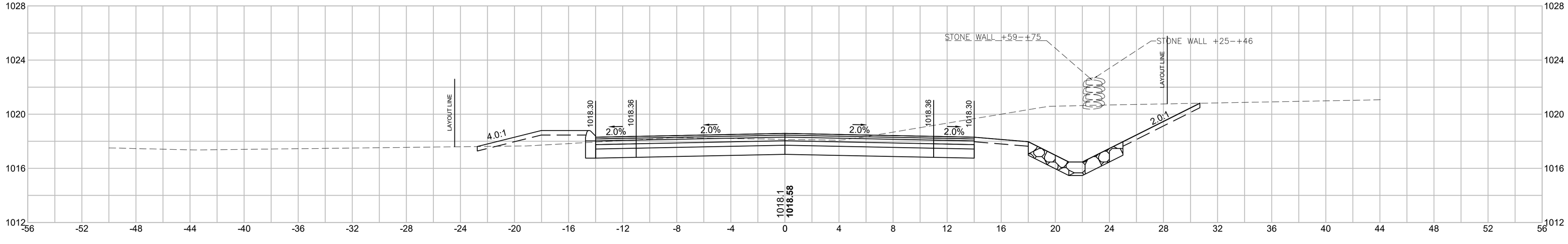
Cut: 77.02 S.F.
Fill: 3.77 S.F.

72+00



Cut: 88.72 S.F.
Fill: 4.56 S.F.

71+50



Cut: 93.13 S.F.
Fill: 5.88 S.F.

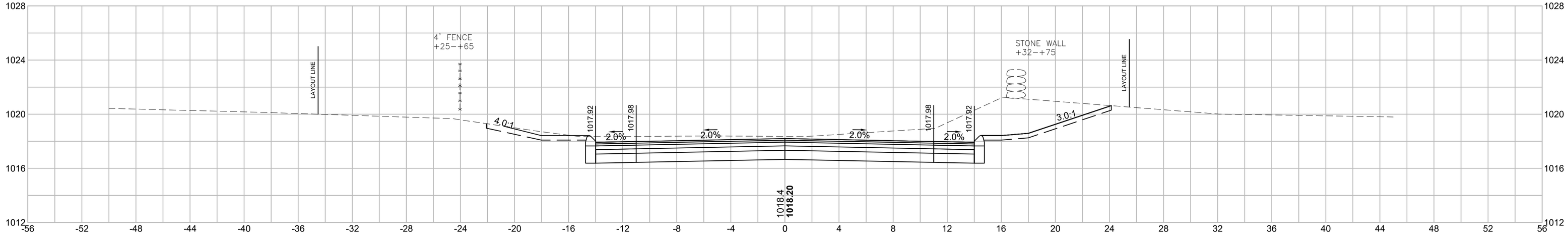
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:27 PM
Proposal No. 608163-128112
A08069 - 505

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	146	179
PROJECT FILE NO.	608163		

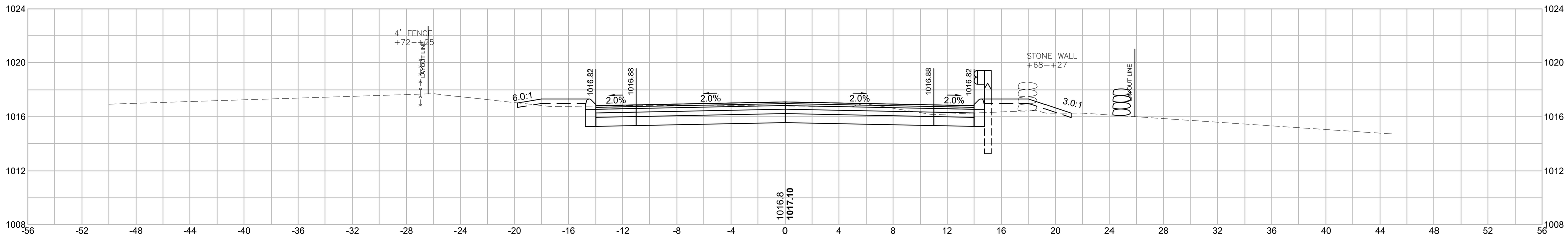
CROSS SECTIONS

74+50



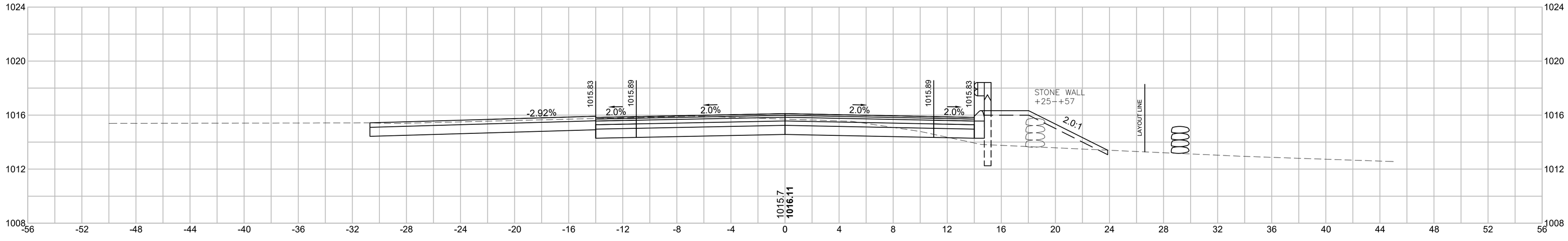
Cut: 85.20 S.F.
Fill: 0.07 S.F.

74+00



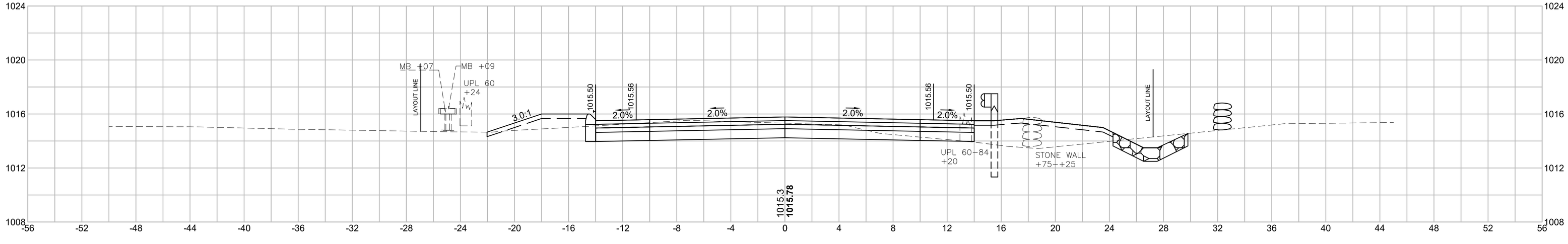
Cut: 38.35 S.F.
Fill: 7.60 S.F.

73+50



Cut: 43.89 S.F.
Fill: 16.92 S.F.

73+00



Cut: 38.63 S.F.
Fill: 22.82 S.F.

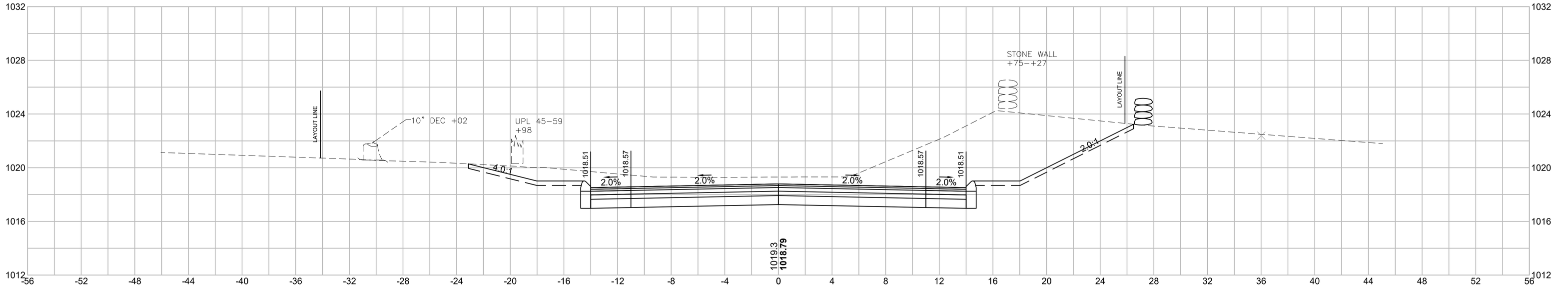
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:28 PM
Proposal No. 608163-128112
A080969 - 507

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	147	179
PROJECT FILE NO.	608163		

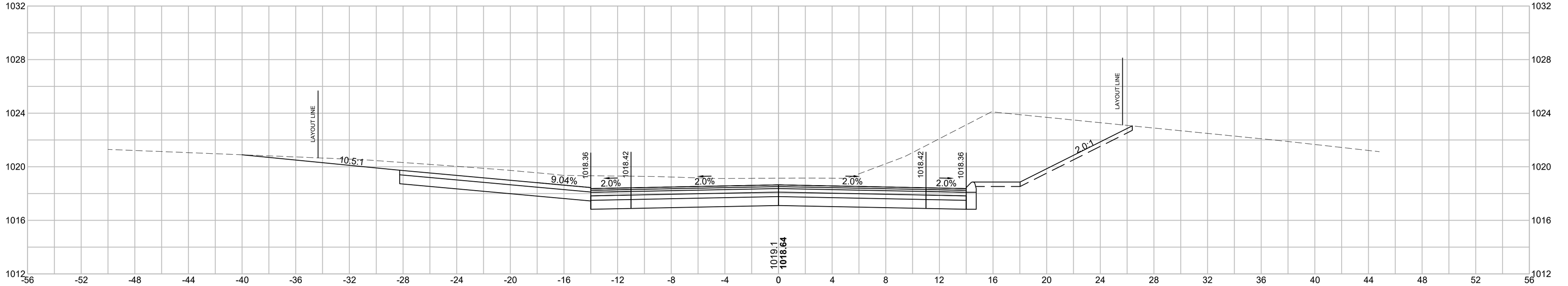
CROSS SECTIONS

75+00



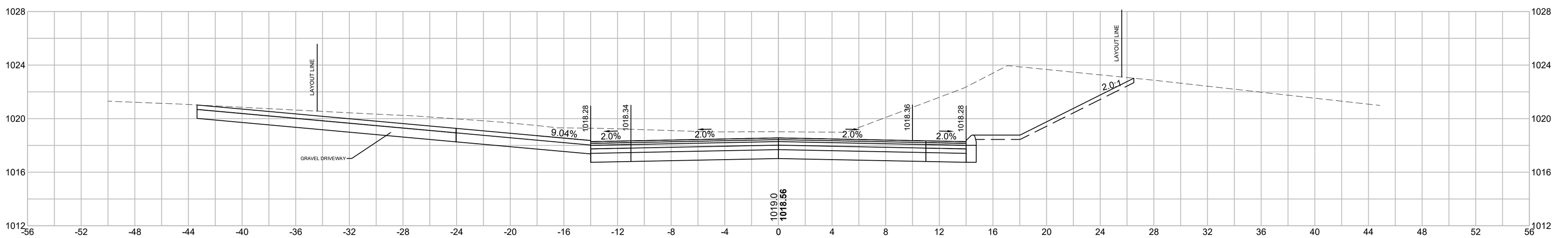
Cut: 135.28 S.F.
Fill: 0.0 S.F.

74+82.50



Cut: 152.96 S.F.
Fill: 0.0 S.F.

74+75



Cut: 165.77 S.F.
Fill: 0.0 S.F.

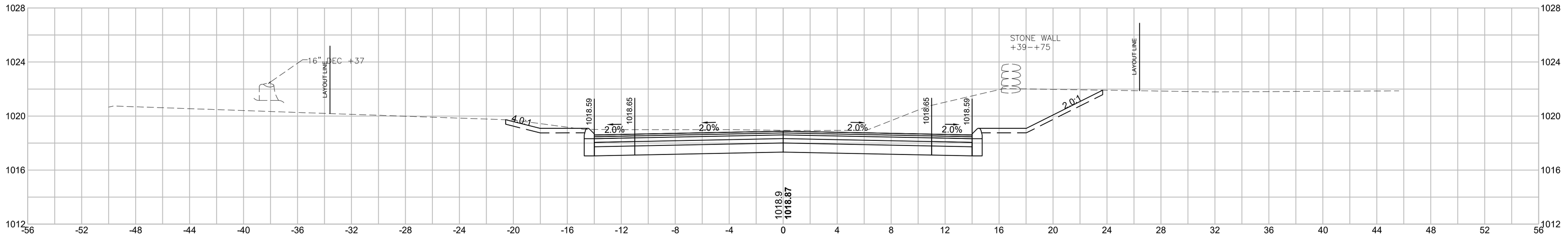
Plotted on 5-Jun-2024 12:29 PM
608163_HD10(XSC_GRADINGCALC).DWG
Proposal No. 608163-128112
AW0809-508

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	148	179
PROJECT FILE NO.	608163		

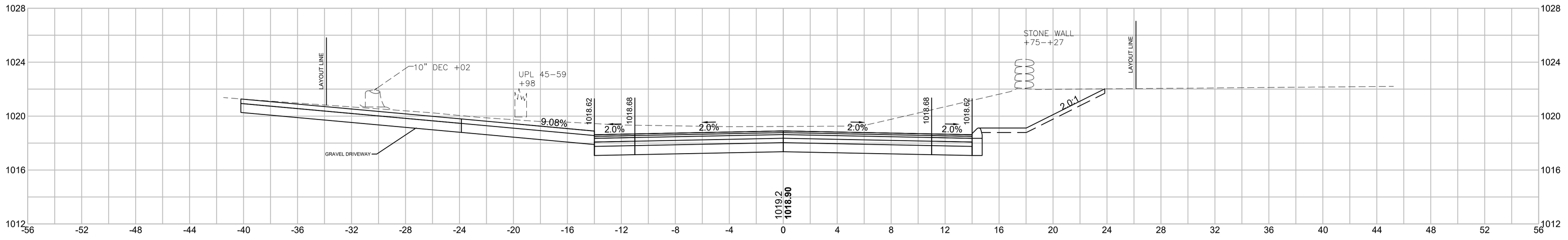
CROSS SECTIONS

75+50



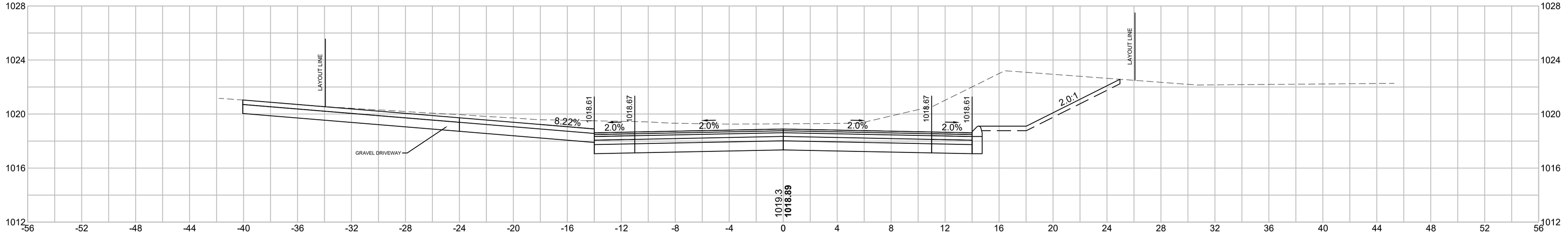
Cut: 89.00 S.F.
Fill: 0.04 S.F.

75+26.50



Cut: 120.30 S.F.
Fill: 0.0 S.F.

75+20



Cut: 133.28 S.F.
Fill: 0.0 S.F.

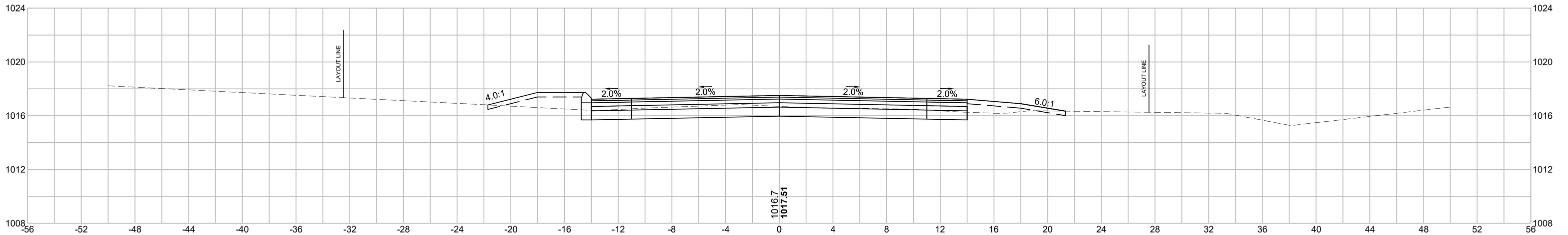
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:30 PM
Proposal No. 608163-128112
A000601 - 509

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	149	179
PROJECT FILE NO.	608163		

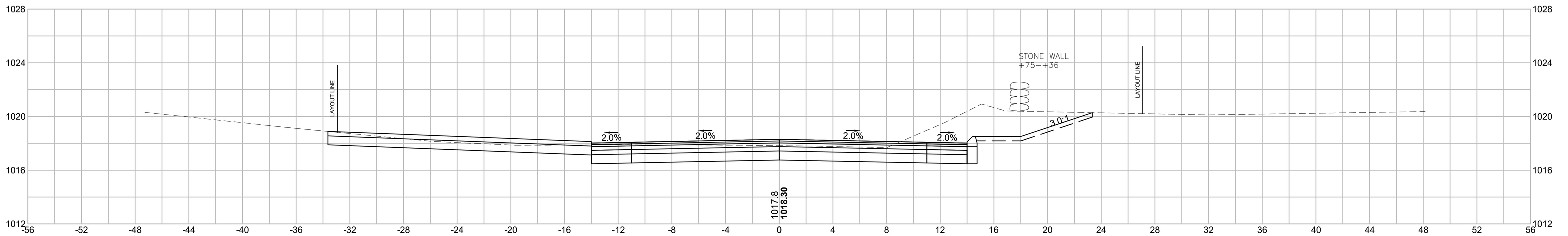
CROSS SECTIONS

76+50



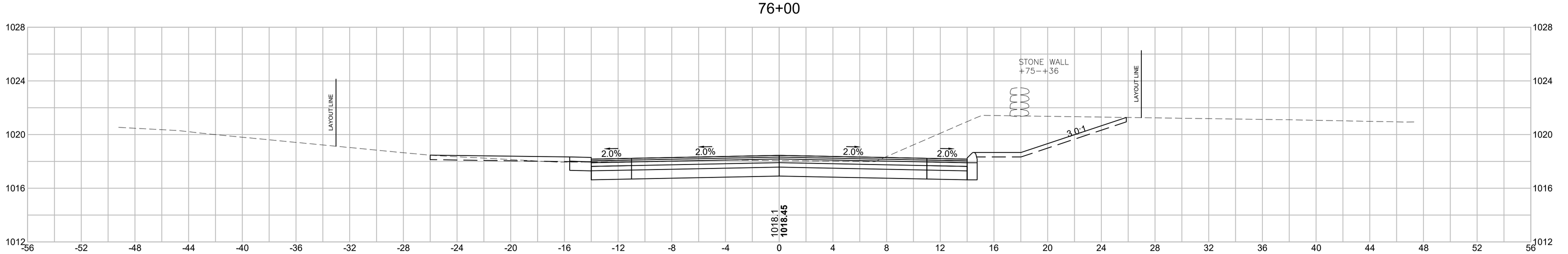
Cut: 22.10 S.F.
Fill: 10.28 S.F.

76+10



Cut: 71.43 S.F.
Fill: 0.00 S.F.

76+00



Cut: 72.86 S.F.
Fill: 2.27 S.F.

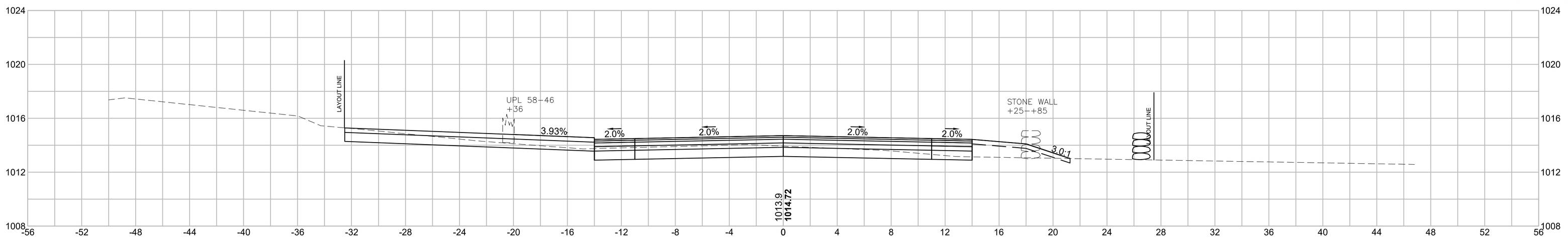
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:31 PM
Proposal No. 608163-128112
A0980V - 010

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	150	179
PROJECT FILE NO.	608163		

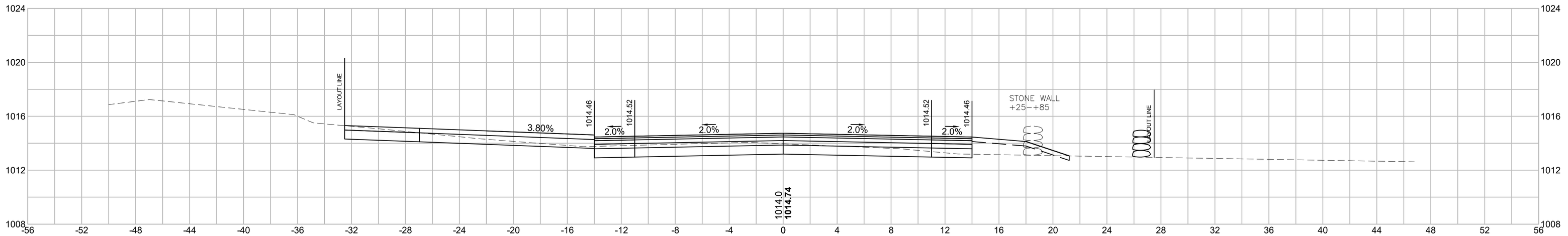
CROSS SECTIONS

77+55.88



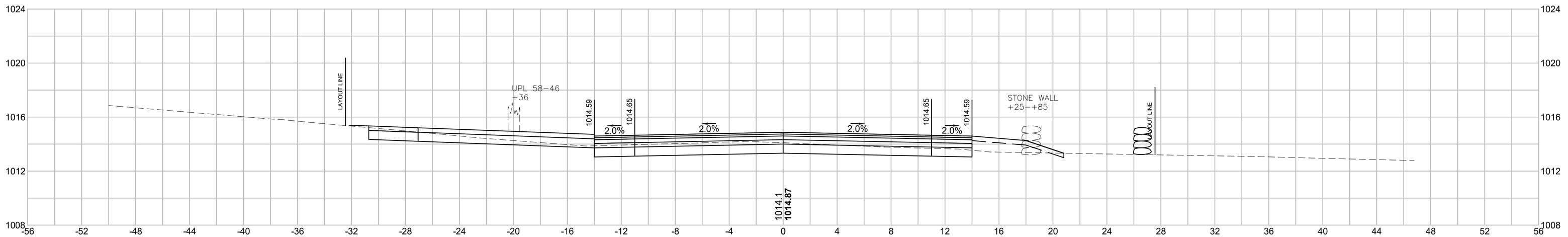
Cut: 29.41 S.F.
Fill: 6.34 S.F.

77+55



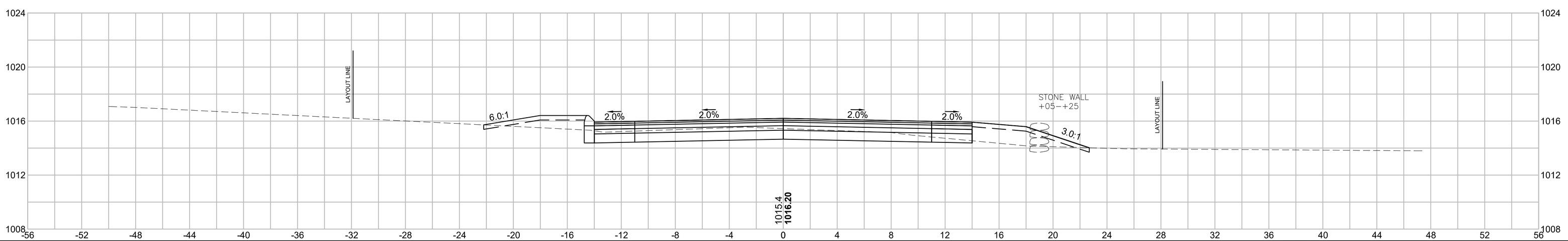
Cut: 29.32 S.F.
Fill: 6.20 S.F.

77+50



Cut: 28.70 S.F.
Fill: 5.37 S.F.

77+00



Cut: 21.40 S.F.
Fill: 14.12 S.F.

A000690 - 511

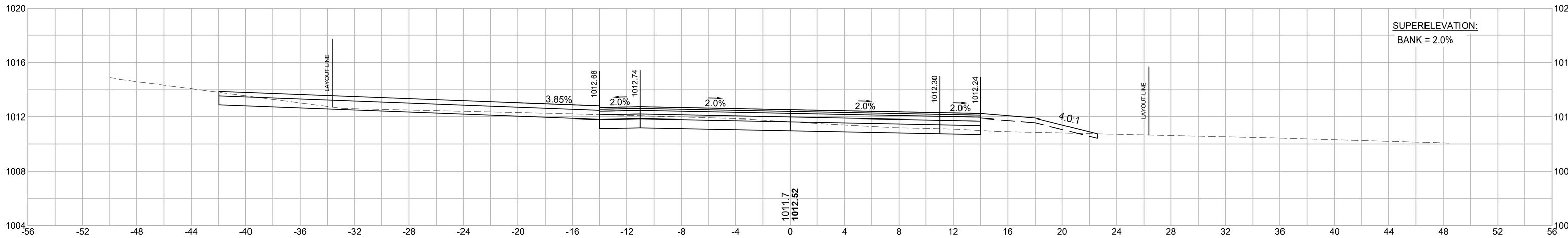
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:32 PM
Proposal No. 608163-120112

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	151	179
PROJECT FILE NO.	608163		

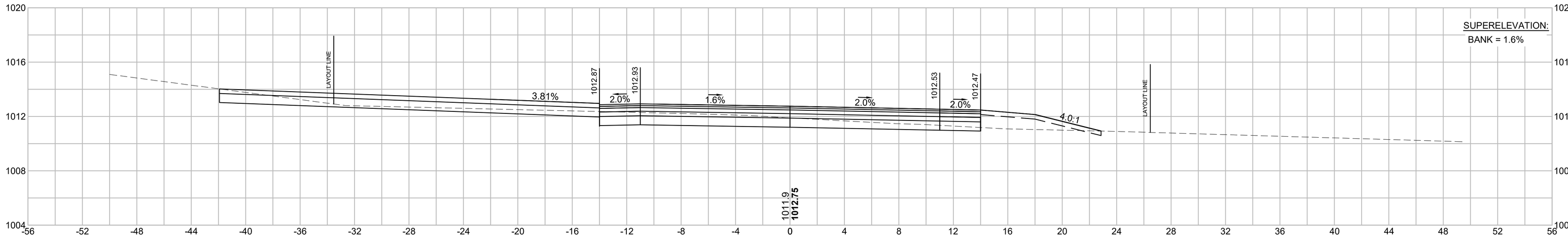
CROSS SECTIONS

78+38.61



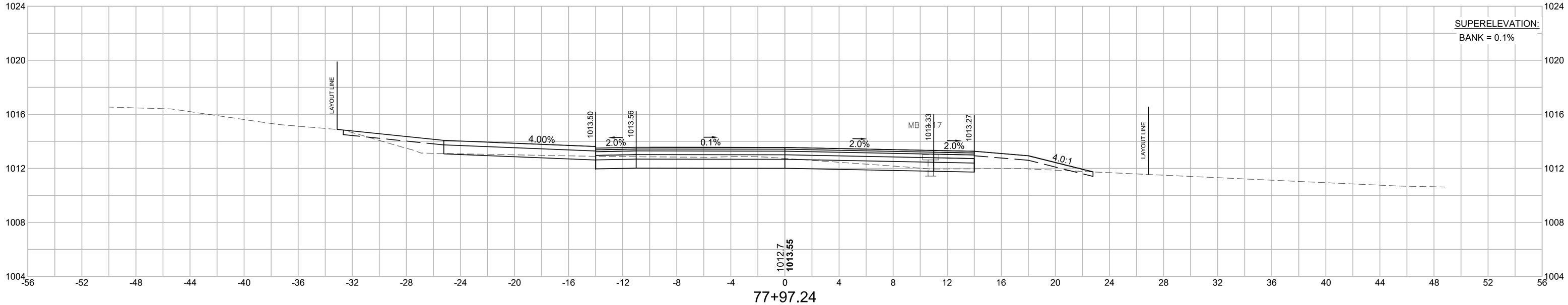
Cut: 26.66 S.F.
Fill: 7.01 S.F.

78+30



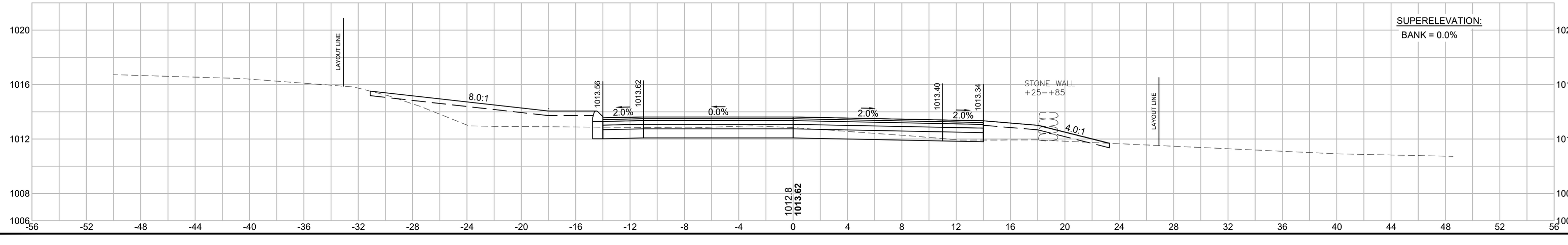
Cut: 28.95 S.F.
Fill: 7.50 S.F.

78+00



Cut: 19.30 S.F.
Fill: 11.80 S.F.

77+97.24



Cut: 17.83 S.F.
Fill: 25.71 S.F.

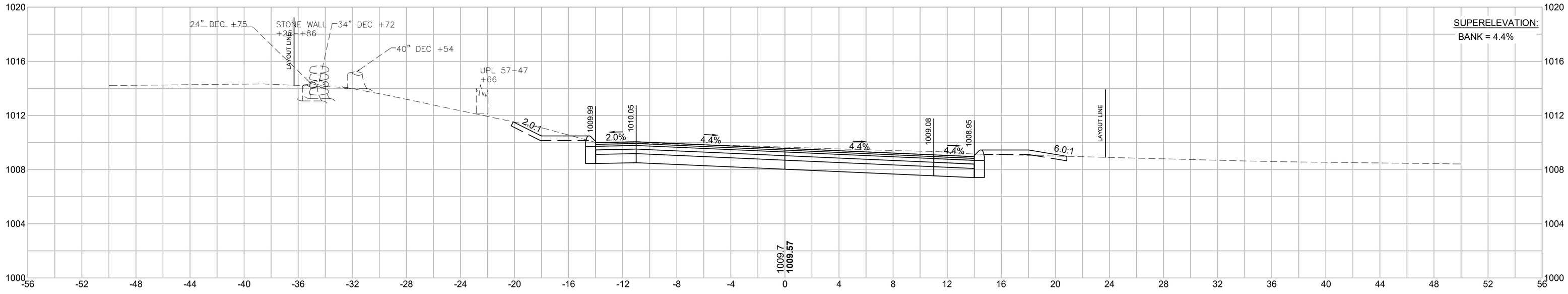
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:33 PM
Proposal No. 608163-128112
A00860 - 512

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	152	179
PROJECT FILE NO.	608163		

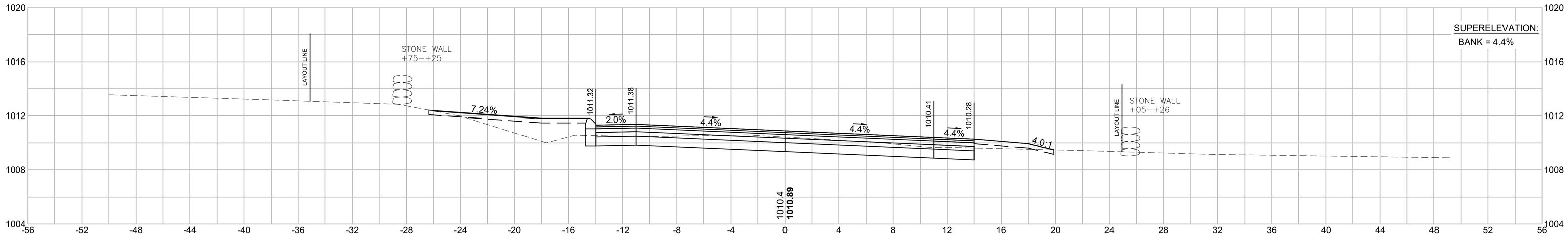
CROSS SECTIONS

79+50



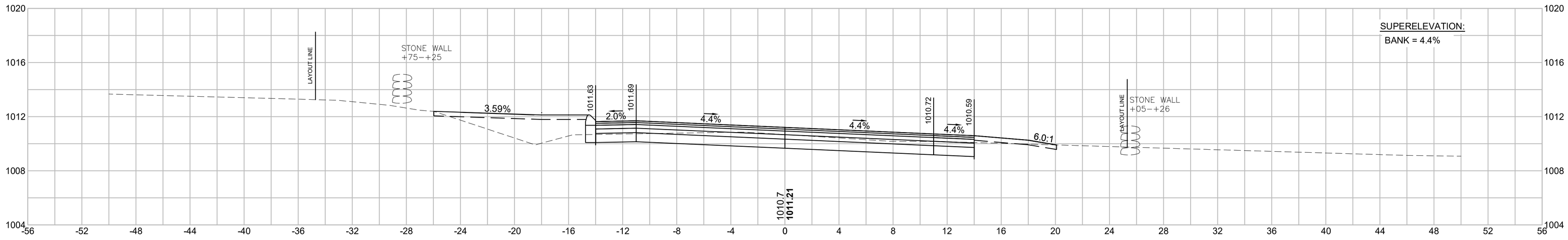
Cut: 52.74 S.F.
Fill: 1.93 S.F.

79+00



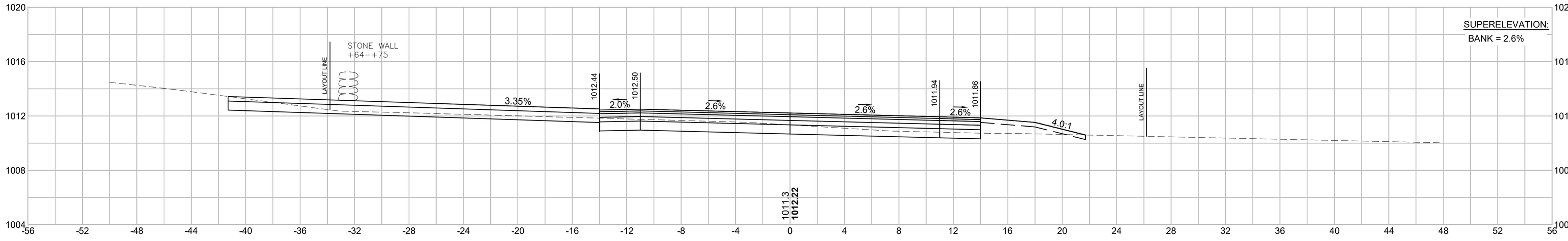
Cut: 27.00 S.F.
Fill: 13.60 S.F.

78+88.24



Cut: 25.62 S.F.
Fill: 16.75 S.F.

78+50



Cut: 27.90 S.F.
Fill: 5.47 S.F.

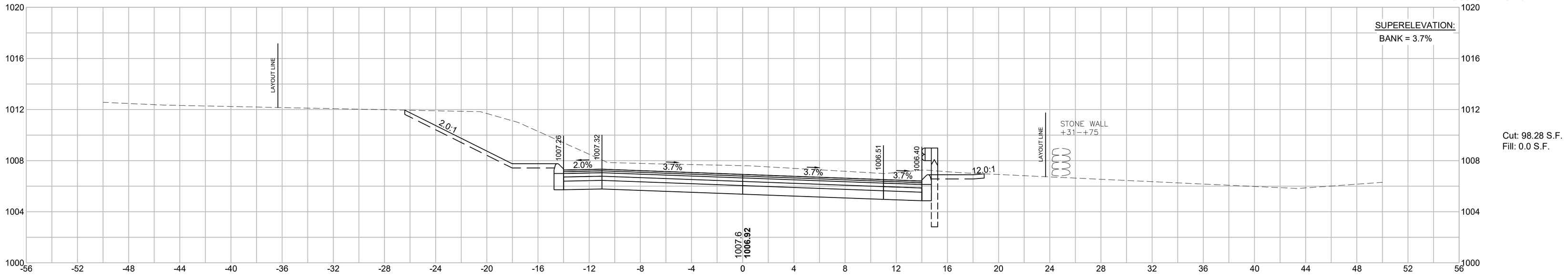
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:35 PM
Proposal No. 608163-128112
A00060 - 513

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	153	179
PROJECT FILE NO.	608163		

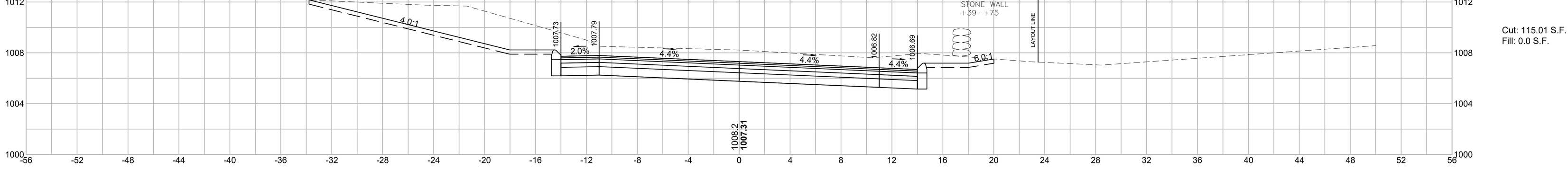
CROSS SECTIONS

80+50



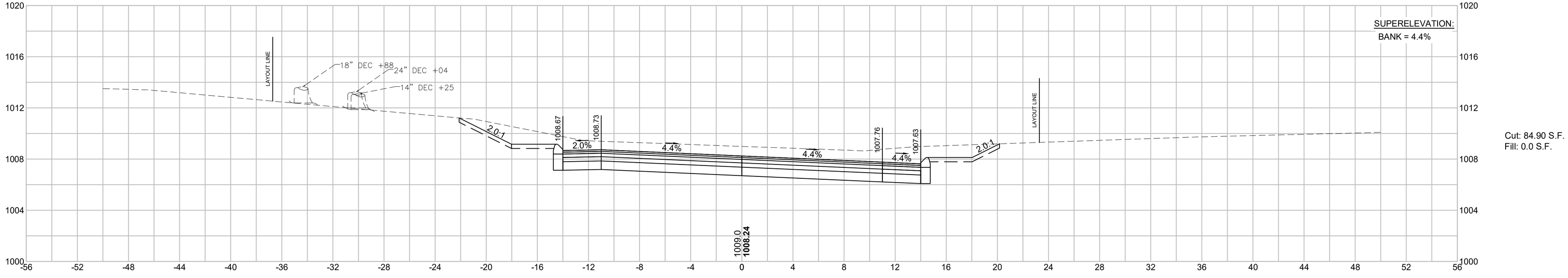
Cut: 98.28 S.F.
Fill: 0.0 S.F.

80+35.31



Cut: 115.01 S.F.
Fill: 0.0 S.F.

80+00



Cut: 84.90 S.F.
Fill: 0.0 S.F.

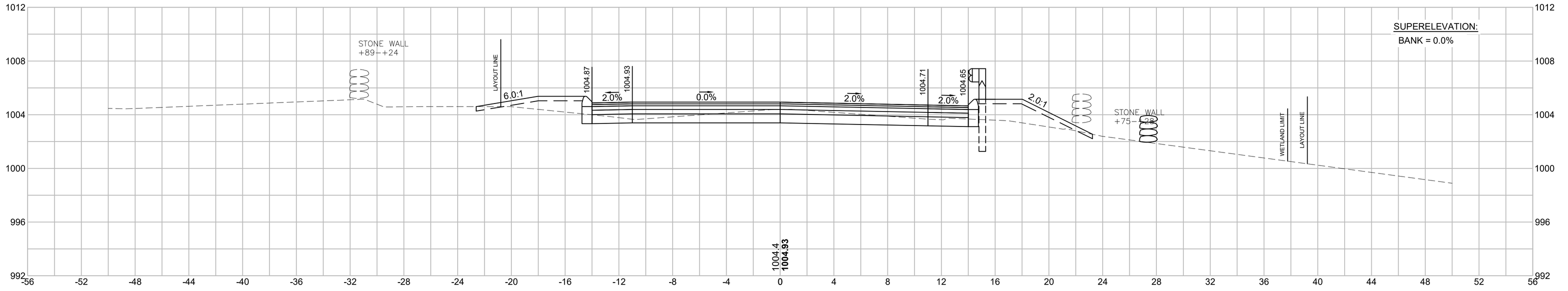
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:35 PM
Proposal No. 608163-128112
A008060 - 514

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	154	179
PROJECT FILE NO.	608163		

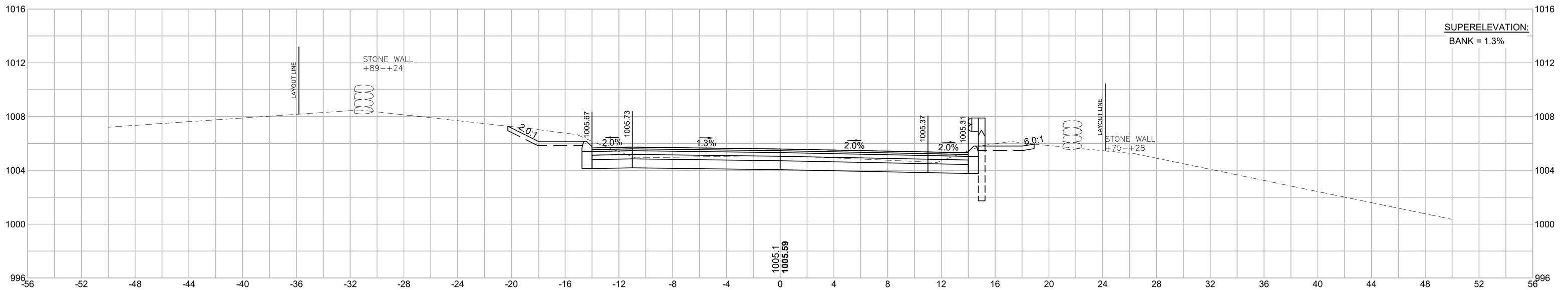
CROSS SECTIONS

81+26.31



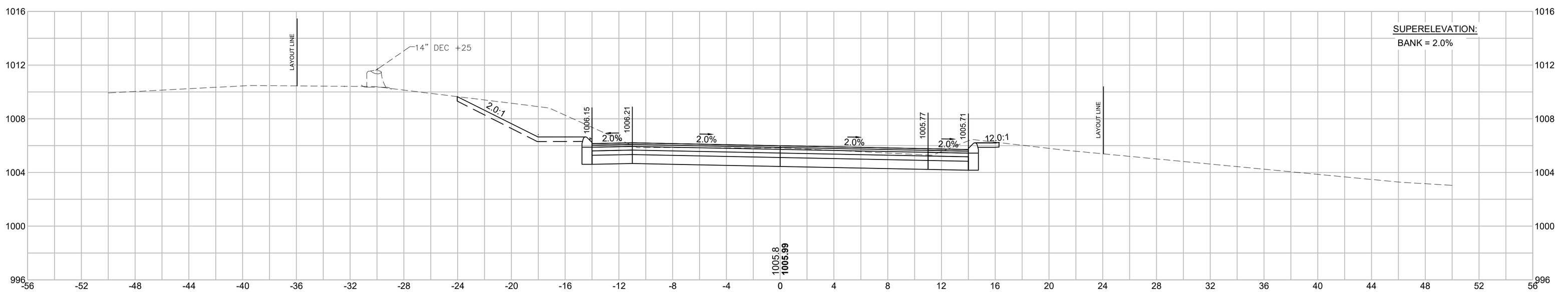
Cut: 19.97 S.F.
Fill: 15.42 S.F.

81+00



Cut: 37.68 S.F.
Fill: 0.0 S.F.

80+84.95



Cut: 58.74 S.F.
Fill: 0.0 S.F.

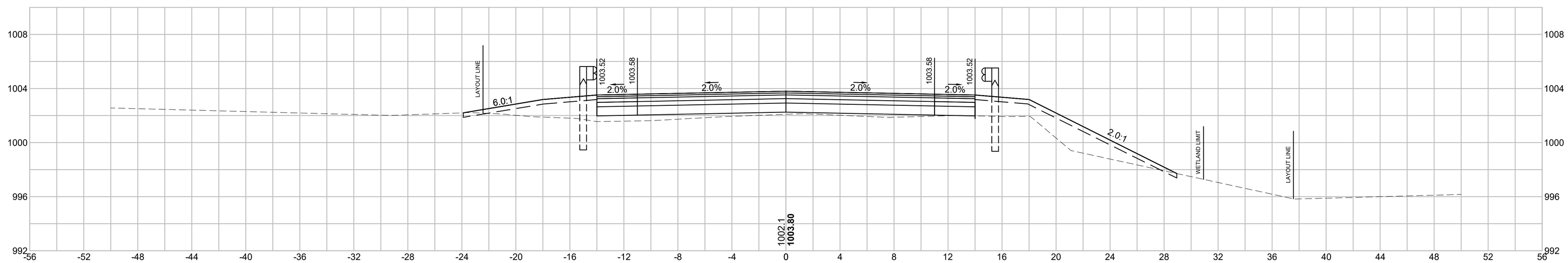
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:36 PM
Proposal No. 608163-128112
AV08090 - 515

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	155	179
PROJECT FILE NO.	608163		

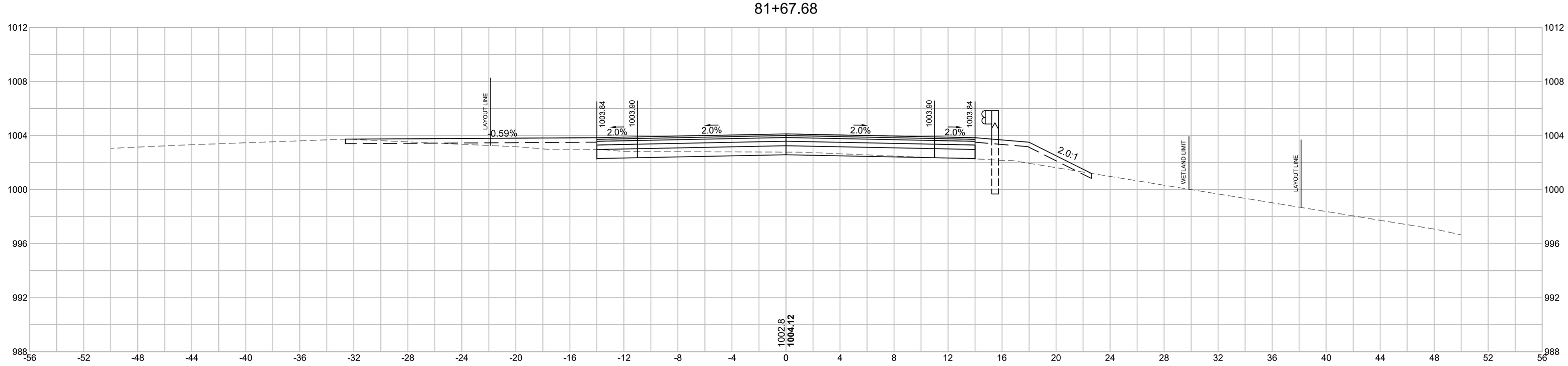
CROSS SECTIONS

81+89.27



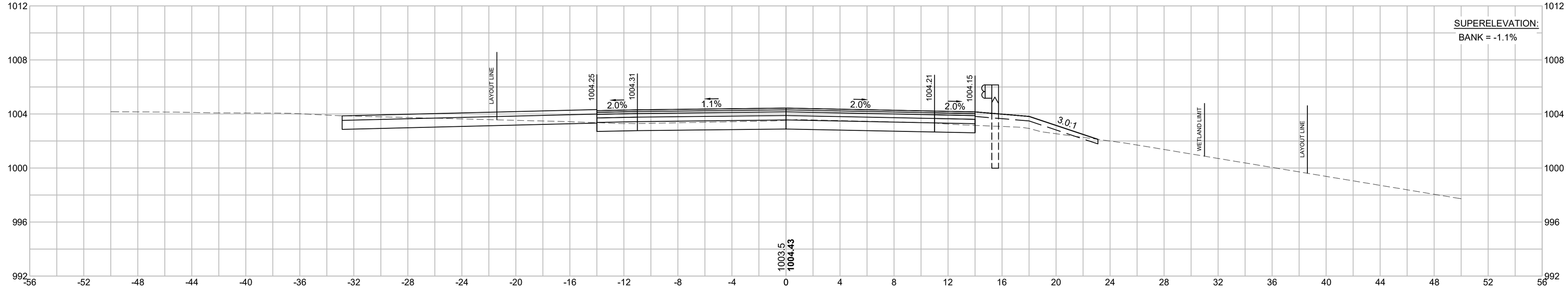
Cut: 0.54 S.F.
Fill: 35.84 S.F.

81+67.68



Cut: 7.80 S.F.
Fill: 18.58 S.F.

81+50



Cut: 27.4 S.F.
Fill: 6.20 S.F.

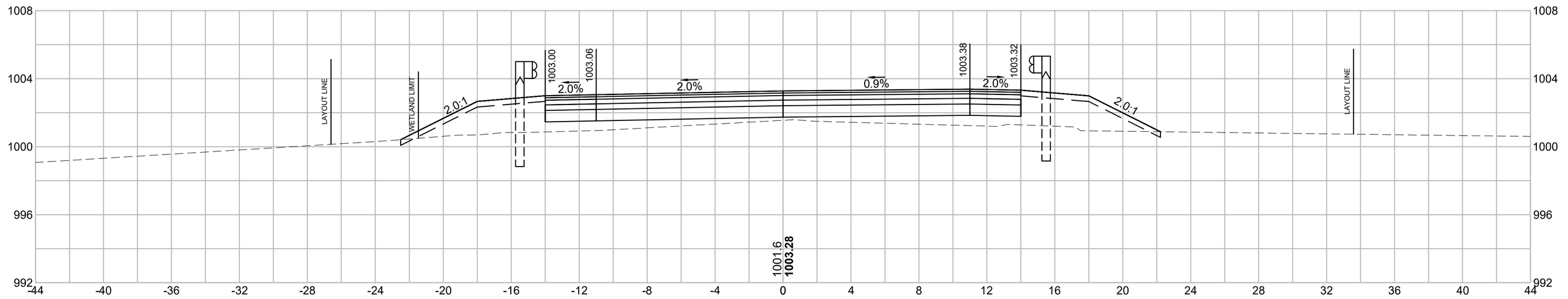
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:37 PM
Proposal No. 608163-128112
AM0809 - 51-6

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	156	179
PROJECT FILE NO.	608163		

CROSS SECTIONS

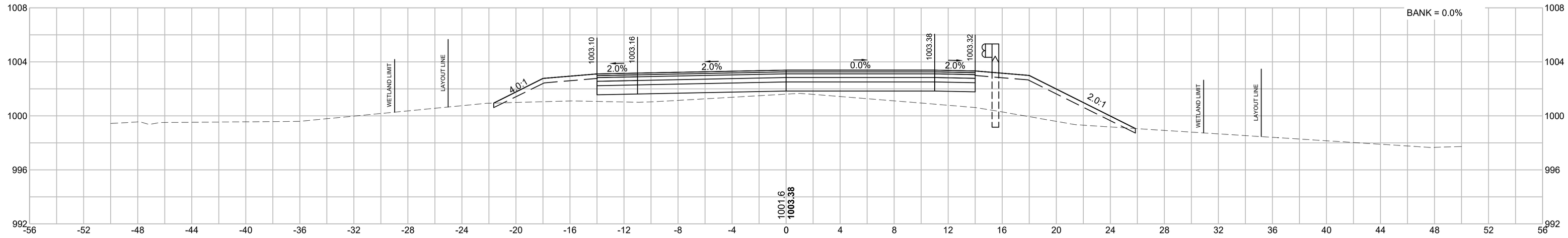
82+50



SUPERELEVATION:
BANK = 0.9%

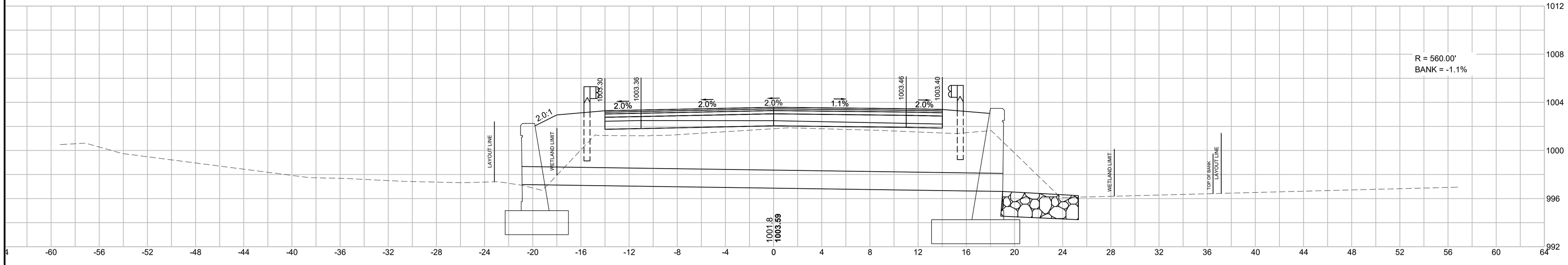
Cut: 0.26 S.F.
Fill: 36.63 S.F.

82+30.60

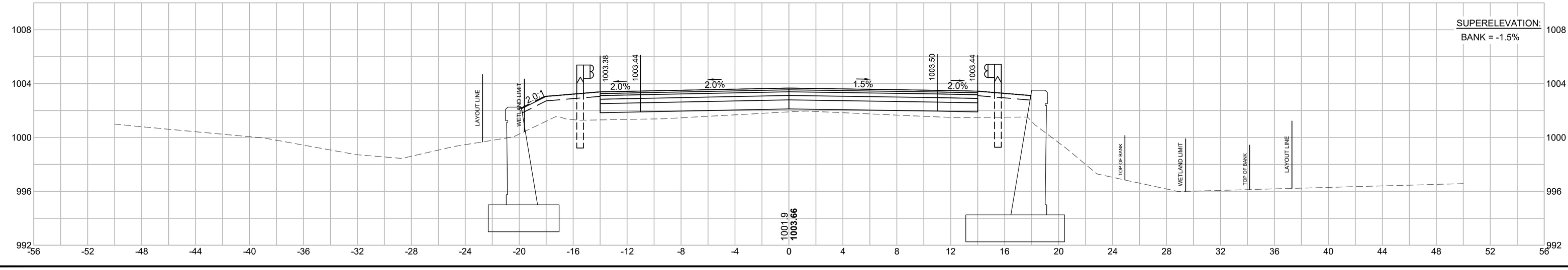


Cut: 0.25 S.F.
Fill: 50.43 S.F.

82+07.06 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)



82+00



Cut: 0.0 S.F.
Fill: 27.77 S.F.

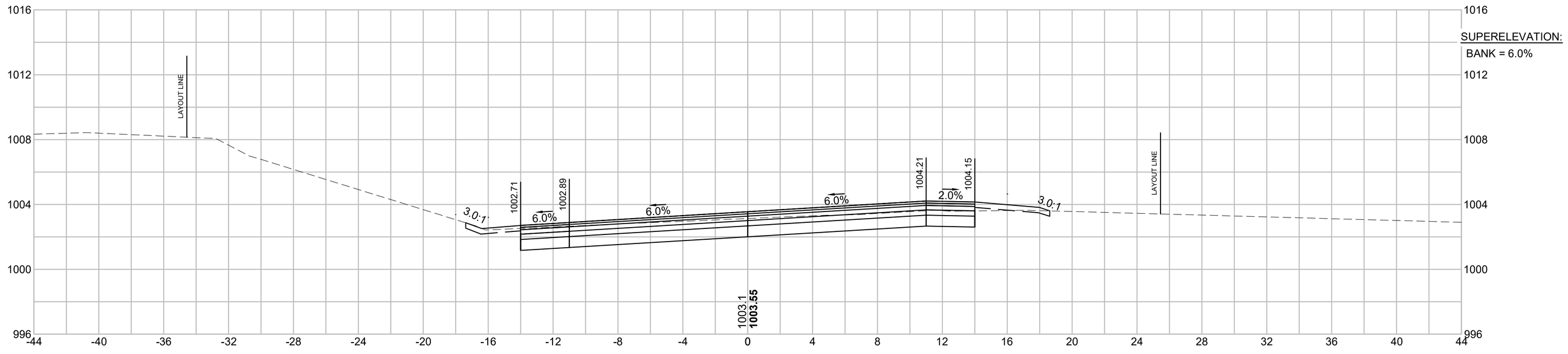
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:38 PM
Proposal No. 608163-128112
A00860 - 517

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	157	179
PROJECT FILE NO.	608163		

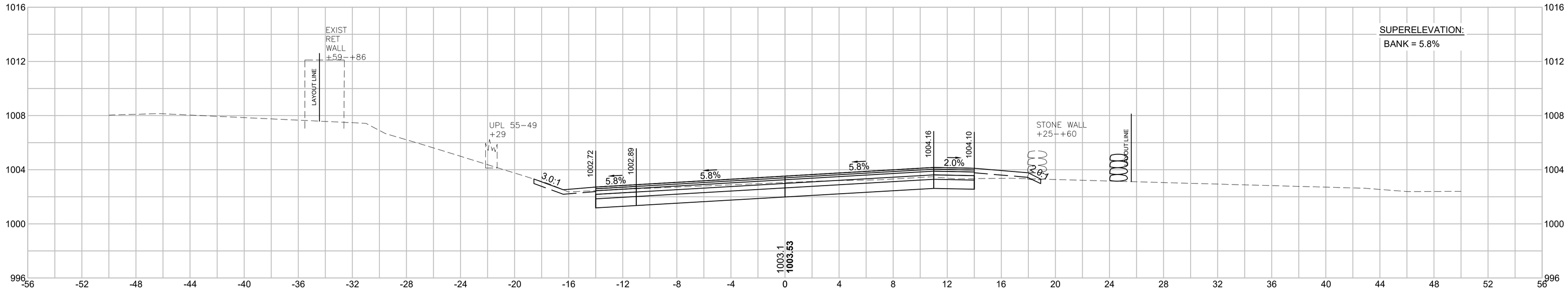
CROSS SECTIONS

83+54.60



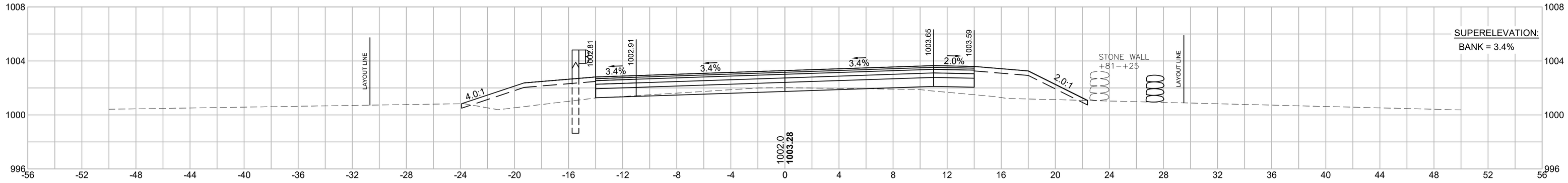
Cut: 33.54 S.F.
Fill: 5.99 S.F.

83+50



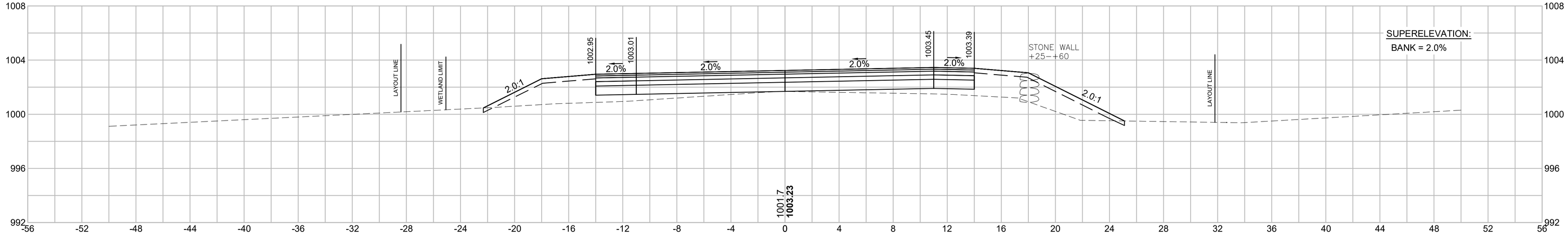
Cut: 31.05 S.F.
Fill: 6.30 S.F.

83+00



Cut: 3.20 S.F.
Fill: 28.54 S.F.

82+71.94



Cut: 0.24 S.F.
Fill: 37.29 S.F.

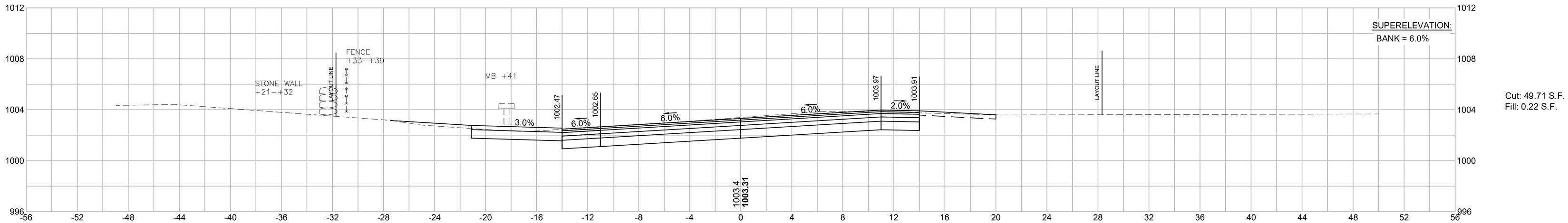
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:39 PM
Proposal No. 608163-128112
AM0800 - 518

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	158	179
PROJECT FILE NO.		608163	

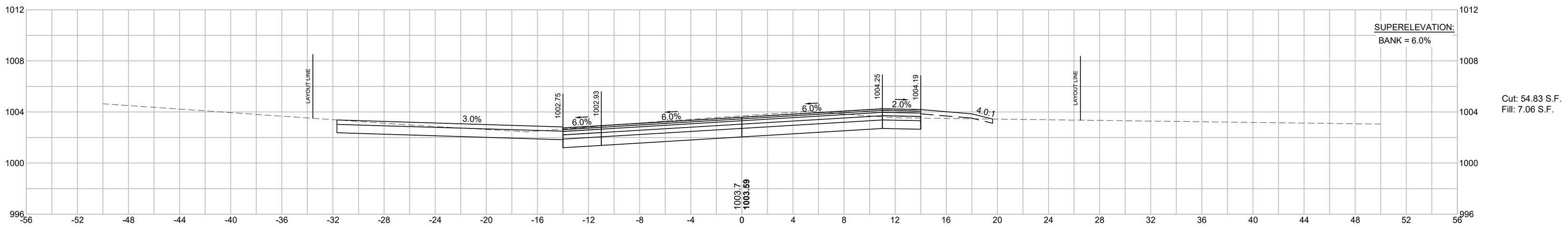
CROSS SECTIONS

84+50



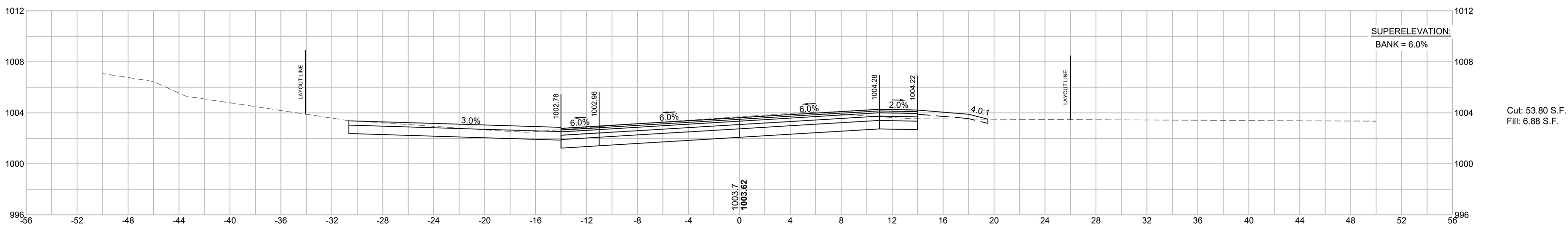
Cut: 49.71 S.F.
Fill: 0.22 S.F.

84+10



Cut: 54.83 S.F.
Fill: 7.06 S.F.

84+00



Cut: 53.80 S.F.
Fill: 6.88 S.F.

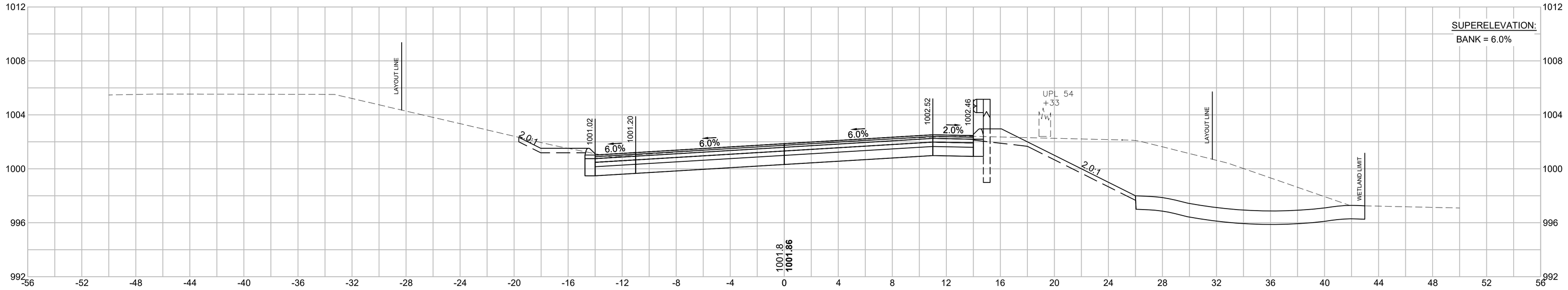
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:40 PM
Proposal No. 608163-128112
A00860 - 519

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	159	179
PROJECT FILE NO.	608163		

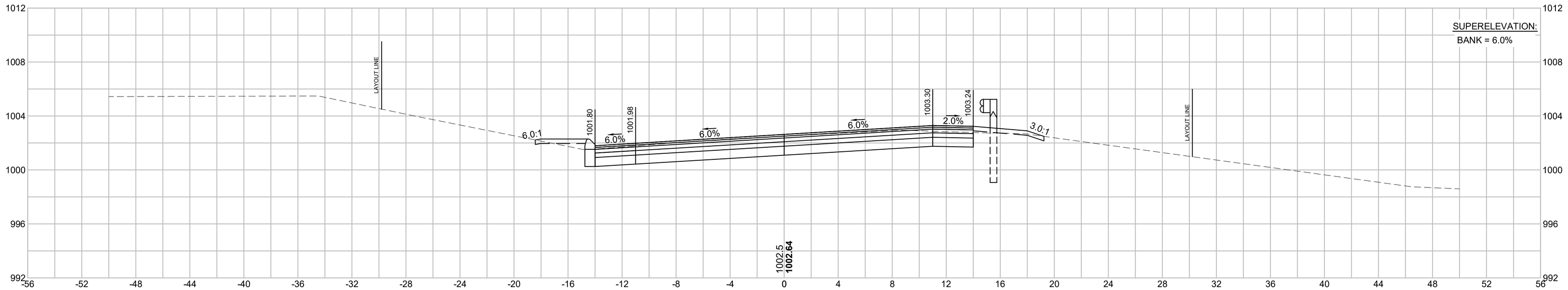
CROSS SECTIONS

85+50



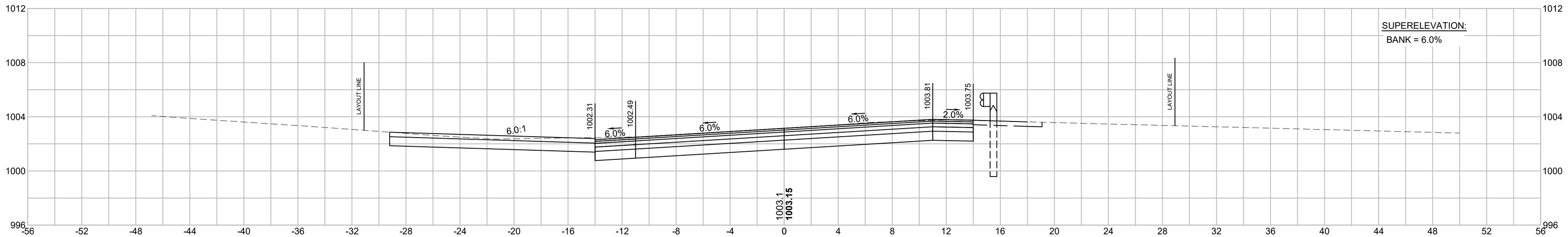
Cut: 117.67 S.F.
Fill: 1.42 S.F.

85+00



Cut: 45.97 S.F.
Fill: 4.23 S.F.

84+65



Cut: 58.80 S.F.
Fill: 0.00 S.F.

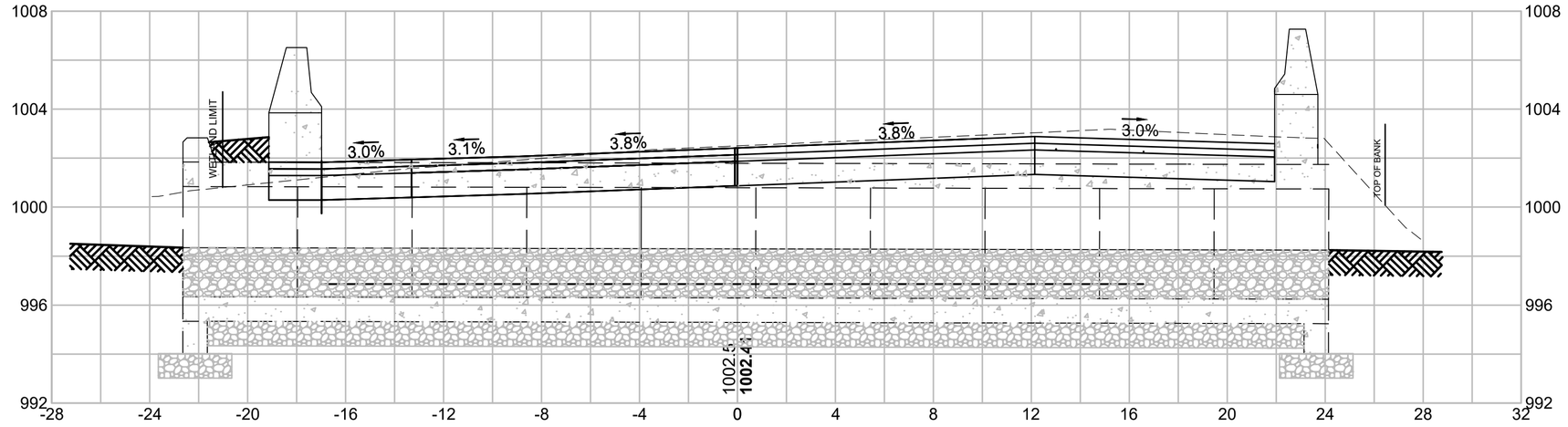
608163_HD1(X)SC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:41 PM
Proposal No. 608163-128112
A000960 - 320

WALES
MONSON ROAD

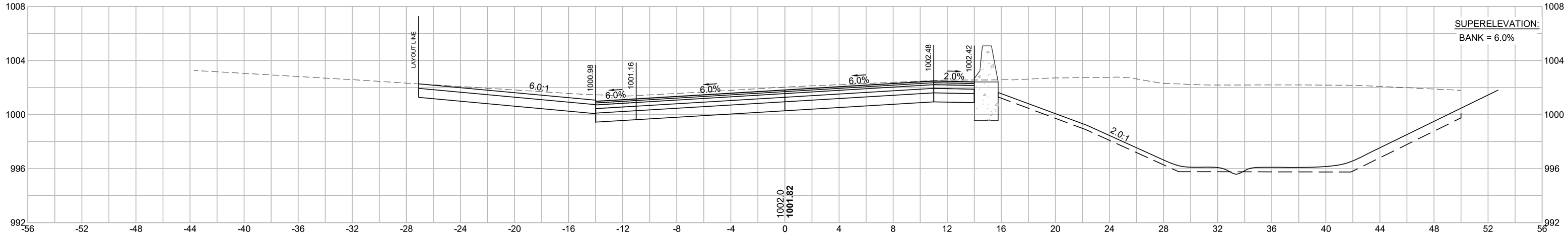
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	160	179
PROJECT FILE NO.	608163		

CROSS SECTIONS

86+45.09 (SECTION CUT ALONG CENTERLINE OF EXISTING CULVERT)

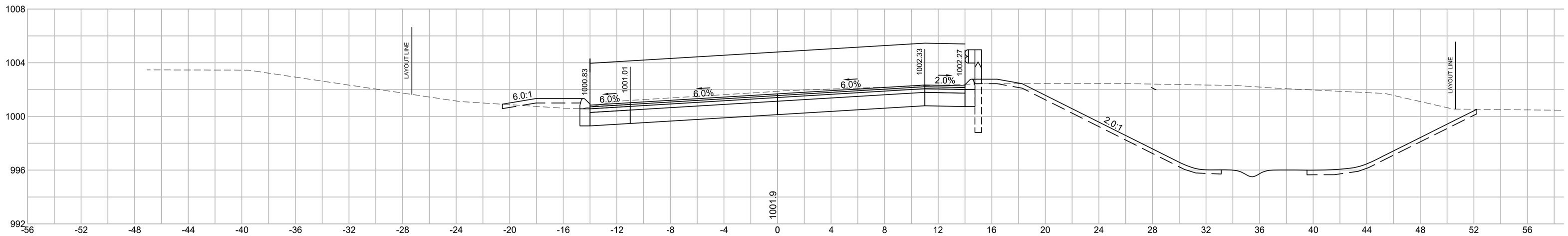


86+15



Cut: 238.87 S.F.
Fill: 0.0 S.F.

86+00



Cut: 202.10 S.F.
Fill: 4.42 S.F.

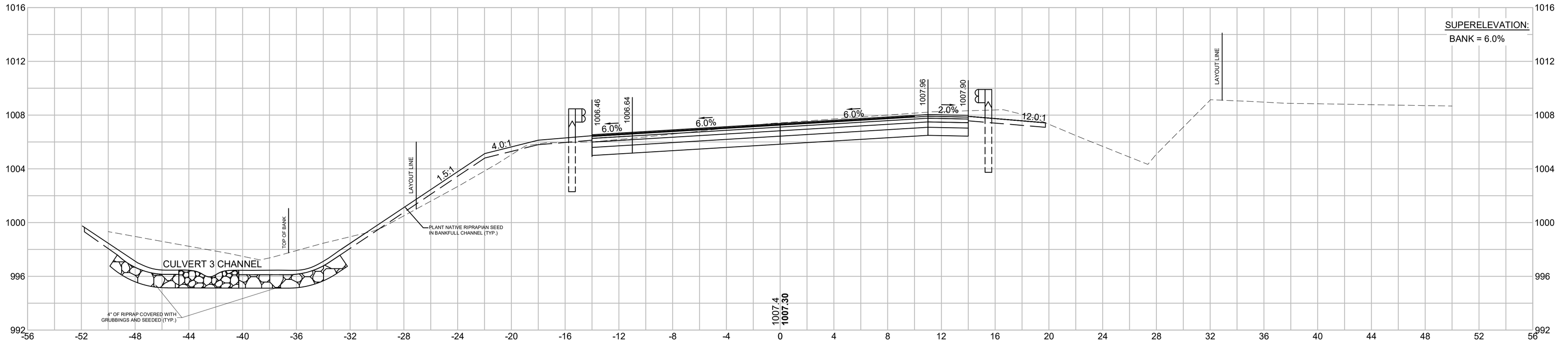
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:42 PM
Proposal No. 608163-128112
AM0860 - 521

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	161	179
PROJECT FILE NO.	608163		

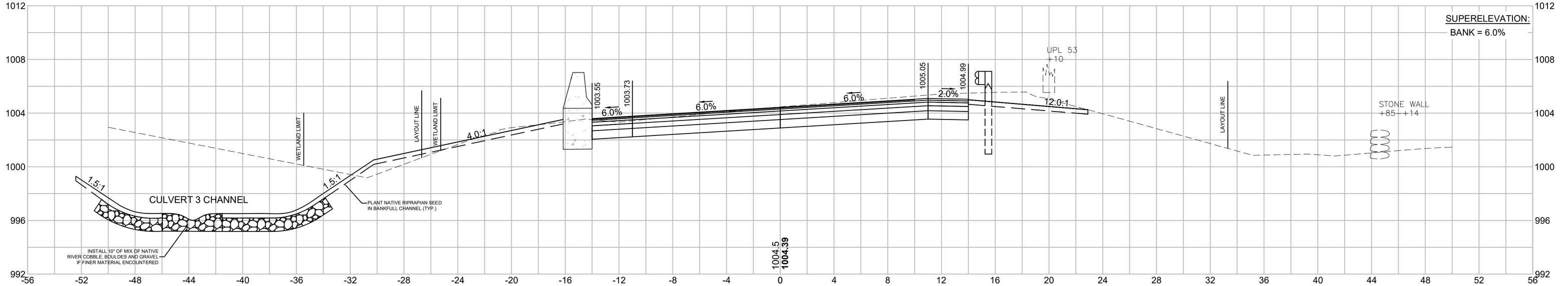
CROSS SECTIONS

87+50



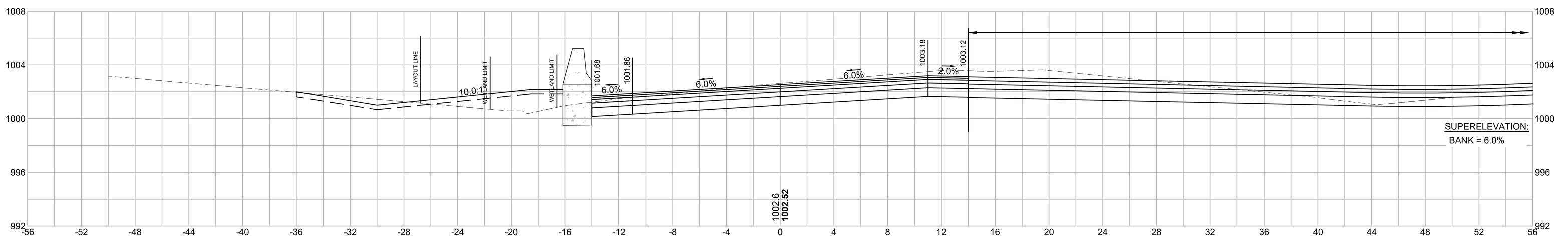
Cut: 91.25 S.F.
Fill: 10.82 S.F.

87+00



Cut: 159.04 S.F.
Fill: 5.58 S.F.

86+50



Cut: 88.36 S.F.
Fill: 14.75 S.F.

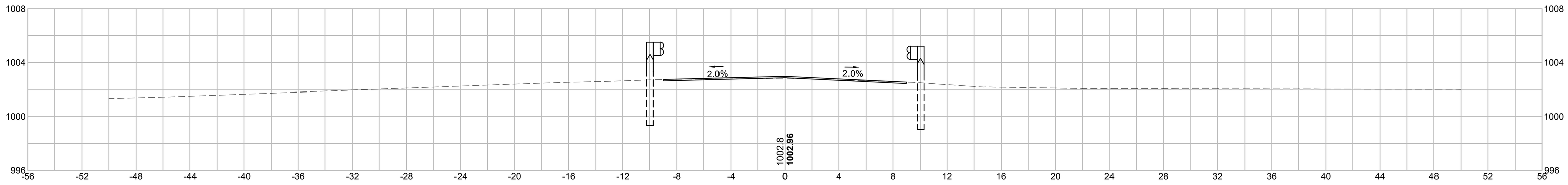
608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:43 PM
Proposal No. 608163-128112
A00860 - 522

WALES
REED HILL ROAD

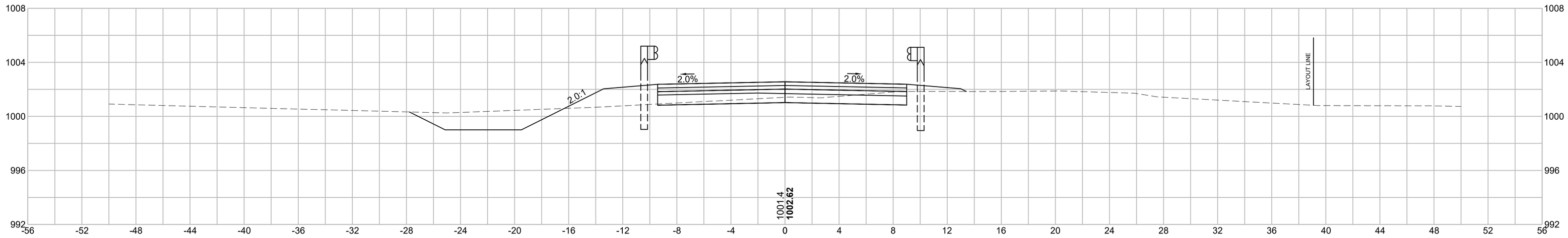
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	162	180
PROJECT FILE NO.	608163		

CROSS SECTIONS

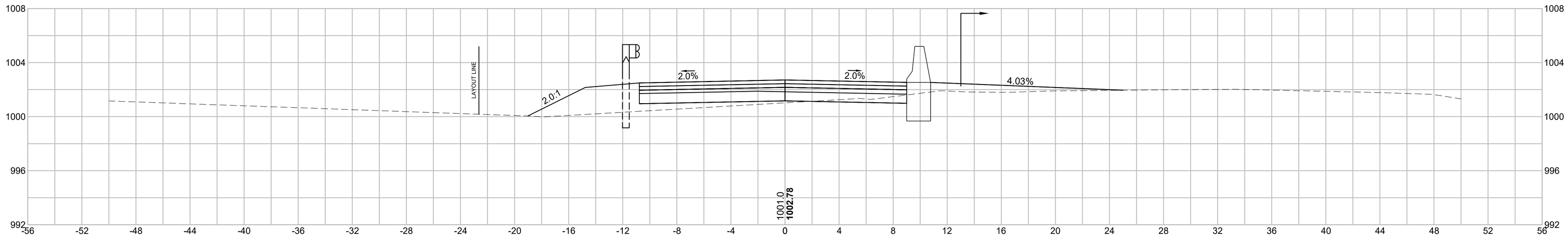
2+00



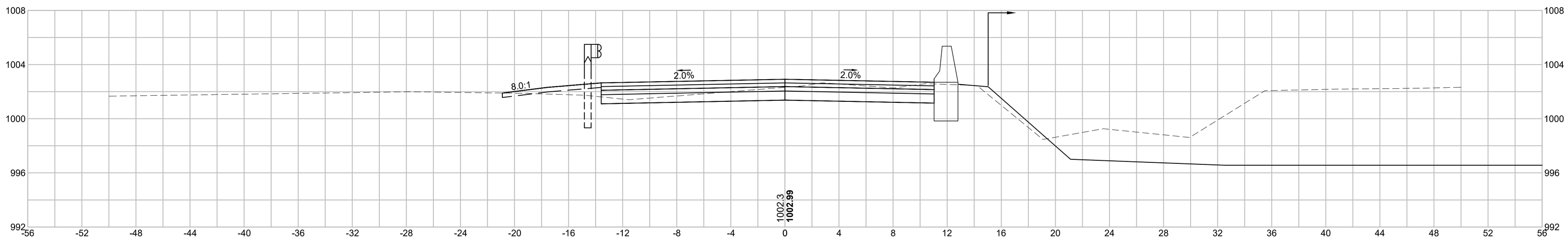
1+50



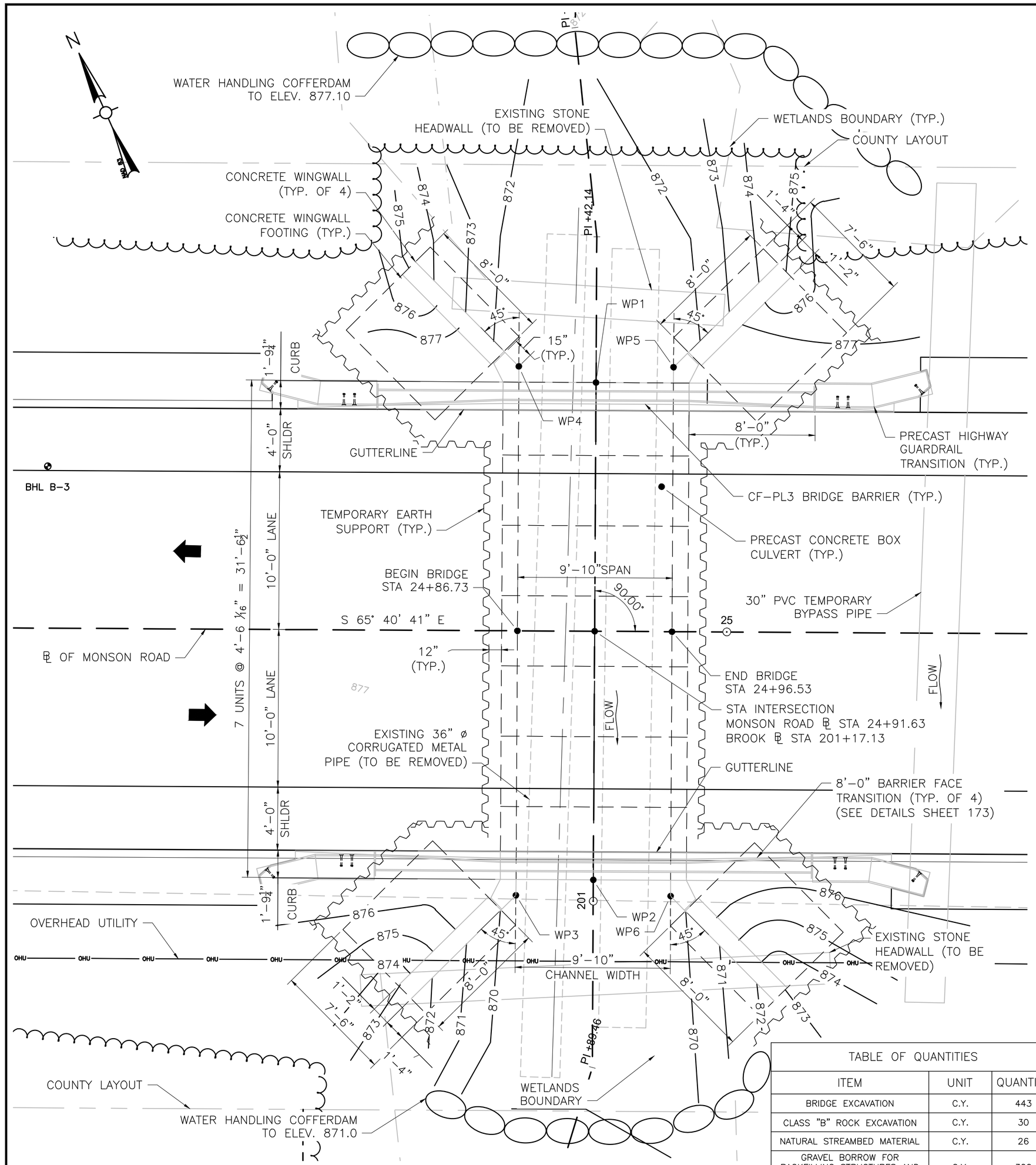
1+40.99



1+30.08



608163_HD10(XSC_GRADINGCALC).DWG Plotted on 5-Jun-2024 12:44 PM
Proposal No. 608163-12812
A00860 - 523



CULVERT 1 PLAN (STA 24+92)

SCALE: 1" = 4'

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2848111.9174	448173.3849
2	2848083.1730	448160.3979
3	2848084.2791	448155.5221
4	2848114.8452	448169.3343
5	2848110.8082	448178.2683
6	2848080.2408	448164.4559

NOTES:

1. THE FACTORED BEARING PRESSURE = 1.70 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.33 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	443
CLASS "B" ROCK EXCAVATION	C.Y.	30
NATURAL STREAMBED MATERIAL	C.Y.	26
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	300
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	18
PRECAST GUARDRAIL HIGHWAY TRANSITION	EA.	4
4000 PSI, 1¼", 565 CEMENT CONCRETE	C.Y.	50
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	27
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	17050
DAMPPROOFING	S.F.	1244
PRECAST CONCRETE BOX CULVERT – SITE 1	L.S.	1
TEMPORARY SUPPORT OF EARTH	L.S.	1

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 21+38± (RT) MAGNAIL IN UTILITY POLE: EL. 876.92 FT

BENCHMARK STA 29+60± (RT) MAGNAIL IN UTILITY POLE: EL. 900.23 FT

BENCHMARK STA 29+90± (LT) MAGNAIL BRASS RIVET: EL. 901.72 FT

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

4000 PSI, 1½", 565 CEMENT CONCRETE.....WINGWALLS

5000 PSI, ¾", 685 CEMENT CONCRETE.....CF-PL3 BARRIER CURB, TRANSITION BARRIER CURB

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	163	180
PROJECT FILE NO.		608163	

CULVERT 1 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	0.903
DESIGN FLOOD DISCHARGE (C.F.S.)	123
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	6.32
DESIGN FLOOD ELEVATION (FEET, NAVD)	873.95
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	174
BASE FLOOD ELEVATION (FEET, NAVD)	874.72
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

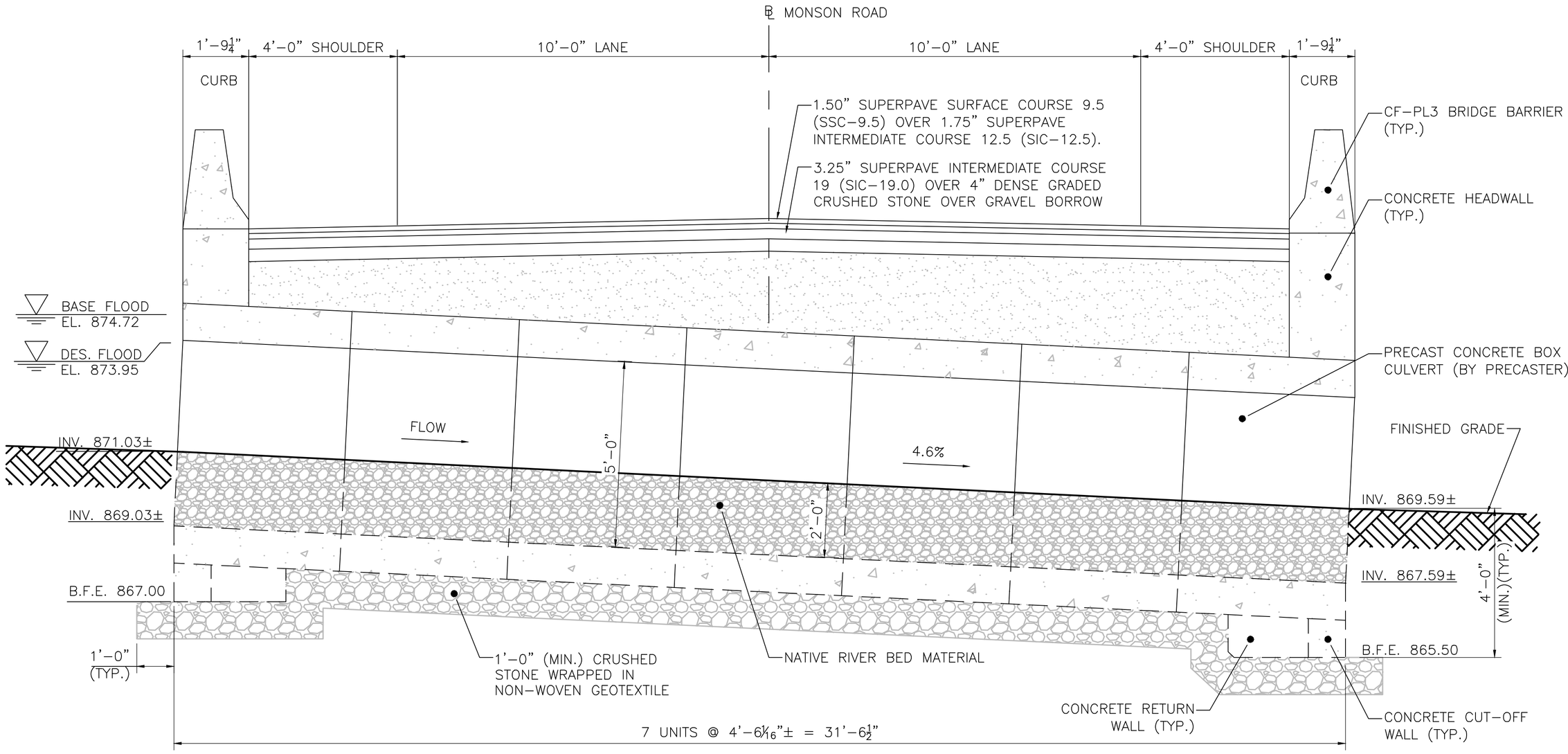
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	43
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	7.72
DESIGN FLOOD ELEVATION (FEET, NAVD)	876.1

608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:48 AM
Proposal No. 608163-128112
A000600 - 524

WALES
MONSON ROAD

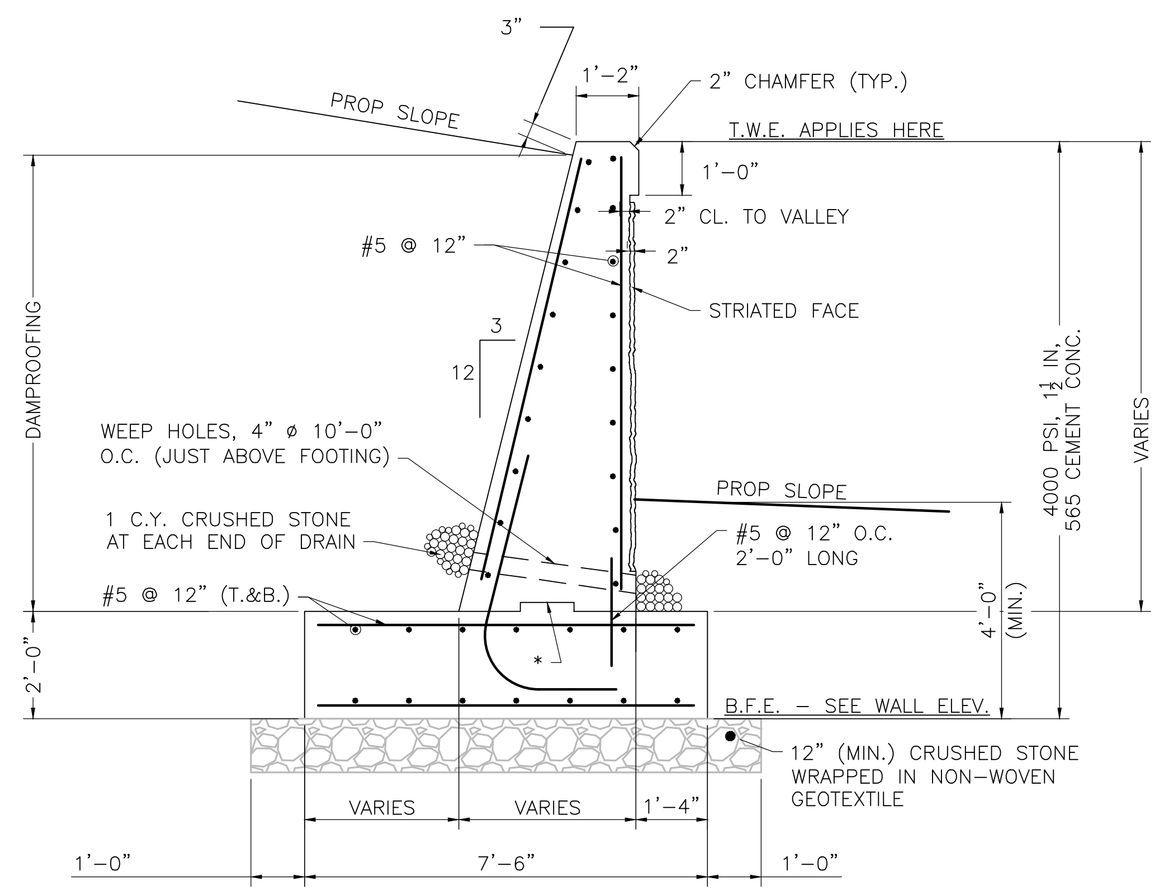
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	164	180
PROJECT FILE NO.	608163		

CULVERT 1 SECTION & DETAILS



CULVERT 1 LONGITUDINAL SECTION

SCALE: ½" = 1'-0"



WINGWALL TYPICAL SECTION

SCALE: ½" = 1'-0"

* – CONSTRUCTION JOINT WITH 12"X2" KEY

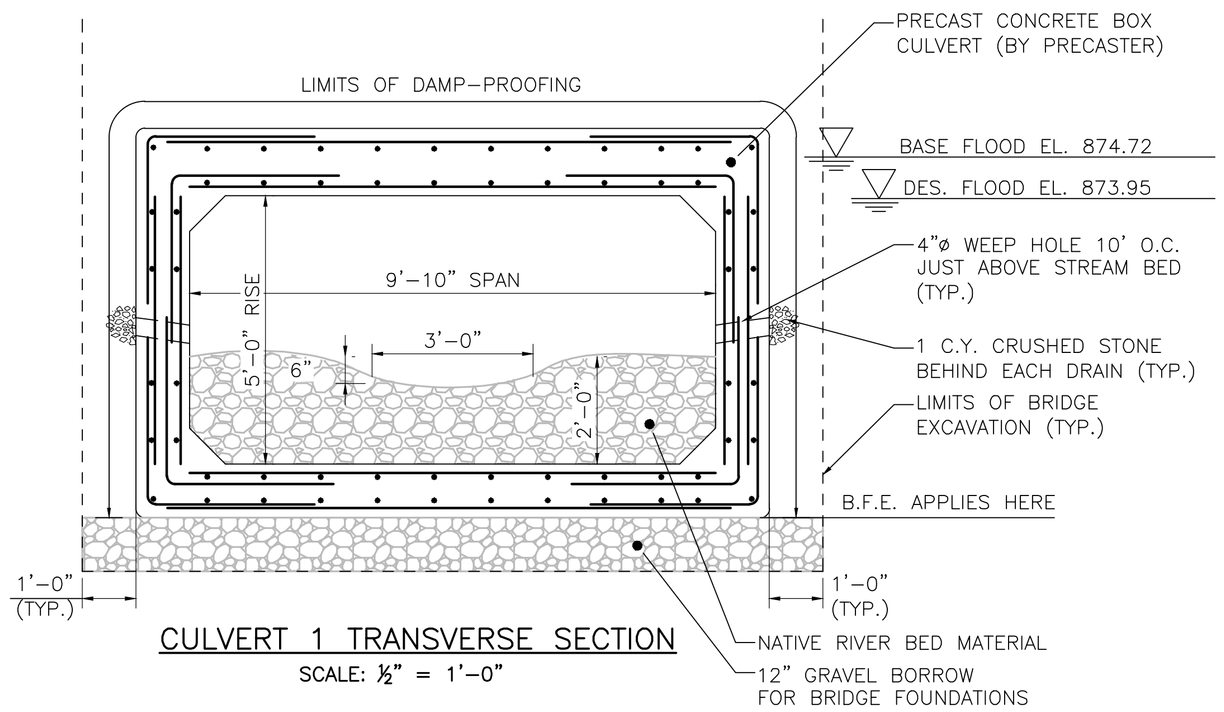
PRECAST BOX CULVERT NOTES:

1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 9'-10" WIDE, 5'-0" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO 9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 1.70 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.33 KSF.
   FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



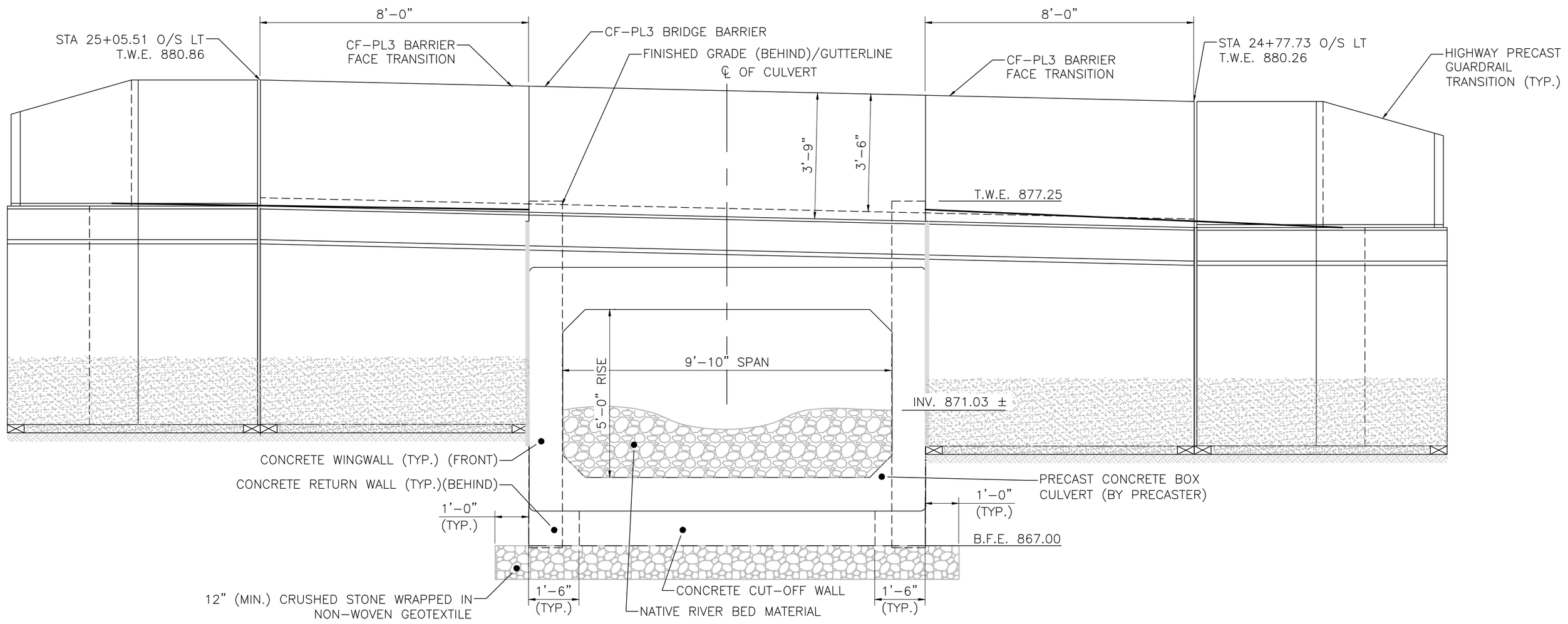
CULVERT 1 TRANSVERSE SECTION

SCALE: ½" = 1'-0"

REFERENCE NOTES:

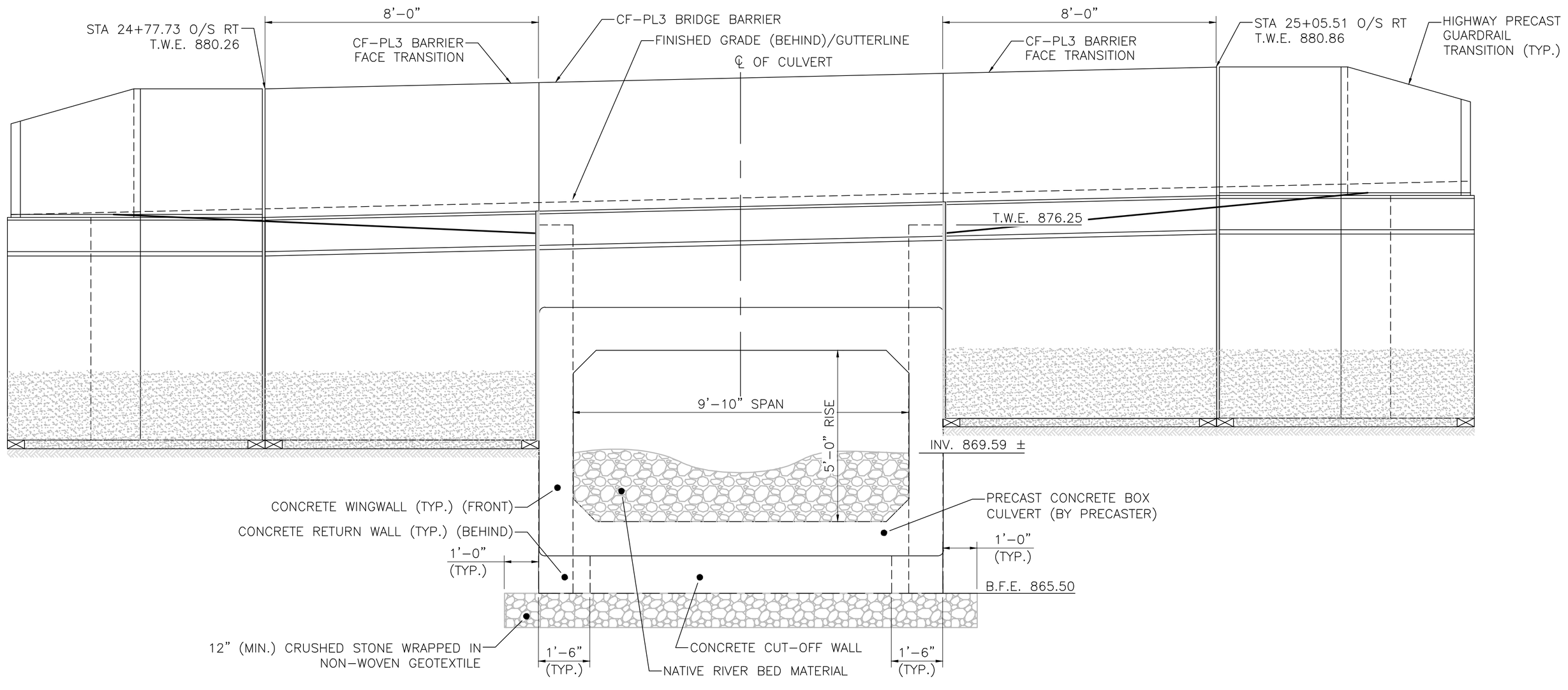
1. FOR CULVERT 1 HEADWALL ELEVATIONS, SEE SHEET NO. 165.
2. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
3. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

608163_HD71(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:49 AM
Proposal No. 608163-128112
A00060 - 525



CULVERT 1 INLET ELEVATION

SCALE: ½" = 1'–0"



CULVERT 1 OUTLET ELEVATION

SCALE: ½" = 1'–0"

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	165	180
PROJECT FILE NO.	608163		

CULVERT 1 HEADWALL ELEVATIONS

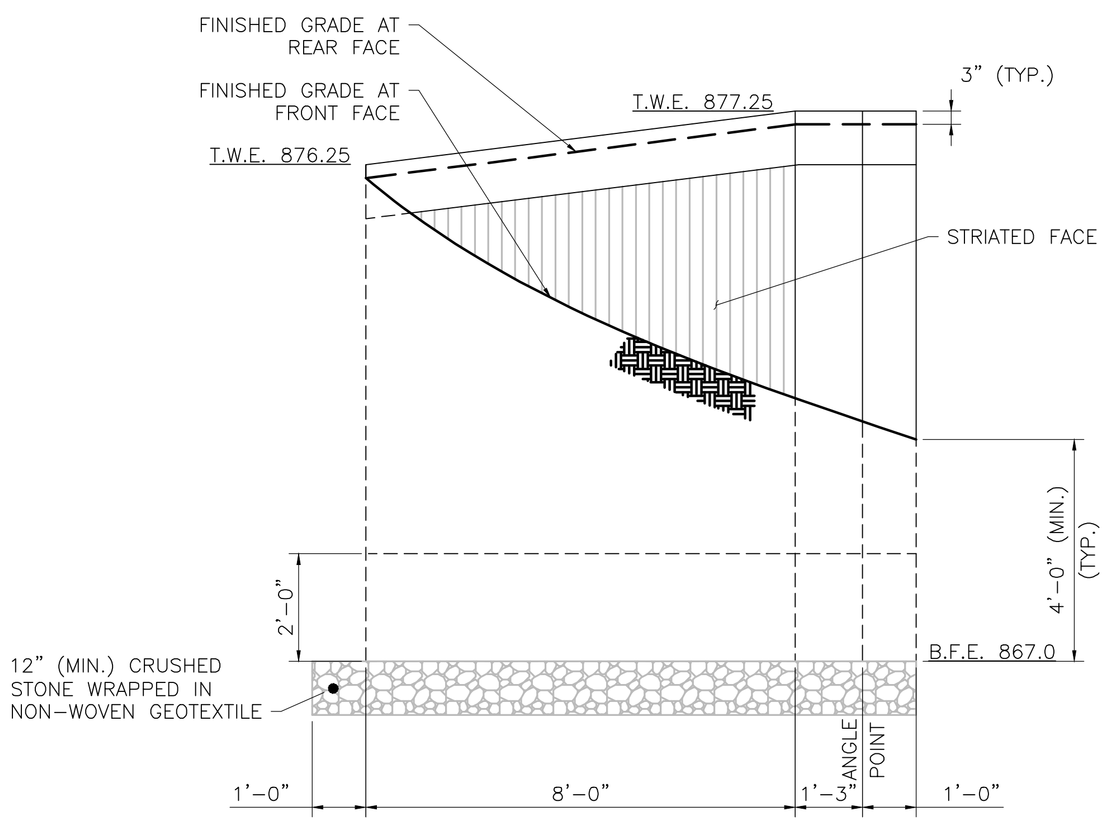
REFERENCE NOTES:

1. FOR CULVERT 1 WINGWALL ELEVATIONS, SEE SHEET NO. 166
2. FOR CONCRETE HEADWALL DETAILS, CUT–OFF AND RETURN WALL DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

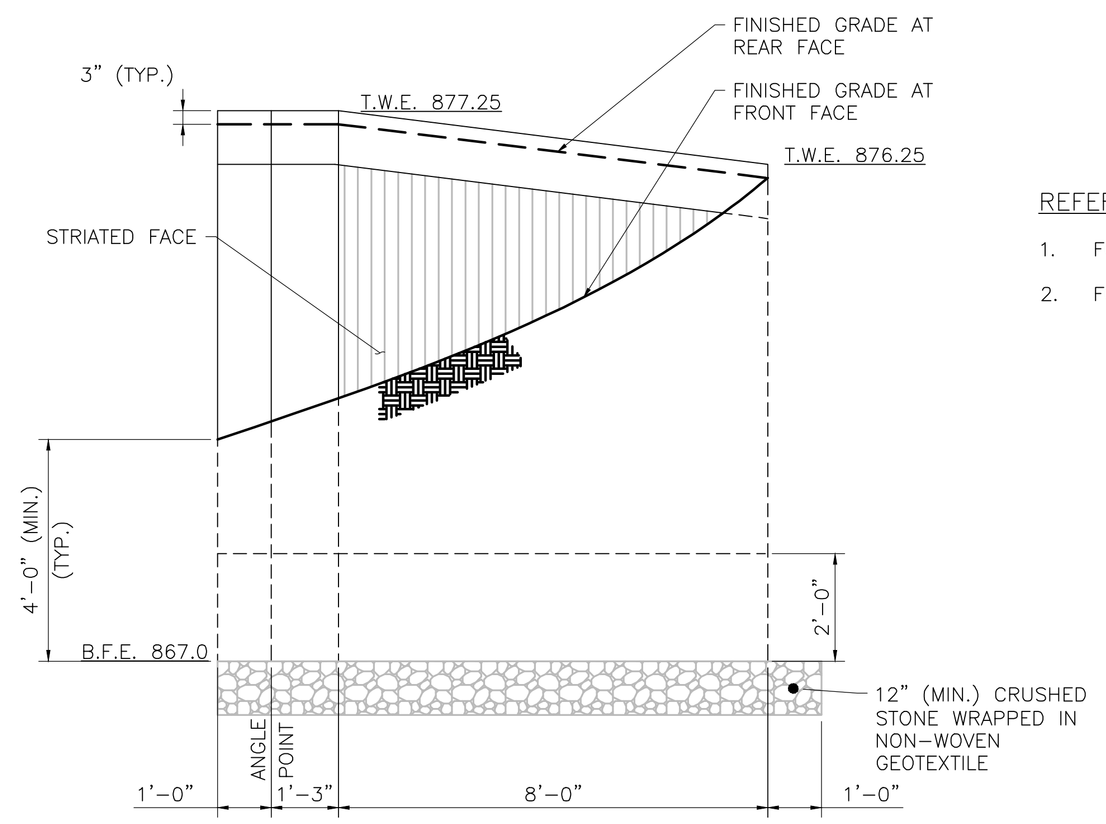
608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:49 AM
Proposal No. 608163-128112
AM0800 - 526

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	166	180
PROJECT FILE NO.	608163		

CULVERT 1 WINGWALL ELEVATIONS



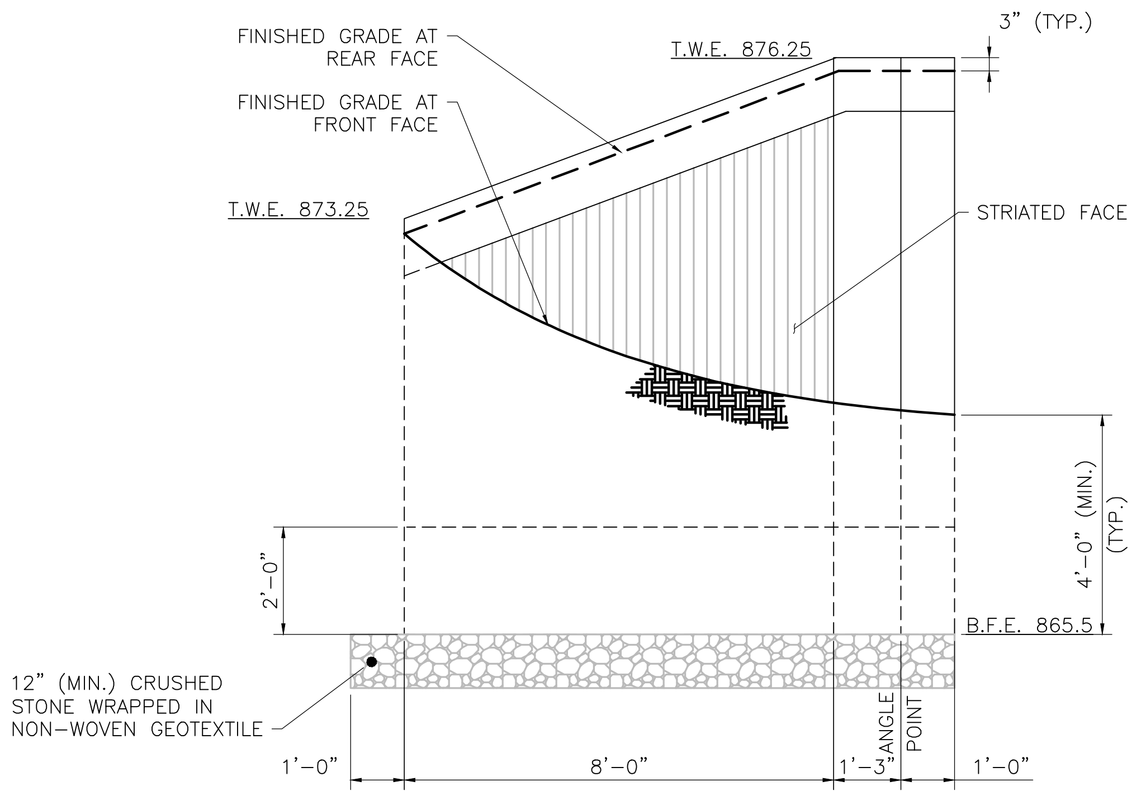
NORTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



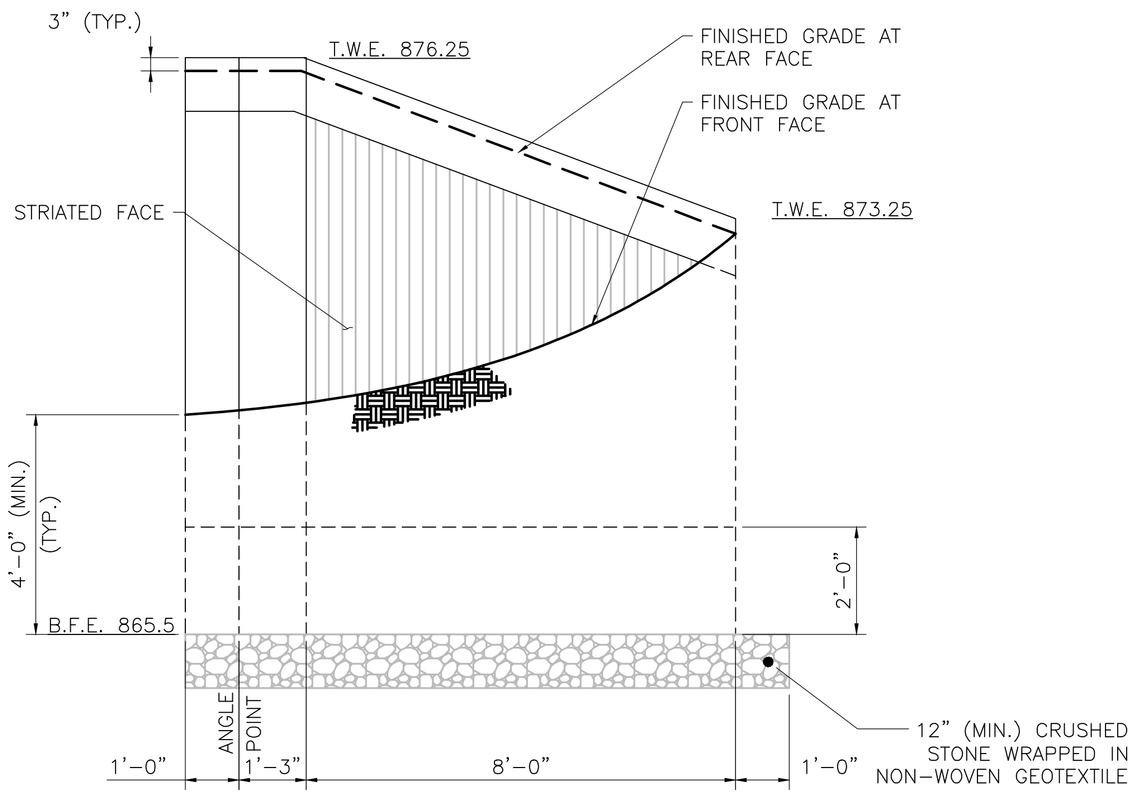
NORTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

REFERENCE NOTES:

1. FOR CULVERT 1 WINGWALL SECTION, SEE SHEET NO. 164.
2. FOR STRIATION DETAILS, AND WINGWALL DETAILS, SEE SHEET NO. 172.

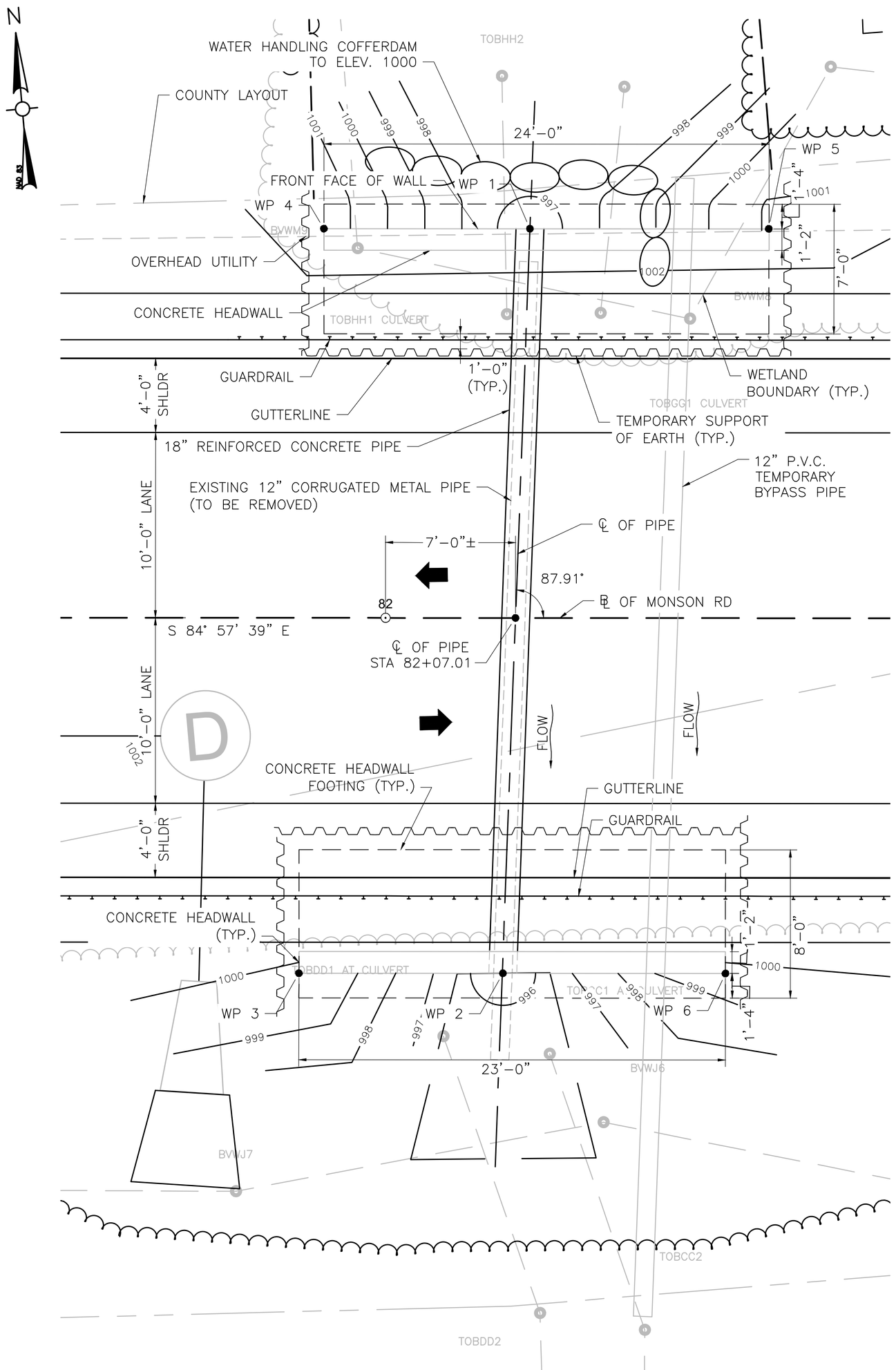


SOUTHWEST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"



SOUTHEAST WINGWALL DEVELOPED ELEVATION
SCALE: ½" = 1'-0"

608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:51 AM
Proposal No. 608163-128112
A00860 - 527



CULVERT 2 PLAN (STA 82+07)

SCALE: 1" = 4'

NOTES:

1. THE FACTORED BEARING PRESSURE = 2.22 KSF AT THE INLET HEADWALL AND 2.38 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.66 KSF AT THE INLET HEADWALL AND 5.83 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, WITH CURRENT INTERIM SPECIFICATIONS FOR HL-93 LOADING.

EXISTING CONDITIONS:

DIMENSIONS SHOWN AND DETAILS DEPICTED ARE BASED UPON THE ORIGINAL BRIDGE PLANS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

BENCH MARK:

BENCHMARK STA 81+25± (LT) SPIKE IN UTILITY POLE: EL. 1005.74

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIALS:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2. AND 3.	26"	32"	39"
6. CONDITION 2. AND 4.	24"	30"	36"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS

CONCRETE MIX:

THE CEMENT CONCRETE SPECIFIED BELOW SHALL BE USED ON THE FOLLOWING BRIDGE COMPONENTS:

4000 PSI, 1½", 565 CEMENT CONCRETE.....HEADWALLS

UTILITIES:

THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES.

WATER HANDLING SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING PIPES.
4. INSTALL THE PROPOSED PIPE & HEADWALLS.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE PROPOSED CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
CLASS "A" TRENCH EXCAVATION	C.Y.	209
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	150
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	20
4000 PSI 1½" 565 CEMENT CONCRETE	C.Y.	52
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	10010
DAMPPROOFING	S.F.	426
TEMPORARY SUPPORT OF EARTH	L.S.	1

WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847313.7204	453680.2286
2	2847273.8336	453675.2733
3	2847274.8008	453664.3163
4	2847314.6939	453669.1581
5	2847312.5891	453693.0567
6	2847272.7828	453687.1995

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	167	180
PROJECT FILE NO.	608163		

CULVERT 2 KEY PLAN AND NOTES

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2025	–
AVERAGE DAILY TRAFFIC – PRESENT	660	–
AVERAGE DAILY TRAFFIC – DESIGN YEAR	760	–
DESIGN HOURLY VOLUME	85	–
DIRECTIONAL DISTRIBUTION	52%	–
TRUCK PERCENTAGE – AVERAGE DAY	3%	–
TRUCK PERCENTAGE – PEAK HOUR	3%	–
DESIGN SPEED	40 MPH	–
DIRECTIONAL DESIGN HOURLY VOLUME	45	–

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YR
DESIGN SPECTRA	
As	0.071g
SDs	0.156g
SD1	0.063g
SITE CLASS	C
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	10.24
DESIGN FLOOD DISCHARGE (C.F.S.)	9
DESIGN FLOOD FREQUENCY (YEARS)	25
DESIGN FLOOD VELOCITY (F.P.S.)	0.14
DESIGN FLOOD ELEVATION (FEET, NAVD)	996.14
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	9
BASE FLOOD ELEVATION (FEET, NAVD)	999.20
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	N/A
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	N/A
CHECK FLOOD PIER SCOUR DEPTH (FEET)	N/A
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	UNKNOWN
FREQUENCY (IF KNOWN, YEARS)	UNKNOWN
MAXIMUM ELEVATION (FEET, NAVD)	UNKNOWN
DATE (MM/YYYY)	UNKNOWN
HISTORY OF ICE FLOES	NONE
EVIDENCE OF SCOUR AND EROSION	NONE

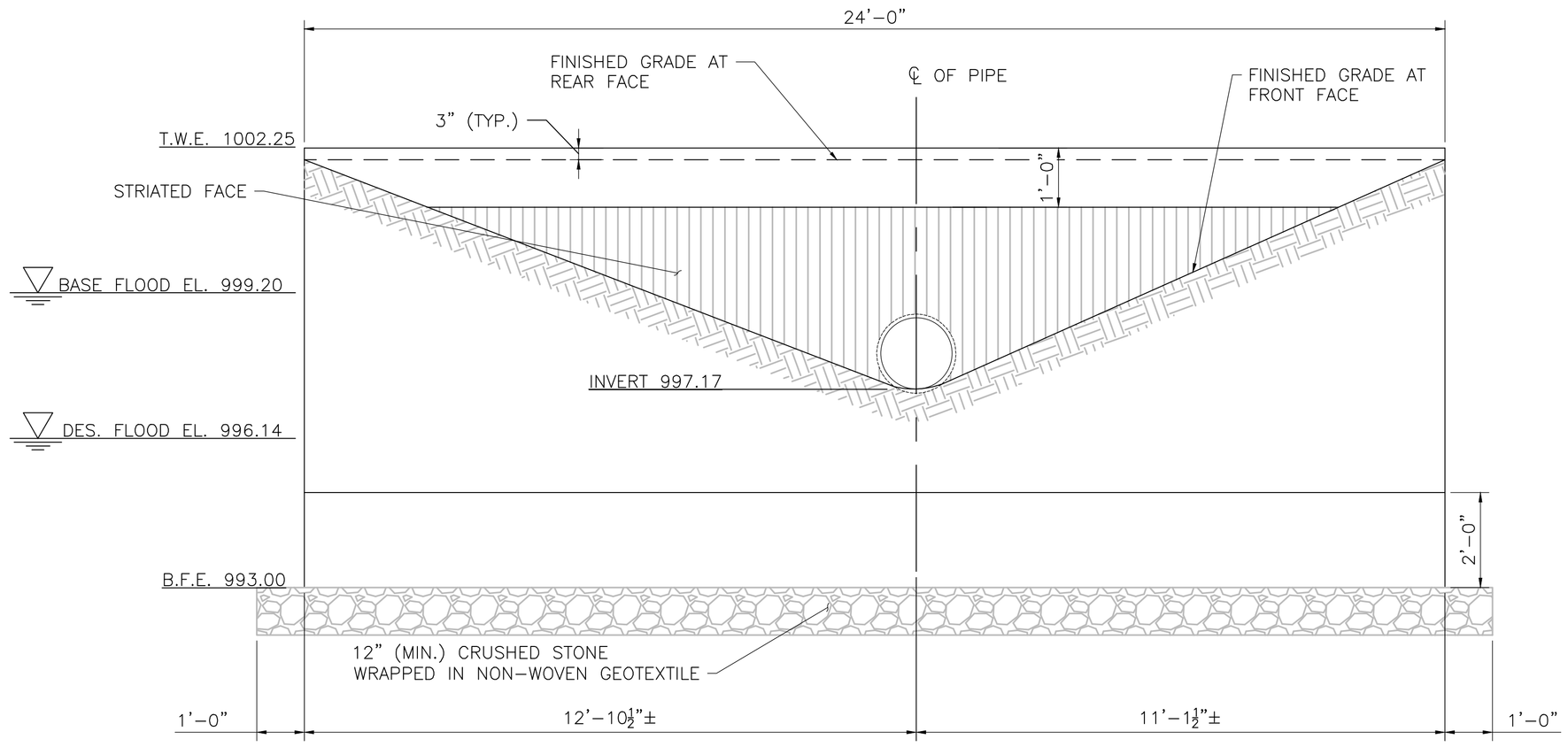
TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	5
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	6.70
DESIGN FLOOD ELEVATION (FEET, NAVD)	998.46

608163_HDT1(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:51 AM
Proposal No. 608163-128112
A008069 - 528

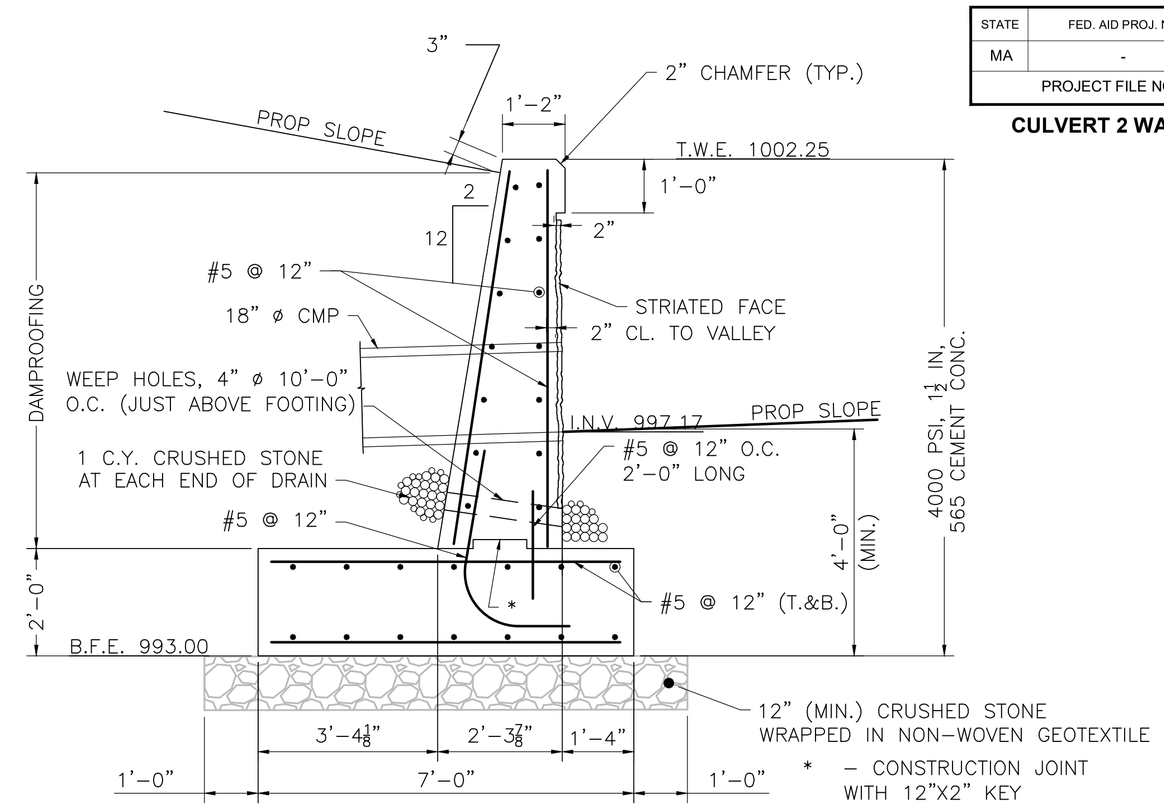
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	168	180
PROJECT FILE NO.	608163		

CULVERT 2 WALL DETAILS



NORTH INLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"

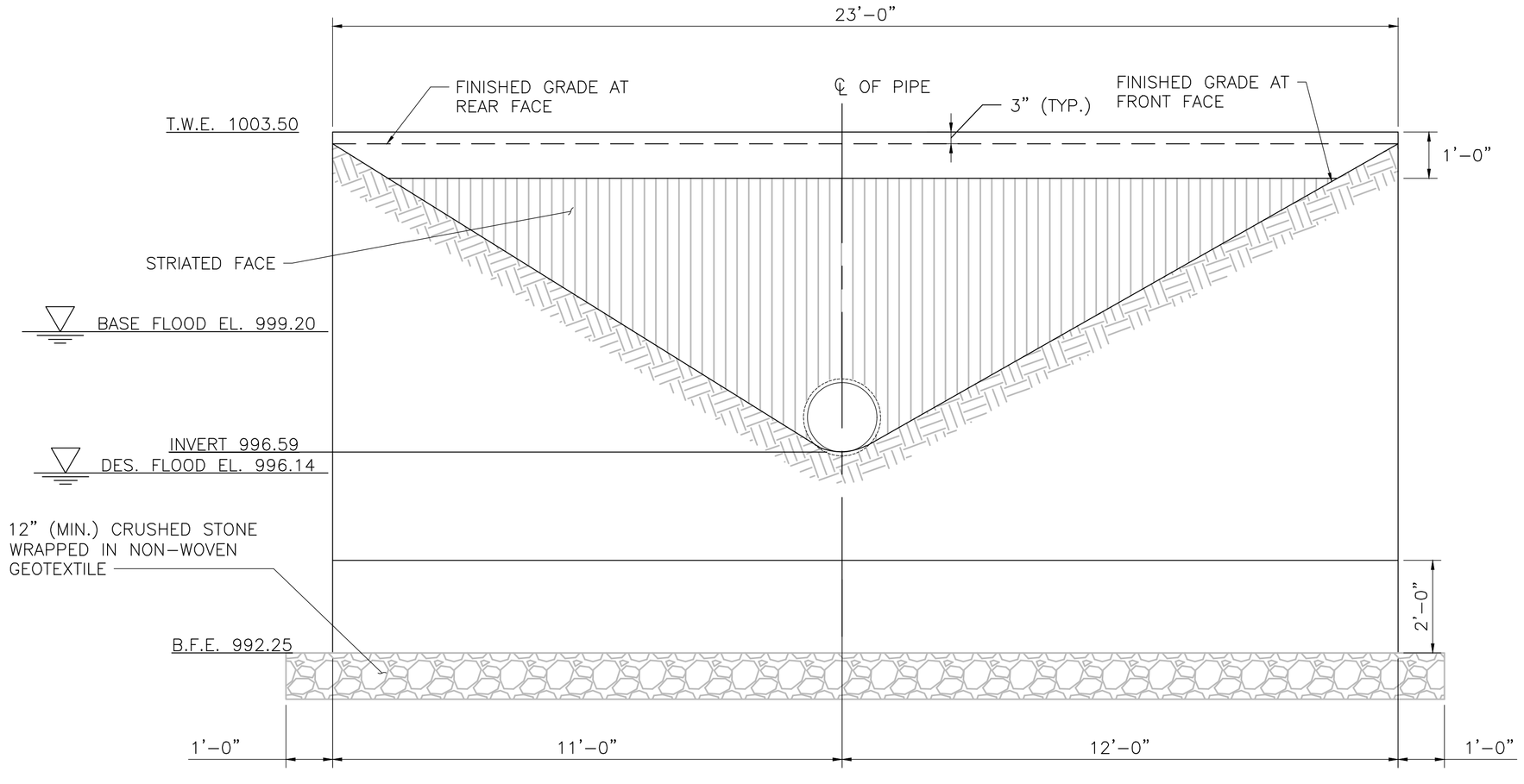


NORTH INLET HEADWALL SECTION
SCALE: ½" = 1'-0"

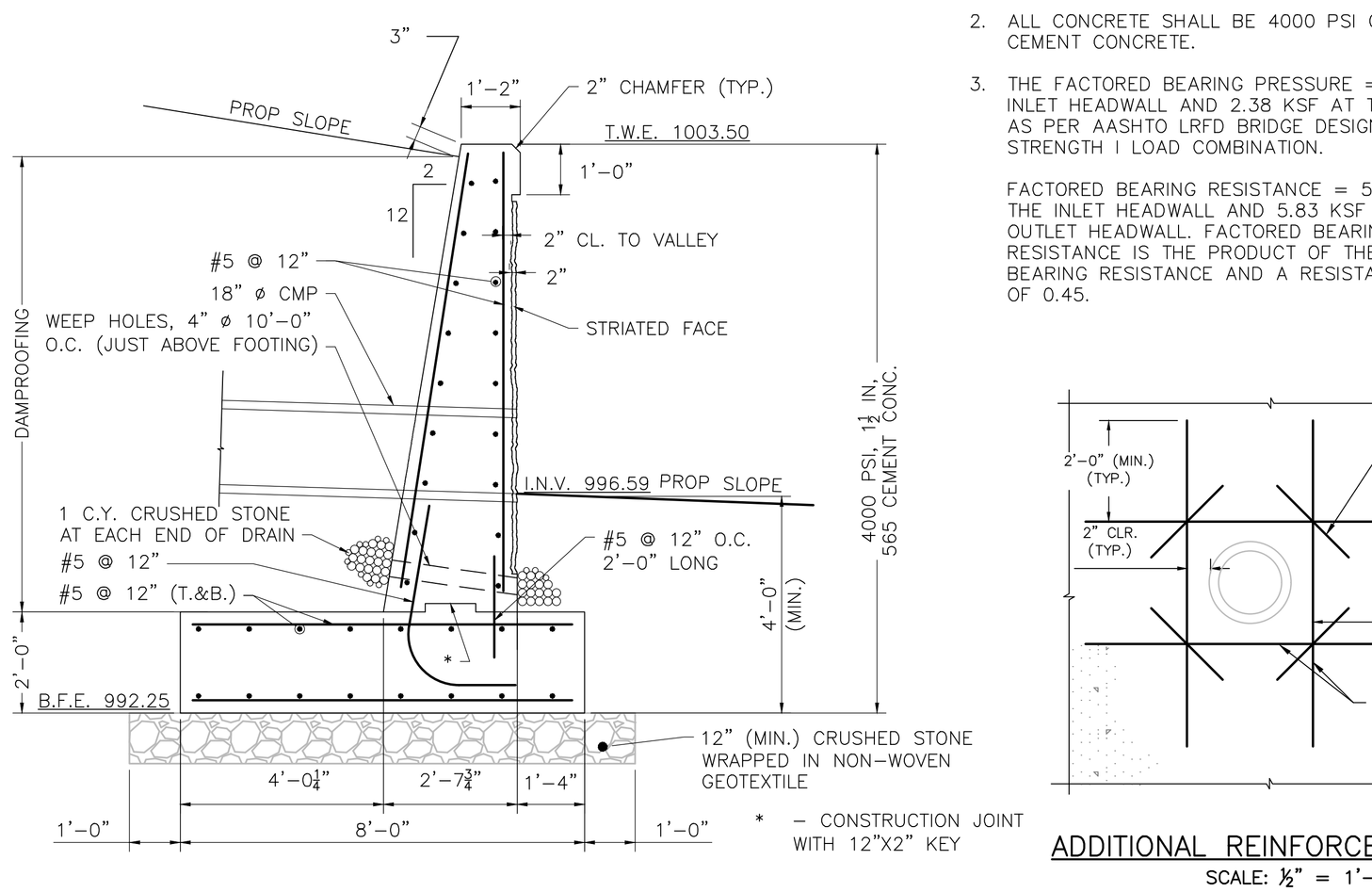
NOTES:

1. INSTALL 4" WEEP HOLES @ 10'-0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 2.22 KSF AT THE INLET HEADWALL AND 2.38 KSF AT THE OUTLET HEADWALL AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

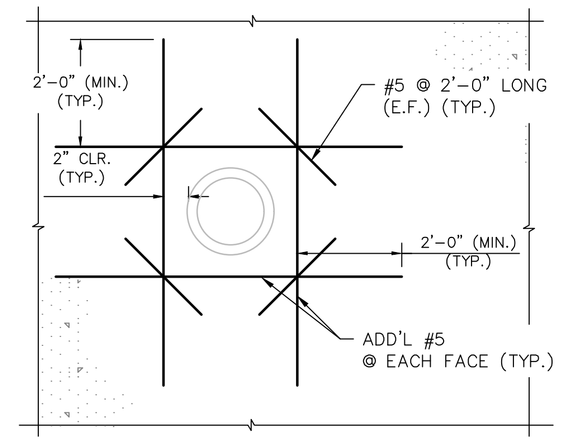
   FACTORED BEARING RESISTANCE = 5.66 KSF AT THE INLET HEADWALL AND 5.83 KSF AT THE OUTLET HEADWALL. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



SOUTH OUTLET HEADWALL ELEVATION
SCALE: ½" = 1'-0"



SOUTH OUTLET HEADWALL SECTION
SCALE: ½" = 1'-0"

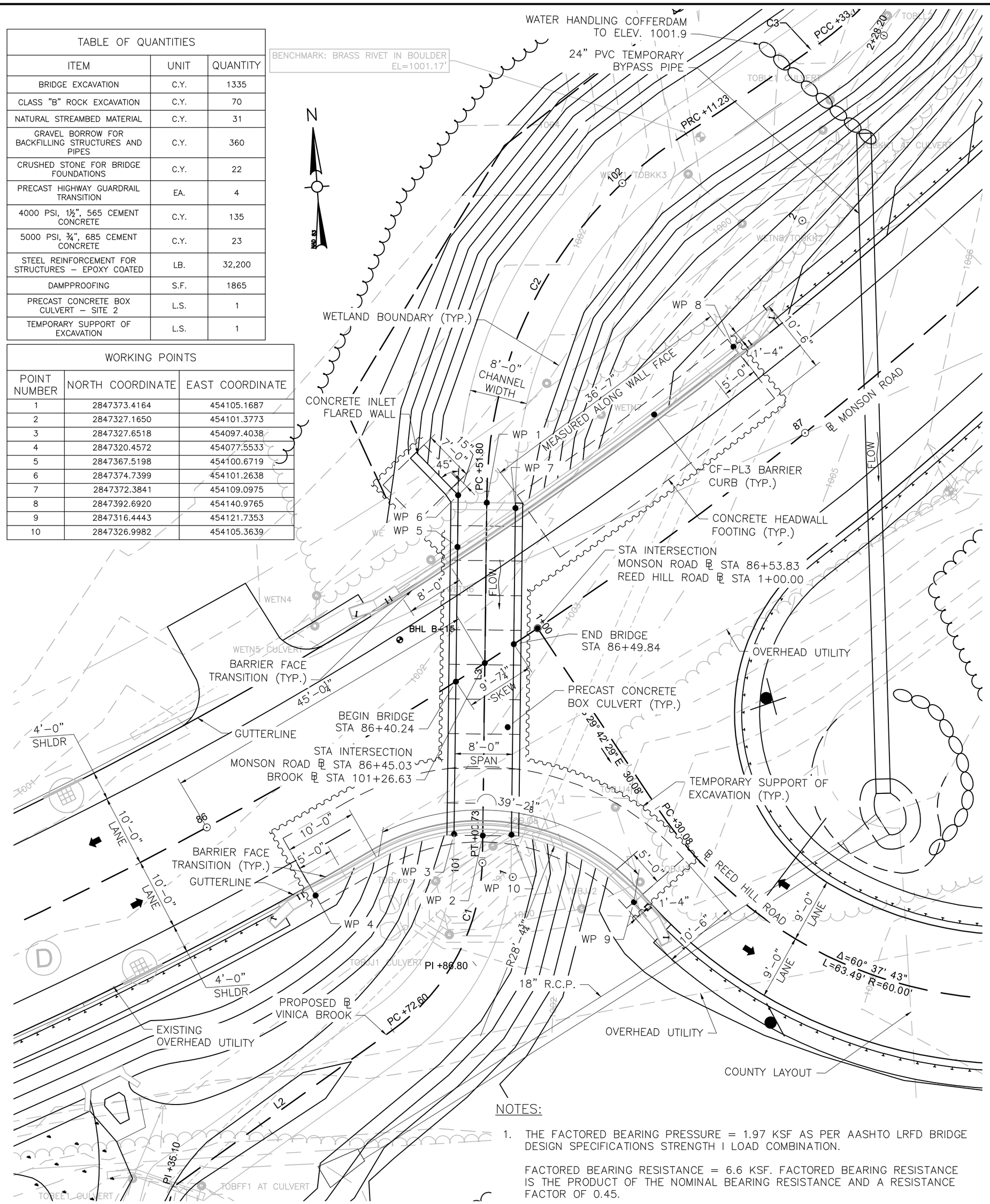


ADDITIONAL REINFORCEMENT AT PIPE
SCALE: ½" = 1'-0"

608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:53 AM
Proposal No. 608163-128112
A008690 - 529

TABLE OF QUANTITIES		
ITEM	UNIT	QUANTITY
BRIDGE EXCAVATION	C.Y.	1335
CLASS "B" ROCK EXCAVATION	C.Y.	70
NATURAL STREAMBED MATERIAL	C.Y.	31
GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	C.Y.	360
CRUSHED STONE FOR BRIDGE FOUNDATIONS	C.Y.	22
PRECAST HIGHWAY GUARDRAIL TRANSITION	EA.	4
4000 PSI, 1½", 565 CEMENT CONCRETE	C.Y.	135
5000 PSI, ¾", 685 CEMENT CONCRETE	C.Y.	23
STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	LB.	32,200
DAMPPROOFING	S.F.	1865
PRECAST CONCRETE BOX CULVERT – SITE 2	L.S.	1
TEMPORARY SUPPORT OF EXCAVATION	L.S.	1

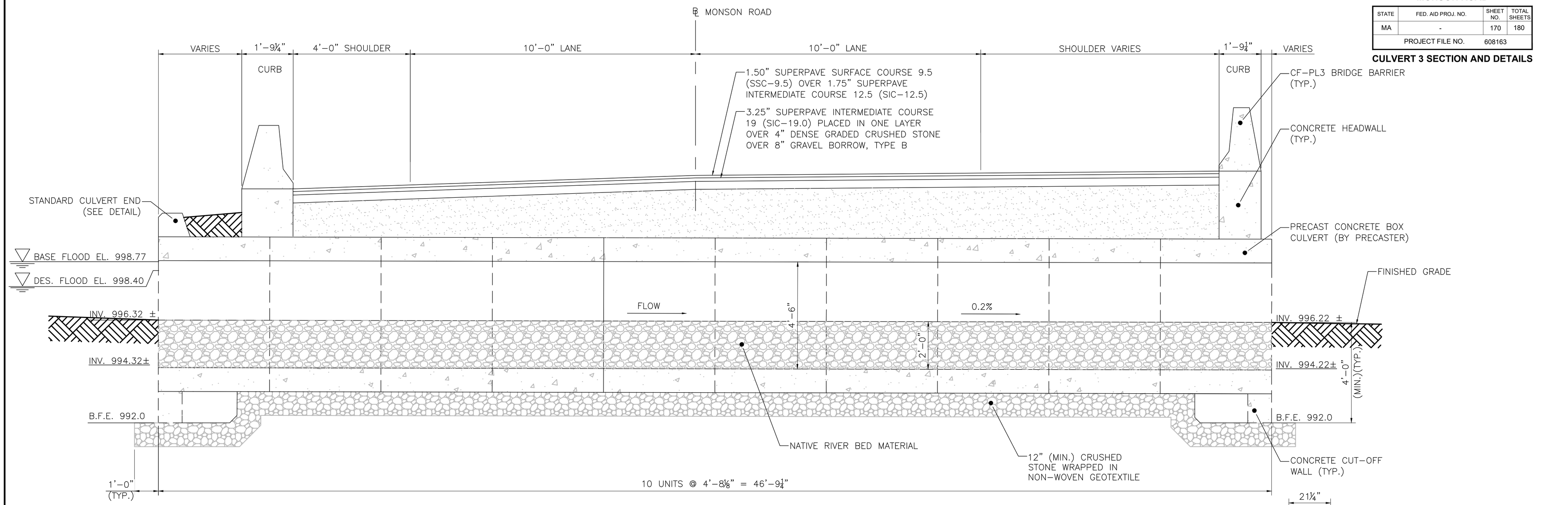
WORKING POINTS		
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE
1	2847373.4164	454105.1687
2	2847327.1650	454101.3773
3	2847327.6518	454097.4038
4	2847320.4572	454077.5533
5	2847367.5198	454100.6719
6	2847374.7399	454101.2638
7	2847372.3841	454109.0975
8	2847392.6920	454140.9765
9	2847316.4443	454121.7353
10	2847326.9982	454105.3639


BENCHMARK: BRASS RIVET IN BOULDER EL=1001.17'
WATER HANDLING COFFERDAM TO ELEV. 1001.9
24" PVC TEMPORARY BYPASS PIPE
N
NAD 83
WETLAND BOUNDARY (TYP.)
CONCRETE INLET FLARED WALL
8'-0" CHANNEL WIDTH
36'-7" MEASURED ALONG WALL FACE
WP 1
WP 7
WP 8
WP 6
WP 5
PC +51.80
45°
7.15'
8'-0"
CF-PL3 BARRIER CURB (TYP.)
CONCRETE HEADWALL FOOTING (TYP.)
STA INTERSECTION
MONSON ROAD ℄ STA 86+53.83
REED HILL ROAD ℄ STA 1+00.00
℄ MONSON ROAD
FLOW
BHL B-15
END BRIDGE
STA 86+49.84
OVERHEAD UTILITY
PRECAST CONCRETE BOX CULVERT (TYP.)
BARRIER FACE TRANSITION (TYP.)
45'-0"
GUTTERLINE
BEGIN BRIDGE
STA 86+40.24
9'-7½" SKEW
8'-0" SPAN
4'-0" SHLDR
STA INTERSECTION
MONSON ROAD ℄ STA 86+45.03
BROOK ℄ STA 101+26.63
29° 42' 29" E
30.08'
TEMPORARY SUPPORT OF EXCAVATION (TYP.)
PC +30.08
℄ REED HILL ROAD
10'-0" LANE
5'-0"
39'-2⅞"
PT +10.73
WP 3
WP 2
WP 4
WP 10
WP 9
C1
C2
C3
R28'-4¾"
PI +86.80
18" R.C.P.
PROPOSED ℄ VINICA BROOK
PC +72.60
EXISTING OVERHEAD UTILITY
OVERHEAD UTILITY
COUNTY LAYOUT
Δ=60° 37' 43"
L=63.49'
R=60.00'
PI +35.10
L2
TOBFF1 AT CULVERT
TOBBL2 AT CULVERT
TOBBR1 AT CULVERT
WETN4
WETN5 CULVERT
WETN7/TOBKK2
TOBKK3
TOBKK1
TOBKK4
TOBKK5
TOBKK6
TOBKK7
TOBKK8
TOBKK9
TOBKK10
TOBKK11
TOBKK12
TOBKK13
TOBKK14
TOBKK15
TOBKK16
TOBKK17
TOBKK18
TOBKK19
TOBKK20
TOBKK21
TOBKK22
TOBKK23
TOBKK24
TOBKK25
TOBKK26
TOBKK27
TOBKK28
TOBKK29
TOBKK30
TOBKK31
TOBKK32
TOBKK33
TOBKK34
TOBKK35
TOBKK36
TOBKK37
TOBKK38
TOBKK39
TOBKK40
TOBKK41
TOBKK42
TOBKK43

WALES
MONSON ROAD

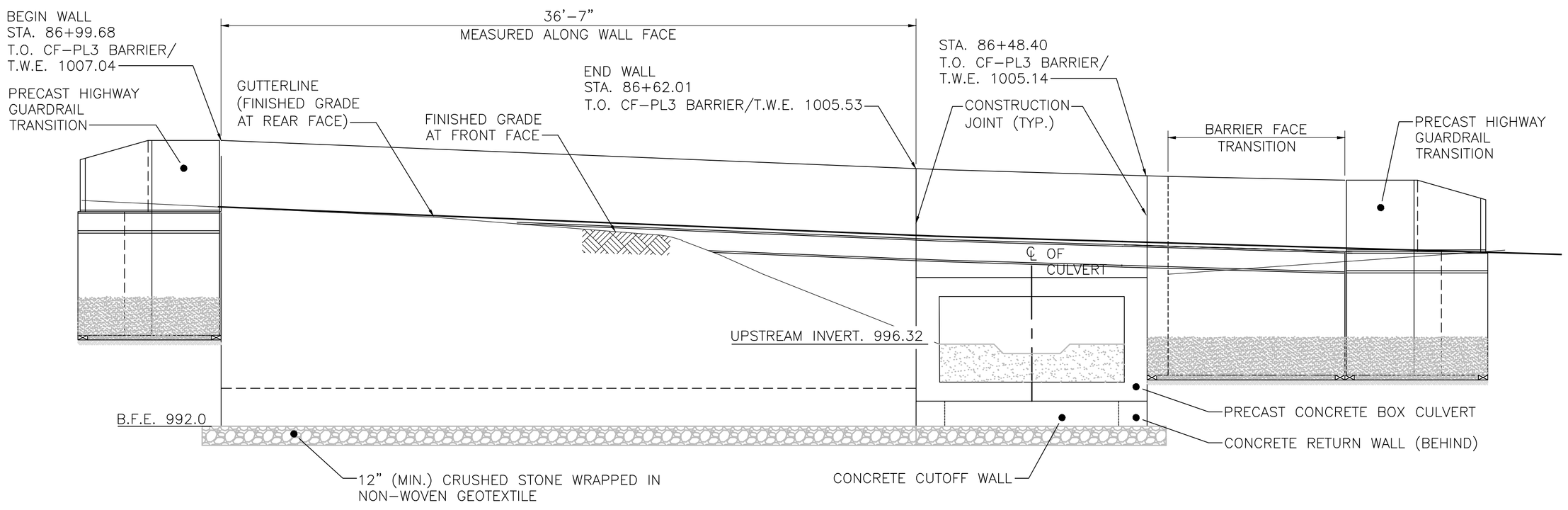
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	170	180
PROJECT FILE NO.	608163		

CULVERT 3 SECTION AND DETAILS



CULVERT LONGITUDINAL SECTION – ALONG STREAM BASELINE

SCALE: ½" = 1'–0"



CULVERT INLET NORTH ELEVATION

SCALE: ¼" = 1'–0"

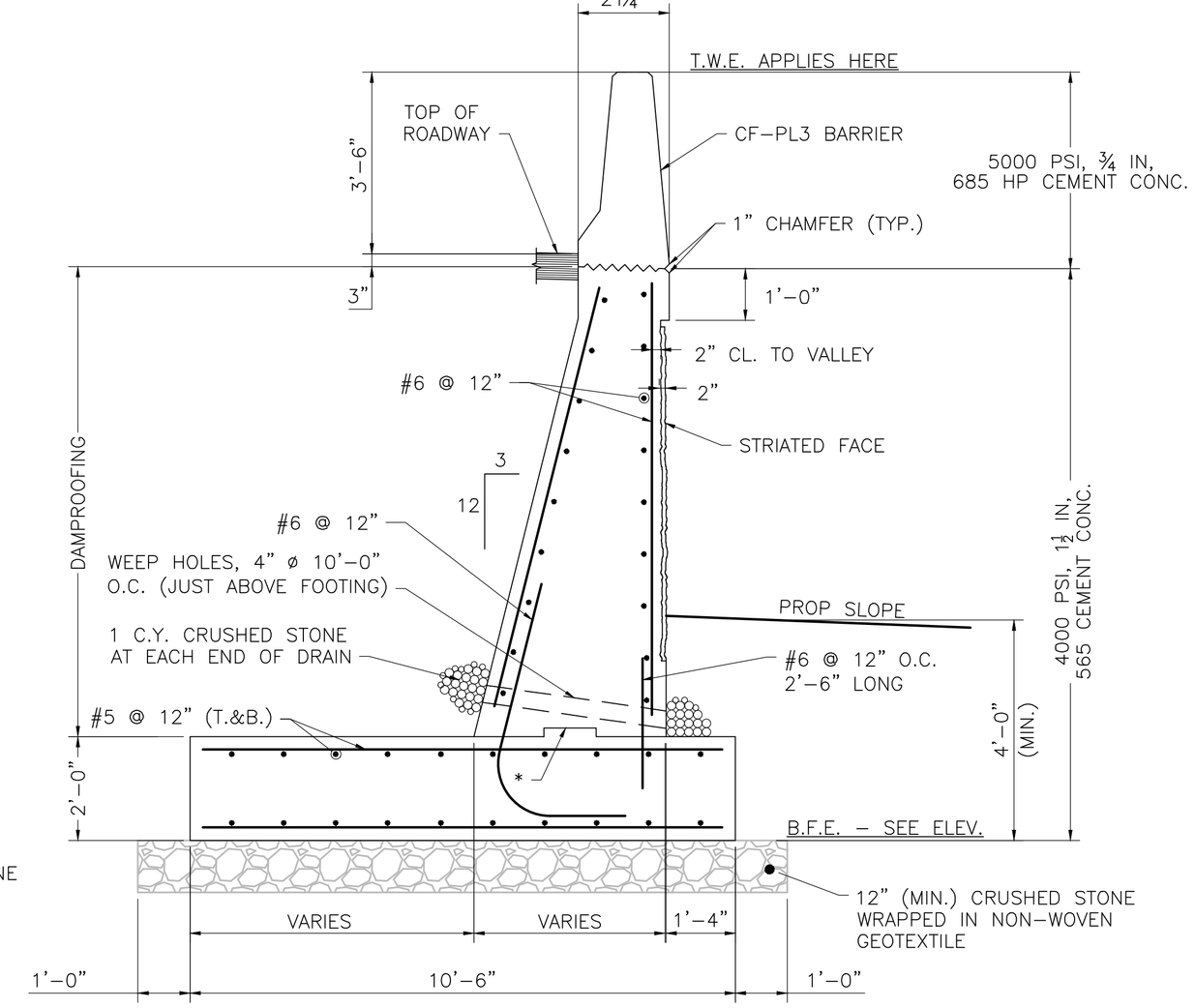
REFERENCE NOTES:

1. FOR CONCRETE HEADWALL DETAILS, CUT–OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

NOTES:

1. INSTALL 4" WEEP HOLES @ 10'–0" O.C. PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF THE WEEP HOLE.
2. ALL CONCRETE SHALL BE 4000 PSI CONCRETE, 1 ½ IN, 565 CEMENT CONCRETE.
3. THE FACTORED BEARING PRESSURE = 1.97 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 6.6 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.



* – CONSTRUCTION JOINT WITH 12"X2" KEY

RETAINING WALL SECTION

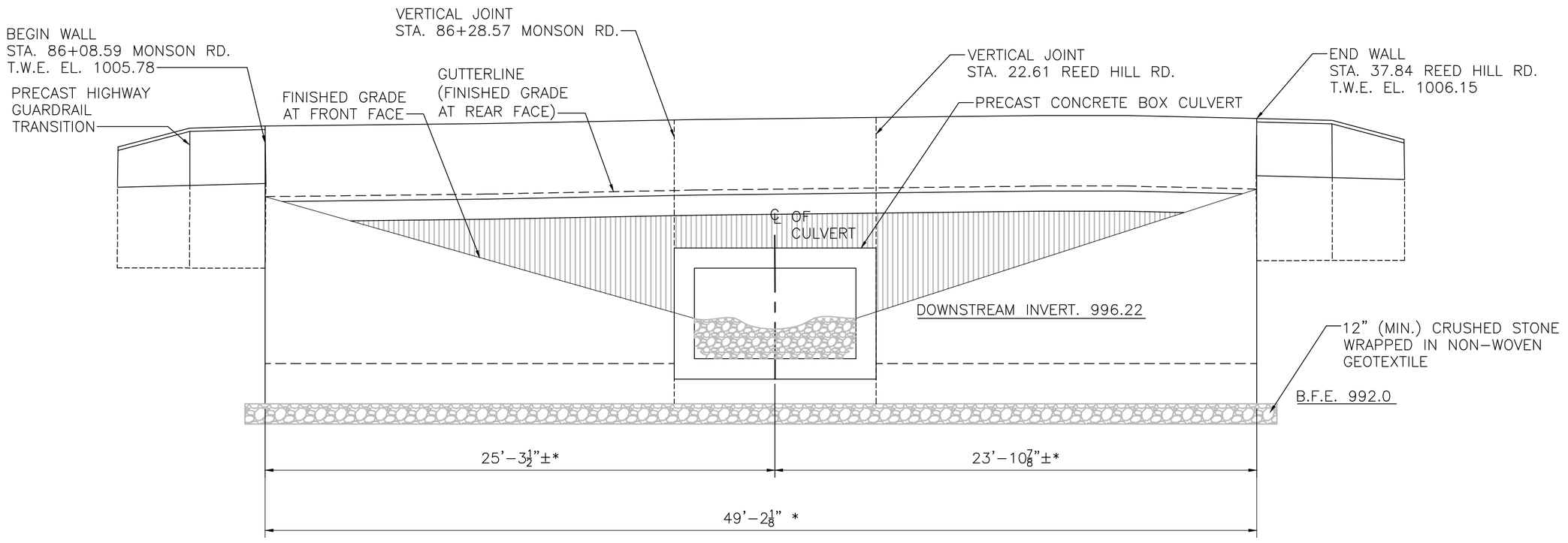
SCALE: ½" = 1'–0"

608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:55 AM
Proposal No. 608163-128112
A00060 - 531

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	171	180
PROJECT FILE NO.	608163		

CULVERT 3 WALL ELEVATION AND DETAILS



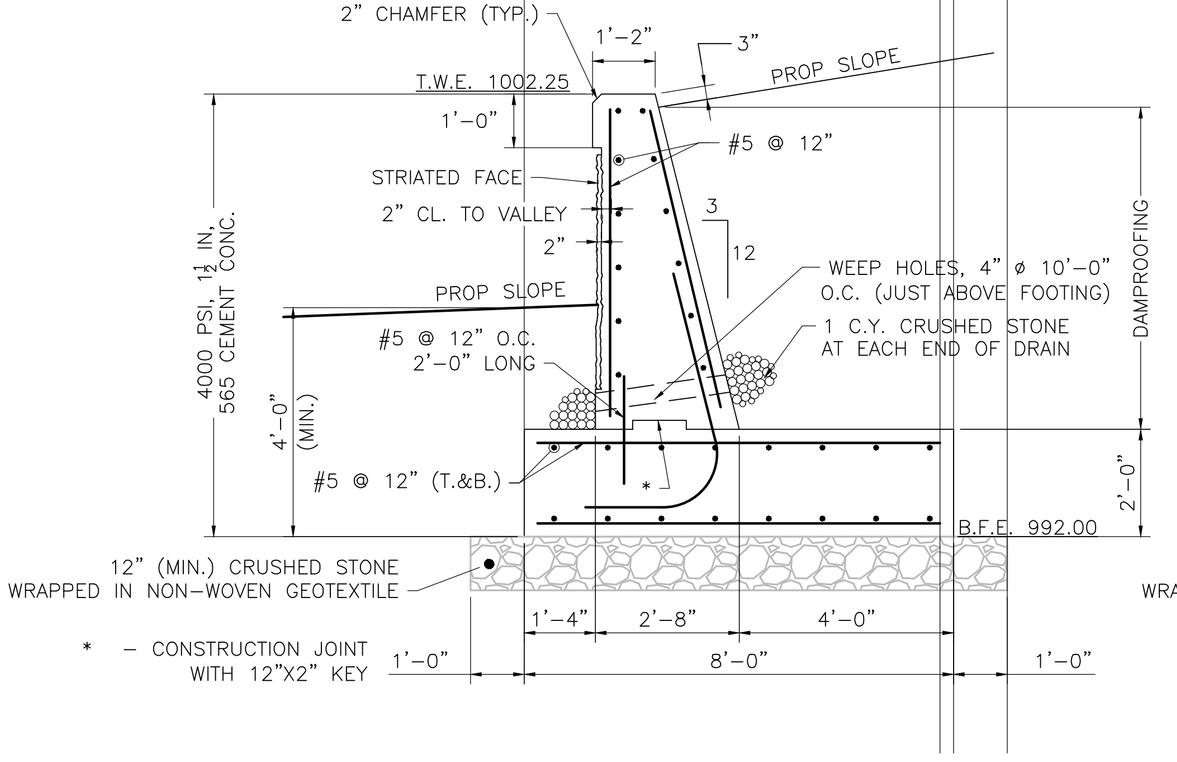
CULVERT 3 OUTLET/SOUTH ELEVATION
SCALE: ¼" = 1'-0"

REFERENCE NOTES:

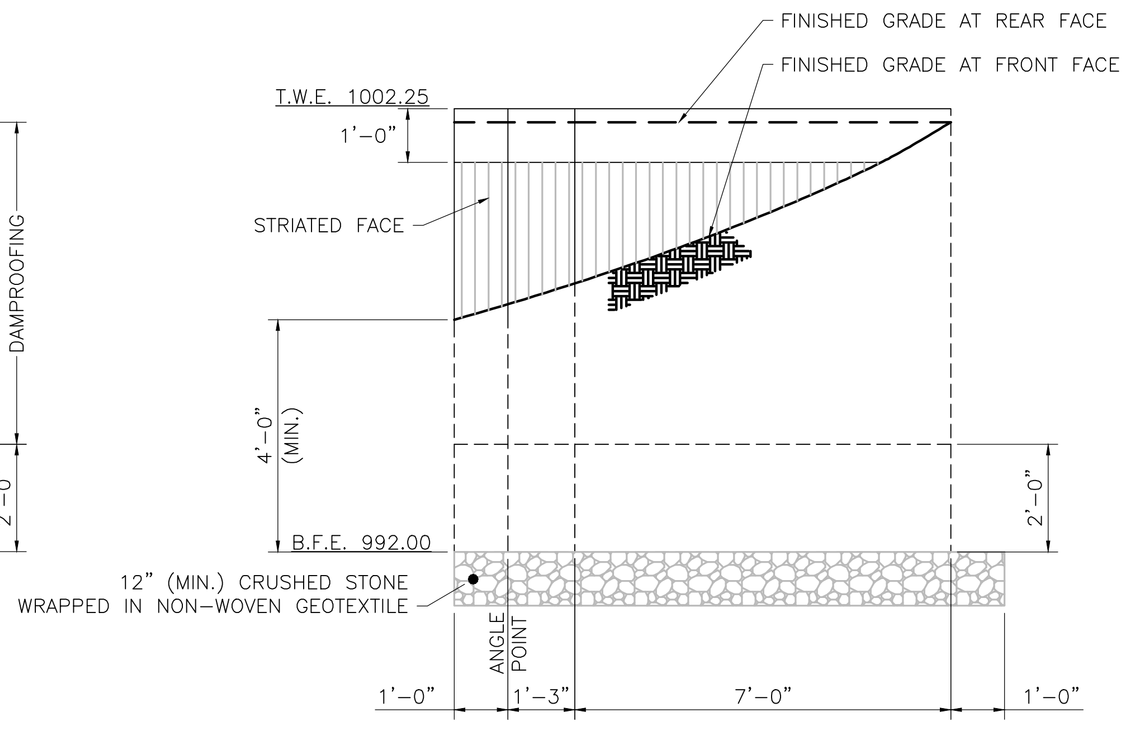
1. FOR CONCRETE HEADWALL DETAILS, CUT-OFF AND RETURN WALL DETAILS, STRIATION DETAILS, CONCRETE END WALL DETAIL AND WINGWALL DETAILS, SEE SHEET NO. 172.

PRECAST BOX CULVERT NOTES:

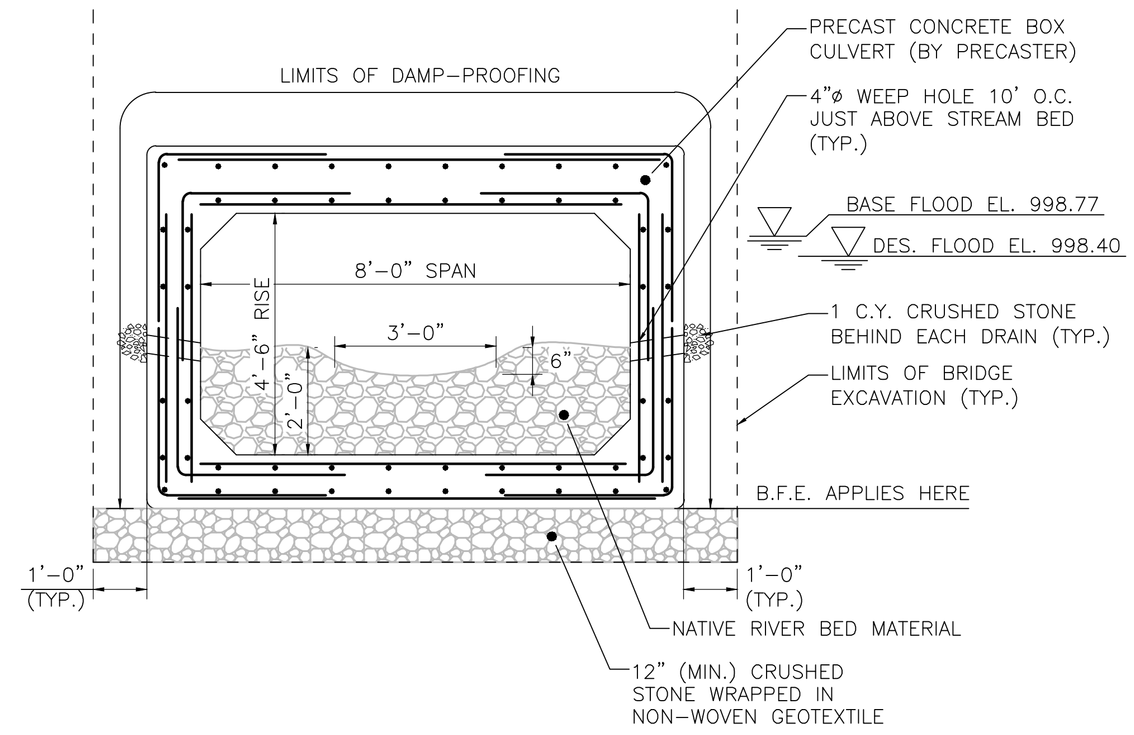
1. THE SECTION IS A PRECAST BOX CULVERT TO BE MONOLITHICALLY CAST OF REINFORCED CONCRETE. THE INSIDE SHALL BE SMOOTH AS TO NOT RESTRICT FLOW.
2. THE INTERNAL DIMENSIONS OF THE BOX CULVERT AT THIS SITE ARE 8'-0" WIDE, 4'-6" HIGH AND A MINIMUM 10" SLAB AND WALL THICKNESS.
3. DESIGN CRITERIA:
   - 3.1. DESIGN SHALL BE IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS (9th EDITION) FOR HL-93 LOADING.
   - 3.2. STEEL REINFORCEMENT SHALL BE GRADED CONFORMING TO AASHTO M31.
   - 3.3. MINIMUM 5000 PSI CEMENT CONCRETE STRENGTH @ 28 DAYS.
   - 3.4. CONCRETE COVER FOR REINFORCING STEEL BARS SHALL BE 2 INCHES.



CULVERT 3 INLET FLARED WALL - SECTION
SCALE: ½" = 1'-0"



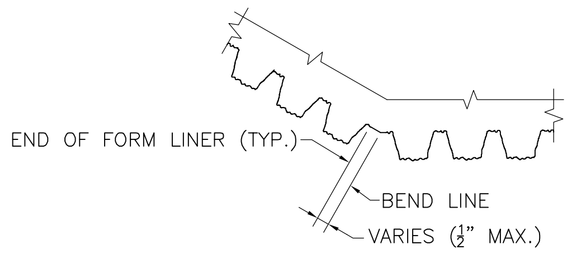
CULVERT 3 INLET FLARED WALL - ELEVATION
SCALE: ½" = 1'-0"



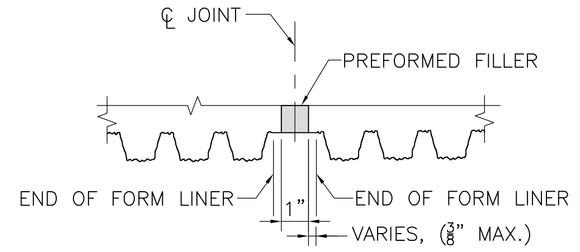
CULVERT 3 TRANSVERSE SECTION
SCALE: ½" = 1'-0"

608163_HD71(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:56 AM
Proposal No. 608163-128112
A00860 - 532

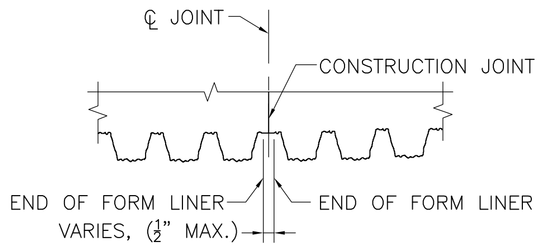
608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:57 AM
Proposal No. 608163-128112
A008690 - 533



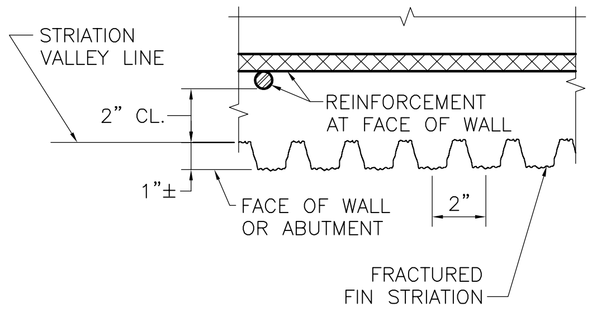
DETAIL AT WALL CORNER
SCALE: 3" = 1'–0"



EXPANSION JOINT
SCALE: 3" = 1'–0"



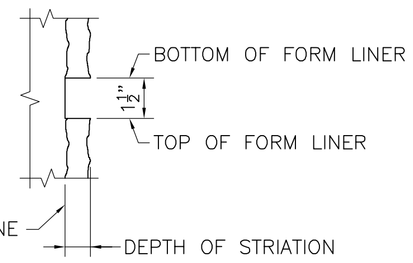
CONSTRUCTION JOINT
SCALE: 3" = 1'–0"

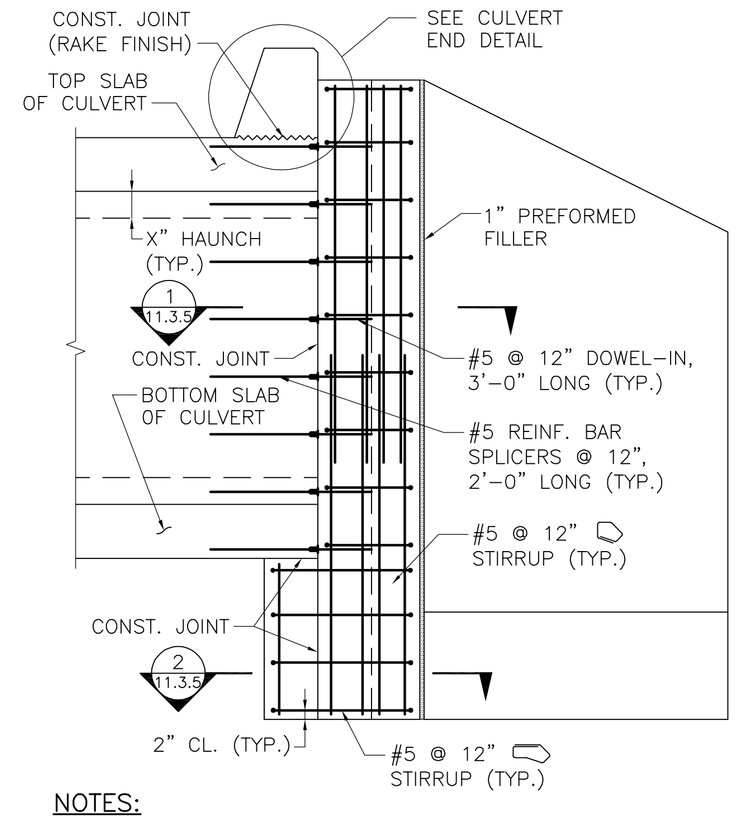


NOTES:

1. THE CONTRACTOR SHALL MAKE SURE THAT THE STRIATION FINS ARE PLUMB AND LINED UP VERTICALLY FROM PANEL TO PANEL FOR THE FULL HEIGHT OF THE WALL.
2. THE HORIZONTAL JOINT MAY BE OMITTED IF THE CONTRACTOR CAN DEMONSTRATE THAT THE FORM LINER PANELS CAN BE INSTALLED END TO END WITHOUT CREATING A VISIBLE SEAM IN THE FINAL CAST CONCRETE.

TYPICAL STRIATION DETAIL
SCALE: 3" = 1'–0"

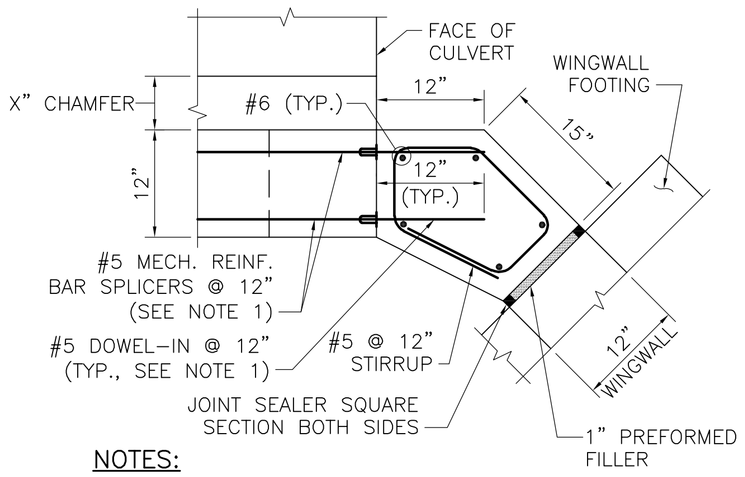




NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 DOWELS, 3'–0" LONG FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

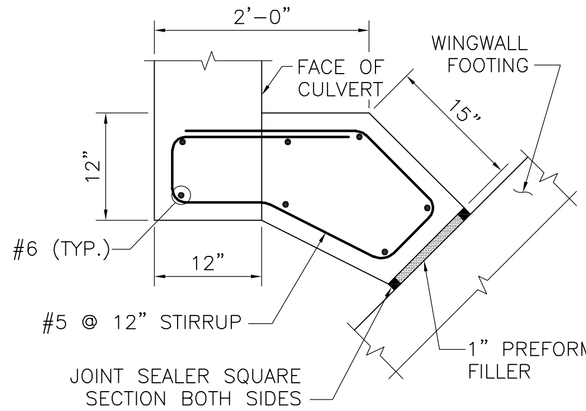
SECTION AT WINGWALL
SCALE: ½" = 1'–0"



NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 DOWELS, 3'–0" LONG, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

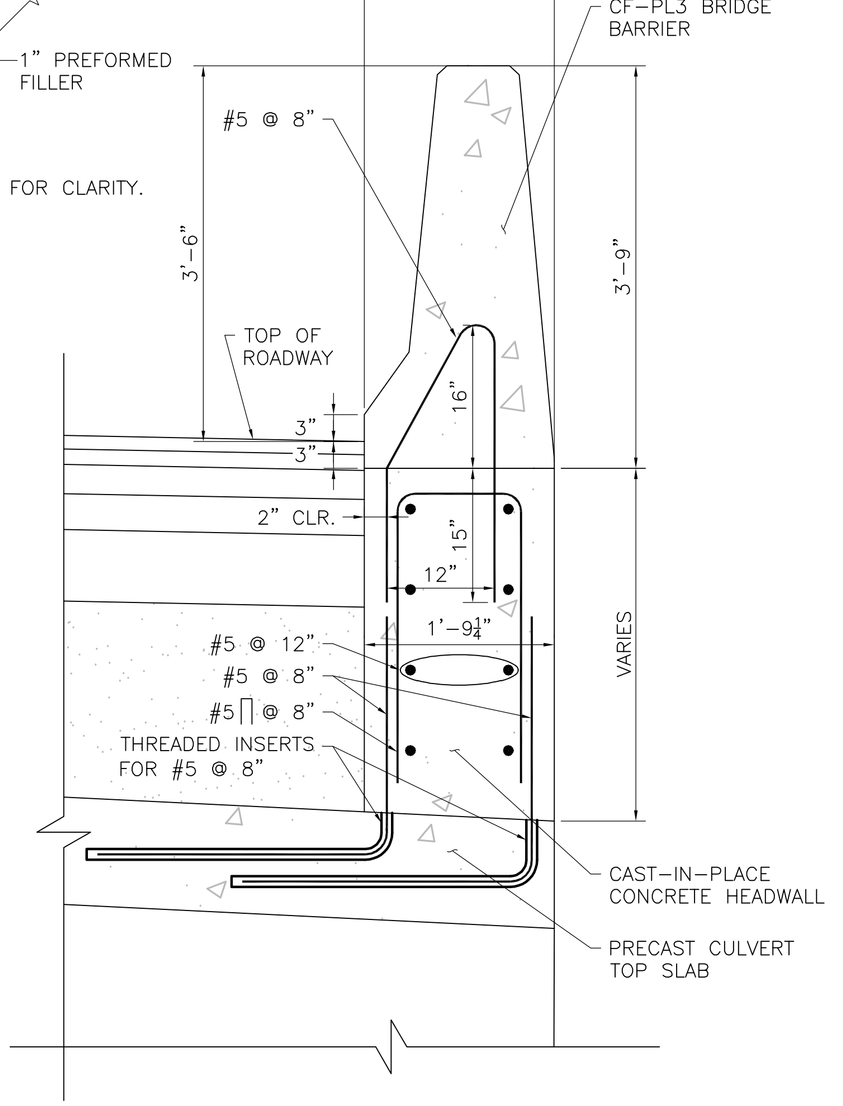
SECTION 1
SCALE: 1" = 1'–0"



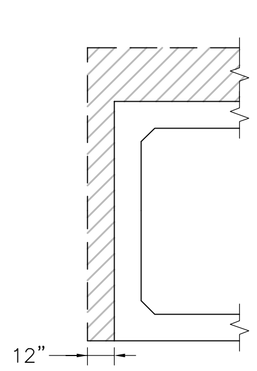
NOTE:

CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

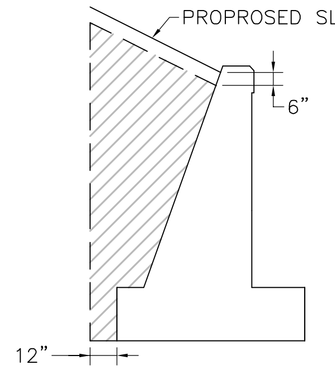
SECTION 2
SCALE: 1" = 1'–0"



SECTION AT BOX CULVERT HEADWALL
SCALE: ½" = 1'–0"



BOX CULVERT
(OR FRAME)

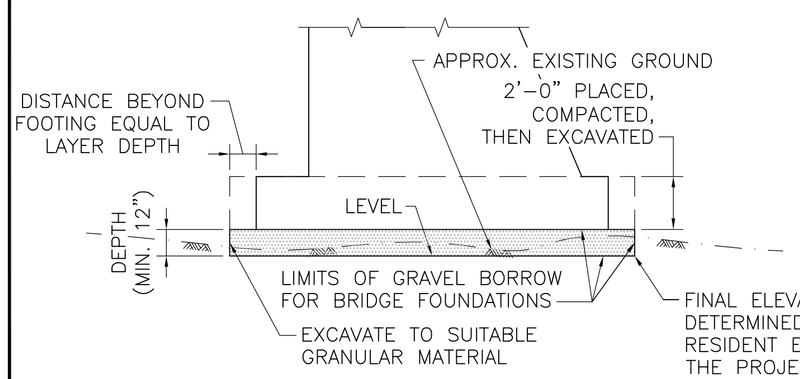


HEADWALL

NOTE:

HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES.

LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
SCALE: ¼" = 1'–0"

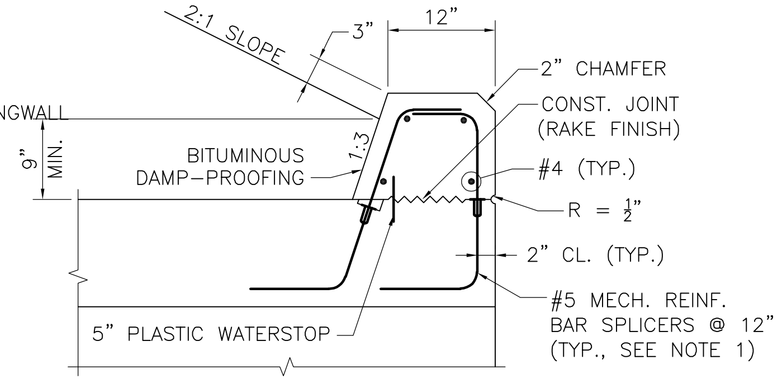


NOTES:

1. SAME TREATMENT IS TO BE USED AT ENDS OF WALLS.

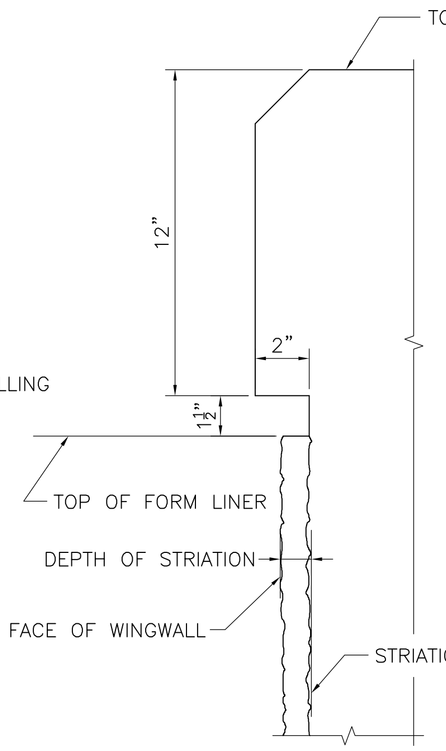
LIMITS OF CRUSHED FOR BRIDGE FOUNDATIONS
NOT TO SCALE

HORIZONTAL PANEL JOINT
SCALE: 3" = 1'–0"



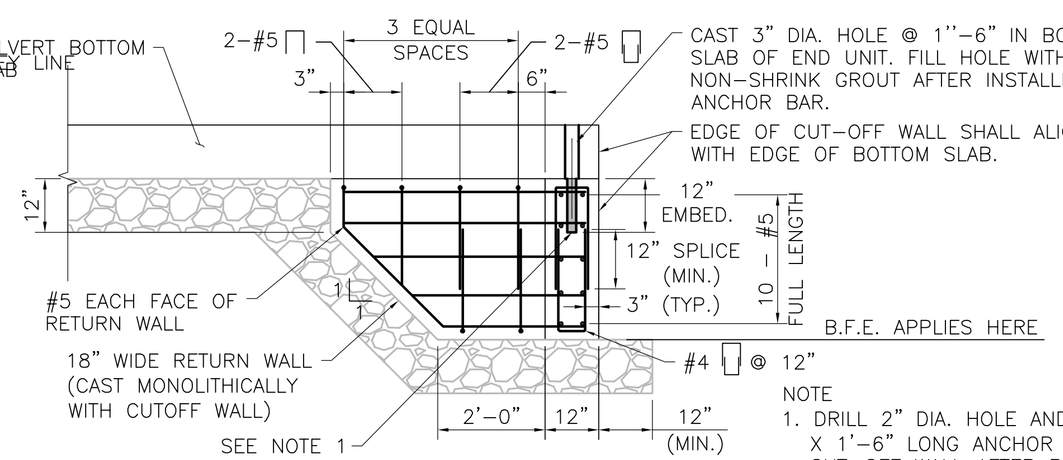
NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 ∫∫ DOWELS, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.



DETAIL AT TOP OF WINGWALL
SCALE: 3" = 1'–0"

CULVERT END DETAIL
SCALE: 1" = 1'–0"



CUT–OFF AND RETURN WALL DETAIL
SCALE: ½" = 1'–0"

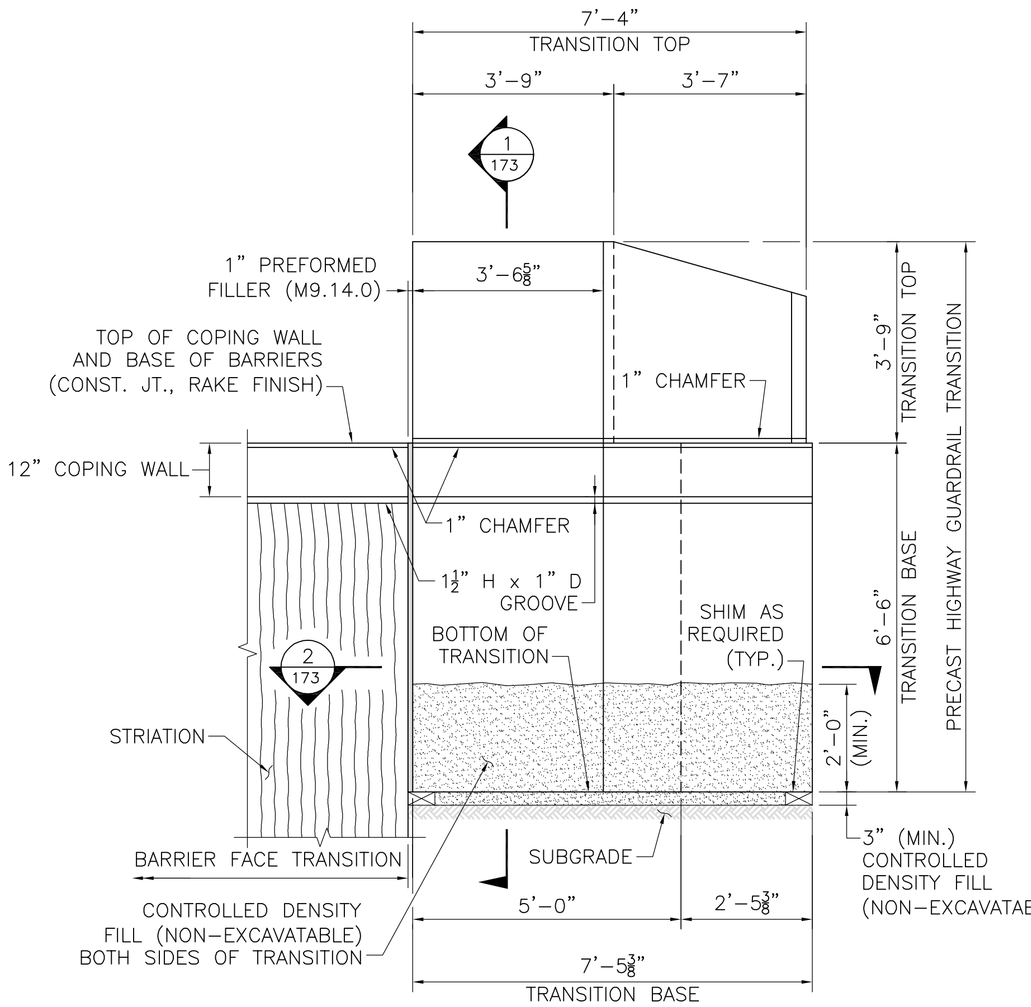
NOTE

1. DRILL 2" DIA. HOLE AND GROUT #6 X 1'–6" LONG ANCHOR BAR INTO CUT–OFF WALL AFTER PLACING END UNIT. USE NON–SHRINK GROUT. CENTER ANCHOR BAR IN HOLE IN BOTTOM SLAB.

WALES
MONSON ROAD

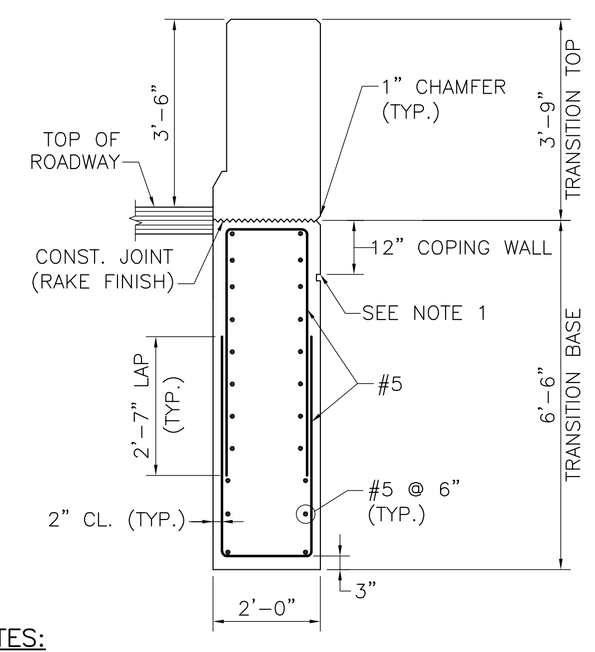
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	173	180
PROJECT FILE NO.	608163		

BARRIER CURB DETAILS I



PRECAST GUARDRAIL TRANSITION ELEVATION AT U-WINGWALL

SCALE: ½" = 1'-0"

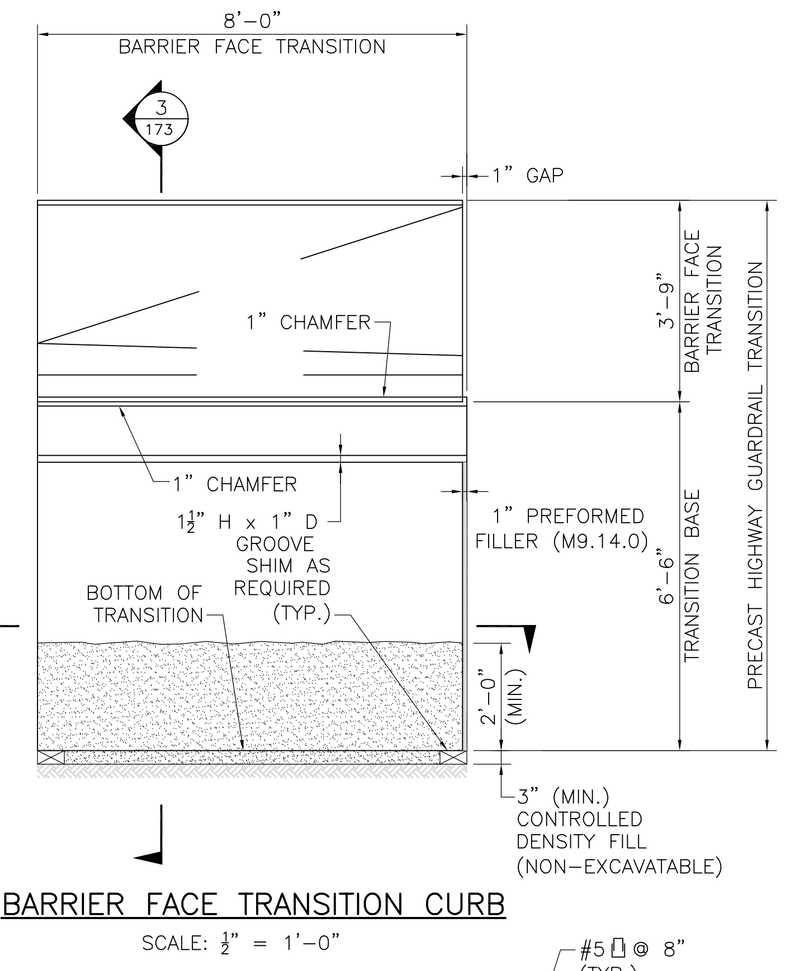


NOTES:

1. 1½" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

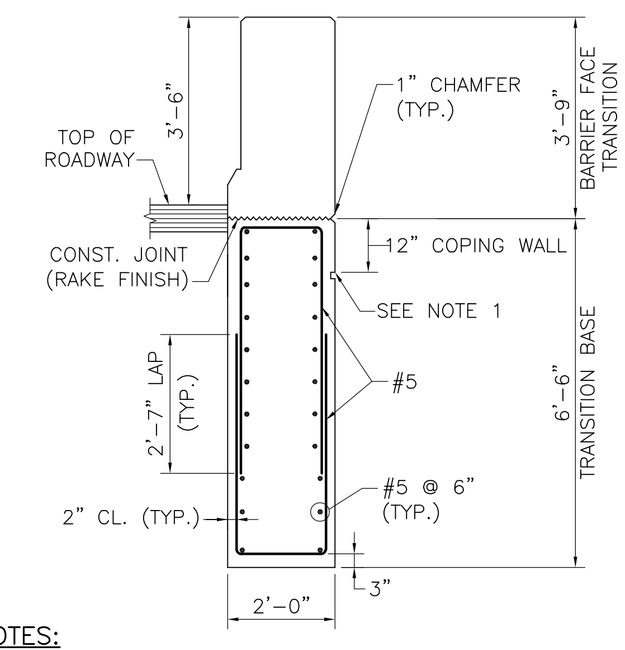
SECTION 1

SCALE: ½" = 1'-0"



BARRIER FACE TRANSITION CURB

SCALE: ½" = 1'-0"

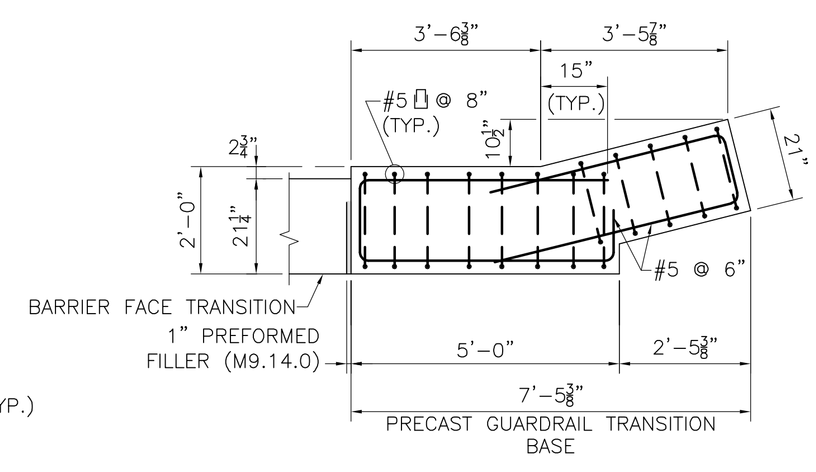


NOTES:

1. 1½" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 3

SCALE: ½" = 1'-0"

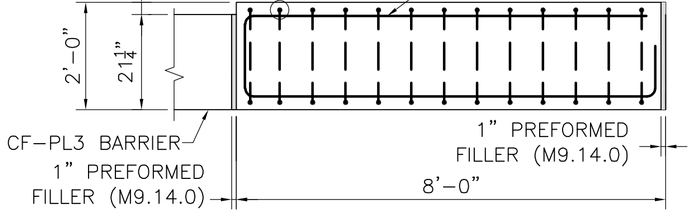


NOTE:

WINGWALL REINFORCEMENT AND STRIATIONS NOT SHOWN FOR CLARITY.

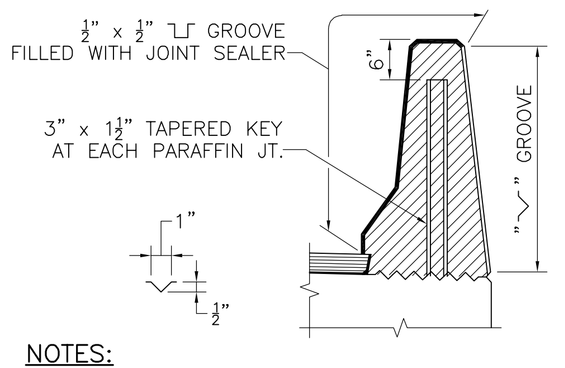
SECTION 2

SCALE: ½" = 1'-0"



SECTION 4

SCALE: ½" = 1'-0"

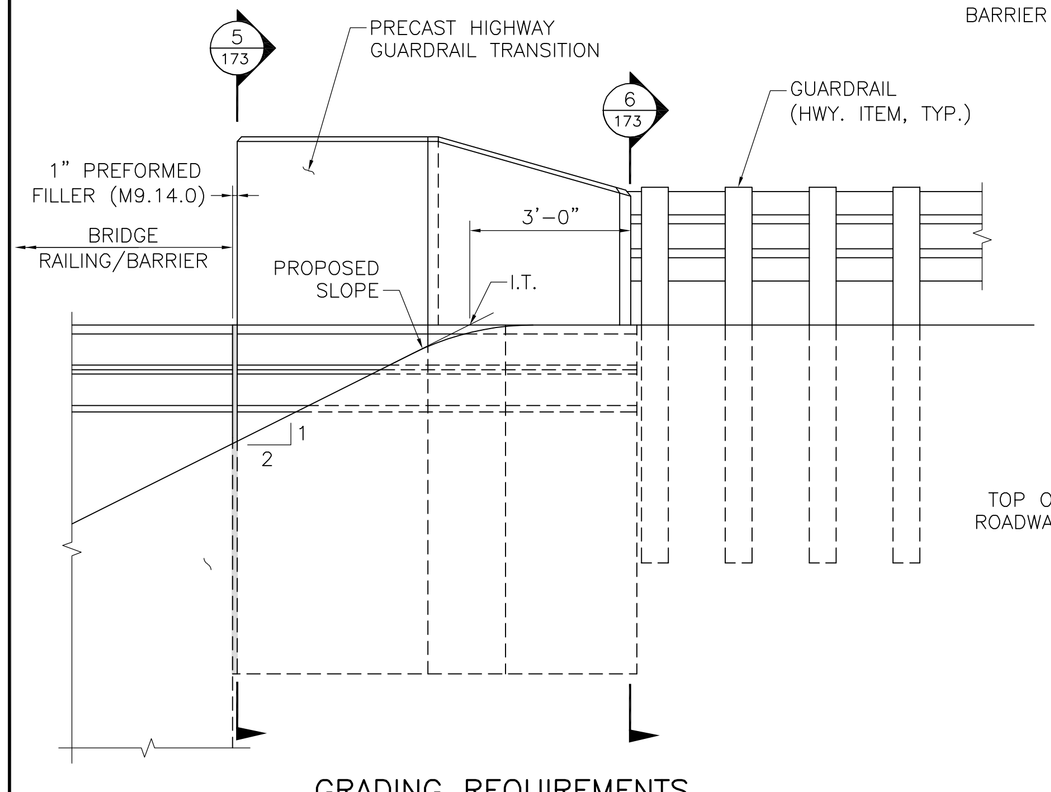


NOTES:

1. ALL CONCRETE ABOVE SLAB SHALL BE POURED IN ALTERNATING SECTIONS WITH NOT LESS THAN 3 DAYS BETWEEN POURS.
2. DO NOT CARRY LONGITUDINAL BARS THROUGH THE PARAFFIN JOINTS. END THE REINFORCEMENT 2" CLEAR OF JOINT.
3. JOINT SHALL BE SQUARE TO FACE OF CURB *(or coping)*.

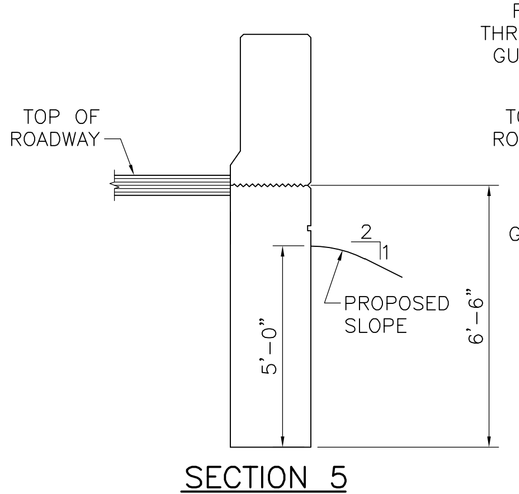
PARAFFIN JOINT DETAILS

SCALE: ¾" = 1'-0"



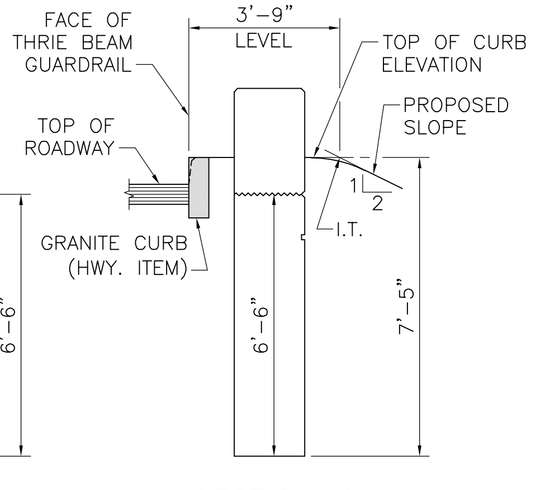
GRADING REQUIREMENTS ELEVATION

SCALE: ½" = 1'-0"



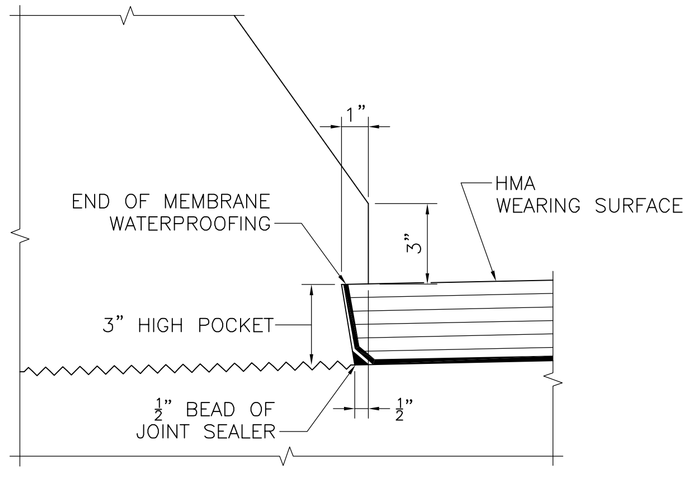
SECTION 5

SCALE: ⅜" = 1'-0"



SECTION 6

SCALE: ⅜" = 1'-0"



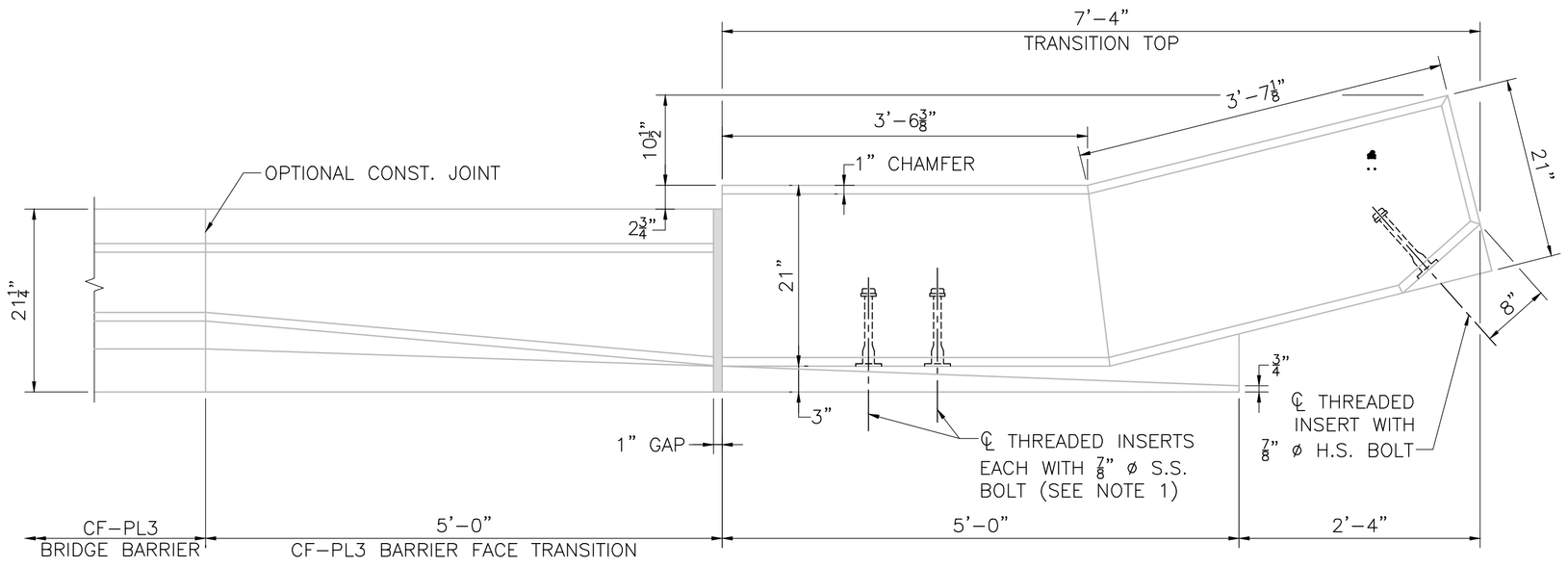
NOTE:

TURN MEMBRANE UP INTO 3" HIGH POCKET.

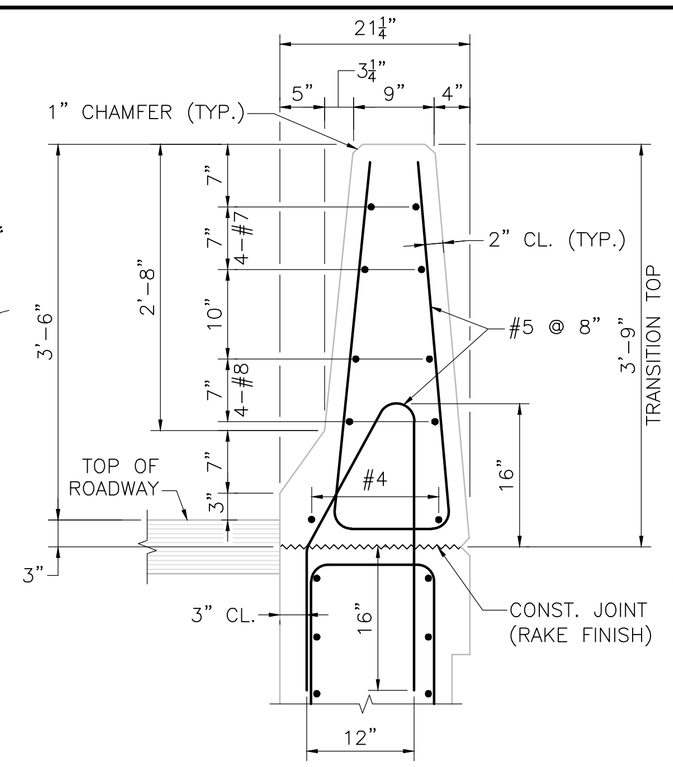
FACE OF SAFETY CURB DETAILS

SCALE: 3" = 1'-0"

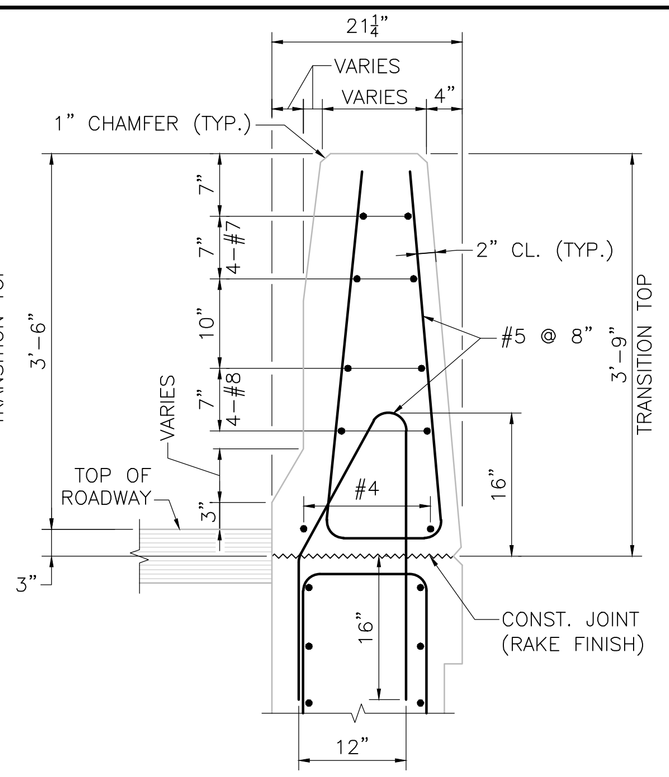
608163_HD11(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 8:59 AM
Proposal No. 608163-128112
A080960 - 534



PLAN
SCALE: 1" = 1'–0"



SECTION 2
TYPICAL CF–PL3 BRIDGE BARRIER
SCALE: 1" = 1'–0"

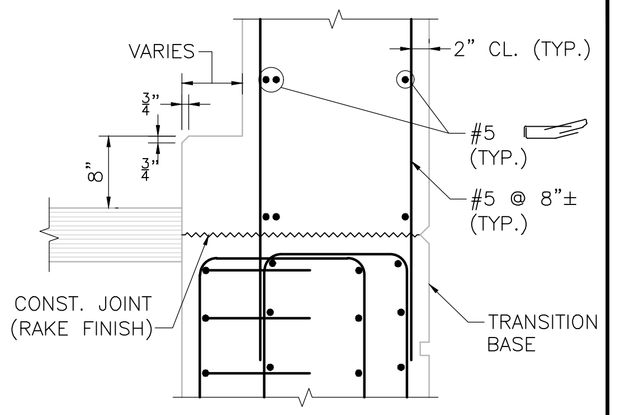


SECTION 3
SCALE: 1" = 1'–0"

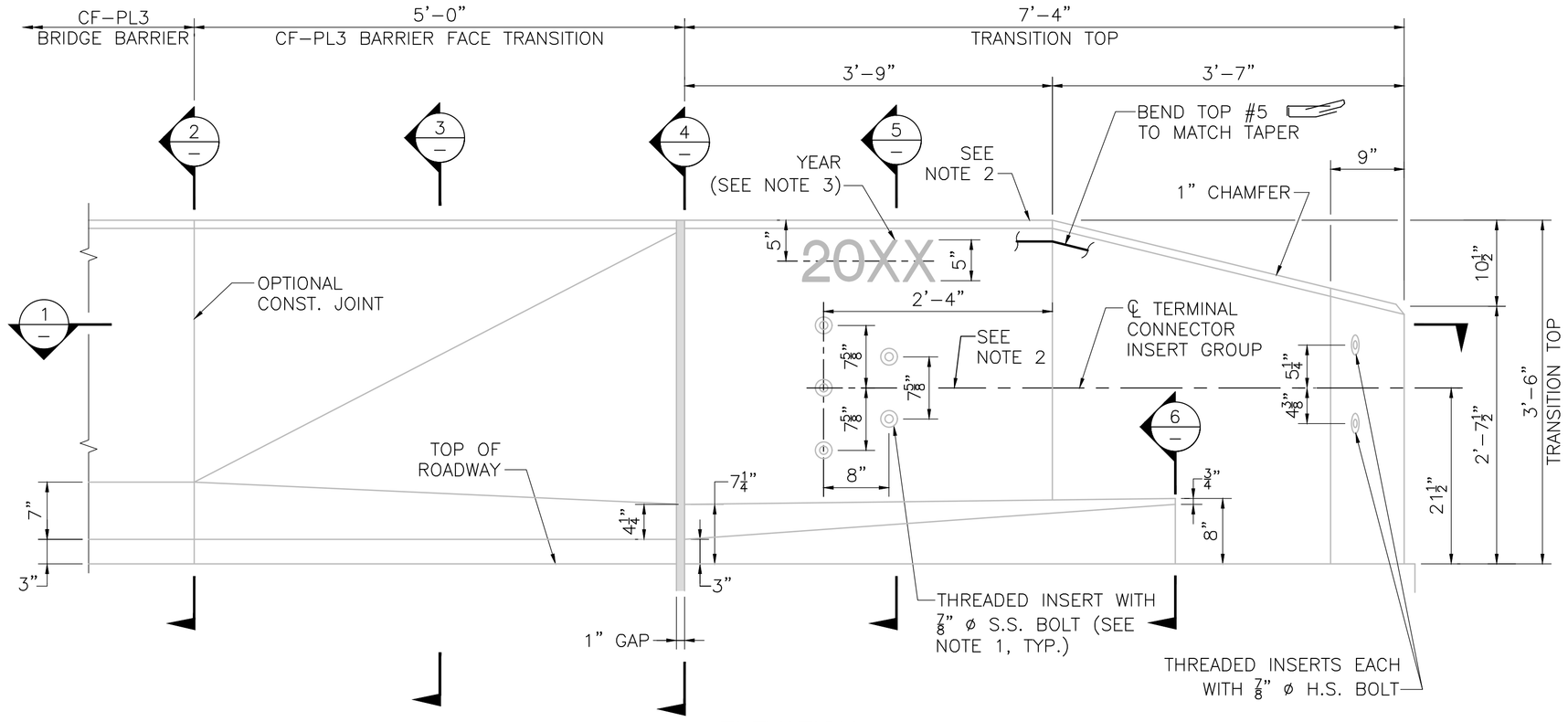
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	174	180
PROJECT FILE NO.	608163		

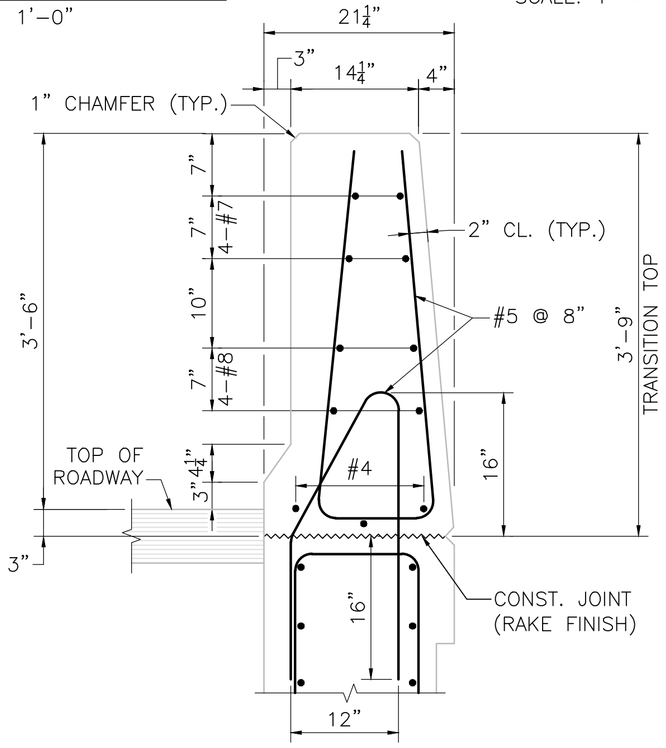
CF-PL3 BARRIER DETAILS



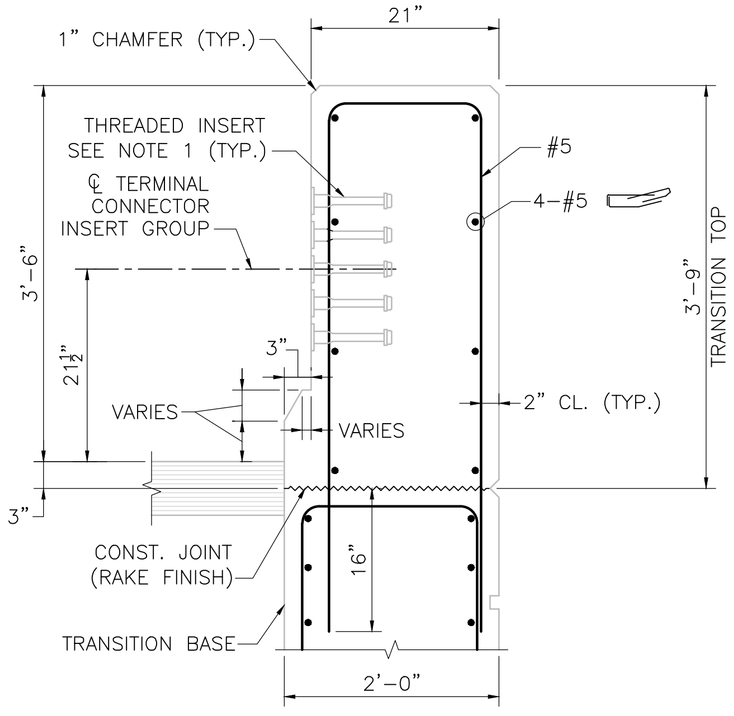
SECTION 6
SCALE: 1" = 1'–0"



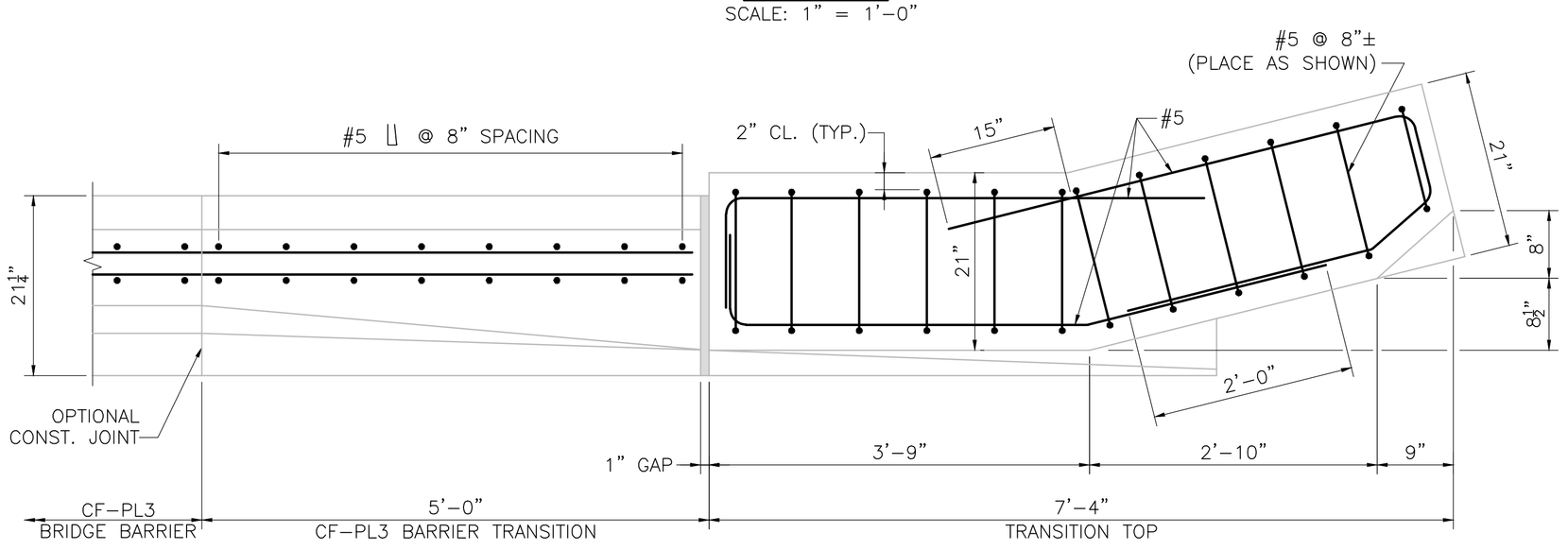
ELEVATION
SCALE: 1" = 1'–0"



SECTION 4
SCALE: 1" = 1'–0"



SECTION 5
SCALE: 1" = 1'–0"



SECTION 1
SCALE: 1" = 1'–0"

NOTES:

1. THREADED INSERTS SHALL BE PREQUALIFIED BY THE MANUFACTURER AS BEING CAPABLE OF DEVELOPING A NOMINAL SHEAR RESISTANCE OF 20 KIPS PER ⅞" ø S.S. BOLT. S.S. BOLTS SHALL BE ⅞" ø x 1½" LONG FULLY THREADED AISI TYPE 304N STAINLESS STEEL. INSERTS FOR ⅞" S.S. BOLTS SHALL BE GALVANIZED AND CAST INTO THE TRANSITION.
2. FOR AN APPROACH GRADE UP TO 3%, THE TRANSITION MAY BE CAST SQUARE AND SET PLUMB WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SQUARE TO THE POST.

   FOR AN APPROACH GRADE IN EXCESS OF 3%, THE TRANSITION TOP AND THE TOP OF THE BRIDGE BARRIERS SHALL FOLLOW THE APPROACH GRADE. THE HEIGHT OF THE TRANSITION TOP SHALL VARY PROVIDED THAT THE MINIMUM DIMENSIONS SHOWN ON THE CONSTRUCTION DRAWINGS ARE MET. THE BOTTOM OF THE TRANSITION BASE SHALL BE SET LEVEL WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SLOPED TO FOLLOW THE APPROACH GRADE.
3. USE LATEST CONTRACT COMPLETION YEAR IN EFFECT WHEN THE FIRST GUARDRAIL TRANSITION IS CAST. USE THIS YEAR FOR ALL GUARDRAIL TRANSITIONS.
4. ALL CONCRETE FOR THE PRECAST HIGHWAY GUARDRAIL TRANSITION SHALL BE 5000 PSI, ¾", 685 HP CEMENT CONCRETE.
5. LIFTING DEVICES (NOT SHOWN), INCLUDING THEIR NUMBER AND LOCATION, SHALL BE DESIGNED AND DETAILED BY THE PRECASTER. THEY SHALL BE GALVANIZED AND SHALL BE PLACED AND RECESSED IN POCKETS TO PROVIDE 1½" CLEAR COVER TO THE FACE OF THE TRANSITION CONCRETE. THESE DEVICES SHALL BE CLEARLY SHOWN ON THE SHOP DRAWINGS ALONG WITH ALL SUPPORTING CALCULATIONS AND/OR CATALOG CUTS. ONCE THE PRECAST TRANSITION IS SET IN PLACE, THE LIFTING DEVICE POCKETS SHALL BE FILLED WITH A NON–SHRINK GROUT THAT MATCHES THE COLOR OF THE TRANSITION CONCRETE WHEN CURED AND THE FILLED POCKETS SHALL BE RUBBED WITH A CORUNDUM STONE TO BLEND OUT THE JOINTS.

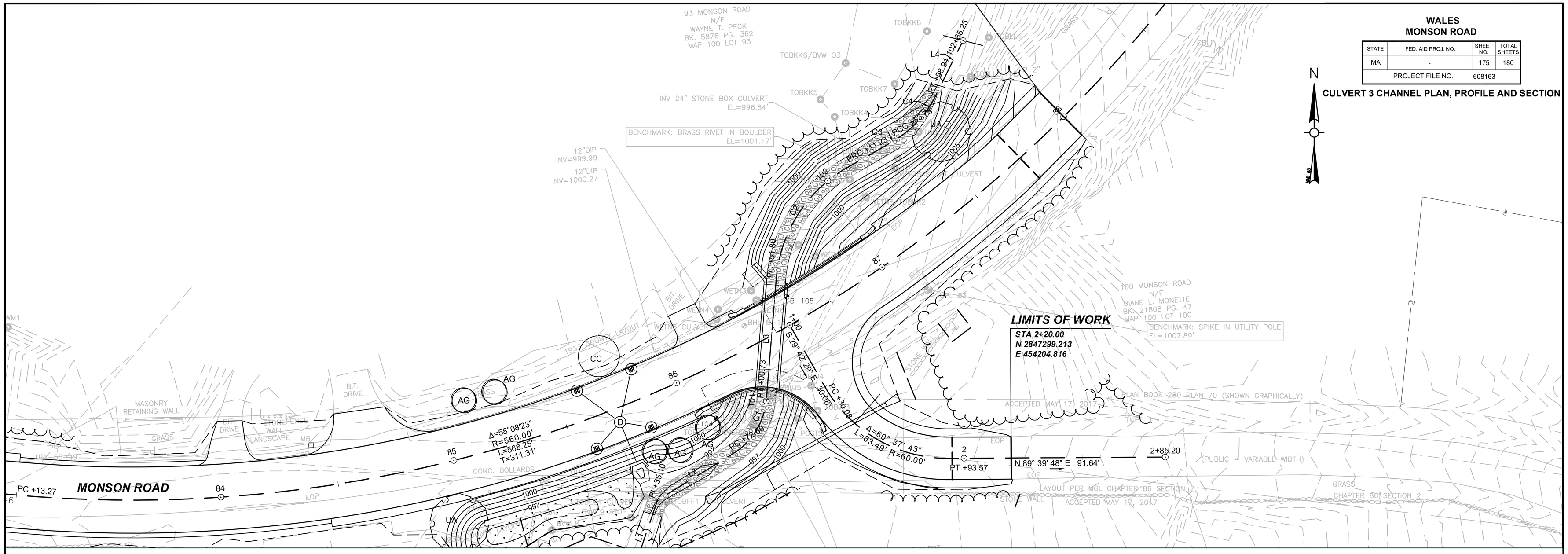
TOP OF PRECAST HIGHWAY GUARDRAIL TRANSITION FOR CF–PL3 BARRIER

608163_HDT1(STRUCTURAL PLAN).DWG Plotted on 5-Jun-2024 9:00 AM
Proposal No. 608163-128112
AM08060 - 535

WALES
MONSON ROAD

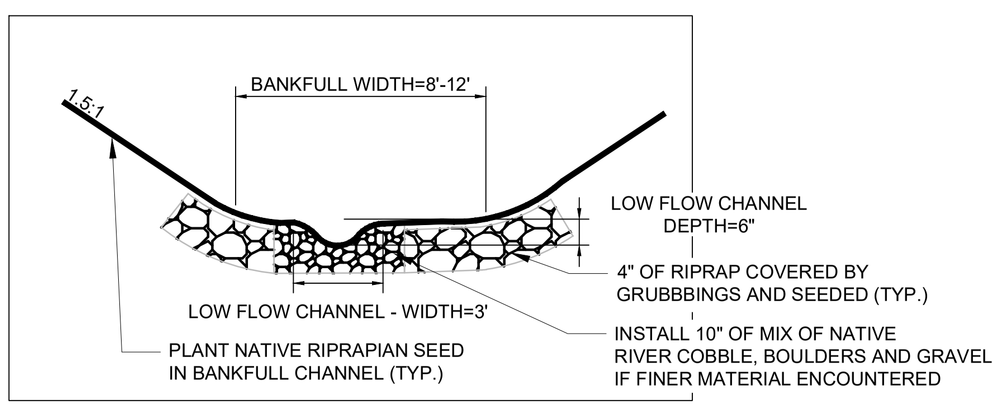
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	175	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL PLAN, PROFILE AND SECTION

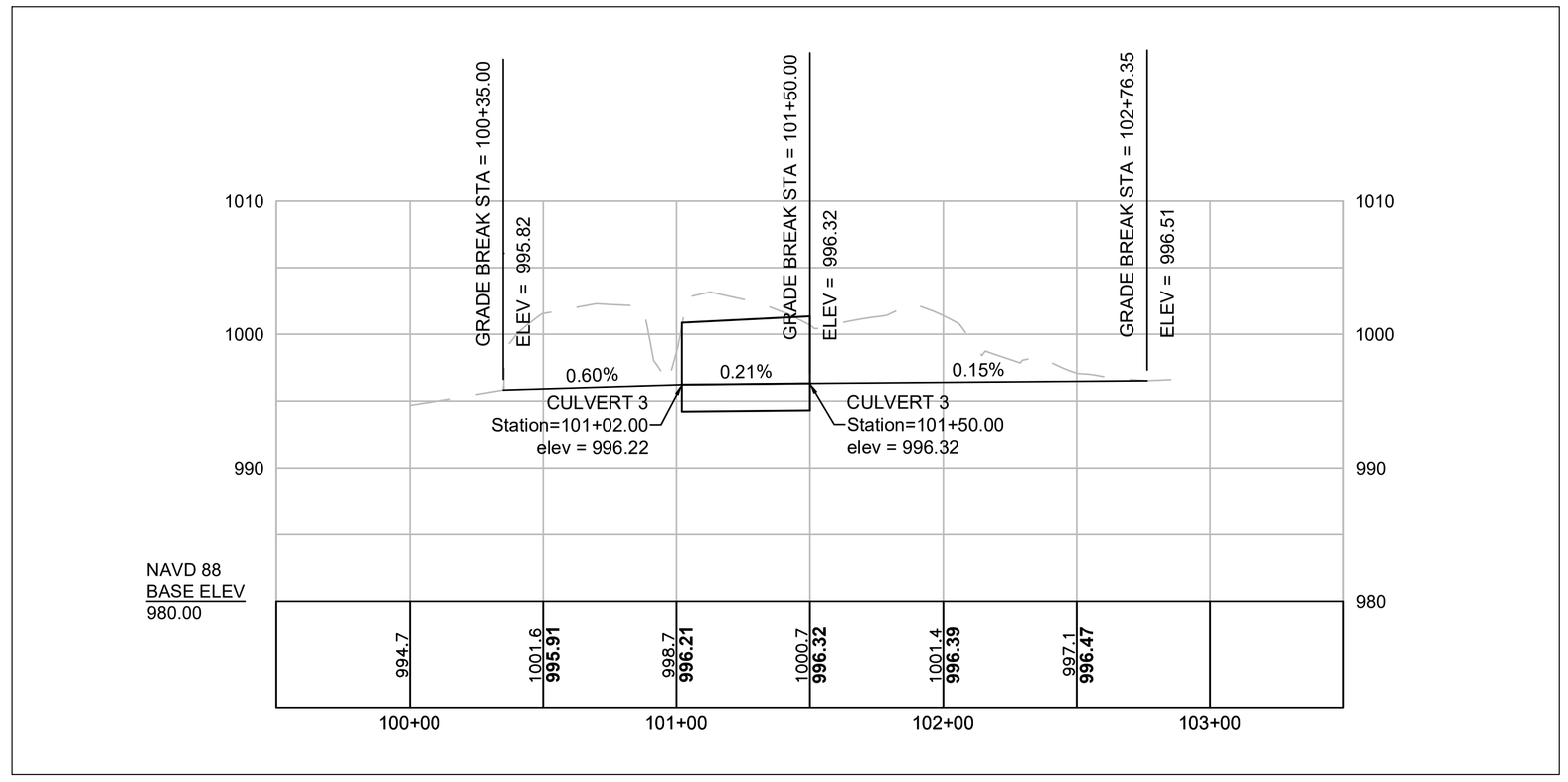


CULVERT 3 CHANNEL PLAN

0 20 40 60 80
SCALE: 1" = 20'



CULVERT 3 CHANNEL TYPICAL SECTION



CULVERT 3 CHANNEL PROFILE

HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

608163_HD12(WATER HANDLING).DWG Plotted on 5-Jun-2024 12:00 PM

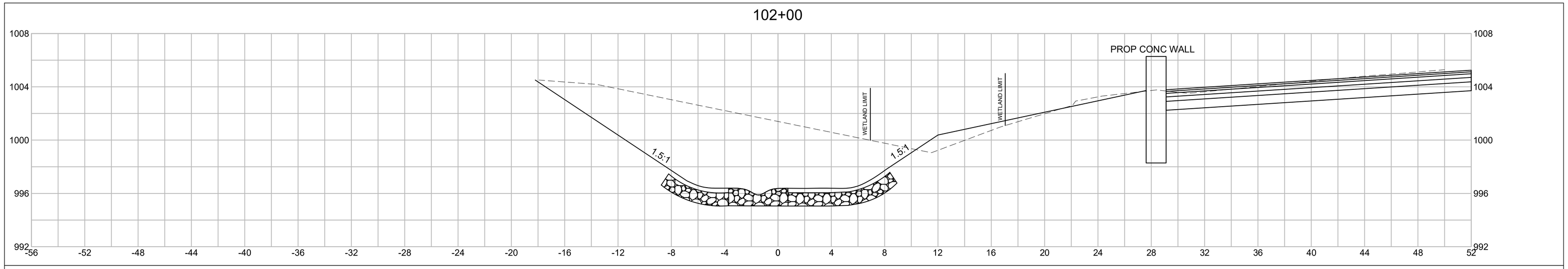
Proposal No. 608163-128112

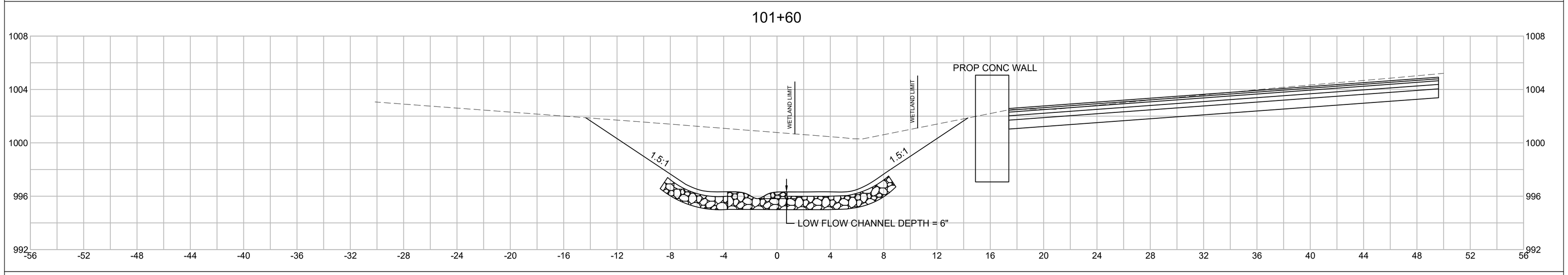
A080869 - 5396

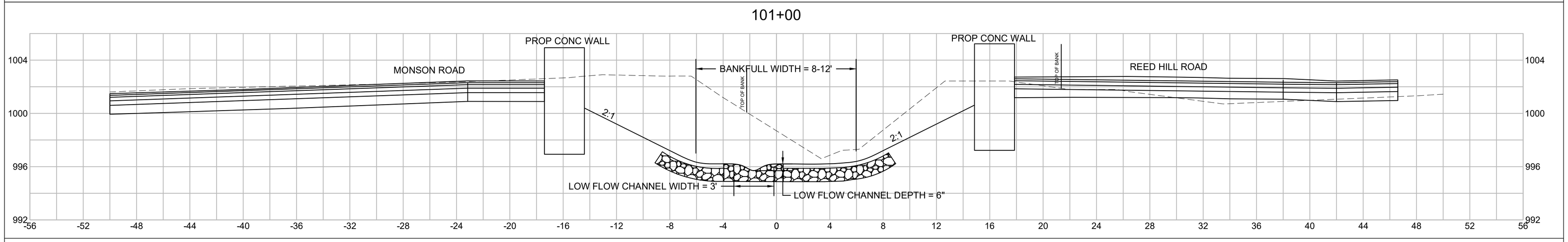
WALES
MONSON ROAD

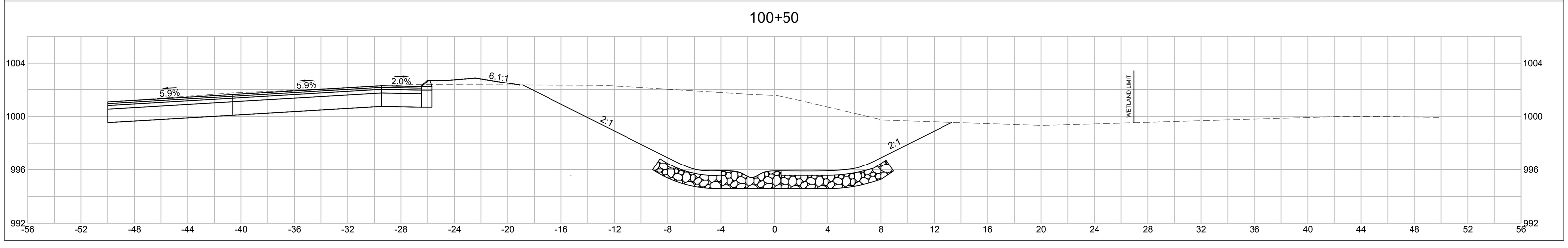
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	176	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS









REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
VER. SCALE IN FEET
4 0 4 8

608163_HD12(WATER HANDLING).DWG Plotted on 5-Jun-2024 12:01 PM

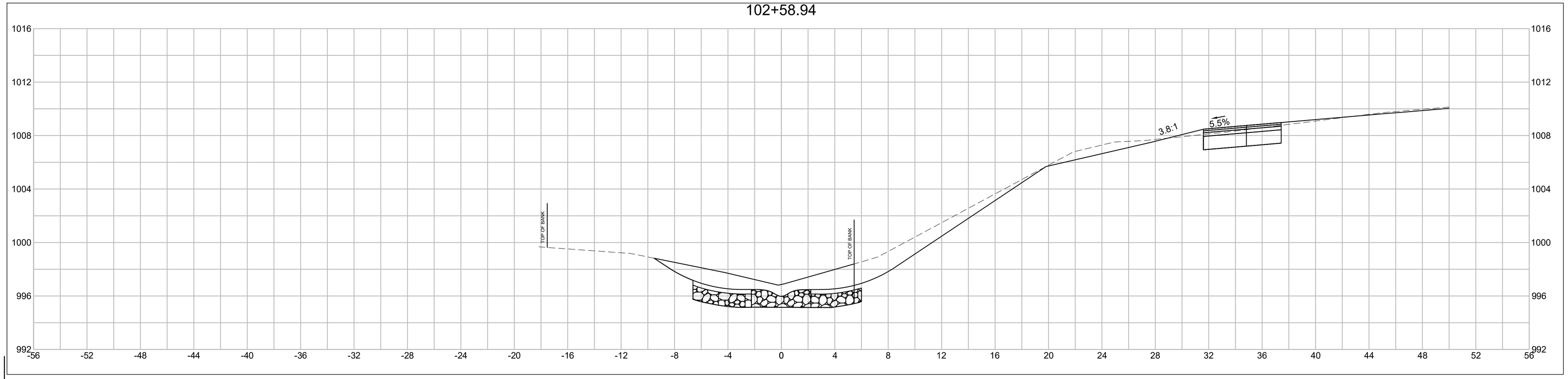
Proposal No. 608163-12H12

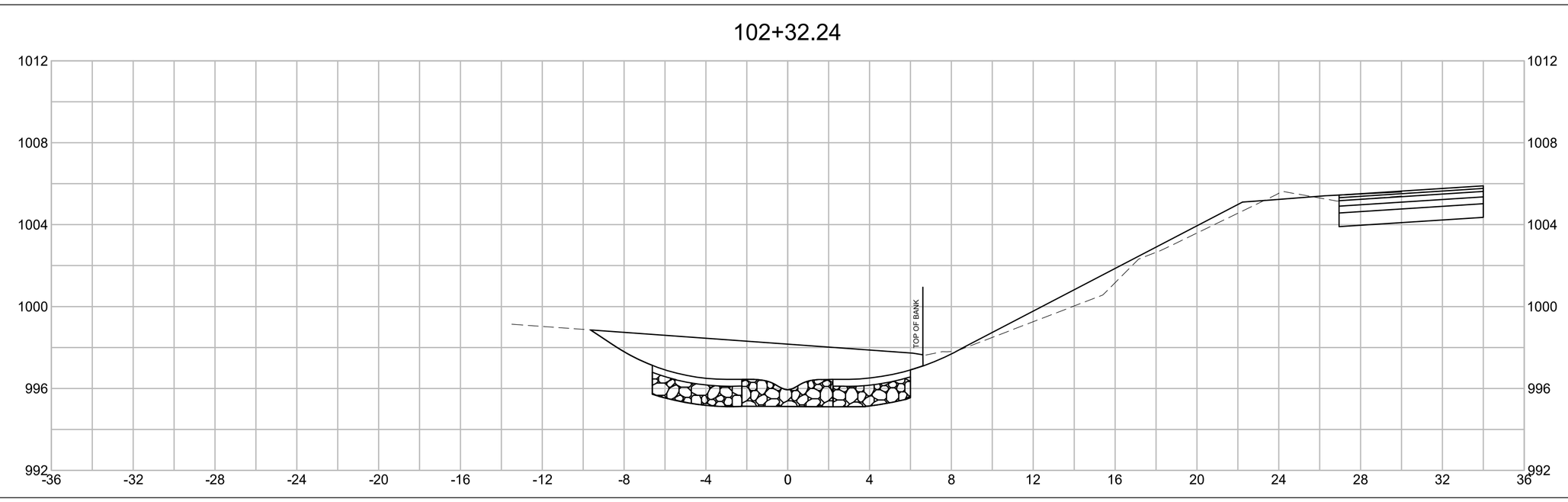
A00860 - 537

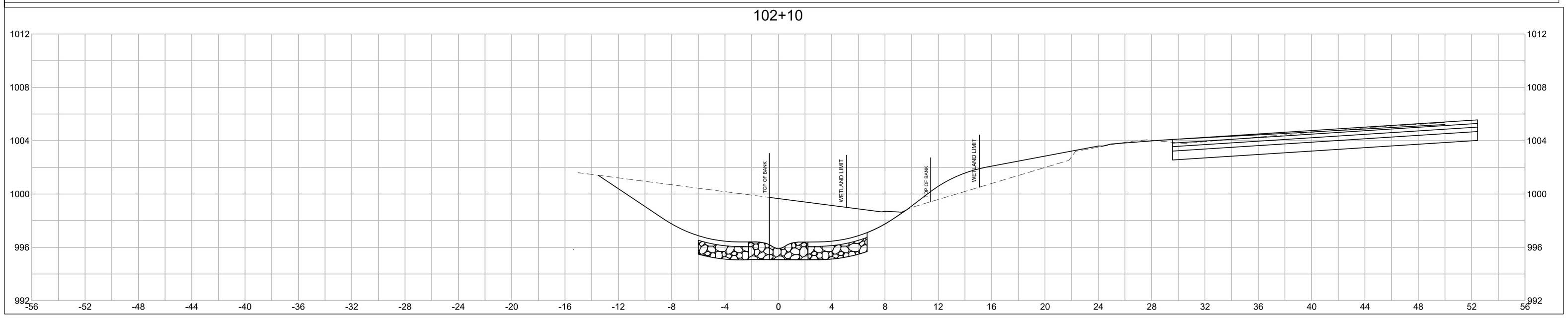
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	177	180
PROJECT FILE NO.	608163		

CULVERT 3 CHANNEL CROSS SECTIONS







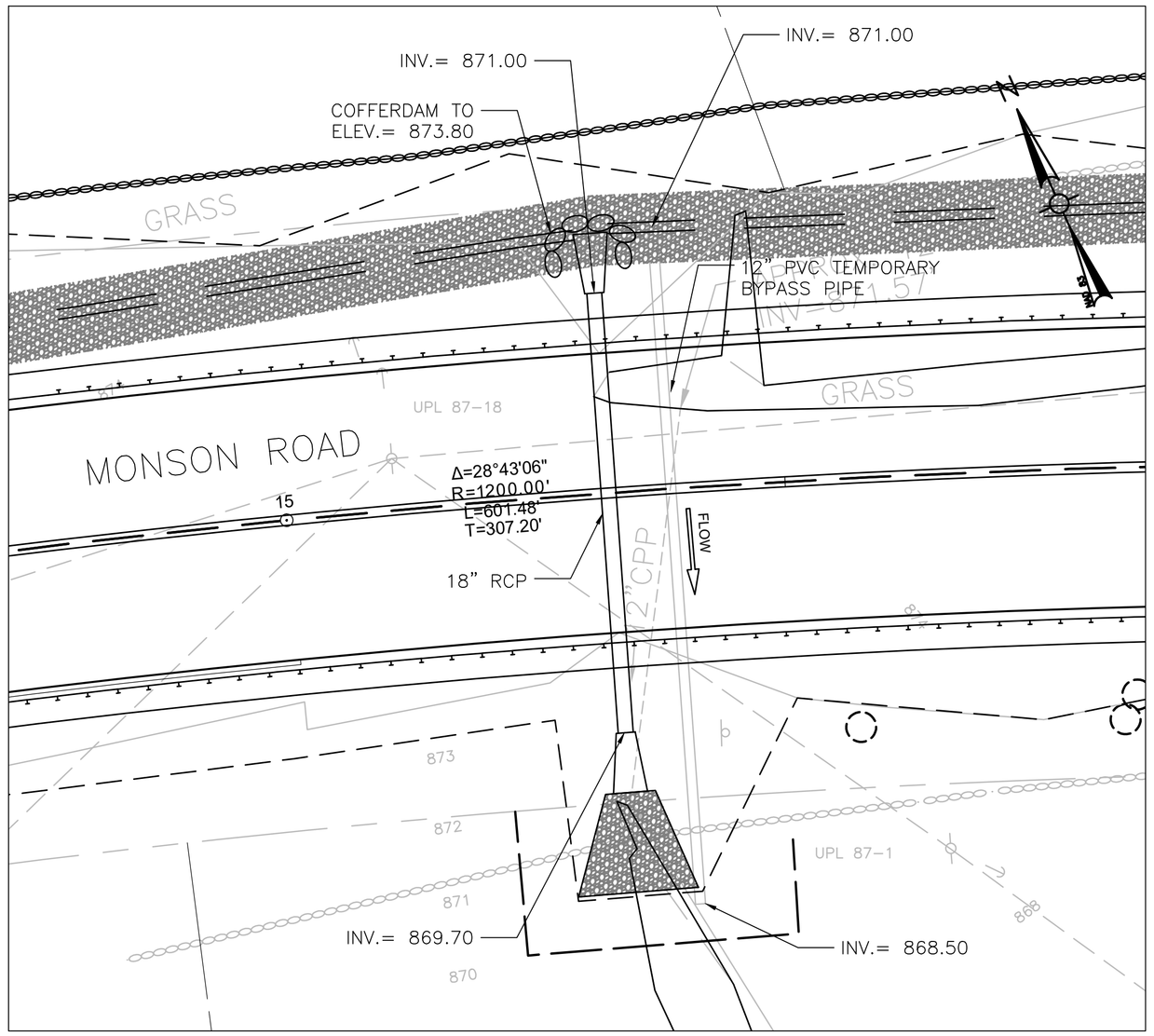
REED HILL ROAD CHANNEL CROSS SECTIONS

HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

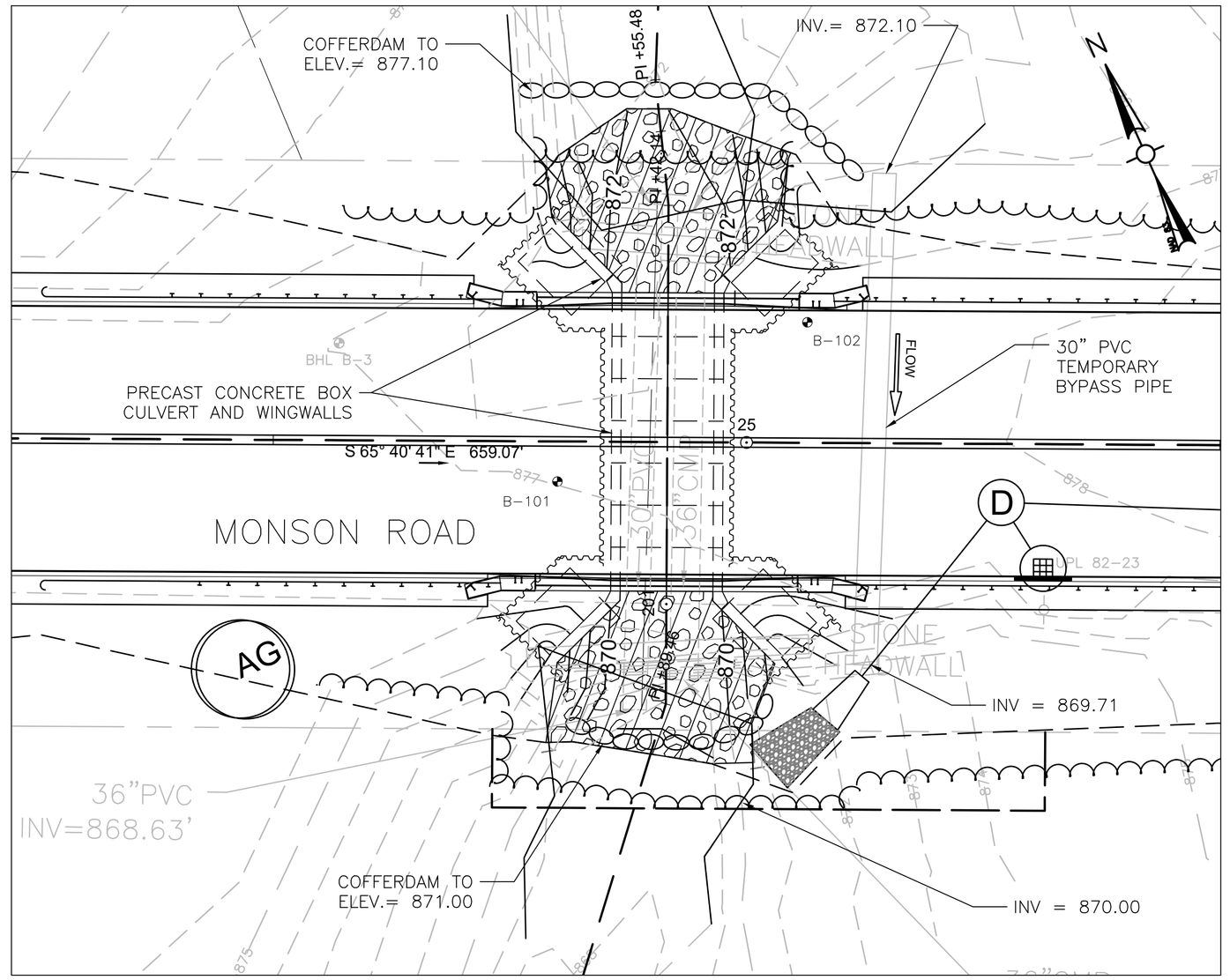
608163_HD12(WATER HANDLING).DWG Plotted on 5-Jun-2024 12:01 PM

Proposal No. 608163-128112

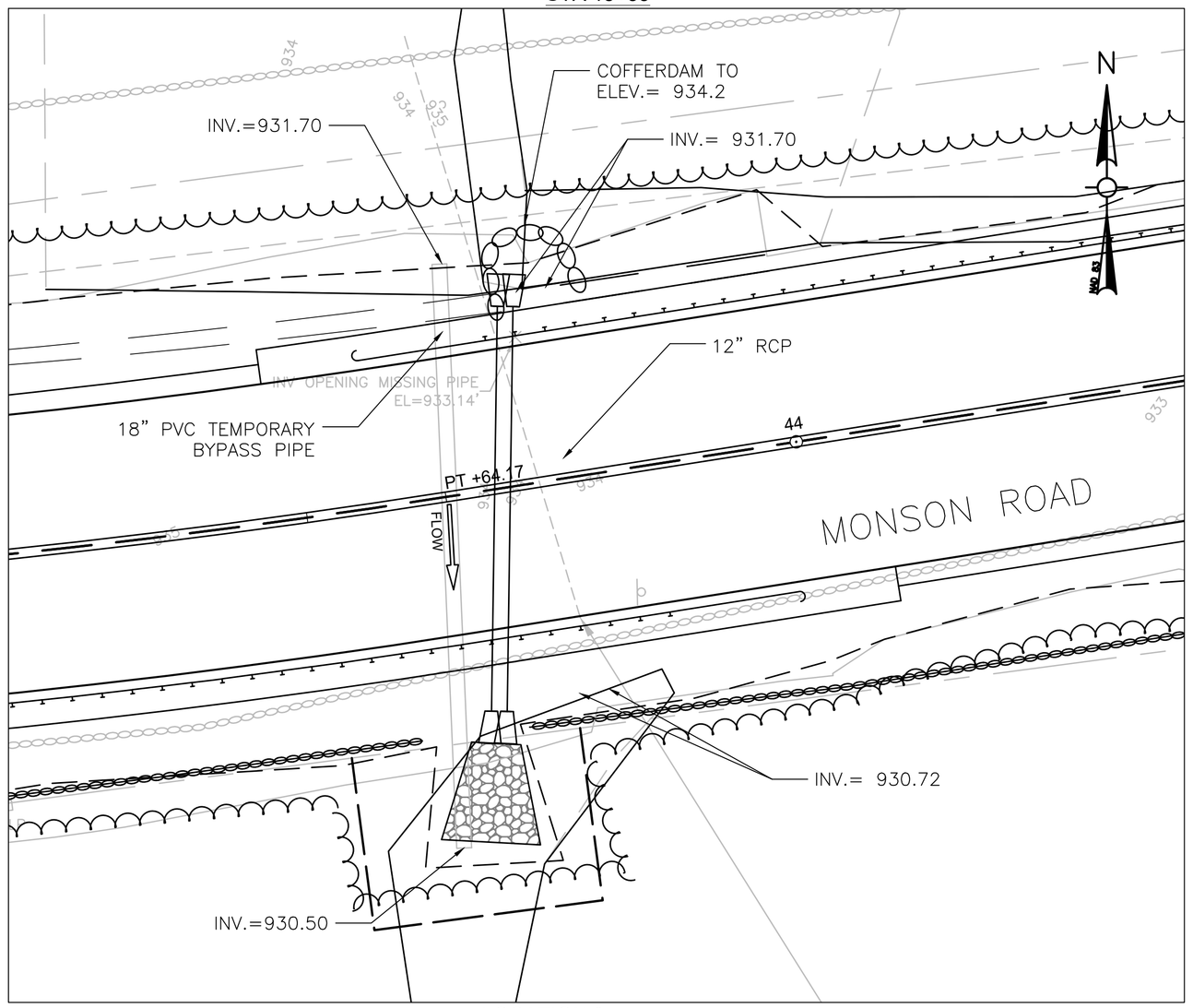
A00860 - 538



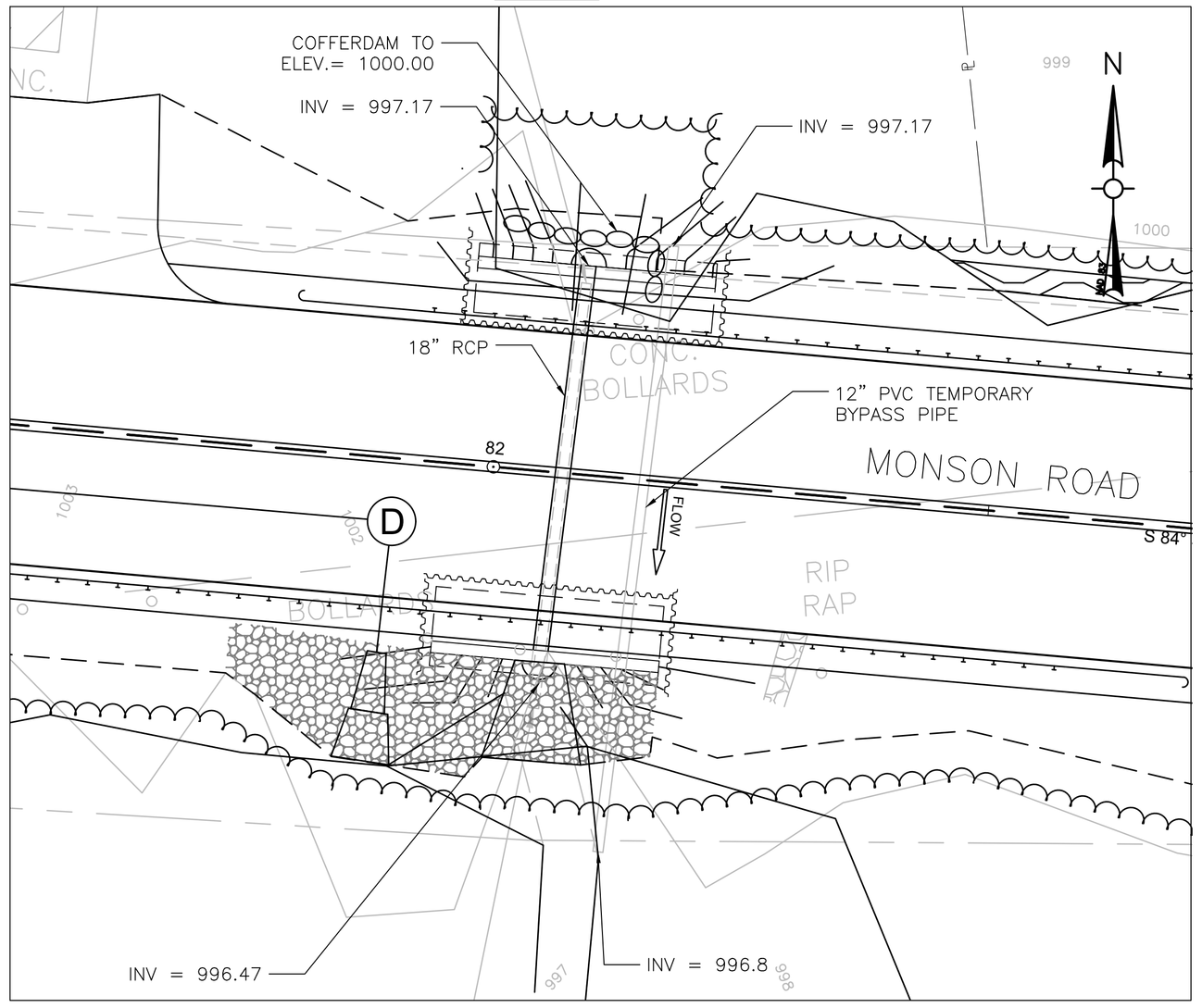
LOCATION 1
STA 15+33



LOCATION 2
STA 24+92



LOCATION 3
STA 43+76



LOCATION 4
STA 82+07

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	178	180
PROJECT FILE NO.		608163	

CONTROL OF WATER PLANS

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT AND PIPES.
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE FOR CULVERTS AND END WALLS

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE) AND INSTALL THE COFFERDAMS IN THE STREAM ON BOTH ENDS OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE.
3. REMOVE THE EXISTING CULVERT AND ENDWALLS.
4. INSTALL THE NEW CULVERT.
5. INSTALL THE END WALLS.
6. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT. RECONFIGURE THE COFFERDAMS AROUND THE SIDE THAT WILL BE CONSTRUCTED NEXT.
7. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
8. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.

0 10 20 30 40
SCALE: 1" = 10'

608163_HD12(WATER HANDLING).DWG Plotted on 5-Jun-2024 12:02 PM
Proposal No. 608163-128112
A00860 - 539

WALES
MONSON ROAD

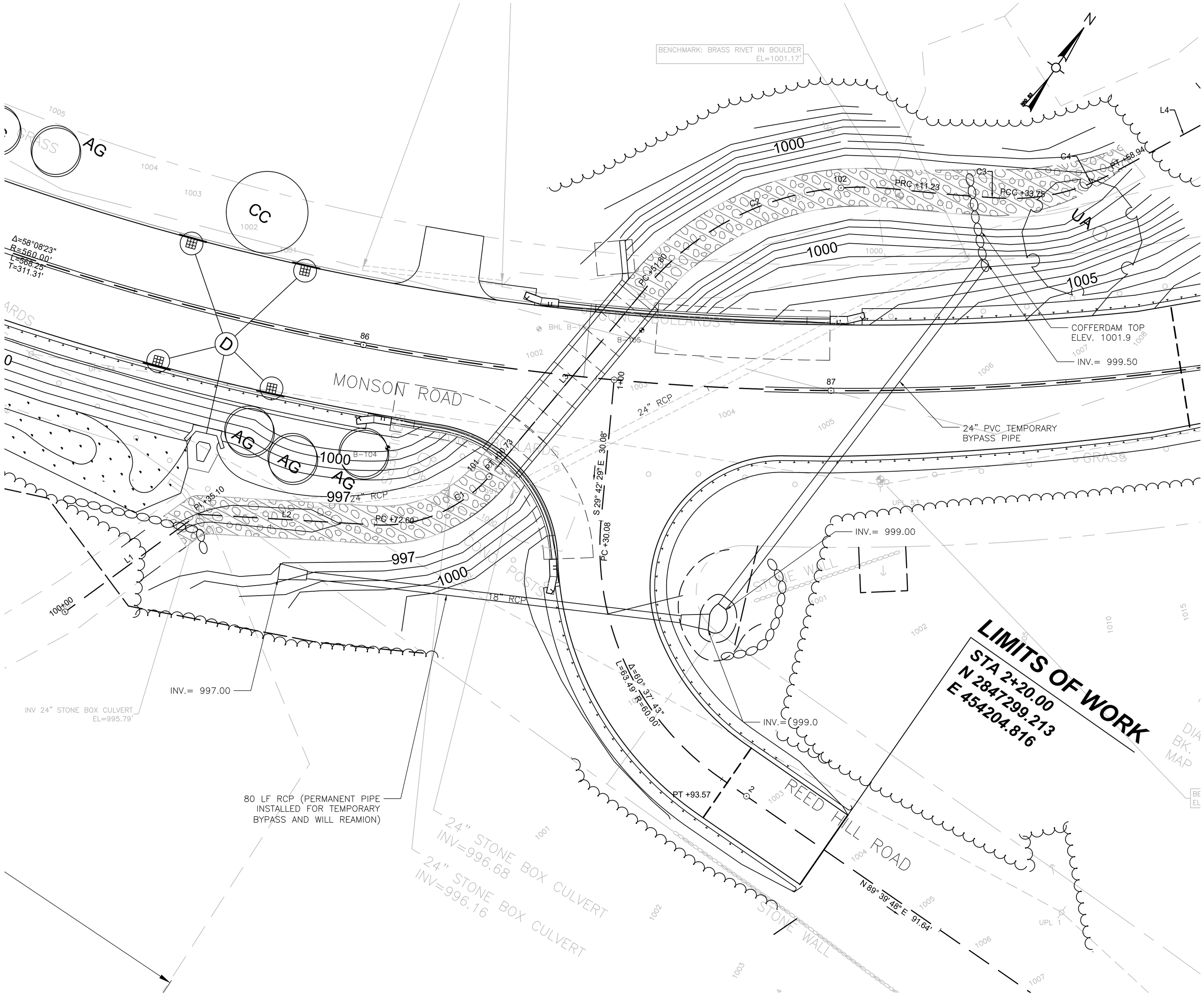
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	179	180
PROJECT FILE NO.		608163	

CONTROL OF WATER PLAN - CULVERT 3

REFER TO TEMPORARY TRAFFIC CONTROL PLANS AND STRUCTURAL PLANS FOR SPECIFIC STAGE CONSTRUCTION REQUIREMENTS.

CONTROL OF WATER SEQUENCE:

1. INSTALL SEDIMENT & EROSION CONTROL MEASURES.
2. INSTALL THE TEMPORARY BY PASS PIPE (SEE PLAN FOR SIZE AND INVERT ELEVATIONS) AND INSTALL THE COFFERDAMS ON THE UPSTREAM END OF THE PROPOSED CULVERT WHILE MAINTAINING FLOW THROUGH THE BY PASS PIPE. SEE PLAN FOR HEIGHT OF COFFERDAM.
3. REMOVE THE EXISTING CULVERT
4. INSTALL THE NEW CULVERT.
5. REMOVE THE BY PASS PIPE, ALLOW THE WATER TO FLOW THROUGH THE CULVERT.
6. RECONFIGURE THE COFFERDAMS, INSTALL OUTLET PROTECTION, FINALIZE GRADING, AND INSTALL GUARD RAIL.
7. REMOVE THE COFFERDAMS, REMOVE THE SEDIMENT & EROSION CONTROL MEASURES.



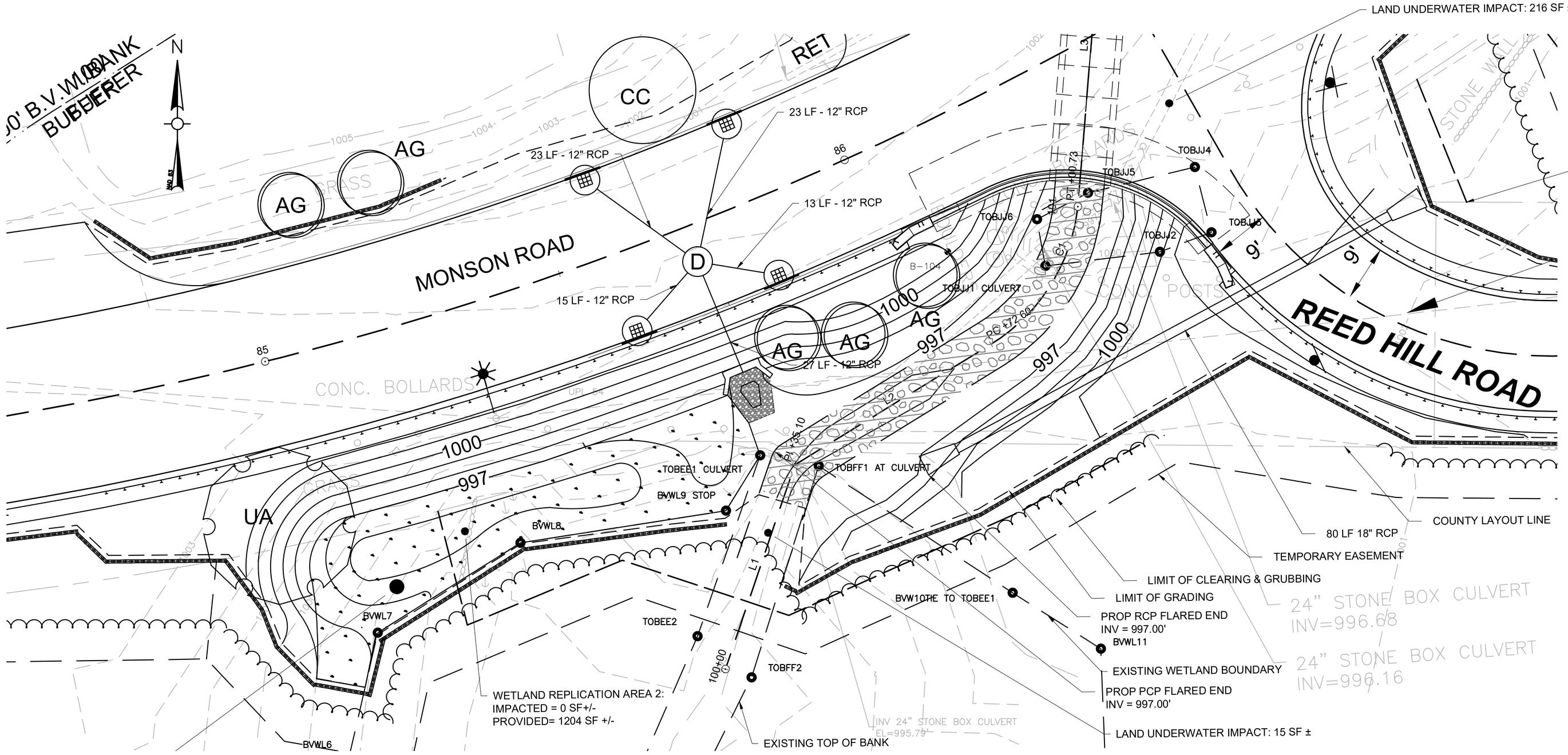
LOCATION 5
STA 87+00 and STA 1+33

608163_HD12(WATER HANDLING).DWG Plotted on 5-Jun-2024 12:02 PM
Proposal No. 608163-128112
A00060 - 540

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	180	180
PROJECT FILE NO.	608163		

WETLAND REPLICATION AREA DETAIL



MIX 765.552 WETLAND MIX - OBLIGATE MIX

BOTANICAL GRASS	COMMON NAME	%PLS BY WEIGHT
CAREX VULPINOIDEA	FOX SEDGE	
CAREX LURIDA	SHALLOW SEDGE	26.50%
SAPERGANIUM EURYCARPUM	GIANT BUR REED ECO PA	15.00%
CAREX LUPULINA	HOP SEDGE	10.00%
CAREX CRINITA	FRINGED SEDGE	7.00%
SCRIPUS CYPERINUS	WOOLGRASS	6.00%
JUNCUS EFFUSUS	SOFT RUSH	4.00%
CAREX COMOSA	BEAREDED SEDGE	3.00%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3.00%
SPARGANIUM AMERICANUM	BURRWEED	3.00%
SCIRPUS VALIDUS	BULRUSH, SOFT-STEM	2.50%
CAREX STRICTA	TUSSOCK SEDGE	2.00%
GLYCERIA CANADENISIS	MANNA GRASS	1.00%
		1.00%
		86.00%
VERBENA HASTATA	BLUE VERVAIN	4.00%
ASTER PUNICEUS	ASTER - SWAMP	2.00%
EUPATORIUM MACULATUM	JOE-PYE WEED	1.50%
EUPATORIUM PERFOLIATUM	BONESET	2.00%
IRIS VERSICOLOR	BLUE FLAG IRIS	2.00%
ALISMA SUBCORDATUM	MUD PLAINTAIN	1.00%
VERONIA NOVEBORACENSIS	NEW YORK IRONWEED	1.00%
BUDENS CERNUA	NODDING BURR MARIGOLD	1.00%
SOLIDAGO PATULA	ROUGHLEAF GOLDENROD	0.50%
MIMULUS RINGENS	MONKEY FLOWER	0.50%
CHELONE GLABRA	WHITE TURTLEHEAD	0.50%
		14.00%
		100.00%

SEED RATING:
SPECIES ECOTYPE SHALL BE AS NATIVE TO NEW ENGLAND REGION AS POSSIBLE. APPLY THIS MIX AT 20 LBS PLS/ACRE.

WETLAND REPLICATION AREA 2 GRADING PLAN

0 10 20 30 40

SCALE: 1" = 10'

WETLAND REPLACEMENT AREA 2 NOTES:

1. A WETLAND SCIENTIST SHALL BE PROVIDED ON-SITE TO MONITOR CONSTRUCTION OF THE WETLAND MITIGATION AREA TO ENSURE COMPLIANCE WITH THE MITIGATION PLAN.
2. AT LEAST 12 INCHES OF NATURAL OR MANMADE TOPSOIL SHALL BE INSTALLED IN THE WETLAND REPLICATION AREA.
3. ONLY PLANT MATERIALS NATIVE AND INDIGENOUS TO THE REGION SHALL BE USED. SPECIES NOT SPECIFIED IN THE REPLICATION PLAN SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE REGULATORY AUTHORITIES. PLANT SPECIES ON THE INVASIVE SPECIES PLANT LIST IN THE CORPS MITIGATION INTRODUCTION: PERFORMANCE STANDARDS AND SUPPLEMENTARY INFORMATION DATED 2/21/01 SHALL NOT BE USED IN AND WITHIN 100 FEET OF MITIGATION SITES.
4. A SUPPLY OF DEAD AND DYING WOODY DEBRIS SHALL COVER AT LEAST 2% OF THE GROUND THROUGHOUT THE MITIGATION SITE AFTER THE COMPLETION OF CONSTRUCTION OF THE MITIGATION SITE. THESE MATERIALS SHOULD NOT INCLUDE INVASIVE SPECIES.
5. TEMPORARY DEVICES AND STRUCTURES TO CONTROL EROSION AND SEDIMENTATION IN AND AROUND MITIGATION SITES SHALL BE DISASSEMBLED AND PROPERLY DISPOSED OF NO LATER THAN NOVEMBER 1 THREE FULL GROWING SEASON AFTER PLANTING. SEDIMENT COLLECTED BY THESE DEVICES SHALL BE REMOVED AND PROPERLY DISPOSED OF IN A MANNER THAT PREVENT ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.

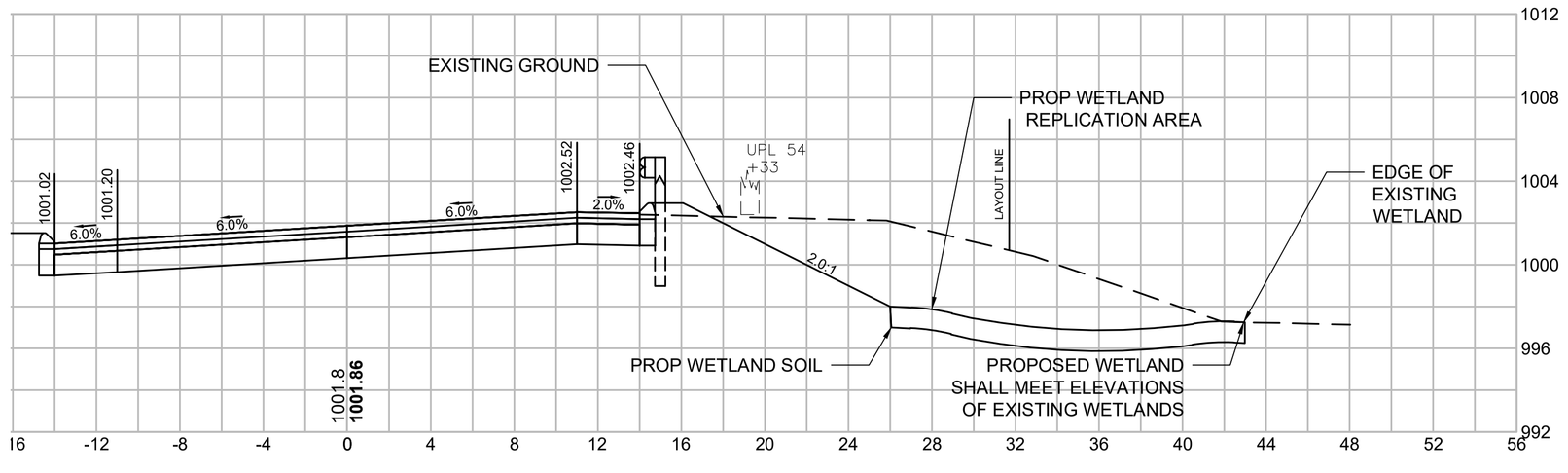
WETLAND REPLICATION AREA 2 PLANTING PLAN

SHRUBS
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM
WINTERBERRY (ILEX VERTICILLATE): 4 PLANTS, SPACED 10 FEET ON CENTER MINIMUM

FERNS
CINNAMON FERN (OSMUNDA CINNAMOMEA): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUMPS OF AT LEAST 5 TOGETHER IN SAME AREA
SENSITIVE FERN (ONOCLEA SENSIBILIS): 50 PLANTS, SPACED 2 FEET ON CENTER, PUT IN CLUMPS OF AT LEAST 5 TOGETHER IN SAME AREA

SEED MIX
IN WETLAND REPLICATION AREA: 765.552 WETLAND SEED - OBLIGATE MIX
(SAME MIX TO BE USED ON PLAN SHEET 16 FOR WETLAND REPLICATION AREA 1)

85+50



WETLAND REPLICATION AREA CROSS SECTION

608163_HD13(WETLAND REPLICATION).DWG Plotted on 5-Jun-2024 9:13 AM
Proposal No. 608163-128112
A00060 - 541

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00861

MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

ORDER OF CONDITIONS

THIS PAGE INTENTIONALLY LEEFT BLANK

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:
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
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: Town of Wales
Conservation Commission

2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

John — a. First Name
Grasso — b. Last Name
Town of Wales — c. Organization
3 Hollow Rd. — d. Mailing Address
Wales — e. City/Town
MA — f. State
01081 — g. Zip Code

4. Property Owner (if different from applicant):

a. First Name
b. Last Name
Town of Wales — c. Organization
3 Hollow Rd. — d. Mailing Address
Wales — e. City/Town
MA — f. State
01081 — g. Zip Code

5. Project Location:

Monson Rd. — a. Street Address
Wales — b. City/Town
Roadway — c. Assessors Map/Plat Number
d. Parcel/Lot Number
Latitude and Longitude, if known: 42.058656d m s - 72.254086d m

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:
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
City/Town

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):
Hampden
a. County | b. Certificate Number (if registered land)
c. Book | d. Page

7. Dates: 6/7/24 a. Date Notice of Intent Filed | 7/11/24 b. Date Public Hearing Closed | 7/30/24 c. Date of Issuance

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):
Notice of Intent
a. Plan Title
Mike Joyce
b. Prepared By
Weston & Sampson
c. Signed and Stamped by
d. Final Revision Date
e. Scale
see attached
f. Additional Plan or Document Title
g. Date

B. Findings

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.

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:
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
City/Town

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) — 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. ☐ Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. ☒ Bordering Vegetated Wetland	238 , 134 Temp	238 , 134 temp	1421	1421
		b. square feet	c. square feet	d. square feet
6. ☐ Land Under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☐ Bordering Land Subject to Flooding	a. square feet	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. ☐ 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. ☒ Riverfront Area	86, 402 a. total sq. feet	86, 402 b. total sq. feet		
Sq ft within 100 ft	45, 289 (3, 528)	45, 289 (3, 528) d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	25, 698 (814)	25, 698 (814) 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
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
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. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ 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. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		
22. ☐ 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
WPA Form 5 – Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
City/Town

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 _____ 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:
WE 314-0183
MassDEP File #

eDEP Transaction #
Wales
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 then two square feet or more than three square feet in size bearing the words,

    "Massachusetts Department of Environmental Protection" [or, "MassDEP"]

    "File Number WE 314-0183"

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:
WE 314-0183
MassDEP File #

eDEP Transaction #
Wales
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:
WE 314-0183
MassDEP File #

eDEP Transaction #
Wales
City/Town

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 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(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
Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
WE 314-0183
MassDEP File #

eDEP Transaction #
Wales
City/Town

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):
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

Provided by MassDEP:
WE 314-0183
MassDEP File #

eDEP Transaction #
Wales
City/Town

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☐ No

2. The _____ hereby finds (check one that applies):
Conservation Commission

   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:

   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):

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
WE 314 0183
MassDEP File #

eDEP Transaction #

Wales
City/Town

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.

7/30/24
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

3
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.

Signatures:

Joanie D'Ambrosia
Zachery Berry
Jennifer Bothwell

☐ by hand delivery on

Date

☒ by certified mail, return receipt requested, on

7/30/24
Date

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:
WE 314-0183
MassDEP File #

eDEP Transaction #

Wales
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.

Town of Wales
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Town of Wales
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Monson Rd / Lynch Rd.
Project Location

WE 314-0183
MassDEP File Number

Has been recorded at the Registry of Deeds of:

Hampden
County

Book

Page

for:

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

Special Conditions – Notice of Intent DEP File # WE 314-0183

1. A member of the Conservation Commission or its agent may enter and inspect the property and the activity that are the subjects of this Order at all reasonable times, with or without probable cause or prior notice, and until a Certificate of Compliance is issued, for the limited purpose of evaluating compliance with this Order (and Town Bylaw and Bylaw Regulations).
2. The applicant shall provide a copy of this Order to the person or persons supervising the activity that is the subject of this Order and will be responsible for ensuring that all persons performing the permitted activity are fully aware of the terms and conditions of this Order.
3. All construction materials, earth stockpiles, landscaping materials, slurry pits, waste products, refuse, debris, stumps, slash, or excavate may only be stockpiled or collected in areas as shown and labeled on the approved plan(s), or if no such areas are shown must be placed or stored outside all resource areas and associated buffer zones under cover and surrounded by a double-staked row of hay bales to prevent contact with rain water.
4. There shall be no pumping of water from wetland resource areas.
5. All waste products, grubbed stumps, slash, construction materials, etc. shall be deposited at least 100 feet from wetland resource areas and 200 feet from rivers, unless specified in this Order.
6. No fuel, oil, or other pollutants shall be stored in any resource area or the buffer zone thereto, unless specified in this Order.
7. No hazardous waste shall be introduced or discharged into or toward wetland resource areas.
8. This Order authorizes only the activity described on the approved plan(s) and approved documents referenced in this Order. Any other or additional activity in areas within the jurisdiction of the Commission will require separate review and approval by the Commission or its agent.
9. Prior to the Pre-Activity Meeting and any work commencing on the site, the applicant shall display the DEP file number for this Order on a sign with minimum dimensions of two feet by two feet at a location clearly visible from the street. The sign shall remain in place and visible until a Certificate of Compliance is issued for the activity.
10. Prior to the Pre-Activity Meeting and commencement of any activity on this site, the approved erosion control shall be installed as indicated on the approved plan.
11. Immediately after installation of erosion controls, the Conservation Commission shall be contacted to conduct a follow-up inspection to ensure that erosion controls have been properly installed.
12. The applicant shall notify the Conservation Commission at least 48 hours prior to any activity on the site and shall provide the name(s) and telephone number(s) of all person(s) responsible for compliance with this Order.
13. All equipment shall be inspected regularly for leaks. Any leaking hydraulic lines, cylinders or any other components shall be fixed immediately.

14. Upon beginning of work, the Project Supervisor or Environmental Professional shall submit to the Conservation Commission written progress reports once a month. Progress reports shall indicate what work has been done in wetland resource areas and associated buffer zones, and what work is anticipated to be done over the next reporting period. The reports shall also address the current condition of erosion and sedimentation controls; describe any erosion and sedimentation control repair and/or replacement; and describe any erosion or sedimentation problems and mitigation measures implemented.
15. Equipment for fuel storage and refueling operations shall be located outside all areas within the jurisdiction of the Commission unless indicated otherwise in the approved plan.

16. If the completed work differs from that in the original plans and/or conditions listed in this Order, a report must be submitted to the Commission thirty (30) days prior to completion specifying how the work differs, at which time the applicant shall first request a modification to the Order. Upon review and approval by the Commission, the applicant may request in writing a Certificate of Compliance as described above.
17. Appropriate erosion control devices shall be in place prior to the beginning of any phases of construction and shall be maintained during construction in the wetland areas and buffer zones. The erosion control specifications provided in the Notice of Intent and the erosion control provision in the Order will be the minimum standards for this project. Additional or modified erosion control measures may be required by the Commission at any time before, during and after construction. These will be maintained until the engineer and a member or agent of the Conservation Commission agree that they are no longer needed, at which time they will be removed, using mutually satisfactory removal procedures.

18. Within thirty days of completion of construction on any given portion of the project, all disturbed areas in the completed portion of the site shall be permanently stabilized with vegetative cover, using sufficient topsoil to assure long-term vegetative growth. Continued maintenance of this area, in a manner which assures permanent stabilization and precludes any soil erosion, shall be the responsibility of the applicant.
19. Erosion and sedimentation control devices shall be inspected after each storm event and repaired or replaced as necessary. Any accumulated silt adjacent to the barriers shall be removed.
20. All stockpiles of soils existing for more than one day shall be surrounded by a row of entrenched silt fence and shall be covered.

21. Upon completion of construction and final soil stabilization, the applicant shall submit the following to the Conservation Commission to request a Certificate of Compliance (COC):
    1. A Completed Request for a Certificate of Compliance form (WPA Form 8A or other form if required by the Conservation Commission at the time of request).

    2. A letter from a Registered Professional Engineer certifying compliance of the property with this Order of Conditions, and detailing any deviations that exist, and their potential

effect on the project. A statement that the work is in "substantial compliance" with no detailing of the deviations shall not be accepted.

3. An "As-Built" plan signed and stamped by a Registered Professional Engineer or Land Surveyor showing post-construction conditions within all areas under the jurisdiction of the Massachusetts Wetlands Protection Act and the [name of municipality] Wetlands Protection Bylaw. This plan shall include at a minimum:

(a) All wetland resource area boundaries with associated buffer zones and regulatory setback areas taken from the plan(s) approved in this Order of Conditions;

ii. Locations and elevations of all stormwater management conveyances, structures and best management designs, including foundation drains, constructed under this Order within any wetland resource area or buffer zone.

iii. Distances from any structures constructed under this Order to wetland resource areas - "structures" include, but are not limited to, all buildings, septic system components, wells, utility lines, fences, retaining walls, and roads/driveways.

iv. A line delineating the limit of work - "work" includes any filling, excavating and/or disturbance of soils or vegetation approved under this Order.

v. Wetland resource replication areas constructed under this Order.

4. Post-construction photographs demonstrating compliance with this Order, including established vegetation where required.

22. The wetland replication shall be performed in accordance with the Plans referenced above, unless specified otherwise in this Order. The Commission reserves the right to require additional plantings to ensure achievement of 75% cover of wetland plant species within two full growing seasons, as specified in 310 CMR 10.55 (4) (b) and (section of local bylaw and regulations).
23. Seasonal monitoring reports shall be prepared for each wetland replication area. Monitoring reports shall describe, using narratives, plans, and color photographs, the physical characteristics of the wetland replication areas with respect to stability, soil characteristics, survival of vegetation and plant mortality, aerial extent and distribution, species diversity and vertical stratification (i.e. herb, shrub and tree layers). A total of four monitoring reports for each replication area shall be submitted over a two-year period. The monitoring reports shall be submitted for the growing season.
24. Any damage caused as a direct result of this project to any wetland resource areas shall be the responsibility of the applicant to repair, restore and/or replace. Sedimentation or erosion into these areas shall be considered damage to wetland resource areas. If sediment reaches these areas the Commission shall be contacted and a plan for abatement

of the problem and proposed restoration/mitigation measures shall be submitted for approval and implementation.

WPA Form 3 – Notice of Intent

Attachment A – Figures

Attachment B – Stormwater Checklist

Determination Division of Fisheries & Wildlife

Monson Rd. – Locus Map

Appendix A – Project Narrative

Appendix B – Alternative Analysis

Appendix C – Site Maps

Appendix D – Stormwater Management Report

Attachment C – Drainage Report

Appendix A – Watershed Maps

Appendix B – Rational Method Data

Appendix C – Hydraflow Reports

Appendix D – HY-8 Reports

Appendix E – HEC – RAS

Appendix F – Drainage Swales

Appendix G – Outlet Protection

Attachment D – Operation & Maintenance Plan

Attachment E – Erosion and Sediment Control Plan & Pollution Prevention

Appendix E – Abutter Notification Information

Appendix F – Wetland Delineation Report

Appendix A – ACOE Wetland Determination Data Forms

Appendix G – Site Photographs

Appendix H – Previous Correspondence with MESA & Proof of Mailing NOI & NHESP

Appendix I – Project Plans

THIS PAGE IS INTENTIONALLY LEFT BLANK

Special Conditions – Notice of Intent DEP File # WE 314-0183

1. A member of the Conservation Commission or its agent may enter and inspect the property and the activities that are the subjects of this Order until a Certificate of Compliance is issued, for the limited purpose of evaluating compliance with this Order. The Wales Conservation Commission and its agents will notify MassDOT a minimum of 24 hours prior to conducting the inspection in order to ensure a safe environment for visitors.
2. The applicant shall provide a copy of this Order to the person or persons supervising the activity that is the subject of this Order and will be responsible for ensuring that all persons performing the permitted activity are fully aware of the terms and conditions of this Order.
3. All construction materials, earth stockpiles, landscaping materials, slurry pits, waste products, refuse, debris, stumps, slash, or excavate may only be stockpiled or collected within authorized impact areas under cover and surrounded by adequate Best Management Practices (BMPs) to prevent contact with rainwater.
4. There shall be no pumping of water from wetland resource areas.
5. All waste products, grubbed stumps, slash, construction materials, etc. shall be deposited at least 100 feet from wetland resource areas and 200 feet from rivers, unless specified in this Order.
6. No fuel, oil, or other pollutants shall be stored in any resource area or the buffer zone thereto, unless specified in this Order.
7. No hazardous waste shall be introduced or discharged into or toward wetland resource areas.
8. This Order authorizes only the activity described on the approved plan(s) and approved documents referenced in this Order. Any other or additional activity in areas within the jurisdiction of the Commission will require separate review and approval by the Commission or its agent.
9. Prior to the Pre-Activity Meeting and any work commencing on the site, the applicant shall display the DEP file number for this Order on a sign with minimum dimensions of two feet by two feet at a location clearly visible from the street. The sign shall remain in place and visible until a Certificate of Compliance is issued for the activity.
10. Prior to the Pre-Activity Meeting and commencement of any activity on this site, the approved erosion control shall be installed as indicated on the approved plan.
11. Immediately after installation of erosion controls, the Conservation Commission shall be contacted to conduct a follow-up inspection to ensure that erosion controls have been properly installed.
12. The applicant shall notify the Conservation Commission at least 48 hours prior to any activity on the site and shall provide the name(s) and telephone number(s) of all person(s) responsible for compliance with this Order.
13. All equipment shall be inspected regularly for leaks. Any leaking hydraulic lines, cylinders or any other components shall be fixed immediately.

14. Upon the beginning of work, the Project Supervisor or Environmental Professional shall submit to the Conservation Commission the Contractor's erosion and sedimentation inspection control reports and one month look-ahead schedules detailing upcoming work. The reports shall also address the current condition of erosion and sedimentation controls; describe any erosion and sedimentation control repair and/or replacement and describe any erosion or sedimentation problems and mitigation measures implemented. The commission is also requesting an Inspection report in the event of a qualifying rain event, storm event, or other non-weather, related event that would lead to a negative impact on the wetlands.
15. Equipment for fuel storage shall be located outside of all areas within the jurisdiction of the Commission unless indicated otherwise in the approved plan. Refueling shall be located outside of jurisdictional resource areas to the extent practicable.
16. If the completed work differs from that in the original plans and/or conditions listed in this Order, a report must be submitted to the Commission thirty (30) days prior to completion specifying how the work differs, at which time the applicant shall first request a modification to the Order. Upon review and approval by the Commission, the applicant may request in writing a Certificate of Compliance as described above.
17. Appropriate erosion control devices shall be in place prior to the beginning of any phases of construction and shall be maintained during construction in the wetland areas and buffer zones. The erosion control specifications provided in the Notice of Intent and the erosion control provision in the Order will be the minimum standards for this project. Additional or modified erosion control measures may be required by the Commission at any time before, during and after construction. These will be maintained until the engineer and a member or agent of the Conservation Commission agree that they are no longer needed, at which time they will be removed, using mutually satisfactory removal procedures.
18. Within thirty days of completion of construction on any given portion of the project, all disturbed areas in the completed portion of the site shall be permanently stabilized with vegetative cover, using sufficient topsoil to assure long-term vegetative growth. Continued maintenance of this area, in a manner which assures permanent stabilization and precludes any soil erosion, shall be the responsibility of the applicant.
19. Erosion and sedimentation control devices shall be inspected after each storm event and repaired or replaced as necessary. Any accumulated silt adjacent to the barriers shall be removed.
20. All stockpiles of soils existing for more than one day shall be surrounded by a row of entrenched silt fence and shall be covered.
21. Upon completion of construction and final soil stabilization, the applicant shall submit the following to the Conservation Commission to request a Certificate of Compliance (COC):
    1. A Completed Request for a Certificate of Compliance form (WPA Form 8A or other form if required by the Conservation Commission at the time of request).

2. A letter from a Registered Professional Engineer certifying compliance of the property with this Order of Conditions, and detailing any deviations that exist, and their potential effect on the project. A statement that the work is in "substantial compliance" with no detailing of the deviations shall not be accepted.

3. An "As-Built" plan signed and stamped by a Registered Professional Engineer or Land Surveyor showing post-construction conditions within all areas under the jurisdiction of the Massachusetts Wetlands Protection Act and the [name of municipality] Wetlands Protection Bylaw. This plan shall include at a minimum:

(a) All wetland resource area boundaries with associated buffer zones and regulatory setback areas taken from the plan(s) approved in this Order of Conditions;

ii. Locations and elevations of all stormwater management conveyances, structures and best management designs, including foundation drains, constructed under this Order within any wetland resource area or buffer zone.

iii. Distances from any structures constructed under this Order to wetland resource areas - "structures" include, but are not limited to, all buildings, septic system components, wells, utility lines, fences, retaining walls, and roads/driveways.

iv. A line delineating the limit of work - "work" includes any filling, excavating and/or disturbance of soils or vegetation approved under this Order.

v. Wetland resource replication areas constructed under this Order.

4. Post-construction photographs demonstrating compliance with this Order, including established vegetation where required.

22. The wetland replication shall be performed in accordance with the Plans referenced above, unless specified otherwise in this Order. The Commission reserves the right to require additional plantings to ensure achievement of 75% cover of wetland plant species within two full growing seasons, as specified in 310 CMR 10.55 (4) (b) and (section of local bylaw and regulations).
23. Seasonal monitoring reports shall be prepared for each wetland replication area. Monitoring reports shall describe, using narratives, plans, and color photographs, the physical characteristics of the wetland replication areas with respect to stability, soil characteristics, survival of vegetation and plant mortality, aerial extent and distribution, species diversity and vertical stratification (i.e. herb, shrub and tree layers). A total of four monitoring reports for each replication area shall be submitted over a two-year period. The monitoring reports shall be submitted for the growing season.
24. Any damage caused as a direct result of this project to any wetland resource areas shall be the responsibility of the applicant to repair, restore and/or replace. Sedimentation or

erosion into these areas shall be considered damage to wetland resource areas. If sediment reaches these areas the Commission shall be contacted and a plan for abatement of the problem and proposed restoration/mitigation measures shall be submitted for approval and implementation.

On August 29th, 2024, the Wales Conservation Commission held a public meeting, where the commission voted unanimously in favor of the suggested amendments submitted by Weston & Sampson / MA DOT. Please see the following pages where those specific changes are noted.

Jennifer Bothwell

Zachary Berry

Joanie D'Ambrosia

SC #1: *"A member of the Conservation Commission or its agent may enter and inspect the property and the activity that are the subjects of this Order at all reasonable times, with or without probable cause or prior notice, and until a Certificate of Compliance is issued, for the limited purpose of evaluating compliance with this Order (and Town Bylaw and Bylaw Regulations)."*

Requested/Approved Change: MassDOT respectfully requests that the language in this SC be revised to "A member of the Conservation Commission or its agent may enter and inspect the property and the activities that are the subjects of this Order until a Certificate of Compliance is issued, for the limited purpose of evaluating compliance with this Order. The Wales Conservation Commission and its agents will notify MassDOT a minimum of 24 hours prior to conducting the inspection in order to ensure a safe environment for visitors."

SC #3: *"All construction materials, earth stockpiles, landscaping materials, slurry pits, waste products, refuse, debris, stumps, slash, or excavate may only be stockpiled or collected in areas as shown and labeled by the approved plan(s), or if no such areas are shown must be placed or stored outside all resource areas and associated buffer zones under cover and surrounded by double-staked row of hay bales to prevent contact with rain water."*

Requested/Approved Change: MassDOT respectfully requests that the language be revised to indicate "All construction materials, earth stockpiles, landscaping materials, slurry pits, waste products, refuse, debris, stumps, slash, or excavate may only be stockpiled or collected within authorized impact areas under cover and surrounded by adequate Best Management Practices (BMPs) to prevent contact with rainwater."

SC #14: *"Upon the beginning of work, the Project Supervisor or Environmental Professional shall submit to the Conservation Commission written progress reports once a month. Progress reports shall indicate what work has been done in wetland resource areas and associated buffer zones, and what work is anticipated to be done over the next reporting period. The reports shall also address the current condition of erosion and sedimentation controls; describe any erosion and sedimentation control repair and/or replacement and describe any erosion or sedimentation problems and mitigation measures implemented."*

Requested/Approved Change: MassDOT respectfully requests that the language be revised to indicate, *"Upon the beginning of work, the Project Supervisor or Environmental Professional shall submit to the Conservation Commission the Contractor's erosion and sedimentation inspection control reports and one month look-ahead schedules detailing upcoming work. The reports shall also address the current condition of erosion and sedimentation controls; describe any erosion and sedimentation control repair and/or replacement and describe any erosion or sedimentation problems and mitigation measures implemented."*

In addition to the requested change, the commission added the following to condition #14: *The commission is also requesting an Inspection report in the event of a qualifying rain event, storm event, or other non-weather, related event that would lead to a negative impact on the wetlands.*

SC #15: *"Equipment for fuel storage and refueling operations shall be located outside of all areas within the jurisdiction of the Commission unless indicated otherwise in the approved plan."*

Requested/Approved Change: MassDOT respectfully requests that the language be revised to indicate, *"Equipment for fuel storage shall be located outside of all areas within the jurisdiction of the Commission unless indicated otherwise in the approved plan. Refueling shall be located outside of jurisdictional resource areas to the extent practicable."*

DOCUMENT A00870

MASSACHUSETTS DIVISION OF FISHERIES & WILDLIFE

NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM

MESA REVIEW REQUEST

THIS PAGE INTENTIONALLY LEFT BLANK

Weston & Sampson℠

5 Centennial Drive, Peabody, MA 01960 (HQ)
Tel: 978.532.1900

LETTER OF TRANSMITTAL

TO
Regulatory Review NHESP 1 Rabbit Hill Road Westborough, MA 01581

DATE	JOB NO.
02/02/18	
ATTENTION	
RE	

MESA Project Review Filing
Monson Road Improvements, Wales, MA

WE ARE SENDING YOU:

☐ Shop Drawing ☐ Attached ☐ Plans ☐ Samples
☐ Change Order ☐ Prints ☐ Copy of Letter ☐ Specifications
☐ Other ☐ Under Separate Cover Via: _____

COPIES	DATE	NO.	DESCRIPTION
1			MESA Project Review form
1			Proof of ownership (property cards)
1			USGS Map
1			Photographs
1			Project Plans (25% Submittal)

THESE ARE TRANSMITTED AS CHECKED BELOW:

☐ For Approval ☐ Approved as Submitted ☐ Resubmit Copies for Approval
☐ For Your Use ☐ Approved as Noted ☐ Submit Copies for Distribution
☑ For Review and Comment ☐ As Requested ☐ Return Corrected Prints
☐ FOR BIDS DUE ☐ Prints Returned After Loan to Us ☐ Returned for Corrections
☐ Other

REMARKS:

COPY TO:

SIGNED: Alan Nafis

If enclosures are not as noted, kindly notify us at once.

MESA PROJECT REVIEW CHECKLIST

Massachusetts Endangered Species Act M.G.L. c. 131A and Regulations (321 CMR 10.00)

Massachusetts Division of Fisheries & Wildlife
Natural Heritage & Endangered Species Program

~~~~ CONTACT INFORMATION ~~~~

If you already completed your Notice of Intent- Form 3, you can send page 1 of the NOI in place of questions 1 through 4 in this section

1. **Project Location:**

Monson Road	Wales, MA	01081
Street Address/Location	City/Town	Zip Code

Map 13, 14	2270
Assessors Map/Plat Number Parcel	/Lot Number

2. **Applicant:**

Bruce Cadiuex		Road Commissioner, Wales, MA
First Name Last	Name	Company

1 Hegan Street		
Mailing Address		

Wales	MA	01081
City/Town	State	Zip Code

413-245-7494	413-245-1374	road-com@townofwales.net
Phone Number	Fax Number	Email address

3. **Property owner (if different from applicant):**

First Name Last	Name	Company

Mailing Address		

	MA	
City/Town	State	Zip Code

Phone Number	Fax Number	Email address

4. **Representative (if any):**

Weston & Sampson		
Company		

Alan Nafis		
Contact Person First Name	Contact Person Last Name	

273 Dividend Road		
Mailing Address		

Rocky Hill	CT	06067
City/Town	State	Zip Code

860-513-1473 (x 3021)	n/a	nafisa@wseinc.com
Phone Number	Fax Number	Email address

~~~~ADDITIONAL INFORMATION ~~~~

1. Will this project require a filing with the Conservation Commission and/or DEP? ☐ No ☑ Yes
2. Will this project meet any threshold for a MA Environmental Policy Act (MEPA) filing (excluding rare species, 301 CMR 11.03 (2))? ☑ No ☐ Yes
3. Has this project previously been issued a NHESP Tracking Number (either by previous NOI Submittal or MESA Information Request Form)? ☑ No ☐ Yes

If Yes - Tracking No._____

~~~~PROJECT DESCRIPTION (attach separate sheet, as needed) ~~~~

Please note, certain projects or activities are exempt from review, see 321 CMR 10.14. The MESA does not allow project segmentation. Your filing must reflect <u>all</u> anticipated work associated with the proposed project (CMR 321 10.16).

Roadway improvements to Monson Road from the intersection of Monson Road and Reed Hill Road in the east to the townline with Monson in the west. Improvements include roadway widening, storm water/ drainage improvements and culvert replacements. The project is being funded through MassDOT TIPP funding (Mass Highway Project # 608163). The total roadway length is approximately 1.5 miles long with approximately 11.3 acres of disturbance. We were informed that the project is fee exempt for NHESP review based on the MassDOT funding source.

~~~~INCLUDE THE FOLLOWING INFORMATION ~~~~

The NHESP will notify the applicant within 30 days if the materials submitted do not satisfy requirements for a filing and request submission of any missing materials (321 CMR 10.18(1)).

<u>ALL Applicants</u> must submit:

- ☑ USGS map (1:24,000 or 1:25,000) with property boundary clearly outlined
- ☑ Project plans for entire site (including wetland Resource Areas, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work)
- ☑ Assessor's map or right-of-way plan of site
- ☑ Project description
- ☑ Statement/proof that applicant is the Record Owner or that applicant is a person authorized in writing by the record owner to submit this filing
- ☑ Photographs representative of the site

Projects altering* <u>10 or more acres</u>, must also submit:

- ☑ A vegetation cover type map of the site
- ☑ Project plans showing Priority Habitat boundaries

The NHESP may request additional information, such as, but not limited to, species and habitat surveys, wetland reports, soil map and reports, and stormwater management reports (321 CMR 10.16).

*****Alteration: Any physical alteration of land, soils, drainage or destruction of plant life, see "Project or Activity" (321 CMR 10.02).

~~~~ FILING FEES ~~~~

See Fee Schedule below

a. Total MESA Fee Paid exempt b. Acreage of Disturbance* 1.5 acres c. Total Site Acreage 11.3

~~~~ REQUIRED SIGNATURES~~~~

I hereby certify under the penalties of perjury that the foregoing MESA filing and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge.

Signature of Property Owner/Record Owner of Property Date

Signature of Applicant (required, if different from Owner) Date

Please send form, required information, and filing fee (payable to "Comm. of MA - NHESP") to:

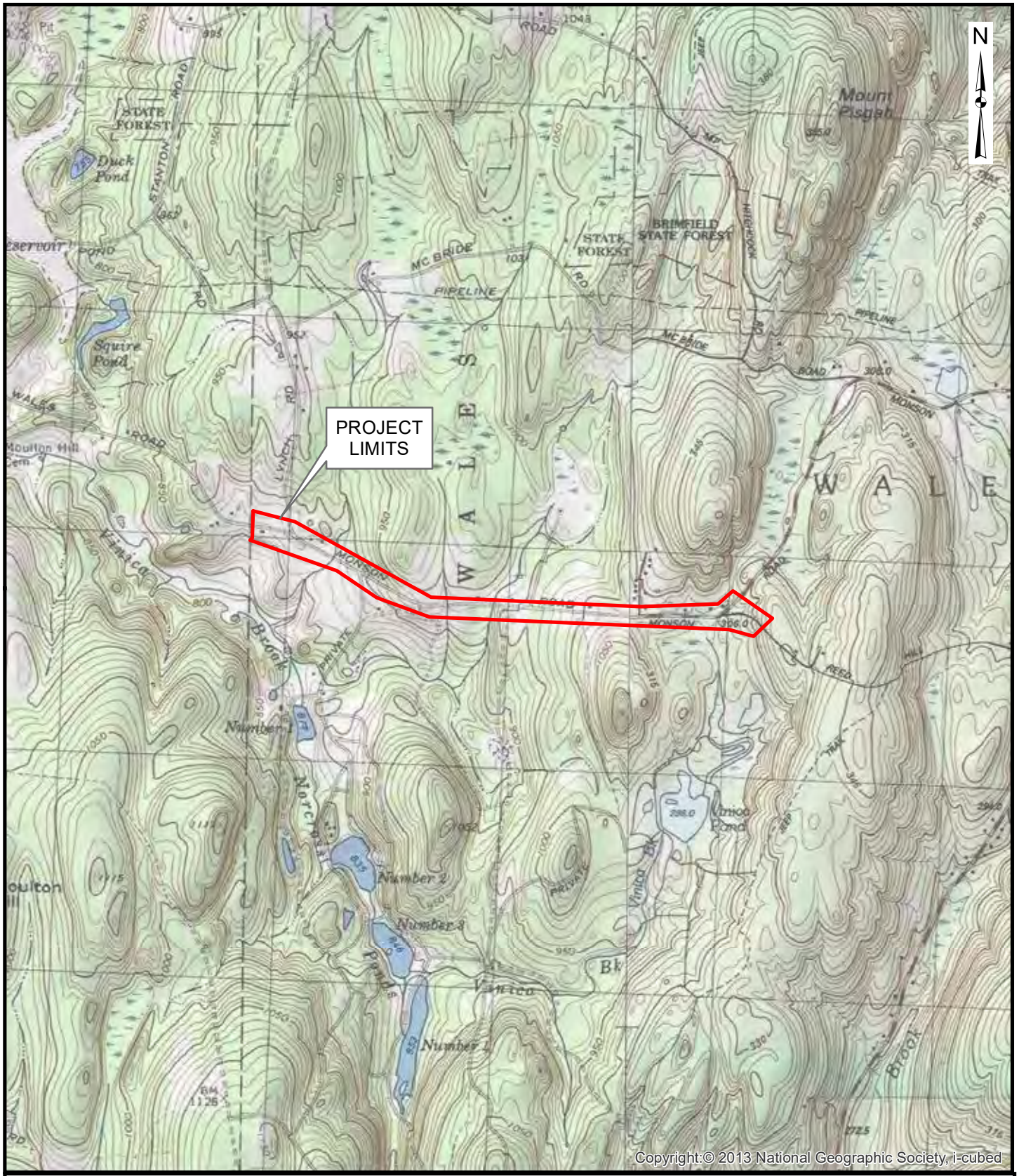
Regulatory Review
Natural Heritage & Endangered Species Program
1 Rabbit Hill Road
Westborough, MA 01581

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

Questions regarding this form should be directed according to the county that the property is located:
Berkshire, Essex, Franklin, Hampshire, Hampden, Middlesex & Worcester Counties call: 508-389-6361
Barnstable, Bristol, Dukes, Nantucket, Norfolk, Plymouth & Suffolk Counties call: 508-389-6385

PROJECT REVIEWS 321 CMR 10.18			
Project Definition	**Project Criteria**	**Fee**	**Response Time**
Simple	Less than 5 acres of disturbance*	$ 300.00	60 days from determination of complete filing
Intermediate *(Moderate)*	5 to 20 acres of disturbance*	$ 1800.00	60 days from determination of complete filing
Complex	More than 20 acres of disturbance* or project requires wetlands variance	$ 4000.00	60 days from determination of complete filing
Linear	Projects greater than 1 mile in length.	$ 4000.00 per Priority Habitat intersected	60 days from determination of complete filing

* Disturbance means direct physical disturbance of the land surface or waterbody, soil and/or vegetation, if only a portion of the project site is located within Priority Habitat, indicate total area of disturbance for site as a whole.



Project Limits

FIGURE 1
MONSON ROAD IMPROVEMENTS
Wales, MA

LOCUS MAP

1 inch = 2,000 feet

1,000 0 1,000

Scale In Feet

Weston & Sampson

Path: P:\MA\Wales, MA\2170841 Monson Rd Reconstruction\CAD\GIS\LocusMap.mxd User: ColesL Saved: 1/31/2018 2:49:29 PM Opened: 1/31/2018 2:49:49 PM

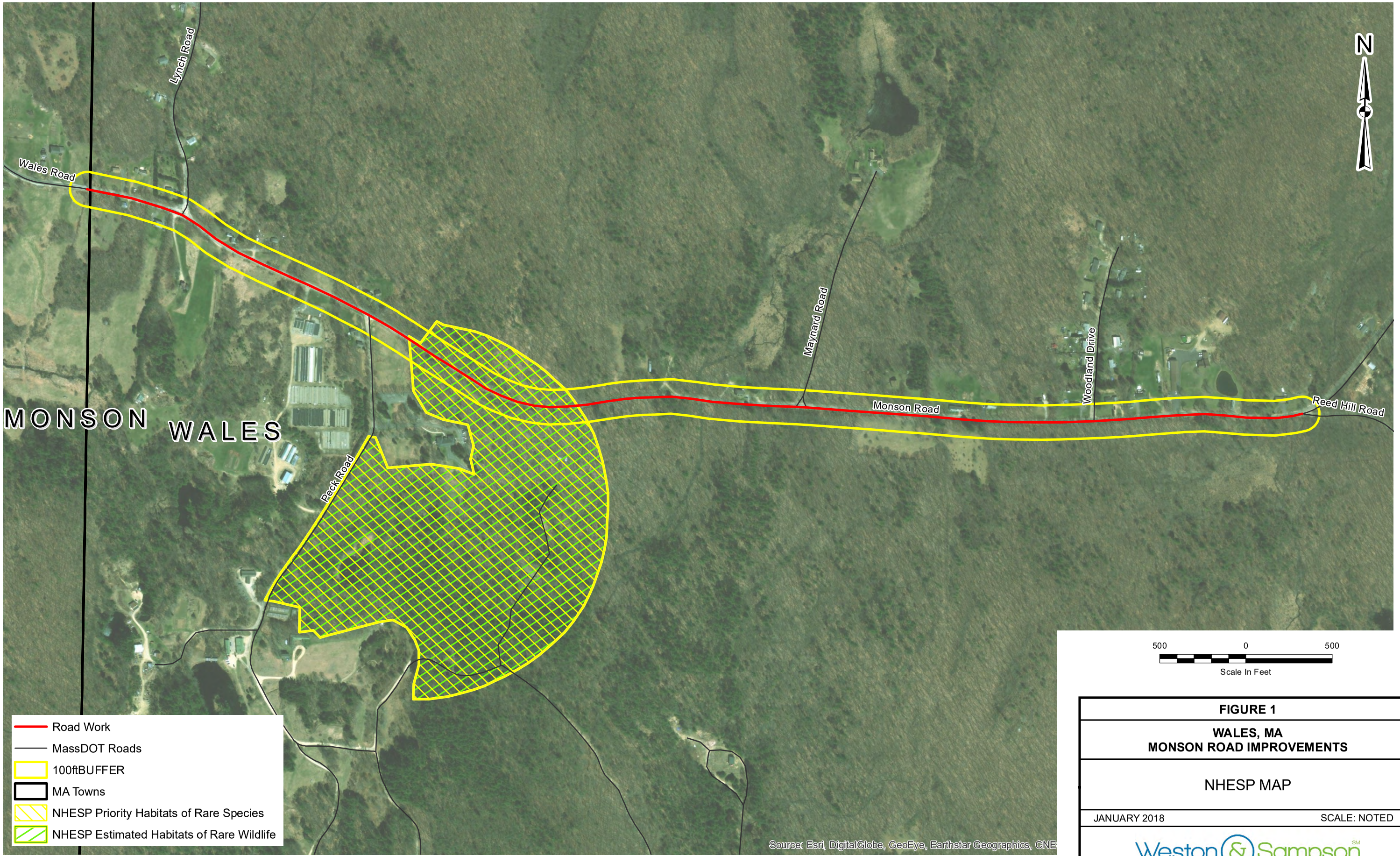


FIGURE 1

WALES, MA
MONSON ROAD IMPROVEMENTS

NHESP MAP

JANUARY 2018 SCALE: NOTED

Weston & Sampson℠

Path: \\wse03.local\WSE\Depts\Water\ERMAP\GIS - Constraints Mapping\Wales\Monson Rd\nhesp map.mxd User: higginsm Saved: 1/23/2018 2:16:09 PM Opened: 1/23/2018 2:16:50 PM

Proposal No. 608163-128112

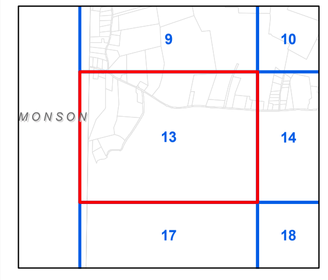
Town of Wales
Massachusetts

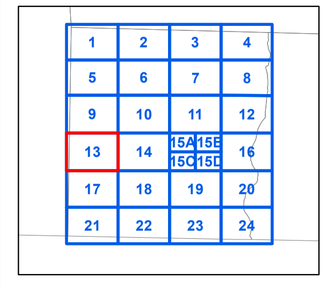
Legend

- Parcels on Current Map
- Parcels on Other Maps
- Current Tax Map Boundary
- Other Tax Map Boundaries
- Easements
- 16 Lot/Address Number
- 1.23 AC Lot Size
- 6A Subdivision Lot Number
- 120.00 Lot Dimensions
- Historic Lines
- Tie Lines
- Buildings
- Wetlands

N W E S

0 200 400
Feet





Disclaimer:

This map is for assessment purposes only.
It is not valid to use as a survey or for conveyance.

Classification, zoning, and site dimensions on this map are used for assessment purposes only. Specific data as listed above should be verified with the proper authority and/or department.

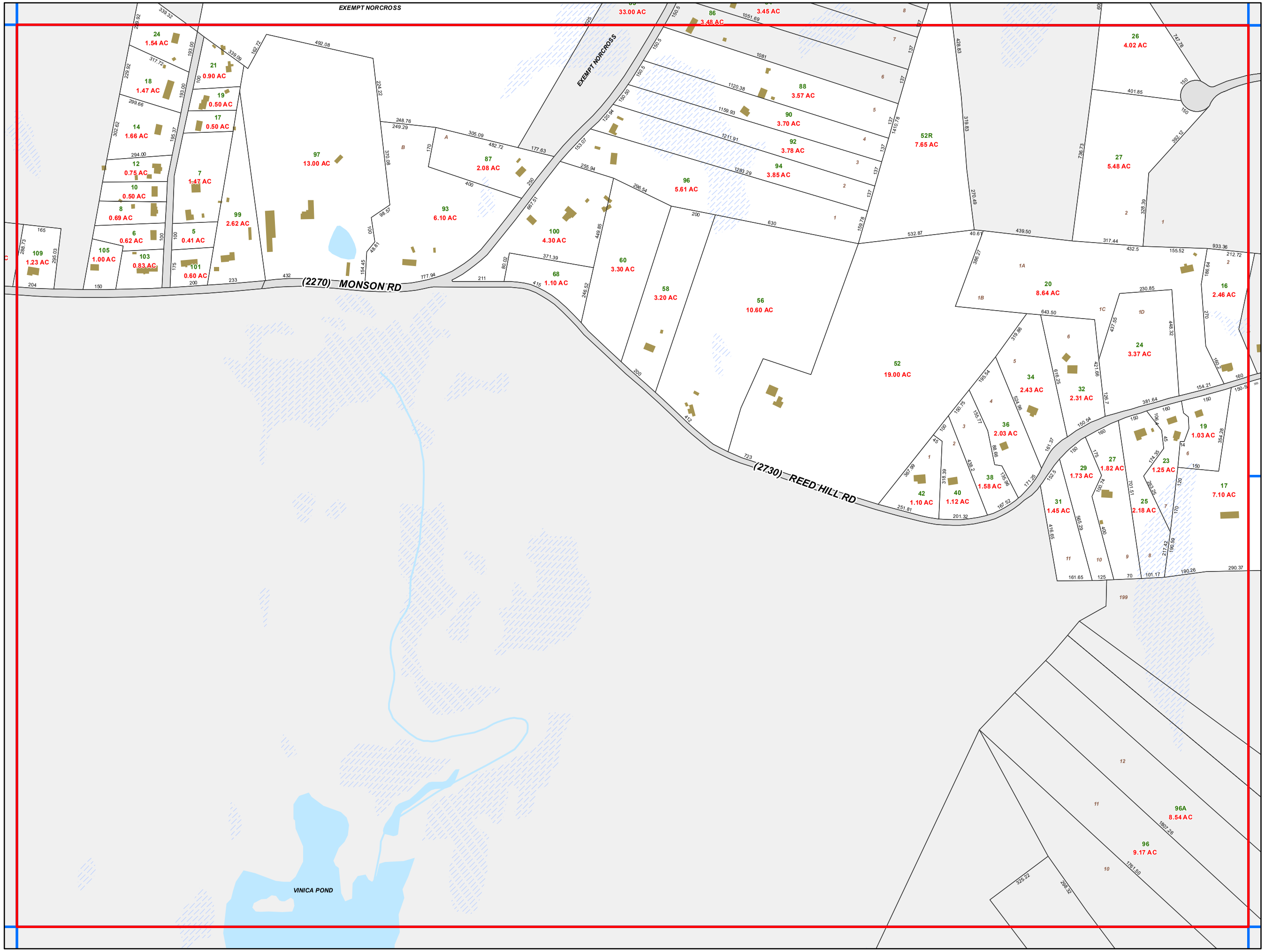
Map: 13

January 2015

Tighe&Bond
www.tighebond.com

Proposal No. 608163-12812

A0087 - 6



Town of Wales Massachusetts

Legend

- Parcels on Current Map
- Parcels on Other Maps
- Current Tax Map Boundary
- Other Tax Map Boundaries
- Easements
- 16 Lot/Address Number
- 1.23 AC Lot Size
- 6A Subdivision Lot Number
- 120.00 Lot Dimensions
- Historic Lines
- Tie Lines
- Buildings
- Wetlands

0 200 400
Feet

9	10	11
13	14	15A / 15C
17	18	19

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15A 15B 15C 15D	16
17	18	19	20
21	22	23	24

Disclaimer:

This map is for assessment purposes only.
It is not valid to use as a survey or for conveyance.

Classification, zoning, and site dimensions on this map are used for assessment purposes only. Specific data as listed above should be verified with the proper authority and/or department.

Map: 14

January 2015

Tighe&Bond
Engineers | Environmental Specialists

A00870 - 10

Project No. 608163.128112

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PLAN AND PROFILE OF

MONSON ROAD IMPROVEMENTS

IN THE CITY/TOWN OF

WALES

HAMPDEN COUNTY

25% SUBMITTAL

WALES
MONSON ROAD

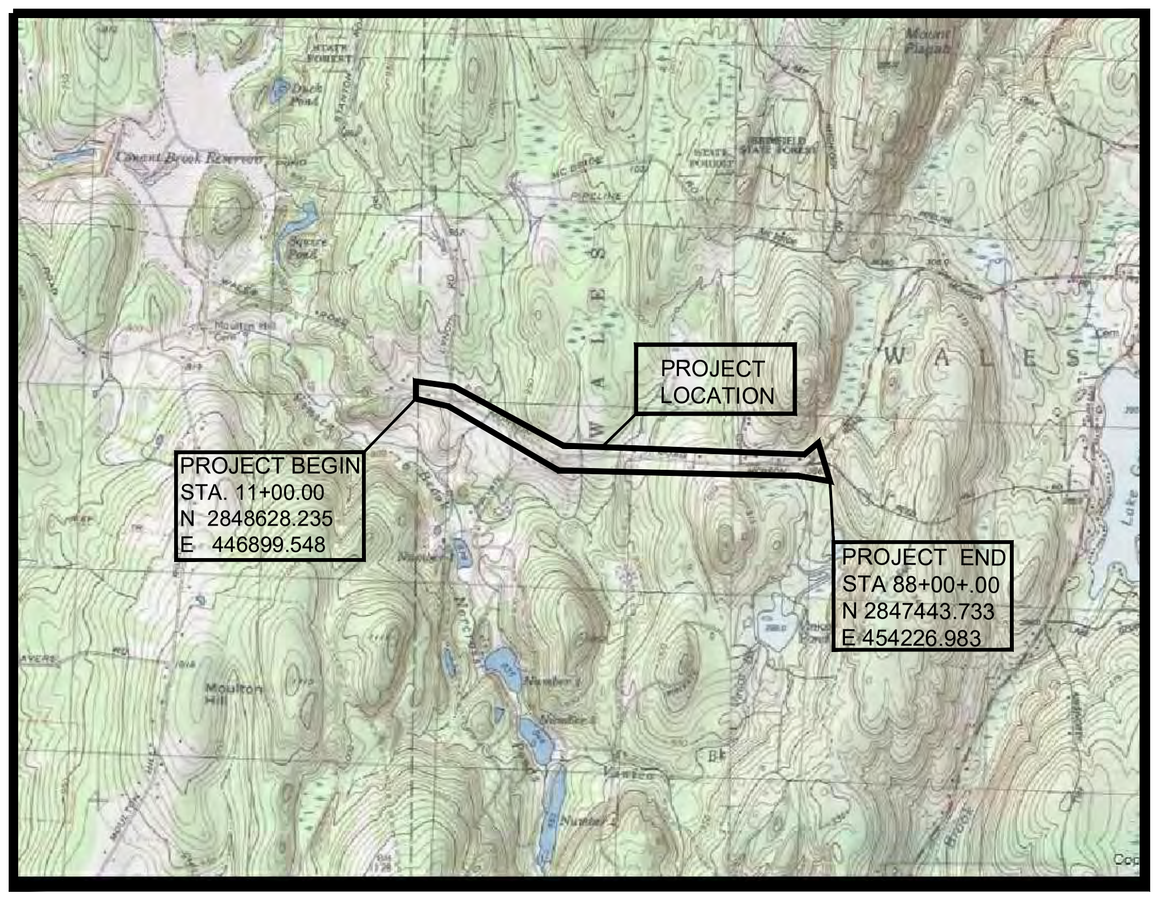
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	50
PROJECT FILE NO.	608163		

TITLE SHEET & INDEX

THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 1988, AS AMENDED, THE SUPPLEMENTAL SPECIFICATIONS DATED JULY 1, 2015, THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS WITH MASSACHUSETTS AMENDMENTS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK, WILL GOVERN.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	KEY PLAN
3	LEGEND & ABBREVIATIONS
4-5	BORING LOGS
6	TYPICAL SECTIONS
7-20	CONSTRUCTION PLANS
21-32	PROFILES
33-46	CURB TIE & GRADING PLANS
47	TRAFFIC SIGN SUMMARY
48-50	CRITICAL CROSS SECTIONS



2000 0 2000 4000

SCALE: 1" = 2000'

LENGTH OF PROJECT = 7700.00 FEET = 1.458 MILES

FEBRUARY 2018

DESIGN DESIGNATION - MONSON ROAD

DESIGN SPEED	40 MPH
ADT (2017)	660
ADT (2025)	760
K	11%
D	52%
T (PEAK HOUR)	3.0%
T (AVERAGE DAY)	3.0%
DHV	85
DDHV	45
FUNCTIONAL CLASSIFICATION	RURAL MAJOR COLLECTOR

DATE	DESCRIPTION	REV #

Weston & Sampson
273 Dividend Road, Rocky Hill, CT 06067
860.513.1473 800.SAMPSON
www.westonandsampson.com

massDOT Massachusetts Department of Transportation Highway Division

RECOMMENDED FOR APPROVAL

CHIEF ENGINEER DATE

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED:

DIVISION ADMINISTRATOR DATE

APPROVED

HIGHWAY ADMINISTRATOR DATE

MONSON ROAD -1-6- COVER, KEY, LEGEND, TYP.DWG Plotted on 6-Feb-2018 1:13 PM

Proposal No. 608163-128112

A00870 - 11

Proposal No. 6081163-128112

MONSON ROAD -1-6- COVER, KEY, LEGEND, TYP.DWG Plotted on 6-Feb-2018 1:13 PM

A00870 - 12

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
		CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
		CHAIN LINK OR METAL FENCE
		WOOD FENCE
		HAY BALES/SILT FENCE
		TREE LINE
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT

TRAFFIC SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
1	1	CONTROLLER PHASE ACTUATED
		TRAFFIC SIGNAL HEAD (SIZE AS NOTED)
		WIRE LOOP DETECTOR (6' x 6' TYP UNLESS OTHERWISE SPECIFIED)
		VIDEO DETECTION CAMERA
		MICROWAVE DETECTOR
		PEDESTRIAN PUSH BUTTON, SIGN (DIRECTIONAL ARROW AS SHOWN) AND SADDLE
	*	EMERGENCY PREEMPTION CONFIRMATION STROBE LIGHT
		VEHICULAR SIGNAL HEAD
		VEHICULAR SIGNAL HEAD, OPTICALLY PROGRAMMED
		FLASHING BEACON
		PEDESTRIAN SIGNAL HEAD, (TYPE AS NOTED OR AS SPECIFIED)
RRSG	RRSG	RAILROAD SIGNAL
OR		SIGNAL POST AND BASE (ALPHA-NUMERIC DESIGNATION NOTED)
	20'	MAST ARM, SHAFT AND BASE (ARM LENGTH AS NOTED)
		HIGH MAST POLE OR TOWER
		SIGN AND POST
		SIGN AND POST (2 POSTS)
	20'	MAST ARM WITH LUMINAIRE
		OPTICAL PRE-EMPTION DETECTOR
		CONTROL CABINET, GROUND MOUNTED
		CONTROL CABINET, POLE MOUNTED
		FLASHING BEACON CONTROL AND METER PEDESTAL
		LOAD CENTER ASSEMBLY
		PULL BOX 12"x12" (OR AS NOTED)
		ELECTRIC HANDHOLE 12"x24" (OR AS NOTED)
		TRAFFIC SIGNAL CONDUIT

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
ONLY	ONLY	LEGEND "ONLY" - WHITE
	SL	STOP LINE
	CW	CROSSWALK
	SWL	SOLID WHITE LINE
	SYL	SOLID YELLOW LINE
	BWL	BROKEN WHITE LINE
	BYL	BROKEN YELLOW LINE
	DWL	DOTTED WHITE LINE
	DYL	DOTTED YELLOW LINE
	DWLEx	DOTTED WHITE LINE EXTENSION
	DYLEx	DOTTED YELLOW LINE EXTENSION
	DBWL	DOUBLE WHITE LINE
	DBYL	DOUBLE YELLOW LINE

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY

ABBREVIATIONS (cont.)

GENERAL

R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STATION
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WCR	WHEEL CHAIR RAMP
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

TRAFFIC SIGNAL ABBREVIATIONS

CAB	CABINET
CCVE	CLOSED CIRCUIT VIDEO EQUIPMENT
DW	STEADY UPRAISED HAND
FDW	FLASHING UPRAISED HAND
FR	FLASHING CIRCULAR RED
FRL	FLASHING RED LEFT ARROW
FRR	FLASHING RED RIGHT ARROW
FY	FLASHING CIRCULAR YELLOW
FYL	FLASHING YELLOW LEFT ARROW
FYR	FLASHING YELLOW RIGHT ARROW
G	STEADY CIRCULAR GREEN
GL	STEADY GREEN LEFT ARROW
GR	STEADY GREEN RIGHT ARROW
GSL	STEADY GREEN SLASH LEFT ARROW
GSR	STEADY GREEN SLASH RIGHT ARROW
GV	STEADY GREEN VERTICAL ARROW
OL	OVERLAP
PED	PEDESTRIAN
PTZ	PAN, TILT, ZOOM
R	STEADY CIRCULAR RED
RL	STEADY RED LEFT ARROW
RR	STEADY RED RIGHT ARROW
TR SIG	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONDUIT
W	STEADY WALKING PERSON
Y	STEADY CIRCULAR YELLOW
YL	STEADY YELLOW LEFT ARROW

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	50
PROJECT FILE NO.	608163		

LEGEND & ABBREVIATIONS

MONSON ROAD -I-B- COVER, KEY, LEGEND, TYP.DWG Plotted on 6-Feb-2018 1:13 PM
Proposal No. 608163-128112
A00870 -13

BORING NUMBER: B-1

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 868 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	4 ft. +/-	Water level measured upon completion of boring

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 868.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	11/24	45 12 16 19	28				FILL	Medium dense, brown, fine to medium SAND, little fine to coarse gravel, trace silt; moist. [FILL]	
	S-2	2.5	0/24	9 5 4 7	9					*No sample recovery; gravel observed in tip of sampler.*	
5 / 863.0	S-3	4.5	12/24	12 13 11 23	24		30.1	56.9	SANDY SILT	Very stiff, brown, fine to medium sandy SILT, trace fine gravel; wet.	

Bottom-of-boring at 6.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-1**

BORING NUMBER: B-3

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 877 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	5 ft. +/-	Water level measured upon completion of boring

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 877.0										Asphalt concrete (AC) pavement, multiple layers (9" total thickness).	
	S-1	1.0	4/24	31 40 17 5	57				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	3.0	10/24	3 2 4 5	6	36.7	50.2			Medium stiff, dark brown-brown, fine to medium sandy SILT, little clay; moist. [FILL]	
5 / 872.0	S-3	5.0	16/24	14 30 28 23	58				SAND	Top 3" - Grey-brown SILT, trace fine sand; wet. Bottom 13" - Very dense, orange-brown, gravelly fine to coarse SAND, some silt; wet.	
10 / 867.0	S-4	10.0	8/15	25 58 100/3"					SILTY SAND	Brown, silty fine to medium SAND, trace fine gravel; wet.	

Drilling refusal at 11.8 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-3**

BORING NUMBER: B-5

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 902 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 902.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	6/24	24 28 17 36	45				FILL	Dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	4/24	24 7 19 17	26					Medium dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	

Bottom-of-boring at 4.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-5**

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	50
PROJECT FILE NO.	608163		

BORING LOCATIONS

BORING NUMBER: B-7

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 941 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 941.0										Asphalt concrete (AC) pavement, multiple layers (8" total thickness).	
	S-1	1.0	12/24	19 78 34 43	112				FILL	Very dense, light grey, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	3.0	10/12	33 67 100/0"						Brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	

Bottom-of-boring at 4.0 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-7**

BORING NUMBER: B-9

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 933 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	14.5 ft. +/-	Water level measured upon completion of boring

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 933.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	9/24	18 12 9 4	18				FILL	Medium dense, brown, gravelly fine to coarse SAND, trace silt, trace debris (asphalt millings); moist. [FILL]	
	S-2	2.5	10/24	11 17 8 16	25					Medium dense, brown, gravelly fine to coarse SAND, some debris (asphalt millings); moist. [FILL]	
5 / 928.0	S-3	5.0	9/24	12 7 15 9	22					Medium dense, brown, gravelly fine to coarse SAND, little silt; moist. [FILL]	
	S-4	7.0	7/24	16 34 20 19	54					Very dense, brown, gravelly fine to coarse SAND, little silt; moist. [FILL]	
10 / 923.0	S-5	9.0	1/24	9 13 14 17	27					Medium dense, brown, medium to coarse SAND, some fine gravel, trace silt; moist. [FILL]	
	S-6	12.5	18/24	12 14 21 29	35	13.5	49.5		SILTY SAND	Dense, brown, silty fine to medium SAND, little fine to coarse gravel; moist.	Drilling refusal at 12.5 ft. (due to accumulation of gravels and cobbles in the borehole)
15 / 918.0	S-7	14.5	13/24	19 41 40 38	81					Very dense, brown, silty fine to medium SAND, little fine to coarse gravel; wet.	

Bottom-of-boring at 16.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-9**

BORING NUMBER: B-10

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 956 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) / Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 / 956.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	10/24	31 25 25 21	50				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	18/24	6 19 19 29	38	14.1	62.8		SILTY SAND	Hard, brown-dark brown, fine to medium sandy SILT, trace fine gravel; moist.	

Bottom-of-boring at 4.5 ft.

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50% gravelly, sandy, silty, clayey: 35-50% some: 20-35% little: 10-20% trace: 0-10%
Organic Soils: PEAT: 50-100% organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-10**

MONSON ROAD -4-5- BORING.DWG Plotted on 6-Feb-2018 1:14 PM

Proposal No. 608163-128112

A00870 - 14

BORING NUMBER: B-11

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 989 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 989.0										Asphalt concrete (AC) pavement, multiple layers (5" total thickness).	
	S-1	0.5	11/24	25 28 27 20	55				FILL	Very dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	11/24	12 9 16 18	25					Medium dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-11

BORING NUMBER: B-12

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 1011 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 1011.0										Asphalt concrete (AC) pavement, multiple layers (4" total thickness).	
	S-1	0.5	8/9	90 100/3"					FILL	Grey-brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.0	20/24	10 8 14 27	22				SANDY SILT	Very stiff, grey-brown, fine to medium sandy SILT, little fine gravel; moist.	
										Bottom-of-boring at 4.0 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-12

BORING NUMBER: B-13

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 1019 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 1019.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	16/24	25 21 13 22	34	11.2	41.8		SAND	Dense, grey-brown, silty fine to coarse SAND, little fine gravel; moist.	
	S-2	2.5	20/24	22 54 80 89	114					Very dense, grey-brown, silty fine to coarse SAND, little fine gravel; moist.	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-13

BORING NUMBER: B-14

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 1009 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 1009.0										Asphalt concrete (AC) pavement, multiple layers (6" total thickness).	
	S-1	0.5	12/24	21 58 8 10	66				SAND	Top 6" - Grey, gravelly fine to coarse SAND, trace silt; moist. [FILL] Bottom 6" - Very dense, orange-brown, silty fine to medium SAND, trace fine to coarse gravel; moist.	
	S-2	2.5	10/24	16 40 34 85	74					Very dense, brown, fine to coarse SAND, some fine to coarse gravel, trace silt; moist.	
										Bottom-of-boring at 4.5 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-14

BORING NUMBER: B-15

PAGE 1 OF 1

CLIENT: Monson Road Improvement Project
PROJECT NUMBER: 2170841
PROJECT NAME: Town of Wales, Massachusetts
PROJECT LOCATION: Wales, Massachusetts

DRILLER: Doug Feely - Seaboard Drilling, Inc.
LOGGED / CHECKED BY: T. Blair, EIT / C. Palmer, PE
RIG TYPE / DRILLING METHODS: Truck / hollow-stem auger (HSA)
CASING DIAMETER: 2-1/4" / 5-5/8" (HSA ID / OD)
SAMPLING METHODS: Standard penetration test (SPT)
SAMPLER TYPE: Standard 24" long x 2" OD (1-3/8" ID) split-spoon
SAMPLER HAMMER: 140-lb. winch operated safety hammer
OTHER:

BORING LOCATION: See attached plan.
GROUND ELEVATION: 1002 ft. +/- **DATUM:** NAVD 88
DRILLING START DATE: 11/21/17 **END DATE:** 11/21/17

GROUNDWATER OBSERVATIONS

DATE	DEPTH	COMMENTS
11/21/2017	Not observed	

DEPTH (ft.) Elevation	TYPE - NO.	DEPTH (ft.)	REC./PEN. (in.)	SPT BLOWS/6"	SPT N-VALUE	% MOISTURE	% FINES (P200)	GRAPHIC LOG	STRATA NAME	MATERIAL DESCRIPTION (see guide below for soil classification based on constituent percentage)	COMMENTS
0 1002.0										Asphalt concrete (AC) pavement, multiple layers (5" total thickness).	
	S-1	0.5	9/24	22 25 21 6	46				FILL	Dense, brown, gravelly medium to coarse SAND, trace silt; moist. [FILL]	
	S-2	2.5	0/6	100 100/0"						Possible boulder or bedrock. Drilling refusal at 2.9 ft.	

Mineral Soil: GRAVEL, SAND, SILT, CLAY: >50%; gravelly, sandy, silty, clayey: 35-50%; some: 20-35%; little: 10-20%; trace: 0-10%
Organic Soils: PEAT: 50-100%; organic (soil): 15-50% with some organics: 5-15%

SAMPLE TYPE		GRANULAR SOILS		COHESIVE SOILS	
SYMBOL	TYPE	N-Value	Density	N-VALUE	CONSISTENCY
S	Split spoon	0-4	Very Loose	< 2	Very Soft
ST	Shelby tube	4-10	Loose	2-4	Soft
AG	Auger grab	10-30	Med. Dense	4-8	Med. Stiff
NX	Rock core	30-50	Dense	8-15	Stiff
DP	Direct push	> 50	Very Dense	15-30	Very Stiff
				> 30	Hard

GENERAL NOTES:
1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: B-15

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	50
PROJECT FILE NO.	608163		

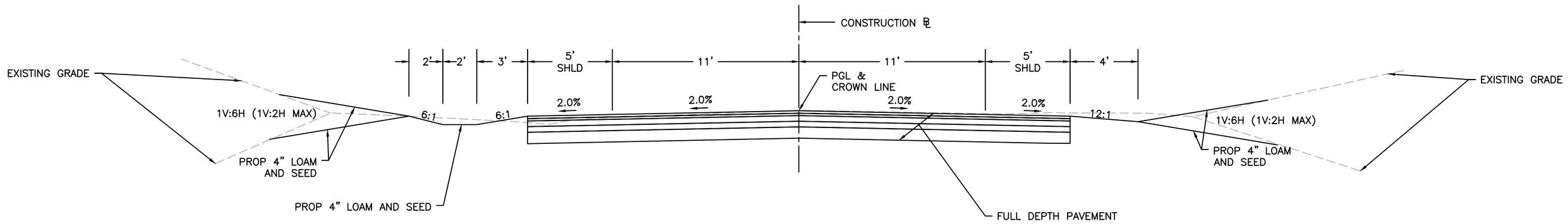
BORING LOCATIONS

W&S BORING LOG - GINT STD US.GDT - 1/22/18 18:27 - P:\MA\WALES, MA\2170841 MONSON RD RECONSTRUCTION\GEOTECH\CAL\FIELD WORK\BORING LOGS - MONSON ROAD IMPROVEMENTS.GPJ
MONSON ROAD -4-5- BORING.DWG Plotted on 6-Feb-2018 1:14 PM
Proposal No. 608163-128112

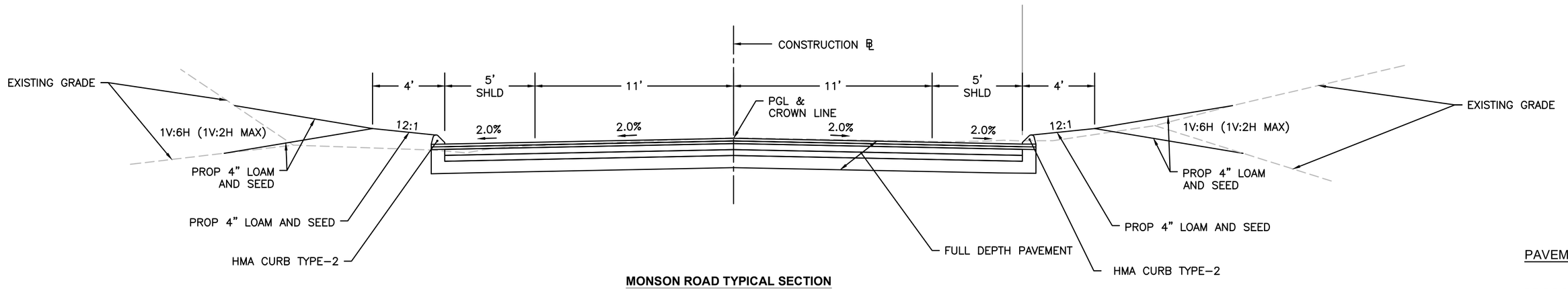
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	50
PROJECT FILE NO.	608163		

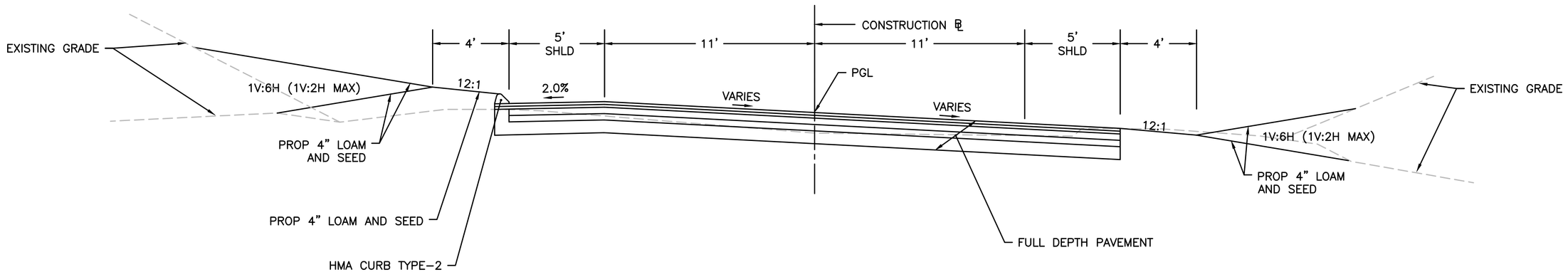
TYPICAL SECTIONS



MONSON ROAD TYPICAL SECTION
WITH SWALE



MONSON ROAD TYPICAL SECTION
WITH CURBING



MONSON ROAD TYPICAL SECTION
SUPER ELEVATION

PAVEMENT NOTES

PROPOSED FULL DEPTH PAVEMENT:

SURFACE COURSE:	1.50" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1.75" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5).
BASE COURSE:	3.25" SUPERPAVE BASE COURSE 25 (SBC-25) PLACED IN ONE LAYER.
SUBBASE:	4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.
	BITUMEN FOR TACK COAT (RS-1) TO BE APPLIED AT 0.05 GAL/SY ON BASE AND INTERMEDIATE PAVEMENT COURSES.

PROPOSED HOT MIX ASPHALT DRIVEWAY OR HOT MIX ASPHALT WALK:

SURFACE COURSE:	1 1/2" HOT MIX ASPHALT MODIFIED TOP COURSE OVER 2" HOT MIX ASPHALT INTERMEDIATE COURSE BINDER
FOUNDATION:	8" GRAVEL BORROW, TYPE b

MONSON ROAD -1-6- COVER, KEY, LEGEND, TYP.DWG Plotted on 6-Feb-2018 1:14 PM
Proposal No. 608163-128112
A00870 - 16

Proposal No. 608163-128112

SCALE: 1" = 20'

0 20 50 100

CONSTRUCTION PLANS

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	50

PROJECT FILE NO. 608163

CONTINUED ON SHEET NO. 8

MONSON ROAD 15

WALES ROAD 10

L=601.48', R=1200.00'
Δ=28° 43' 06"
S 83° 11' 15" E 157.79'
S 83° 11' 15" E 100.10'
PC +57.89
PROP EOP
PROP SAWCUT
TOS
REM
SWEL
DYCL
EOP
BOS
RET
GRASS SWALE
PROP HMA CURB
PROP HMA DWY
PROP GRAV DWY
TEMP CONST EASEMENT
RELOCATE UPL 87-18 (BY OTHERS)
53 LF 18" RCP
W7-6 modified
R2-1 (30 MPH)
1930 COUNTY LAYOUT
100' WETLAND BUFFER
4' FENCE
4' WOOD RAIL FENCE
12" STONE BOX CULVERT INV=858.99
12" STONE BOX CULVERT INV=859.32
INV=869.63
36"CPP
STEPS MB
CONC. DRIVE
GRAV. DRIVE
STONE RET. WALL
UPL 86
UPL 87-1
CBLP
SYCL
MB
WF#IW–B2
WF#IW–B3
WF#IW–B4
WF#IW–B5
WF#IW–B6
WF#IW–B7
WF#IW–B8
WF#IW–B9
WF#WA–A1
WF#WA–A2
WF#WA–A3
WF#WA–A4
WF#WA–A5
WF#WA–A6
WF#WA–A7
WF#WA–A8
WF#WA–A9
WF#WA–A10

TOWN OF MONSON
TOWN OF WALES

LIMITS OF WORK
STA 11+00.00
N 2848628.235
E 446899.548

N

2
N: 2848640.443'
E: 446927.827'
EL: 863.280'
PP IN IR

GRANITE TOWN LINE MONUMENT

161 M
SC
BK.
MAP

163 MONSON ROAD
N/F
JOSEPH WARREN KEIFER
BK. 17676 PG. 138
MAP 100 LOT 163

165 WALES ROAD
N/F
ST. GERMAIN, LYNDA
BK. 9559 PG. 79
MAP 100 LOT 165

167 MONSON ROAD
N/F
LYNNETTE M. BIGGS
BK. 16452 PG. 495
MAP 100 PG. 167

324 WALES RD
MONSON, MA
N/F
LYNNETTE M BIGGS
BK. 16452 PG. 495
MAP 159 LOT 002

WALES ROAD, MONSON
N/F
THE NORCROSS WILDLIFE FOUNDATION INC
BK. 9529 PG. 478
MAP 159 PG. 02C

170 MONSON ROAD
N/F
MICHAEL P THIBEAULT
BK. 16309 PG. 348
MAP 100 PG. 170

162 MONSON RD
N/F
DONNA J GILES
BK. 15085 PG. 175
MAP 100 LOT 162

Proposal No. 608163-128112

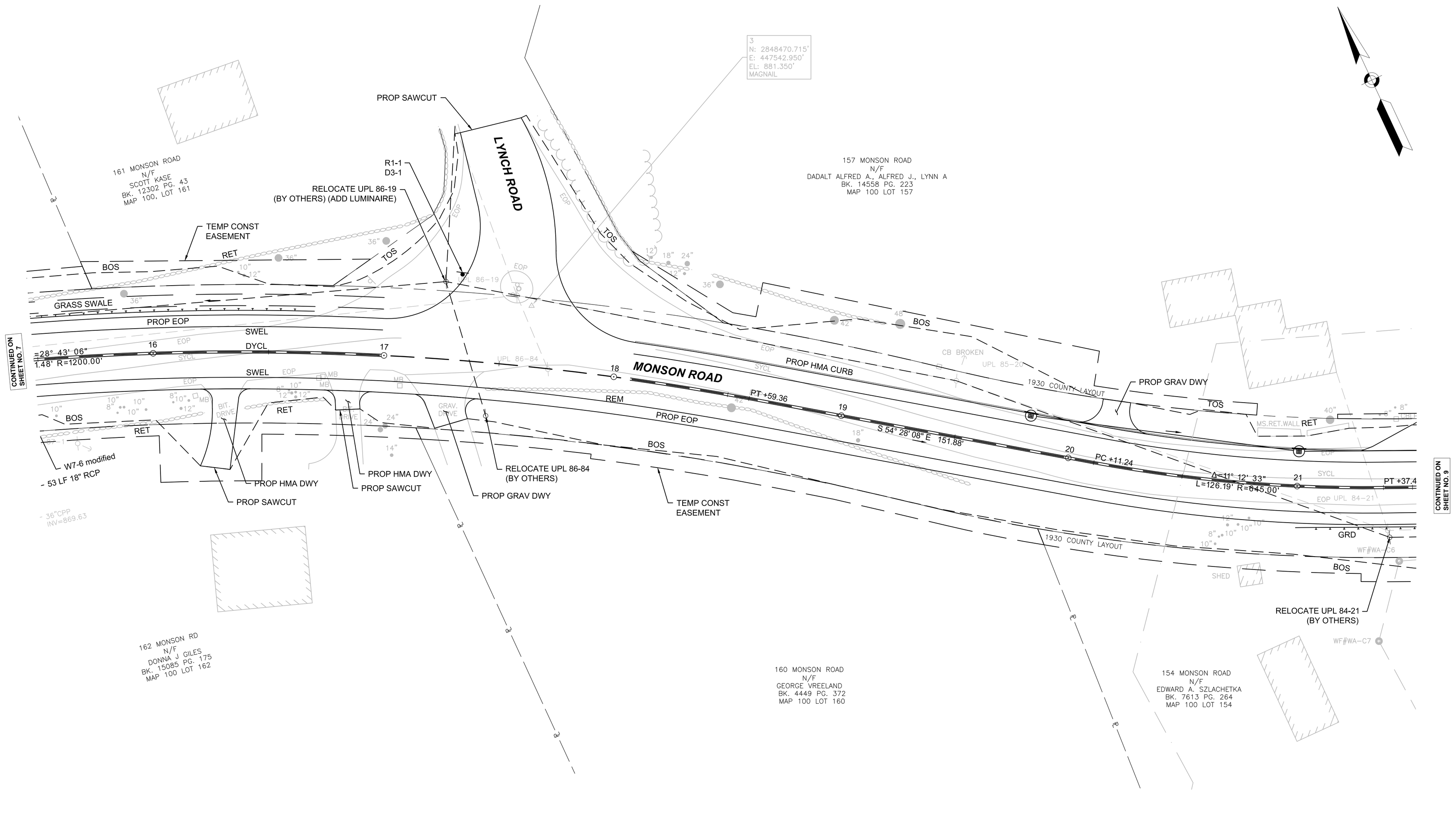
MONSON ROAD 7-20- PLAN.DWG Plotted on: 6-Feb-2018 1:15 PM

A00870 - 17

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	50
PROJECT FILE NO.		608163	

CONSTRUCTION PLANS



A00670 - 18

MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:15 PM

Proposal No. 608163-128112

Proposal No. 608163-128112

MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:16 PM

A00870 - 19

SCALE: 1" = 20'

0 20 50 100

CONTINUED ON SHEET NO. 10

CONTINUED ON SHEET NO. 8

MONSON ROAD

PROP EOP

PROP HMA CURB

GRASS SWALE

SWEL

DYCL

SYCL

EOP

PROP HMA DWY

PROP SAWCUT

RELOCATE UPL 84-21 (BY OTHERS)

RELOCATE UPL 82-23 (BY OTHERS)

RELOCATE UPL 83-22 (BY OTHERS)

TEMP CONST EASEMENT

REBUILD MASONRY WALL

50 LF 36" PVC

RET

BOS

TOS

GRD

REM

PT +37.43

S 65° 40' 41" E 659.07'

1930 COUNTY LAYOUT

100' WETLAND BUFFER

150 MONSON ROAD
N/F
JEFFFERY NISSENBAUM
BK. 5910 PG. 404
MAP 100 LOT 150

151 MONSON ROAD
N/F
PLUMLEY 2006 REVOCABLE TRUST
BK. 17422 PG. 415
MAP 100 LOT 151

155 MONSON ROAD
N/F
JODI L ROBERTS
BK. 14558 PG. 227
MAP 100.0 LOT 155

WALES
MONSON ROAD

CONSTRUCTION PLANS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	50

PROJECT FILE NO. 608163

Proposal No. 6081631-128112

A00870 - 20

MONSON ROAD -7-2b- PLAN.DWG Plotted on 6-Feb-2018 1:16 PM

SCALE: 1" = 20'

0 20 50 100

MONSON ROAD

PROP EOP

PROP HMA CURB

PROP EOP

GRASS SWALE

SWEL

DYCL

PC +96.50

SWEL

PROP HMA CURB

PROP EOP

BOS

RET

PROP SAWCUT

PECK ROAD

R1-1

D3-2

RELOCATE UPL 80-25 (BY OTHERS) (ADD LUMINAIRE)

R2-1 (35 MPH)

RELOCATE UPL 79-26 (BY OTHERS)

TEMP CONST EASEMENT

PROP HMA DWY

TEMP CONST EASEMENT

T.O.S.

BOS

RET

BOS

BOS

PROP EOP

PROP EOP

PT +16.24

BHL B-5

BHL B-4

BHL B-3

BHL B-2

BHL B-1

UPL 80-84

UPL 79-26

UPL 80-25

UPL 81-24

27

28

29

30

31

32

L=319.74' R=2200.00'

Δ=8° 19' 37"

CONTINUED ON SHEET NO. 11

CONTINUED ON SHEET NO. 9

1930 COUNTY LAYOUT

1930 COUNTY LAYOUT

T.O.S.

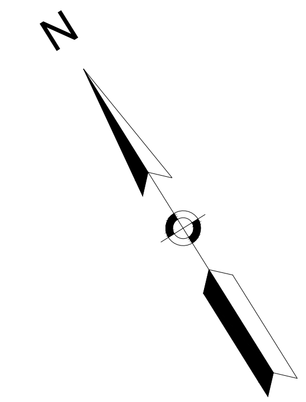
T.O.S.

T.O.S.

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	11	50
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



139 PECK ROAD
N/F
NORCROSS WILDLIFE FOUNDATION INC.
MAP 100 LOT 139

℄

℄

TEMP CONST
EASEMENT

TOS

BOS

1930 COUNTY LAYOUT

TOS

PROP HMA CURB

SWEL

EOP

DYCL

SYCL

32

33

34

MONSON ROAD

S 57° 21' 04" E 623.60'

35

36

37

PC +39.84

SWEL

EOP

PROP EOP

PROP HMA CURB

GRD

UPL 78-27

REM

RET

TOS

BOS

UPL 77-28

EOP

PROP EOP

BOS

1930 COUNTY LAYOUT

TEMP CONST
EASEMENT

RELOCATE UPL 78-27
(BY OTHERS)

RELOCATE UPL 77-28
(BY OTHERS)

100' WETLAND BUFFER

BF#TOB-B1

BF#TOB-B2

18"CMP
INV=911.51

BF#TOB-B3

BF#TOB-B4

BF#TOB-B5

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
MAP 100 LOT 120

ROAD

SANCTUARY INC.
OT 120

CONTINUED ON
SHEET NO. 10

CONTINUED ON
SHEET NO. 12

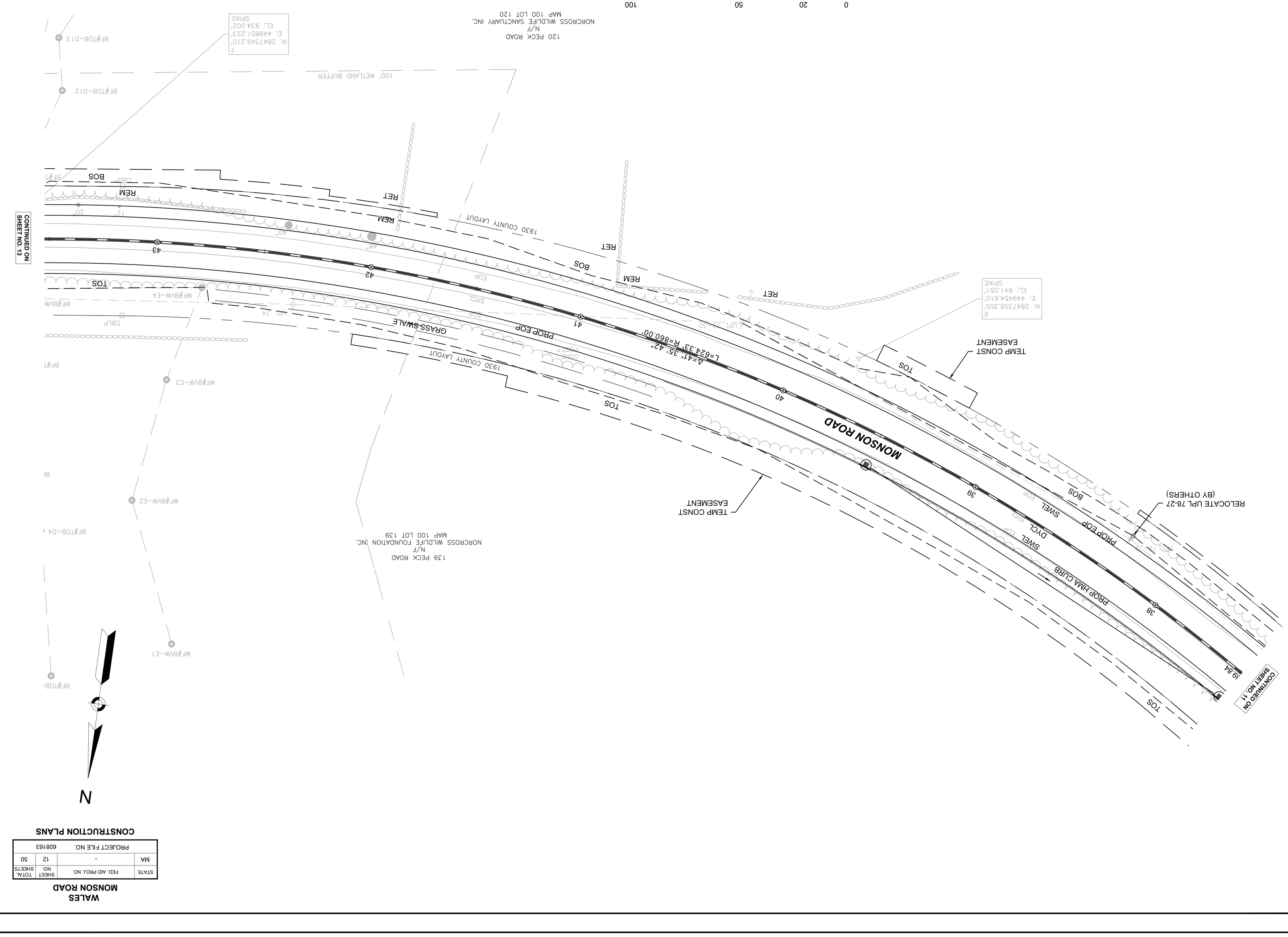
0 20 50 100

SCALE: 1" = 20'

A00870 - 21

MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:17 PM

Proposal No. 608163-128112



Proposal No. 608163-128112

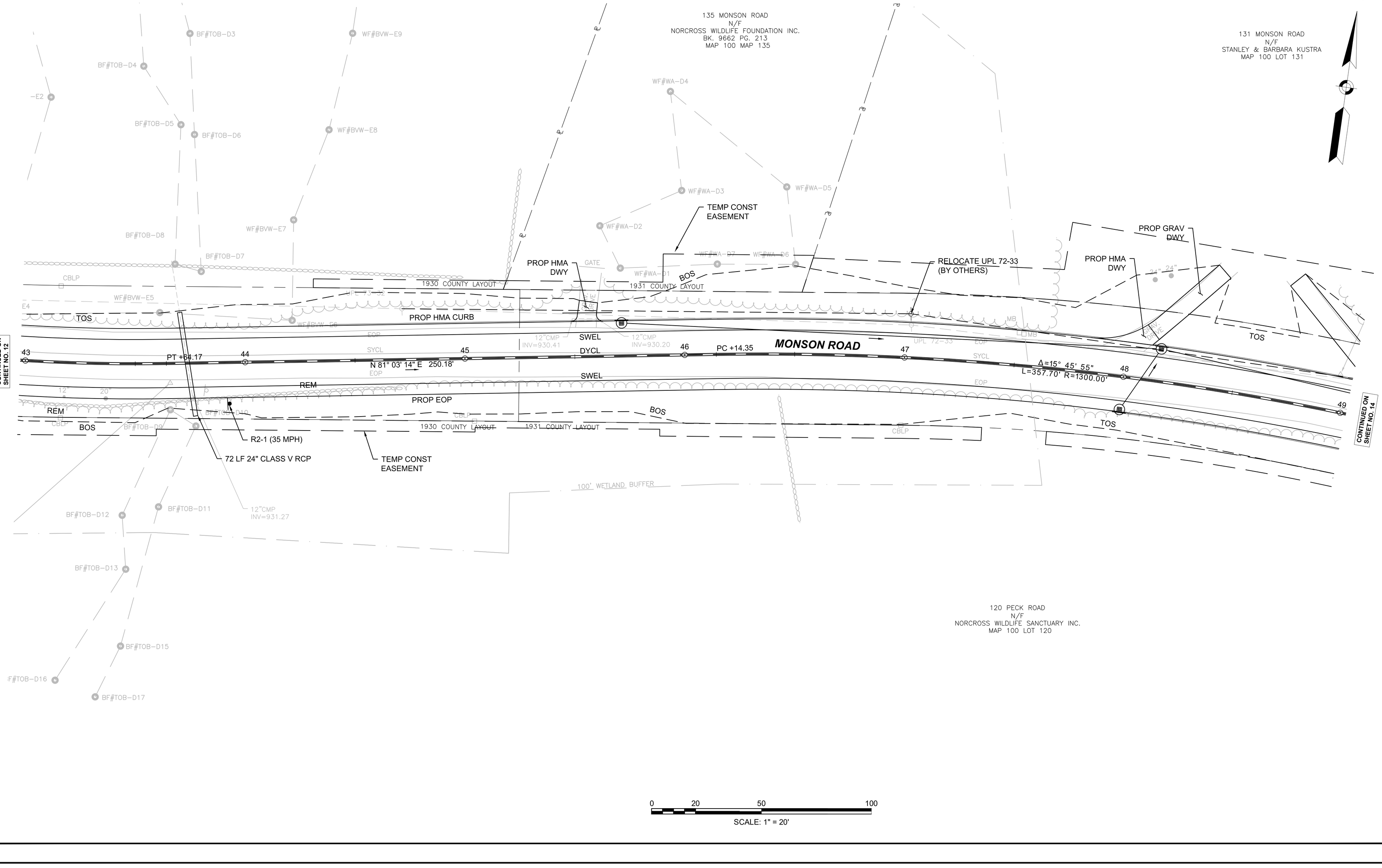
MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:17 PM

A00870 - 22

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	13	50
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

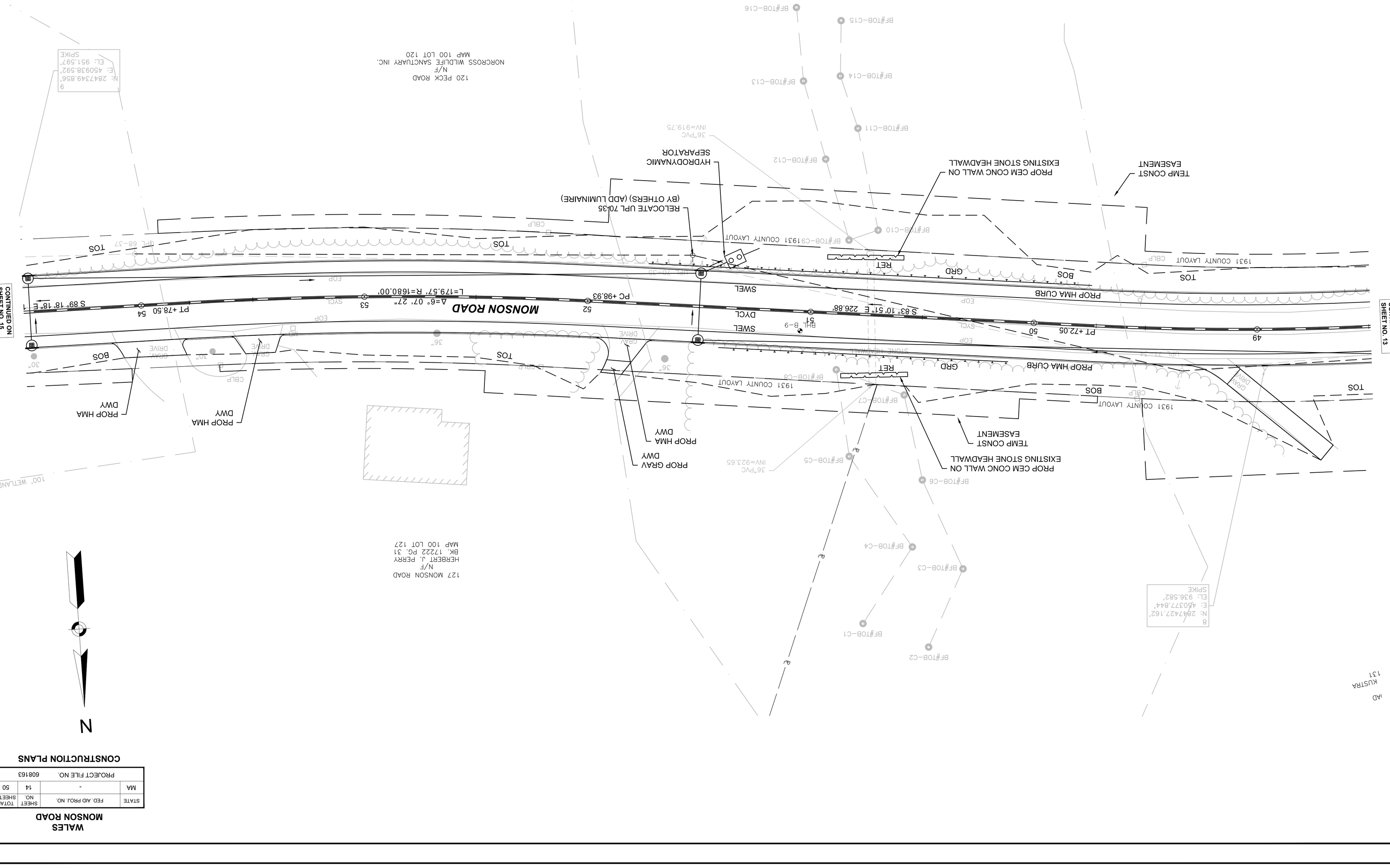


A00870 - 23
MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:17 PM
Proposal No. 608163-12812

Proposal No. 6081631-128112

SCALE: 1" = 20'

0 20 50 100



CONSTRUCTION PLANS

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	14	50
PROJECT FILE NO.	608163		

MONSON ROAD 7-2D- PLAN.DWG Plotted on: 6-Feb-2018 1:18 PM

A00870 - 24

Proposal No. 608163-128112

CONTINUED ON SHEET NO. 16

CONTINUED ON SHEET NO. 14

SCALE: 1" = 20'

0 20 50 100

120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
MAP 100 LOT 120

121 MONSON ROAD
N/F
MICHAEL P & VIRGINIA S. LATO
BK. 5961 PG. 267
MAP 100 LOT 121

MONSON ROAD

MAYNARD ROAD

100' WETLAND BUFFER

100' WETLAND BUFFER

PROP HMA CURB

PROP HMA CURB

SWEL

SWEL

SWEL

REM

RET

RET

R8R

TOS

TOS

TOS

BOS

BOS

1932 COUNTY LAYOUT

1932 COUNTY LAYOUT

1931 COUNTY LAYOUT

1932 COUNTY LAYOUT

1931 COUNTY LAYOUT

PROP HMA DWY

TEMP CONST EASEMENT

R1-1

PROP HMA DWY

PROP GRAV DWY

D3-3

PROP HMA DWY

ADD LUMINAIRE

R2-1 (35 MPH)

PC +09.11

DVCL

A=4° 28' 52"

L=131.40' R=1680.00'

PT +40.51

S 89° 18' 18" E 130.61'

WF#BW–A1

WF#BW–A2

WF#BW–A3

WF#BW–A4

WF#BW–A5

WF#BW–A6

WF#BW–A7

WF#BW–A8

WF#BW–A9

WF#BW–A10

WF#BW–A11

WF#BW–A12

WF#BW–A13

WF#BW–A14

WF#BW–A15

BHL B–10

UPL 67.5–37.5

UPL 68–37

GATE

CBLP

N: 2847349.856'
E: 450938.592'
EL: 951.597'
SPIKE

54 55 56 57 58 59 60

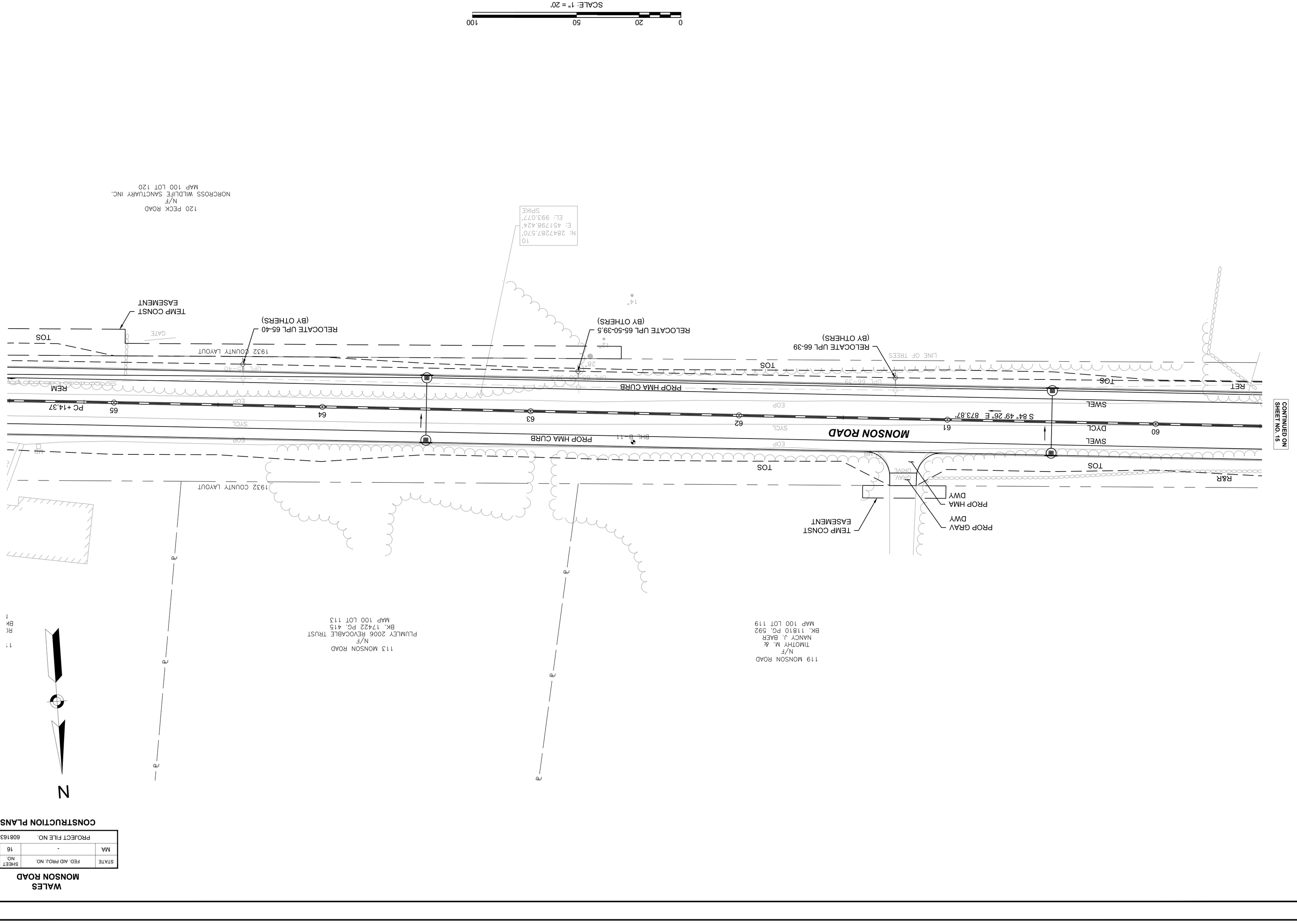
N

WALES
MONSON ROAD
CONSTRUCTION PLANS

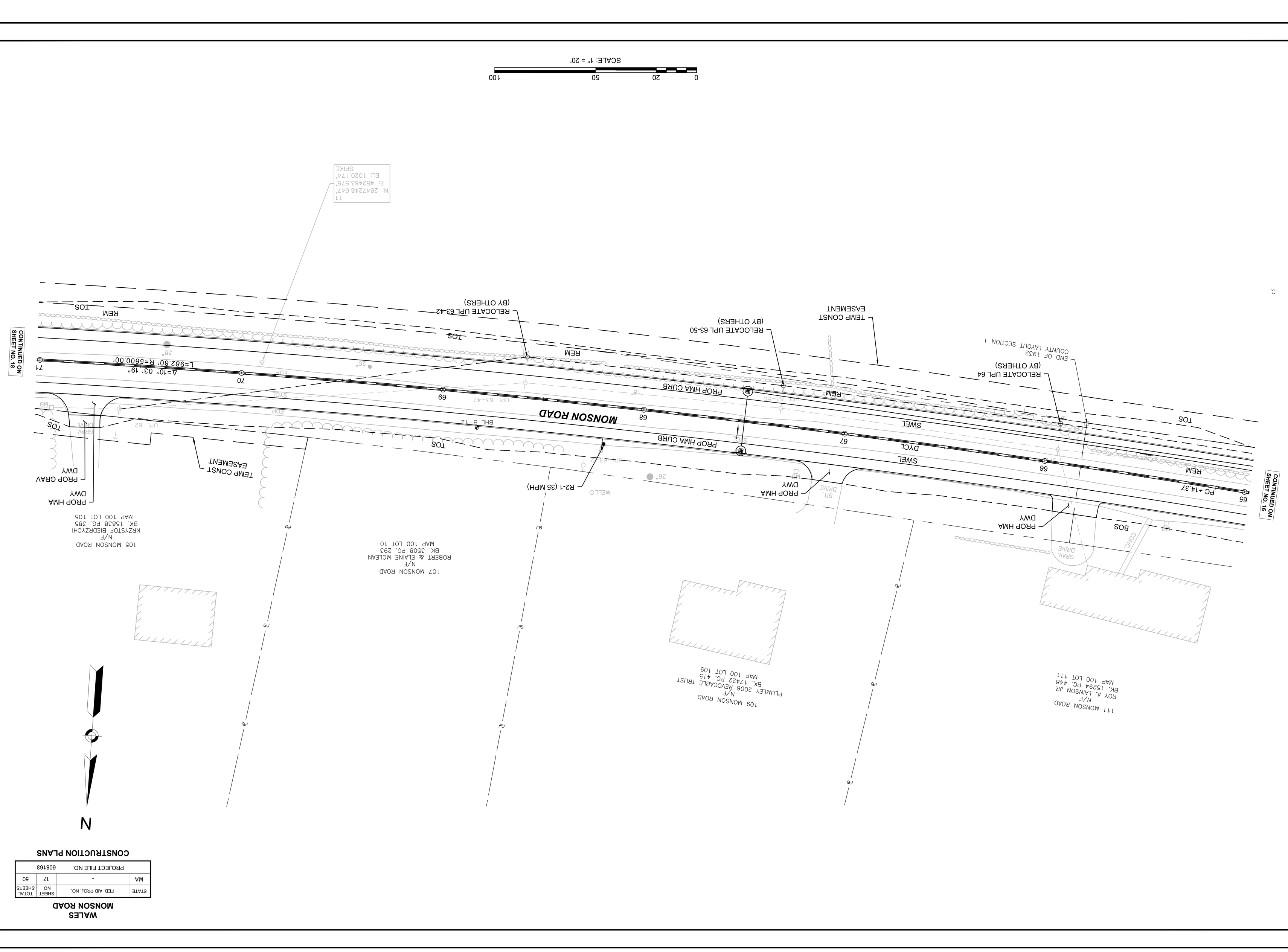
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	50
PROJECT FILE NO. 608163			

MONSON ROAD-7-20-PLAN.DWG Plotted on 6-Feb-2018 1:18 PM

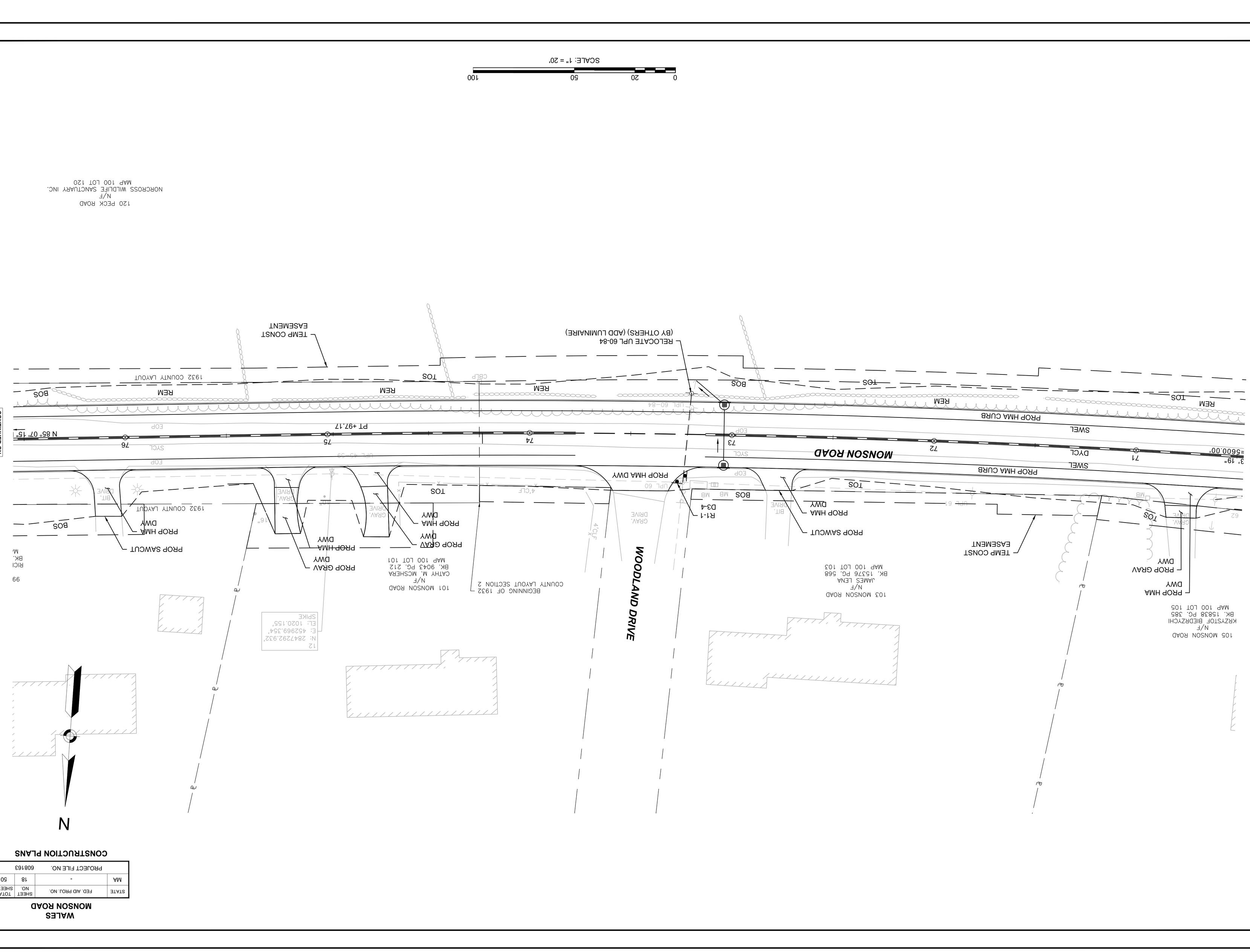
A00870 - 25



Proposal No. 608163-128112
MONSON ROAD-7-2b-PLAN.DWG Plotted on 6-Feb-2018 1:18 PM
A00870 - 26



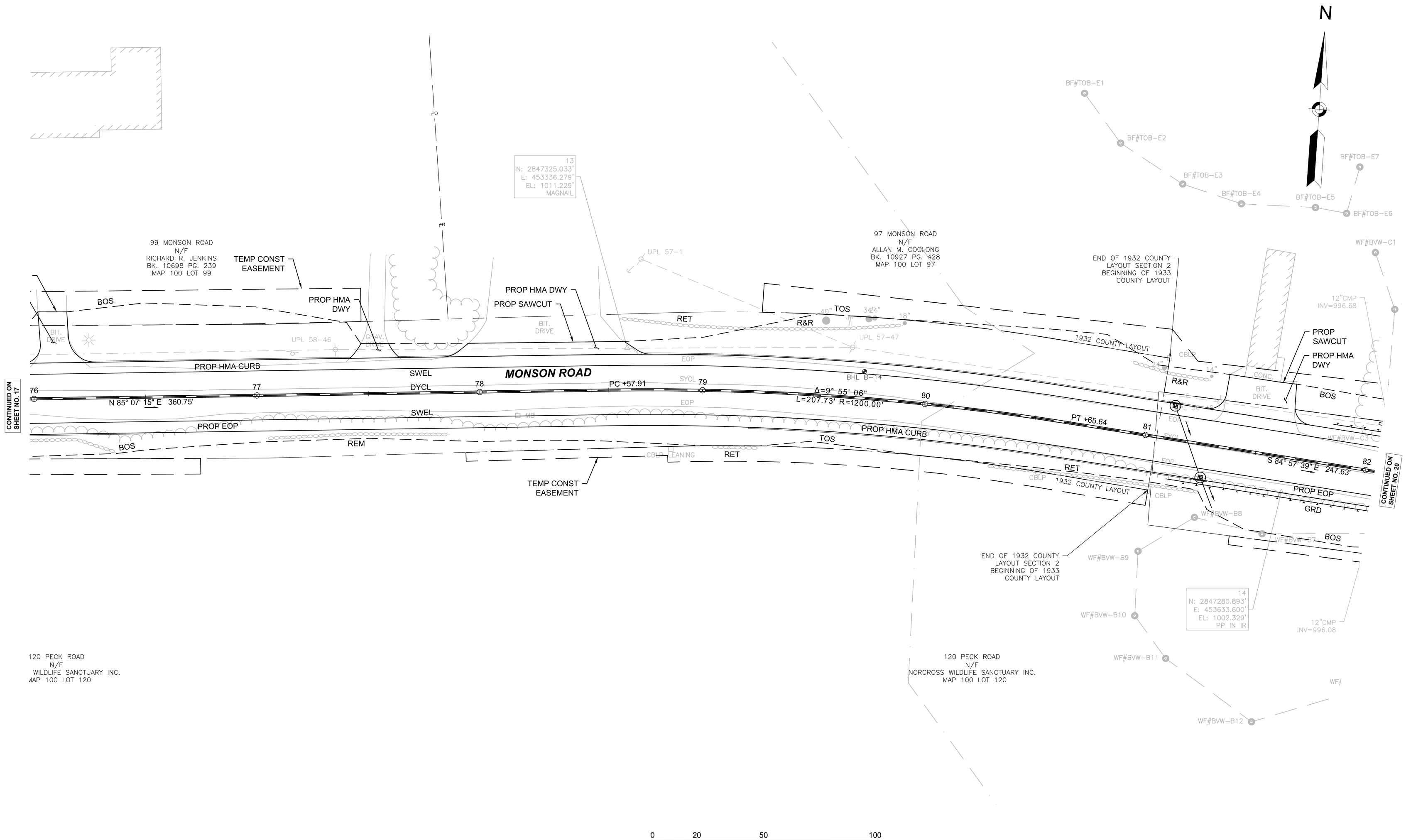
Proposal No. 6081163-128112
MONSON ROAD-7-20-PLAN.DWG Plotted on 6-Feb-2018 1:19 PM
A00870 - 27


SCALE: 1" = 20'
0
20
50
100
CONSTRUCTION PLANS
WALES
MONSON ROAD
STATE
MA
FED. AID PROJ. NO.
-
SHEET NO.
18
TOTAL SHEETS
50
PROJECT FILE NO.
608163
MONSON ROAD
WOODLAND DRIVE
CONTINUED ON SHEET NO. 19
CONTINUED ON SHEET NO. 17
1932 COUNTY LAYOUT
TEMP CONST EASEMENT
RELOCATE UPL 60-84 (BY OTHERS) (ADD LUMINAIRE)
PROP HMA CURB
PROP HMA DWY
PROP SAWCUT
PROP GRAV DWY
REM
TOS
BOS
SWEL
DYCL
SYCL
EOP
CBLP
UPL 60-84
PT +97.17
N 85° 07' 15" E
-5600.00'
3.19"
R1-1
D3-4
4'CLF
GRAV. DRIVE
BIT. DRIVE
120 PECK ROAD
N/F
NORCROSS WILDLIFE SANCTUARY INC.
MAP 100 LOT 120
101 MONSON ROAD
N/F
CATHY M. MCSHERA
BK. 9043 PG. 212
MAP 100 LOT 101
103 MONSON ROAD
N/F
JAMES LENA
BK. 15376 PG. 568
MAP 100 LOT 103
105 MONSON ROAD
N/F
KRZYSTOF BIEDRZYCHI
BK. 15838 PG. 385
MAP 100 LOT 105
BEGINNING OF 1932 COUNTY LAYOUT SECTION 2
12
N: 2847292.932'
E: 452969.354'
EL: 1020.155'
SPIKE
99
RICK
BK.
M.
N

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	19	50
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS



MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:20 PM
Proposal No. 608163-128112
A00870: 29

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	20	50
PROJECT FILE NO.	608163		

CONSTRUCTION PLANS

N

LIMITS OF WORK
STA 88+00+.00
N 2847443.733
E 454226.983

93 MONSON ROAD
N/F
WAYNE T. PECK
BK. 5876 PG. 362
MAP 100 LOT 93

24" STONE BOX CULVERT
INV=997.00

BENCHMARK: BRASS RIVET
EL=1001.17'

100' WETLAND BUFFER

12"DIP
INV=999.99

12"DIP
INV=1000.27

15
N: 2847321.333'
E: 453991.876'
EL: 1001.537'
PP IN IR

W7-6 modified

S3-1

120 LF 36" RCP

PROP SAWCUT

PROP HMA DWY

ADD LUMINAIRE

TEMP CONST EASEMENT

R1-1
D3-5

PROP SAWCUT

CONTINUED ON SHEET NO. 19

PROP SAWCUT

PROP HMA DWY

PROP MASONRY WALL

TEMP CONST EASEMENT

R2-1 (35 MPH)

PROP HMA DWY

PROP SAWCUT

S 84° 57' 39" E 247.63'

PC +13.27

MONSON ROAD

Δ=58° 08' 23"
L=568.25' R=560.00'

Δ=60° 37' 43"
L=63.49' R=60.00'

PT +93.57

S 29° 42' 29" E 30.08'

PC +30.08

N 89° 39' 48" E 91.64'

58 LF 18" RCP

TEMP CONST EASEMENT

ADD LUMINAIRE

PROP SAWCUT

12"CMP
INV=996.68

12"CMP
INV=996.08

24" STONE BOX CULVERT
INV=996.68

24" STONE BOX CULVERT
INV=996.16

24" STONE BOX CULVERT
INV=995.84

100' WETLAND

0 20 50 100
SCALE: 1" = 20'

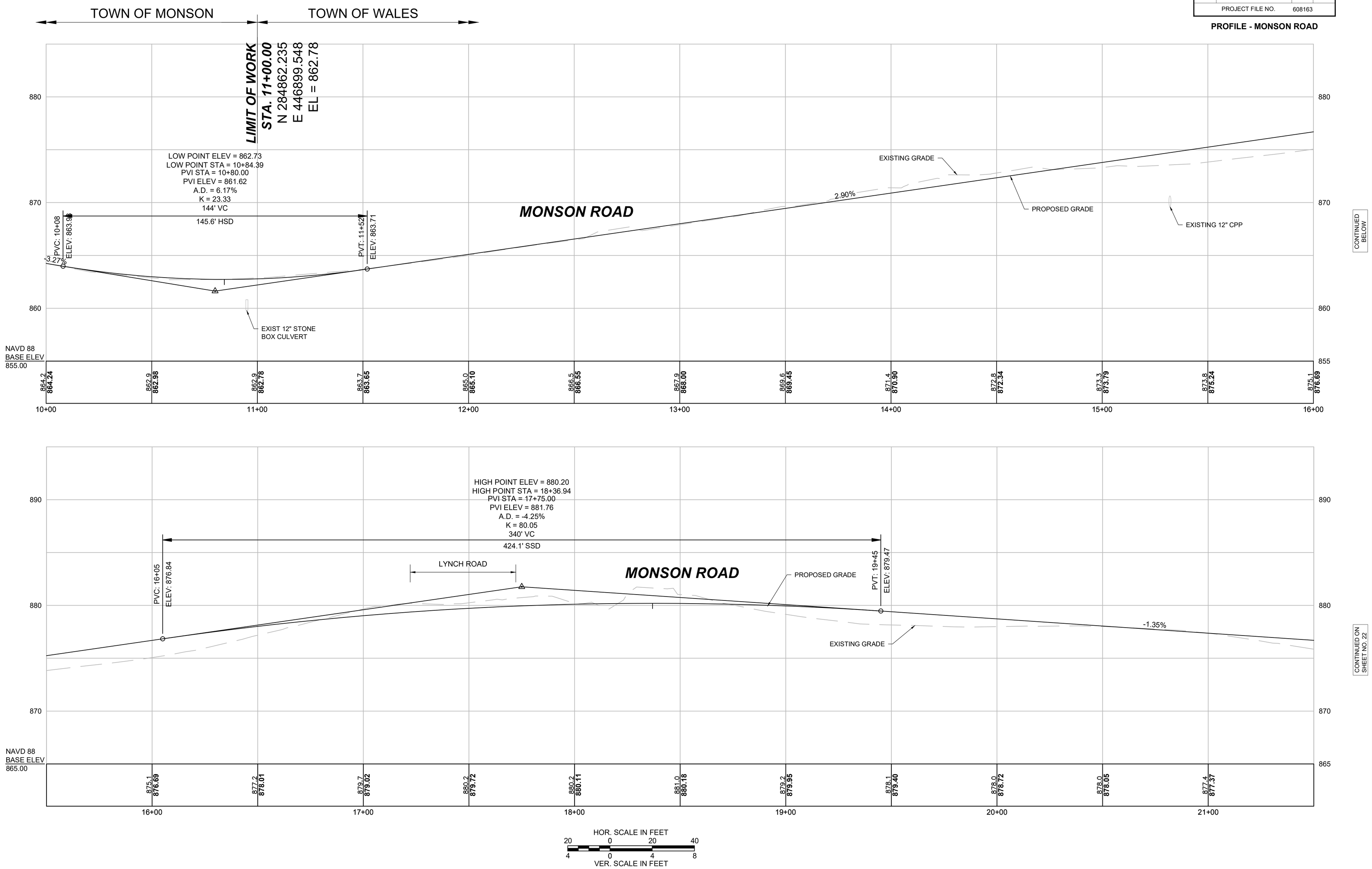
AV08030 - 36

MONSON ROAD -7-20- PLAN.DWG Plotted on 6-Feb-2018 1:20 PM
Proposal No. 608163-128112

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	50
PROJECT FILE NO.	608163		

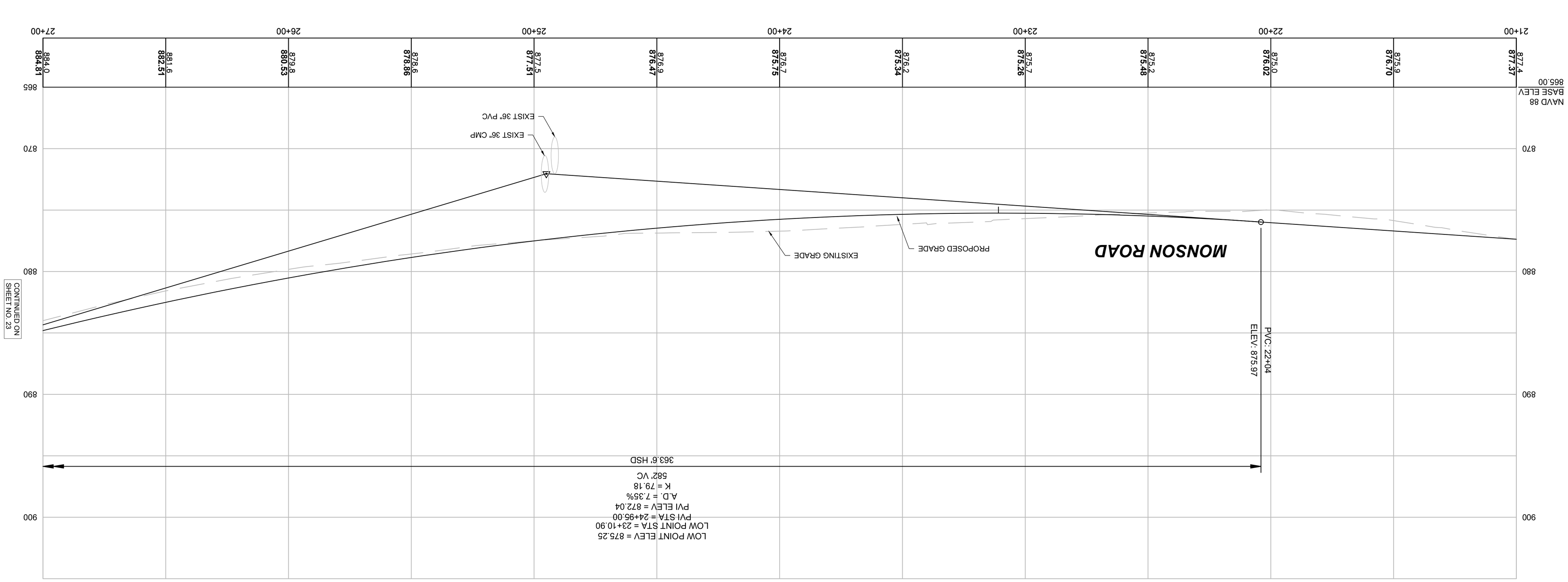
PROFILE - MONSON ROAD



864.2	862.9	862.9	863.7	865.0	866.5	867.9	869.6	871.4	872.8	873.3	875.1
864.24	**862.98**	**862.78**	**863.65**	**865.10**	**866.55**	**868.00**	**869.45**	**870.90**	**872.34**	**873.79**	**875.24**	**876.69**

875.1	877.2	879.7	880.2	880.2	881.0	879.2	878.1	878.0	878.0	877.4	
876.69	**878.01**	**879.02**	**879.72**	**880.11**	**880.18**	**879.95**	**879.40**	**878.72**	**878.05**	**877.37**	

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:21 PM
Proposal No. 608163-128112
A00870 - 31



WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	50
PROJECT FILE NO. 608163			

PROFILE - MONSON ROAD

Proposal No. 608163-128112

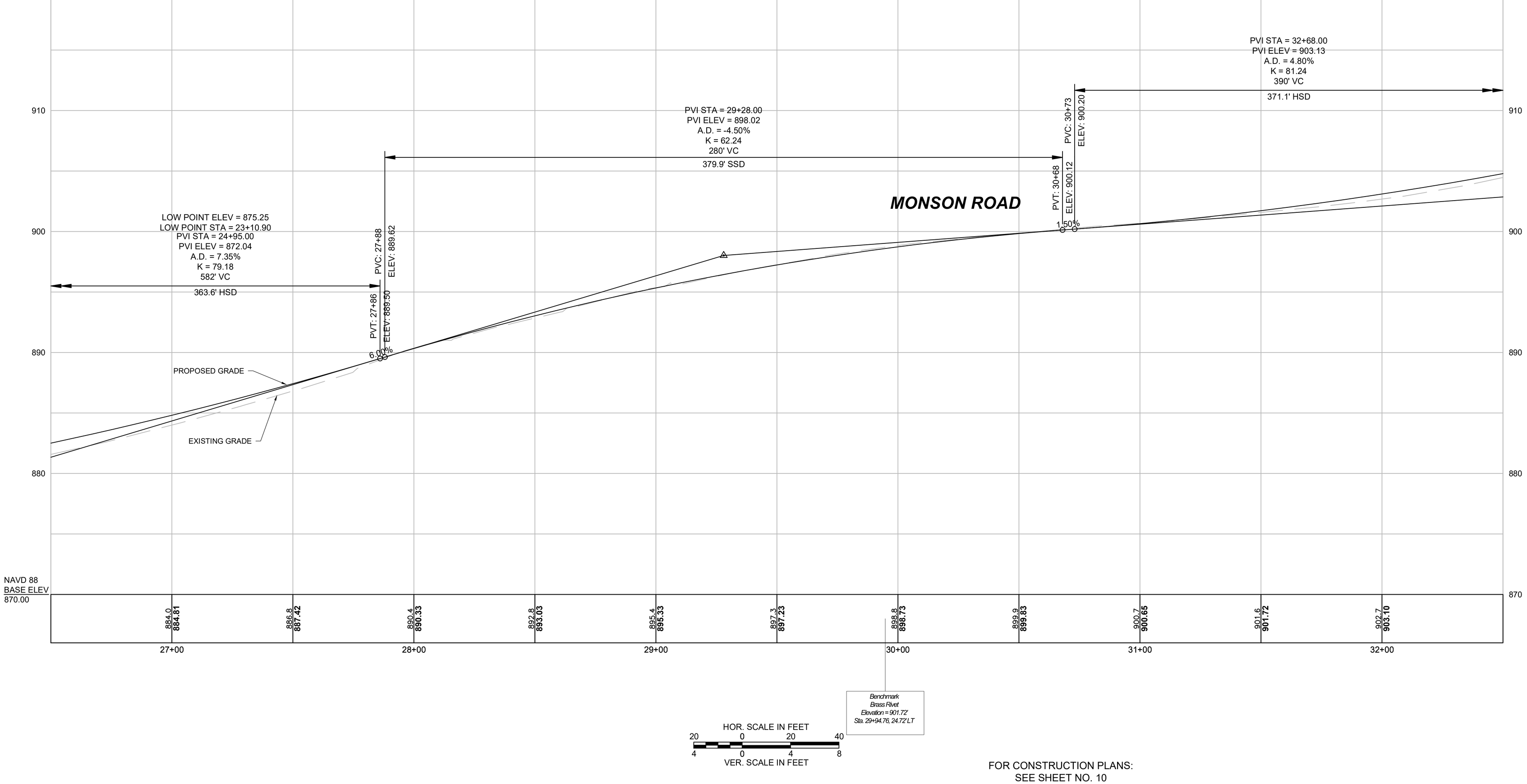
MONSON ROAD -21+32- PROFILE.DWG Plotted on 6-Feb-2018 1:22 PM

AD8780 - 22 -

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



CONTINUED ON SHEET NO. 22

CONTINUED ON SHEET NO. 24

Benchmark
Brass Rivet
Elevation = 901.72'
Sta. 29+94.76, 24.72' LT

HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

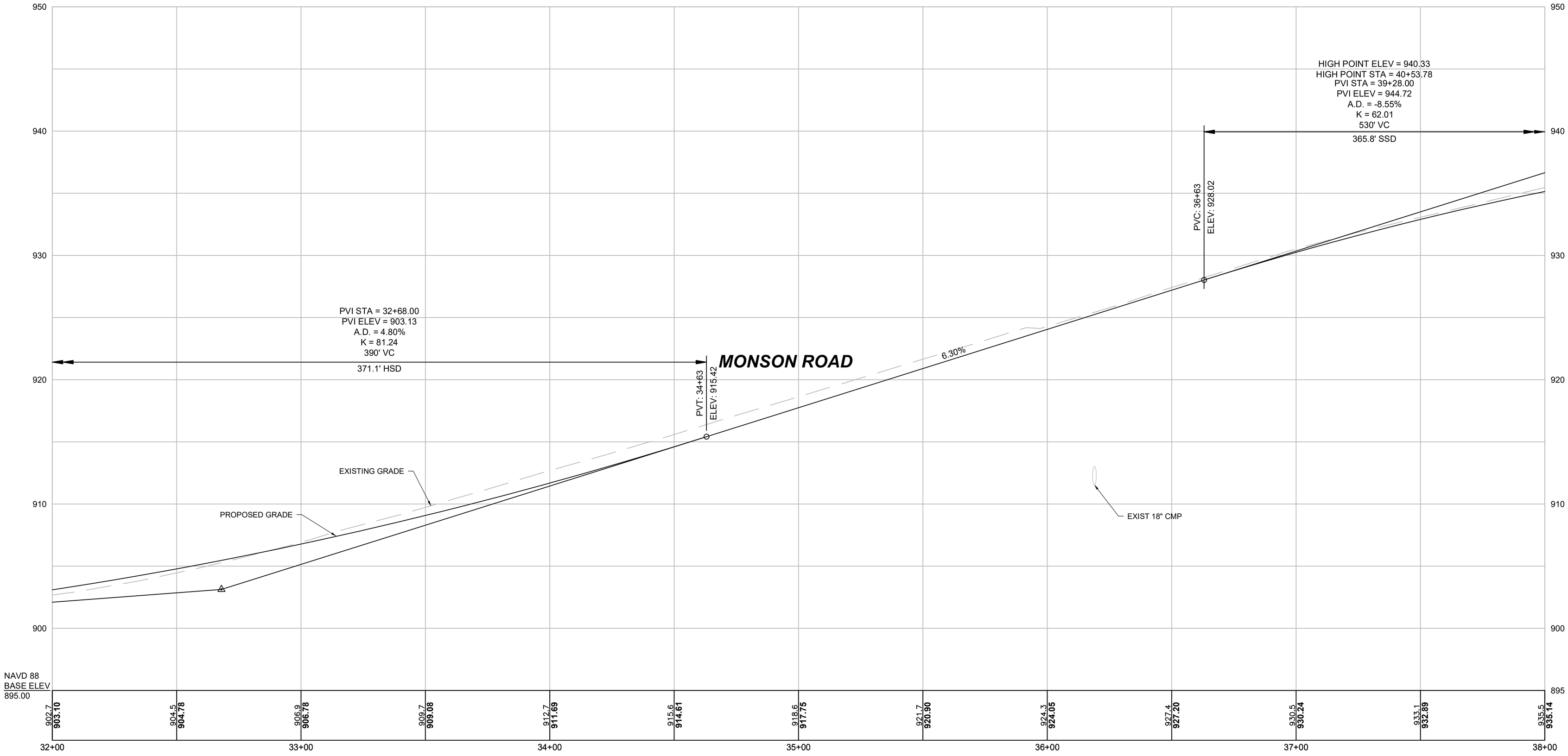
FOR CONSTRUCTION PLANS:
SEE SHEET NO. 10

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:22 PM
Proposal No. 608163-128112
A00870 - 33

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



CONTINUED ON SHEET NO. 23

CONTINUED ON SHEET NO. 25

HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 11

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:23 PM
Proposal No. 608163-128112
A00870 - 34

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	25	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD

HIGH POINT ELEV = 940.33
HIGH POINT STA = 40+53.78
PVI STA = 39+28.00
PVI ELEV = 944.72
A.D. = -8.55%
K = 62.01
530' VC
365.8' SSD

PVT: 41+93
ELEV: 938.77

MONSON ROAD

EXISTING GRADE

PROPOSED GRADE

-2.25%

CONTINUED ON SHEET NO. 24

CONTINUED BELOW

950
940
930
920

NAVD 88
BASE ELEV
920.00

38+00	39+00	40+00	41+00	42+00	43+00
935.5 **935.14**	937.7 **936.99**	939.5 **938.43**	940.7 **939.47**	941.3 **940.10**	941.5 **940.33**
940.6 **940.16**	939.4 **939.59**	938.2 **938.61**	937.0 **937.49**	935.7 **936.37**	

LOW POINT ELEV = 932.31
LOW POINT STA = 45+71.26
PVI STA = 45+05.00
PVI ELEV = 931.77
A.D. = 2.85%
K = 80.73
230' VC
478.2' HSD

PVC: 43+90
ELEV: 934.35

PVT: 46+20
ELEV: 932.46

MONSON ROAD

PROPOSED GRADE

0.60%

EXISTING GRADE

EXIST 12" CMP

CONTINUED ABOVE

CONTINUED ON SHEET NO. 26

HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS:
SEE SHEET NOS. 12-13

950
940
930
920

NAVD 88
BASE ELEV
920.00

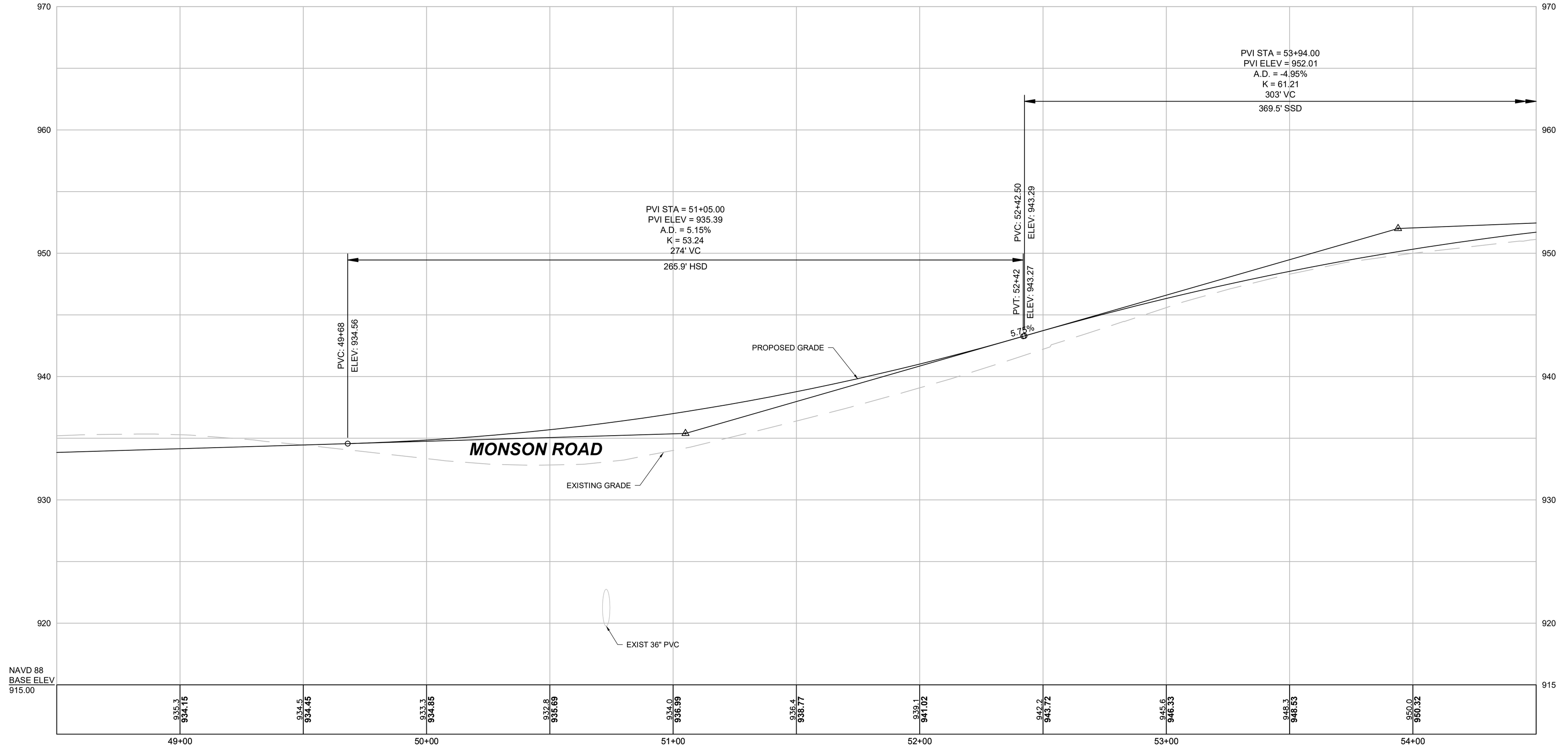
43+00	44+00	45+00	46+00	47+00	48+00	49+00
935.7 **936.37**	934.6 **935.25**	933.7 **934.13**	932.9 **933.22**	932.0 **932.63**	931.3 **932.34**	930.6 **932.36**
930.4 **932.64**	931.1 **932.94**	932.7 **933.25**	934.4 **933.55**	935.2 **933.85**	935.3 **934.15**	

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:23 PM
Proposal No. 608163-128112
A00870 - 35

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	26	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 14

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:24 PM

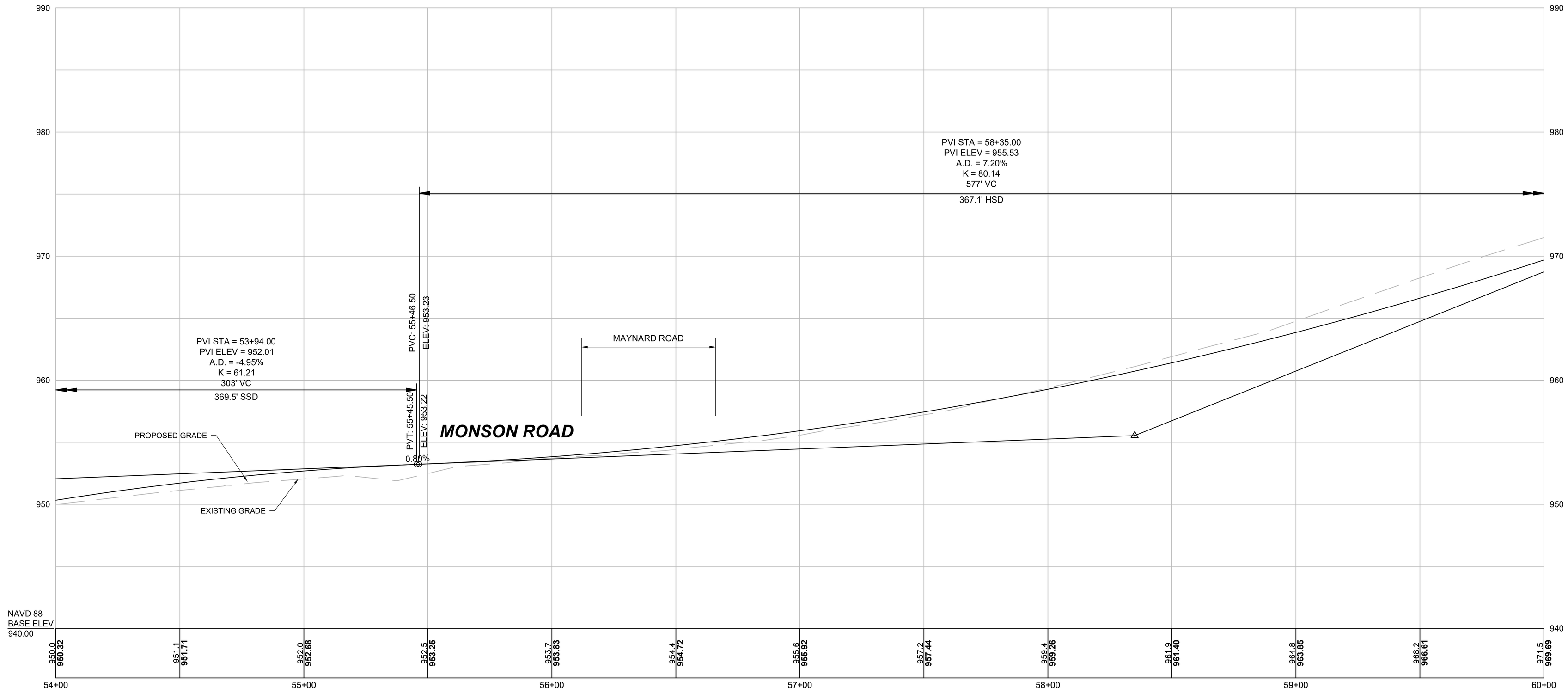
Proposal No. 608163-128112

A00870: 36

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	27	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 15

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:24 PM

Proposal No. 608163-128112

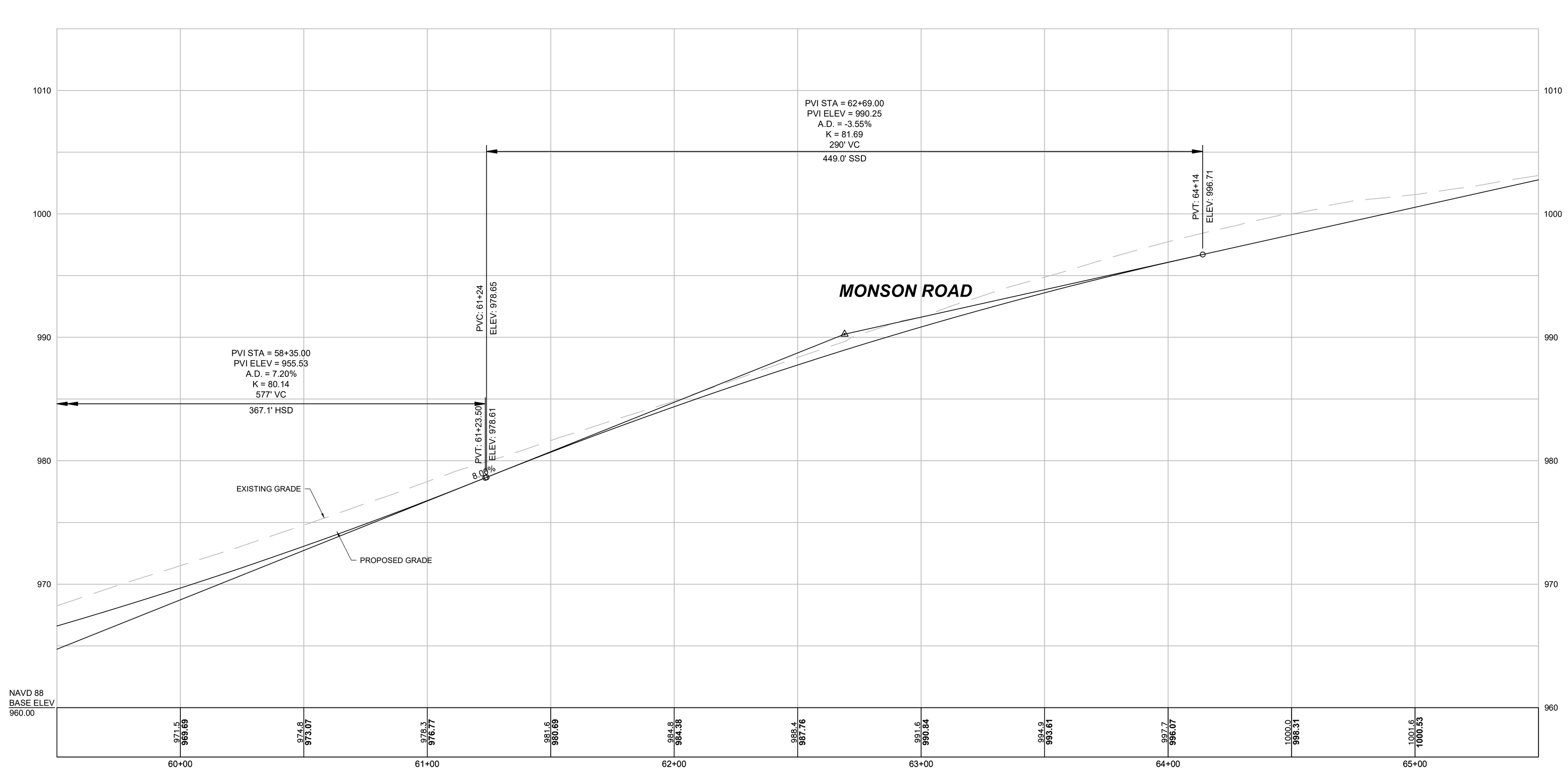
A00870 - 37

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	28	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD

CONTINUED ON SHEET NO. 27



CONTINUED ON SHEET NO. 29

HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 16

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:25 PM

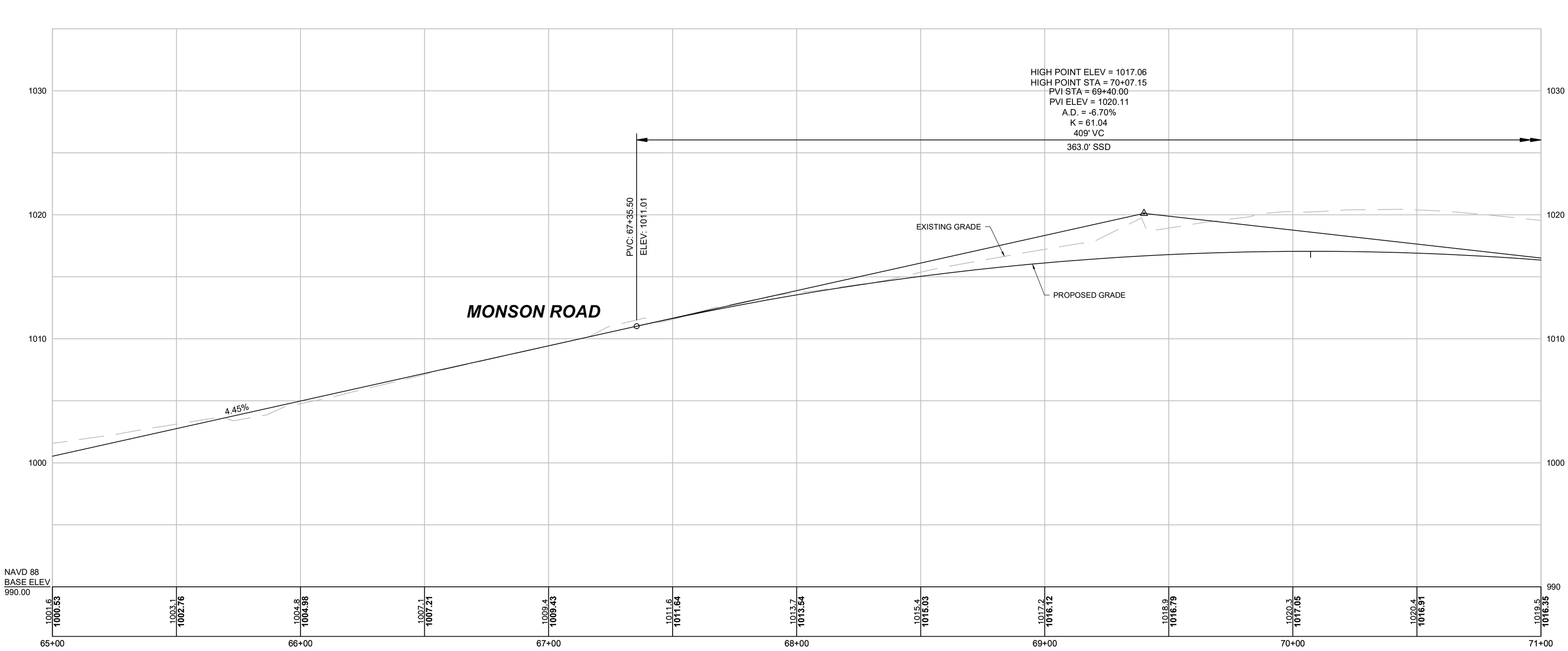
Proposal No. 608163-12812

A00870: 38

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	29	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



CONTINUED ON SHEET NO. 28

CONTINUED ON SHEET NO. 30

HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

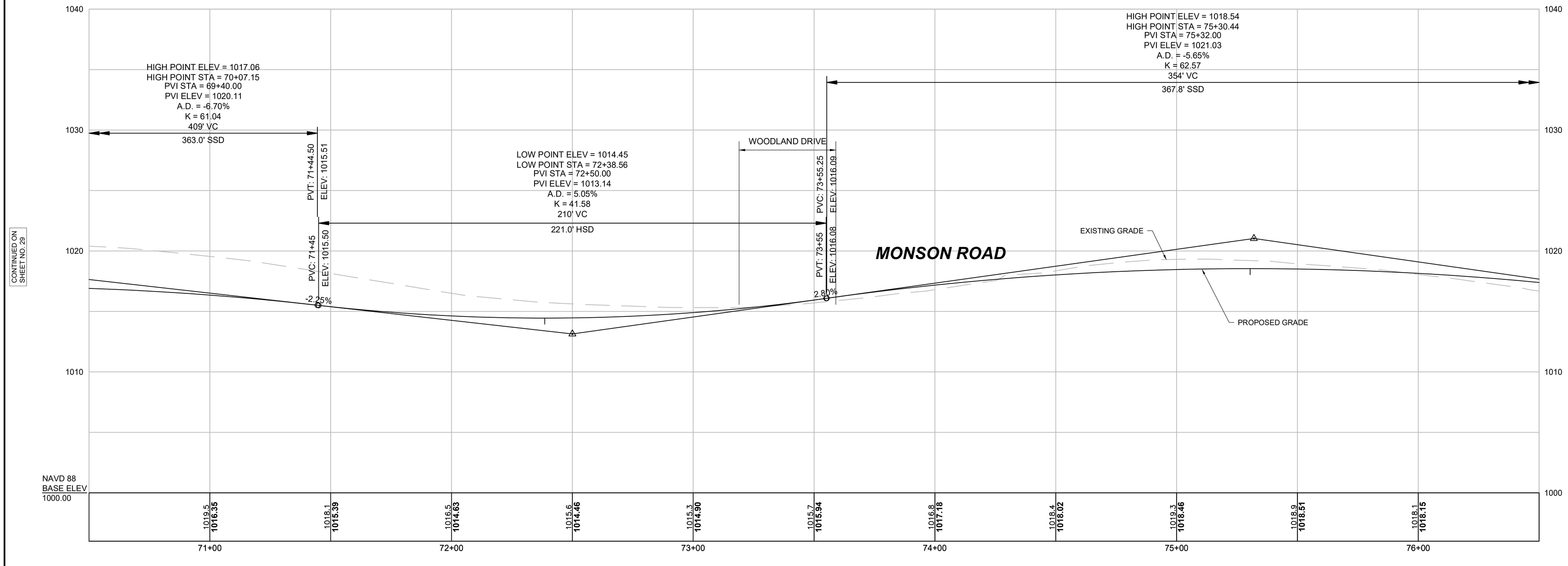
FOR CONSTRUCTION PLANS:
SEE SHEET NO. 17

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:25 PM
Proposal No. 608163-128112
A00870: 39

WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	30	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD



HOR. SCALE IN FEET
20 0 20 40
4 0 4 8
VER. SCALE IN FEET

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 18

MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:25 PM
Proposal No. 608163-128112
A0008270 - 40

Proposal No. 6080121281121

FOR CONSTRUCTION PLANS:
SEE SHEET NO. 19

HOR. SCALE IN FEET
20 0 20 40

VER. SCALE IN FEET
4 0 4 8

NAVD 88
BASE ELEV
990.00

76+00	77+00	78+00	79+00	80+00	81+00	82+00
1018.15	1017.40	1016.24	1014.82	1013.40	1011.97	1010.55	1009.12	1007.70	1006.43	1005.48	1004.84	1004.47
1018.1	1016.7	1015.4	1014.1	1012.7	1011.3	1010.4	1009.7	1009.0	1007.6	1005.1	1003.5	1001.9

990
1000
1010
1020
1030

CONTINUED ON SHEET NO. 30

HIGH POINT ELEV = 1018.54
HIGH POINT STA = 75+30.44
PVI STA = 75+32.00
PVI ELEV = 1021.03
A.D. = -5.65%
K = 62.67
354' VC
367.8' SSD

PVT: 77+08.75
ELEV: 1016.00

-2.85%

MONSON ROAD

PROPOSED GRADE

EXISTING GRADE

PVC: 80+00
ELEV: 1007.70

PVI STA = 80+85.00
PVI ELEV = 1005.27
A.D. = 2.15%
K = 79.07
170' VC
946.2' HSD

PVT: 81+70
ELEV: 1004.68

CONTINUED ON SHEET NO. 32

PROFILE - MONSON ROAD

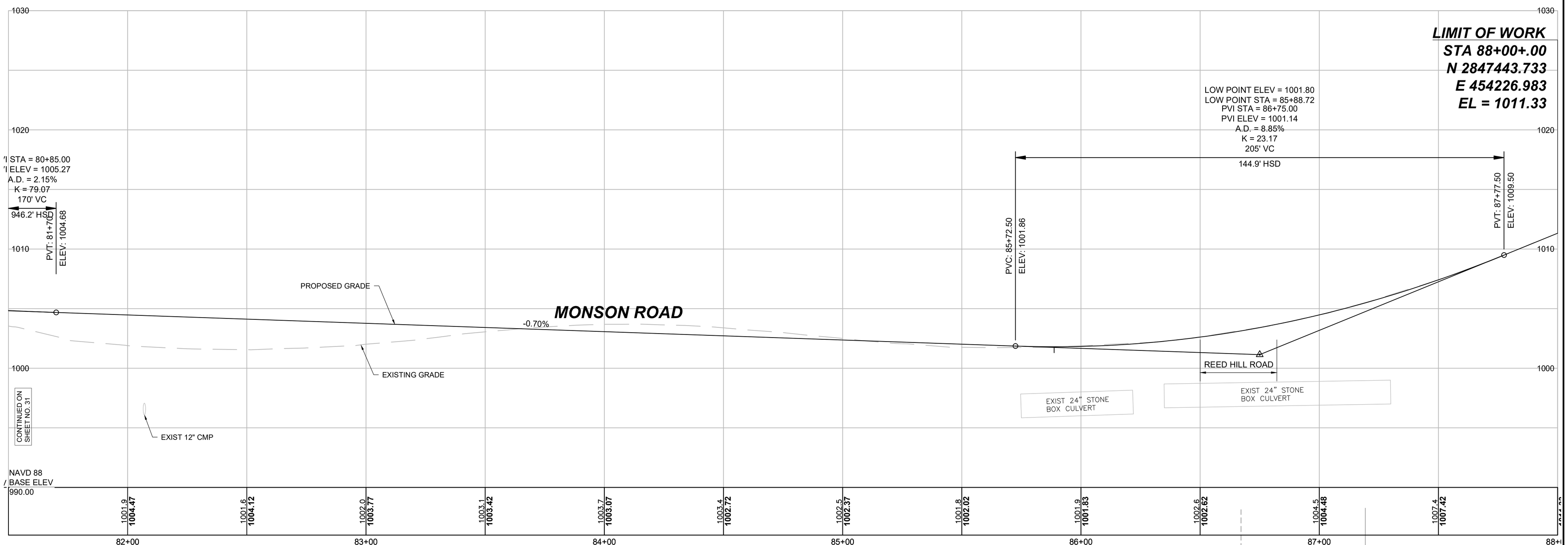
PROJECT FILE NO. 608163			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	31	50

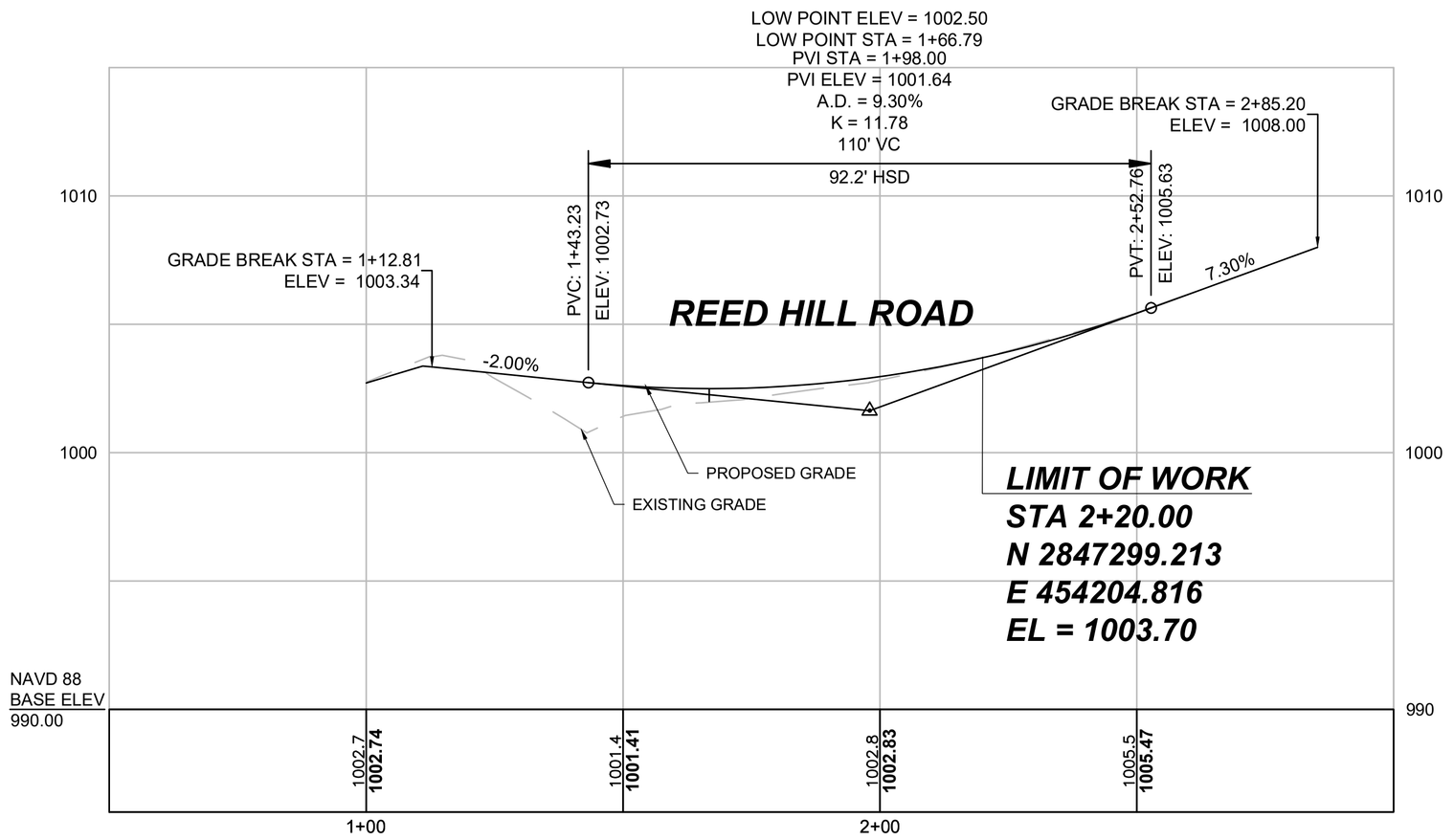
WALES
MONSON ROAD

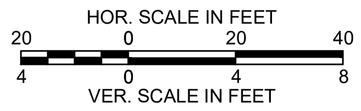
WALES
MONSON ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	50
PROJECT FILE NO.	608163		

PROFILE - MONSON ROAD







STA 86+63.21 MONSON RD ℄ =
STA 1+00.00 REED HILL RD ℄

Benchmark
Brass Rivet
Elevation = 1001.17'
Sta. 87+15.35, 41.26' LT

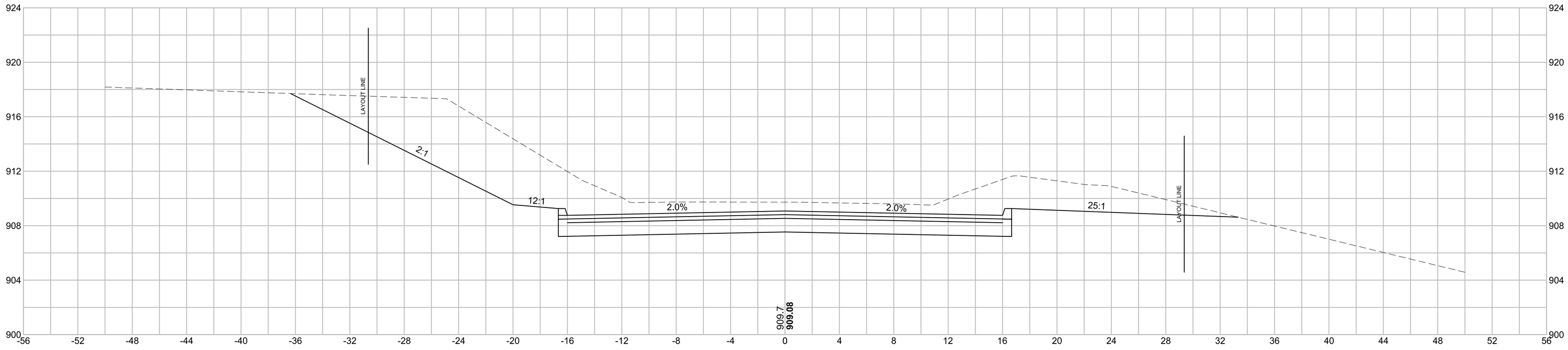
MONSON ROAD -21-32- PROFILE.DWG Plotted on 6-Feb-2018 1:26 PM
Proposal No. 608163-128112
A00870 - 42

WALES
MONSON ROAD

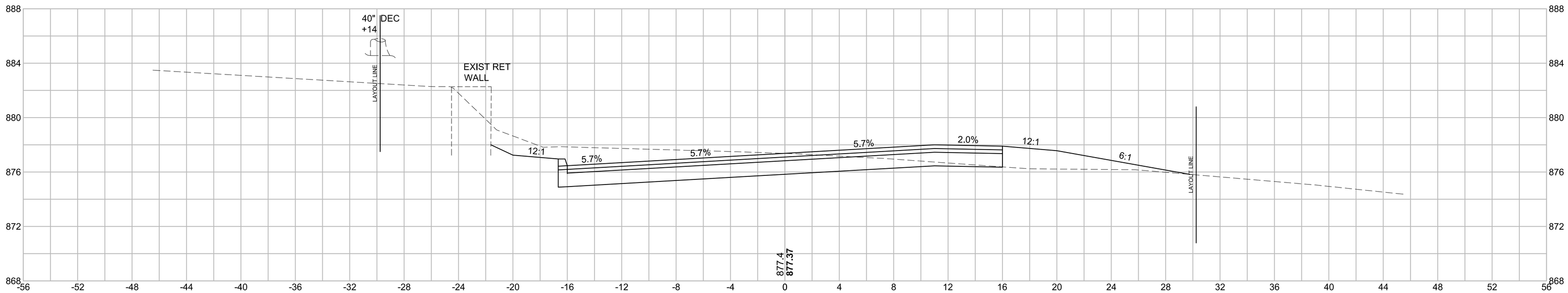
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	48	50
PROJECT FILE NO.	608163		

CRITICAL CROSS SECTIONS

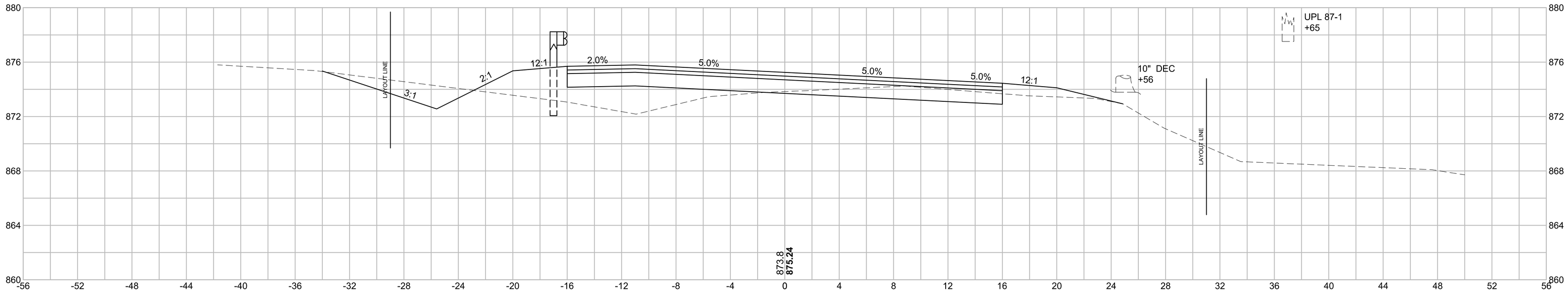
33+50



21+00



15+50



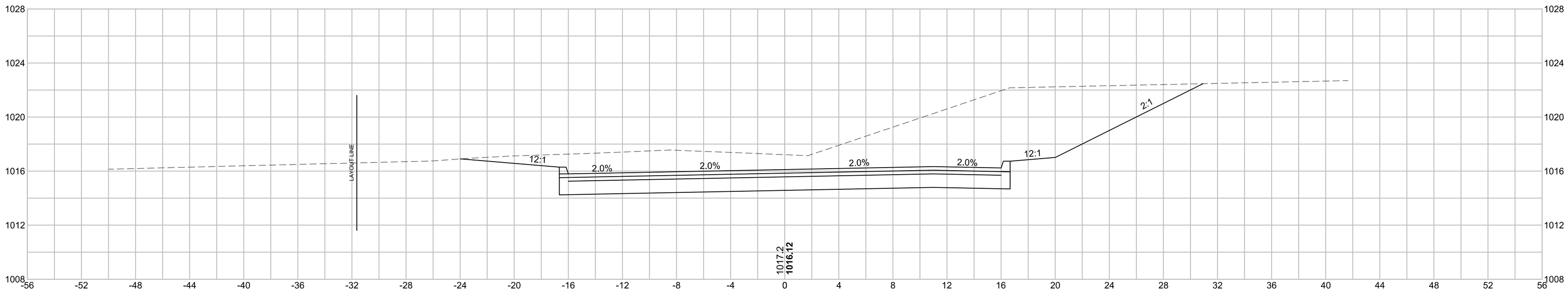
MONSON ROAD - MODEL.DWG Plotted on 6-Feb-2018 2:06 PM
Proposal No. 608163-128112
A00870 - 43

WALES
MONSON ROAD

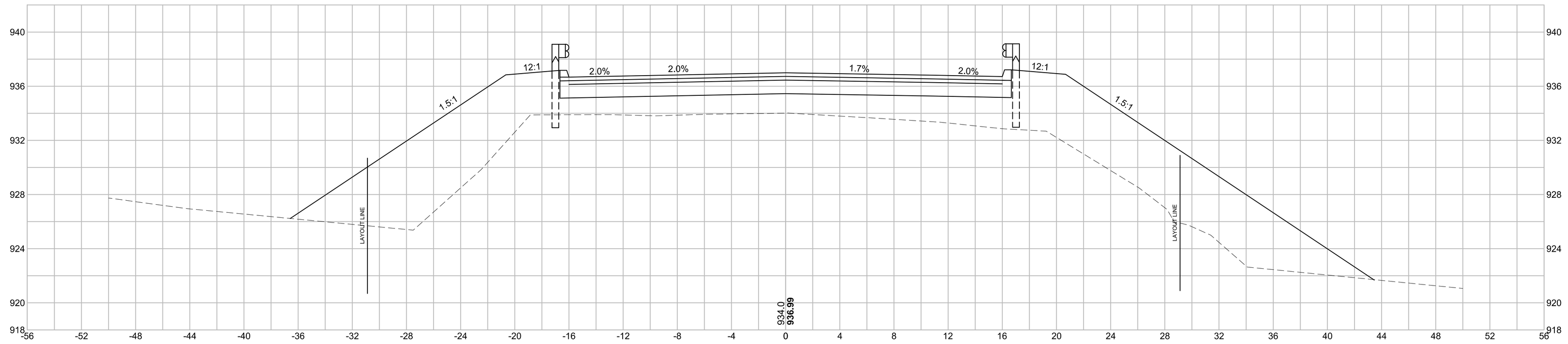
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	49	50
PROJECT FILE NO.	608163		

CRITICAL CROSS SECTIONS

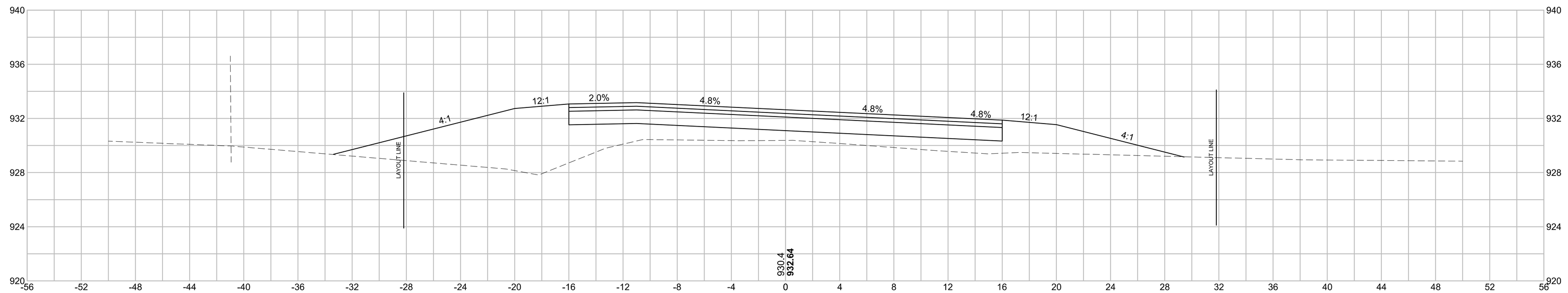
69+00



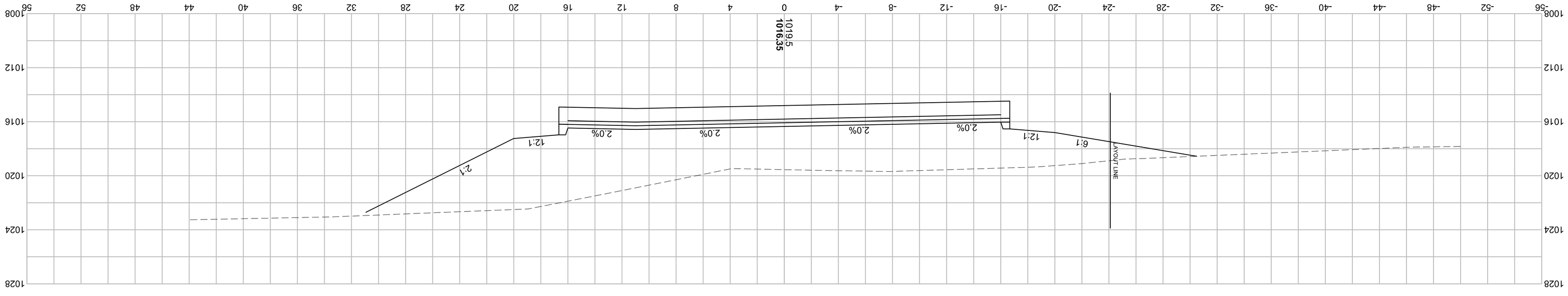
51+00



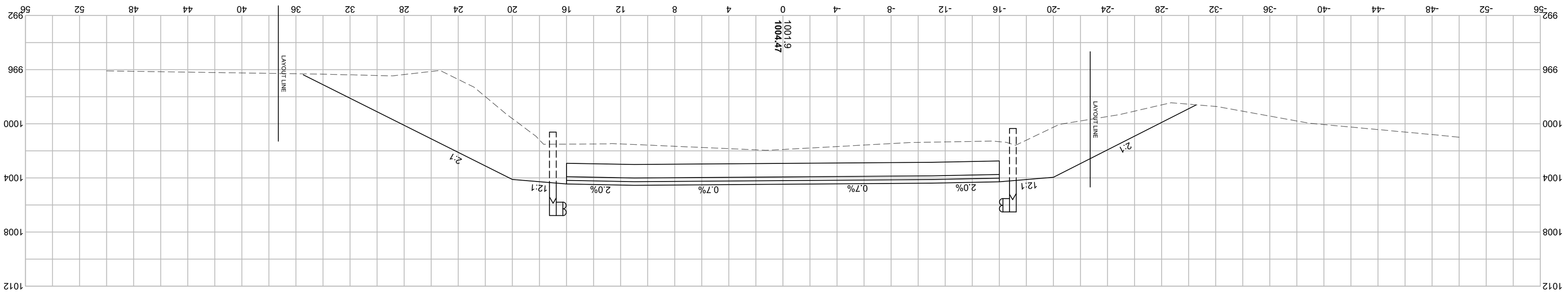
46+50



MONSON ROAD - MODEL.DWG Plotted on 6-Feb-2018 2:07 PM
Proposal No. 608163-128112
A00870 - 44



71+00



82+00

CRITICAL CROSS SECTIONS

PROJECT FILE NO. 608163		
MA	-	50
STATE	FED. AID PROJ. NO.	SHEET NO. 50 TOTAL SHEETS

WALES
MONSON ROAD

Proposal No. 6081163-128112

MONSON ROAD - MODEL.DWG Plotted on 6-Feb-2018 2:09 PM

A00870 - 45

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00871

MASSACHUSETTS DIVISION OF FISHERIES & WILDLIFE

NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM

NO TAKE LETTER

THIS PAGE INTENTIONALLY LEFT BLANK

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

July 01, 2024

John Grasso
Town of Wales
3 Hollow Road
Wales, Massachusetts 01081

Wales Conservation Commission
Box 834
Wales, MA 01081

RE: Applicant: John Grasso, Town of Wales
Project Location: Monson Road
Project Description: Transportation improvement Project
DEP Wetlands File No.: 314-0183
NHESP File No.: 24-18601
Heritage Hub Form ID: RC-86199

Dear Commissioners & Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received a Notice of Intent with site plans (dated June 2024, revised date N/A) in compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.58(4)(b), 10.59). The Division also received the MESA Review Checklist and supporting documentation for review pursuant to the MA Endangered Species Act Regulations (321 CMR 10.18).

WETLANDS PROTECTION ACT (WPA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not adversely affect** the actual Resource Area Habitat of state-protected rare wildlife species. Therefore, it is our opinion that this project meets the state-listed species performance standard for the issuance of an Order of Conditions.

Please note that this determination addresses only the matter of rare wildlife habitat and does not pertain to other wildlife habitat issues that may be pertinent to the proposed project.

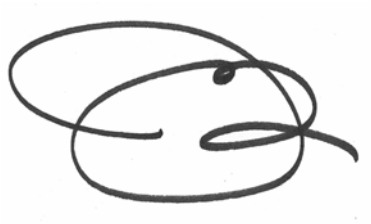
MASSACHUSETTS ENDANGERED SPECIES ACT (MESA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site

plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at Melany.Cheeseman@mass.gov, (508) 389-6357.

Sincerely,



Jesse Leddick
Assistant Director

cc:

DOCUMENT A00875

POLICY DIRECTIVE P-22-001
AND
POLICY DIRECTIVE P-22-002

THIS PAGE INTENTIONALLY LEFT BLANK

massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-001
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Off-Site Stockpiling of Soil from MassDOT Construction Projects

Purpose

The purpose of this Policy Directive is to formally establish a policy and procedures for managing and stockpiling soil generated and transported from MassDOT construction projects. This Policy Directive does not supersede any Federal, State, or Local regulations.

Date of Effect

This Policy Directive is effective immediately for all projects, including active construction projects.

For active construction projects and for other projects advertised prior to October 15, 2022, changes to the contract documents needed to implement the requirements of this Policy Directive will be considered on a case-by-case basis and shall be approved by the District Highway Director, as necessary.

For projects advertised on or after October 15, 2022, MassDOT will include the requirements and implementation procedures of this Policy Directive in the construction contract documents.

Policy Requirements

This policy is intended to prevent the off-site relocation of excavated soil generated from MassDOT projects to areas near residential receptors and to control potential fugitive dusts and/or contaminants. To that end, excavated soil may not be moved from the project site without knowledge of the content of the material. Knowledge may include visual field observations for presence of staining, odor, and/or debris, screening with a photoionization detector (PID), laboratory analysis, and/or site history. Pavement millings and other non-soil materials are not subject to the requirements of this Policy Directive.

Moving soil from a MassDOT project site to a temporary off-site storage location must be approved in writing by the District Highway Director.

The Contractor must select a storage location that is at least 500 feet away from residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially

zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.

Temporary off-site storage of excavated soil from a MassDOT project is only permissible at a location approved and permitted by MassDOT. The temporary storage location should be located within the same municipality where the soil was excavated, where possible. Stockpiled soil must be securely covered, and appropriate measures must be taken to minimize fugitive dust and erosion.

Signs indicating the source of the soil, the date the soil was generated, and contact information must be erected and maintained until the stockpiled soils are transported to a disposal facility or reused on the project site.

Implementation Procedures

To ensure that off-site storage of excavated soils is managed properly on MassDOT projects, this policy requires the following:

1. **Off-Site Stockpile Storage Locations**
    a. The Contractor shall provide proposed off-site storage locations to the Engineer for approval at least 30 days prior to transporting soil off site. Off-site storage locations should be in the same municipality as the work site.
    b. The Contractor shall keep excavated soil on site until adequately characterized to the satisfaction of the Engineer.
    c. The Contractor shall provide notification of the approved off-site storage location to the local Board of Health and the Town Manager's/Mayor's Office at least 7-days prior to transporting soil off site.
    d. The Contractor shall provide the Engineer with at least 3-days' notice prior to transporting soil off site.
    e. For off-site storage locations on MassDOT property, the Contractor is required to obtain an Access Permit through the District Permits Office prior to storage of soil or other materials. MassDOT will issue these permits at no cost to the Contractor. Information to be submitted by the Contractor as part of the permit application shall include:
        i. A description of material to be stored off-site, including available analytical data;
        ii. A figure of the location with distances to residences and residential receptors; and
        iii. Anticipated duration of temporary storage.
    f. Stockpile locations should not be within 500 feet of residential receptors (e.g., residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities).
        i. If the stockpile location must be within 500 feet of residential receptors, then soil must be less than RCS-1 (per 310 CMR 40.1600) and free of potentially hazardous or regulated items.

g. For off-site storage locations on non-MassDOT property, the Contractor must notify the property owner(s) at least 7 days prior to transporting material.
h. Exceptions to these rules will be reviewed by MassDOT and may be approved by the District Highway Director on a case-by-case basis.

2. Off-Site Stockpile Management

a. The Contractor shall keep soil stockpiles on impermeable surfaces (e.g., asphalt or concrete) or on 10-mil polyethylene sheeting.
b. The Contractor shall cover soil stockpiles with 10-mil polyethylene sheeting and surround with a berm made of hay bales, straw wattles, or similar.
    i. Piles that are actively being worked on must be covered and re-secured at the end of the work shift.
c. The Contractor shall label stockpiles with signs, including:
    i. Location of origin (including any Release Tracking Numbers)
    ii. Stockpile ID number (including MassDOT District office-assigned tracking ID, if different)
    iii. Date of initial accumulation
    iv. Applicable telephone numbers for the Contractor and MassDOT.
d. The Contractor shall mitigate fugitive dust at storage locations under the direction of an appropriately trained/certified environmental professional.
e. The Contractor shall remedy noncompliance with this policy within 48 hours.
f. The Contractor shall remedy noncompliance with this policy on the SAME DAY for potentially hazardous material, as determined by the Engineer.
g. The Contractor shall handle excavated soil according to federal, state, and local regulations.
h. The Contractor shall use appropriate shipping documents for all movements of excavated soil on public roadways (e.g., Bill of Lading, Material Shipping Record, Manifest, Asbestos Waste Shipment Record, etc.).

THIS PAGE INTENTIONALLY LEFT BLANK

massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-002
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Use of MassDOT Property for Staging and other Construction-Related Operations

Purpose

This Policy Directive is intended to address the use of MassDOT property by MassDOT Contractors for construction staging and other construction-related operations that are not specifically defined in the construction contract. Such use of MassDOT property will only be allowed if permitted by the District Office in accordance with 700 CMR 13.00, Approval of Access to MassDOT Highways and Other Property. This includes the use of MassDOT property for staging, laydown, and storage of equipment and materials, including soil excavated from a project site.

This Policy Directive requires the Contractor/applicant to obtain a Non-Vehicular Access Permit from MassDOT to use MassDOT property for these purposes.

This Policy Directive is effective immediately and applies to all MassDOT construction projects.

General Permit Considerations and Conditions

In addition to other normal MassDOT Access Permit procedures, MassDOT shall consider the following during the application, review, implementation and monitoring processes of Access Permits required by this Policy Directive:

- Storage and placement of the Contractor's equipment and materials should not be allowed within the clear zone of the roadway.
- Stockpiled soils should not be located within 500 feet of residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.
- The Contractor/applicant shall identify the access/egress locations of the proposed storage areas. MassDOT will only approve locations determined to be safe for roadway users, construction workers and the general public.
- The Contractor may be required to submit a Traffic Management Plan and/or Lighting Plan for MassDOT review and approval as part of the permit application, depending on the proposed use of the area.

- The Contractor shall submit the permit application through MassDOT's online State Highway Access Permit System (SHAPS).
- MassDOT will waive the permit application fee for any application received from a MassDOT Contractor for any permit required by this Policy Directive and will waive any subsequent amendment and extension fees that may otherwise be required.
- MassDOT will review the permit application in accordance with applicable standard procedures and will apply standard permit terms and conditions, as necessary.
- The Resident Engineer will verify that the permit is approved before allowing the Contractor to use the affected area for the requested purpose.
- Areas permitted are for use by the approved applicant only and are not to be shared with or used by other vendors. Subcontractors specifically engaged with the applicant working on the specific MassDOT project will be allowed to use the area in accordance with the terms of the permit.
- Permits are issued on an annual basis and will require the Contractor to file for an extension each year to continue use.

Exemptions from Permit Requirements

Equipment and materials being used for active construction operations and located within the work zone of the construction contract are exempt from this permit requirement, provided they do not interfere with the safety or operation of the roadway or the work zone. Examples of these types of exempt uses are:

- Equipment and materials parked or stored within a protected (barriered) work zone.
- Materials placed in the work zone prior to same-day installation or use.
- Soils excavated temporarily and scheduled to be replaced, such as for trenching operations or for installation of drainage structures.

DOCUMENT B00420

PROPOSAL

WALES

For: **Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)**

COMMONWEALTH OF MASSACHUSETTS

LOCATION

The work referred to herein is in the Town of WALES in Hampden County, in the Commonwealth of Massachusetts, and is shown by the locus map (Document 00331) in the Proposal Pamphlet, the work locations extend as follows:

Monson Road

Beginning – Station 11+00.00 +/-
Ending –Station 88+00.00 +/-

The contract prices shall include the furnishing of all materials (except as otherwise herein specified), the performing of all the labor requisite or proper, the providing of all necessary machinery, tools, apparatus and other means of construction, the doing of all the abovementioned work in the manner set forth, described and shown in the specifications and on the drawings for the work, and in the form of contract, and the completion thereof within **646 CALENDAR DAYS** upon receipt of a Notice to Proceed, except that if the completion date falls between December 1 and March 15 then the same number of days beyond December 1st will be extended after March 15th.

The Work of this project is described by the following Items and quantities.

THIS PAGE INTENTIONALLY LEFT BLANK

Project # 608163 **Contract # 128112**

Location : WALES

Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)

ITEM #	QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	AMOUNT
100.	1	SCHEDULE OF OPERATIONS - FIXED PRICE $82500 AT Eighty Two Thousand Five Hundred Dollars LUMP SUM	$82,500.00	$82,500.00
101.	2.4	CLEARING AND GRUBBING AT _____ PER ACRE		
102.521	650	TREE AND PLANT PROTECTION FENCE AT _____ PER FOOT		
103.	20	TREE REMOVED - DIAMETER UNDER 24 INCHES AT _____ EACH		
104.	12	TREE REMOVED - DIAMETER 24 INCHES AND OVER AT _____ EACH		
120.	18,000	EARTH EXCAVATION AT _____ PER CUBIC YARD		
121.	1,020	CLASS A ROCK EXCAVATION AT _____ PER CUBIC YARD		
140.	1,300	BRIDGE EXCAVATION AT _____ PER CUBIC YARD		
141.	60	CLASS A TRENCH EXCAVATION AT _____ PER CUBIC YARD		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
141.1	25	TEST PIT FOR EXPLORATION AT _____ PER CUBIC YARD		
142.	180	CLASS B TRENCH EXCAVATION AT _____ PER CUBIC YARD		
144.	120	CLASS B ROCK EXCAVATION AT _____ PER CUBIC YARD		
151.	13,570	GRAVEL BORROW AT _____ PER CUBIC YARD		
151.1	97	GRAVEL BORROW FOR BRIDGE FOUNDATION AT _____ PER CUBIC YARD		
151.2	730	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES AT _____ PER CUBIC YARD		
156.	410	CRUSHED STONE AT _____ PER TON		
170.	26,430	FINE GRADING AND COMPACTING - SUBGRADE AREA AT _____ PER SQUARE YARD		
180.01	1	ENVIRONMENTAL HEALTH AND SAFETY PROGRAM AT _____ LUMP SUM		

Project # 608163	Contract # 128112			
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
180.02	30	PERSONAL PROTECTION LEVEL C UPGRADE AT _____ PER HOUR		
180.03	20	LICENSED SITE PROFESSIONAL SERVICES AT _____ PER HOUR		
181.11	7,600	DISPOSAL OF UNREGULATED SOIL AT _____ PER TON		
181.12	4,560	DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY AT _____ PER TON		
181.13	2,280	DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY AT _____ PER TON		
181.14	760	DISPOSAL OF HAZARDOUS WASTE AT _____ PER TON		
201.	57	CATCH BASIN AT _____ EACH		
202.	22	MANHOLE AT _____ EACH		
203.	3.5	SPECIAL MANHOLE AT _____ EACH		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
221.	24	FRAME AND COVER AT _____ EACH		
222.1	41	FRAME AND GRATE - MASSDOT CASCADE TYPE AT _____ EACH		
241.12	3,530	12 INCH REINFORCED CONCRETE PIPE CLASS III AT _____ PER FOOT		
241.15	140	15 INCH REINFORCED CONCRETE PIPE CLASS III AT _____ PER FOOT		
241.18	170	18 INCH REINFORCED CONCRETE PIPE CLASS III AT _____ PER FOOT		
242.12	11	12 INCH REINFORCED CONCRETE PIPE FLARED END AT _____ EACH		
242.15	4	15 INCH REINFORCED CONCRETE PIPE FLARED END AT _____ EACH		
242.18	4	18 INCH REINFORCED CONCRETE PIPE FLARED END AT _____ EACH		
244.12	130	12 INCH REINFORCED CONCRETE PIPE CLASS V AT _____ PER FOOT		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
402.	2,800	DENSE GRADED CRUSHED STONE FOR SUB-BASE AT _____ PER CUBIC YARD		
402.12	110	DENSE GRADED CRUSHED STONE FOR SHOULDERS AT _____ PER CUBIC YARD		
415.3	125	PAVEMENT MICRO MILLING AT _____ PER SQUARE YARD		
443.	110	WATER FOR ROADWAY DUST CONTROL AT _____ PER 1000 GALLONS		
450.22	2,200	SUPERPAVE SURFACE COURSE - 9.5 (SSC - 9.5) AT _____ PER TON		
450.31	2,400	SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC -12.5) AT _____ PER TON		
450.32	4,500	SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC - 19.0) AT _____ PER TON		
452.	3,920	ASPHALT EMULSION FOR TACK COAT AT _____ PER GALLON		
453.	28,000	HMA JOINT ADHESIVE AT _____ PER FOOT		

Project # 608163	Contract # 128112			
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
472.	580	TEMPORARY ASPHALT PATCHING AT _____ PER TON		
504.2	71	GRANITE CURB TYPE VA4 - SPLAYED END AT _____ EACH		
509.	50	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT AT _____ PER FOOT		
514.	39	GRANITE CURB INLET - STRAIGHT AT _____ EACH		
570.2	7,610	HOT MIX ASPHALT CURB TYPE 2 AT _____ PER FOOT		
620.13	2,800	GUARDRAIL, TL-3 (SINGLE FACED) AT _____ PER FOOT		
627.83	33	GUARDRAIL TANGENT END TREATMENT, TL-3 AT _____ EACH		
628.24	7	TRANSITION TO BRIDGE RAIL AT _____ EACH		
628.305	4	TEMPORARY IMPACT ATTENUATOR, NON-REDIRECTIVE, TL-3 AT _____ EACH		

Project # 608163	Contract # 128112			
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
628.4	12	TEMPORARY IMPACT ATTENUATOR, REMOVED AND RESET AT _____ EACH		
629.11	8	PRECAST HIGHWAY GUARDRAIL TRANSITION AT _____ EACH		
691.01	2,200	BALANCE STONE WALL REMOVED AND REBUILT AT _____ PER FOOT		
697.1	41	SILT SACK AT _____ EACH		
698.3	2,100	GEOTEXTILE FABRIC FOR SEPARATION AT _____ PER SQUARE YARD		
702.	260	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY AT _____ PER TON		
715.	21	RURAL MAIL BOX REMOVED AND RESET AT _____ EACH		
740.	24	ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) AT _____ PER MONTH		
748.	1	MOBILIZATION AT _____ LUMP SUM		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
751.	1,140	LOAM FOR ROADSIDES AT _____ PER CUBIC YARD		
751.1	500	LOAM FOR LAWNS AT _____ PER CUBIC YARD		
755.35	1	INLAND WETLAND REPLICATION AREA AT _____ LUMP SUM		
755.45	25	WETLAND RESTORATION AT _____ PER SQUARE YARD		
755.75	40	WETLAND SPECIALIST AT _____ PER HOUR		
755.76	1	WETLANDS MONITORING REPORTS AT _____ LUMP SUM		
756.	1	NPDES STORMWATER POLLUTION PREVENTION PLAN AT _____ LUMP SUM		
765.	14,700	SEEDING AT _____ PER SQUARE YARD		
767.121	10,700	SEDIMENT CONTROL BARRIER AT _____ PER FOOT		

Project # 608163	Contract # 128112			
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
767.9	800	JUTE MESH AT _____ PER SQUARE YARD		
769.	3,540	PAVEMENT MILLING MULCH UNDER GUARD RAIL AT _____ PER FOOT		
776.553	2	MAPLE - RED - OCTOBER GLORY, 3-3.5 INCH CALIPER AT _____ EACH		
780.100	13	ELM - PRINCETON, 2-2.5 INCH CALIPER AT _____ EACH		
782.534	13	REDBUD - EASTERN, 2-2.5 INCH CALIPER AT _____ EACH		
783.042	27	SERVICEBERRY - AUTUMN BRILLIANCE, 2-2.5 INCH CALIPER AT _____ EACH		
813.811	1	UNDERGROUND SERVICE RELOCATION NO. 1 AT _____ EACH		
813.812	1	UNDERGROUND SERVICE RELOCATION NO. 2 AT _____ EACH		
813.813	1	UNDERGROUND SERVICE RELOCATION NO. 3 AT _____ EACH		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
813.814	1	UNDERGROUND SERVICE RELOCATION NO. 4 AT _____ EACH		
813.815	1	UNDERGROUND SERVICE RELOCATION NO. 5 AT _____ EACH		
816.82	1	TEMPORARY TRAFFIC CONTROL SIGNAL - LOCATION NO. 1 AT _____ LUMP SUM		
816.83	1	TEMPORARY TRAFFIC CONTROL SIGNAL - LOCATION NO. 2 AT _____ LUMP SUM		
816.85	1	PORTABLE DRIVEWAY ASSISTANCE DEVICE AT _____ LUMP SUM		
832.	110	WARNING-REGULATORY AND ROUTE MARKER - ALUMINUM PANEL (TYPE A) AT _____ PER SQUARE FOOT		
833.7	33	DELINEATION FOR GUARD RAIL TERMINI AT _____ EACH		
847.1	14	SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL AT _____ EACH		
848.1	4	SIGN SUP (N/GUIDE)+RTE MKR W/2 BRKWAY POST ASSEMBLIES-STEEL AT _____ EACH		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
850.41	5,760	ROADWAY FLAGGER AT _____ PER HOUR		
851.1	40	TRAFFIC CONES FOR TRAFFIC MANAGEMENT AT _____ PER DAY		
852.	460	SAFETY SIGNING FOR TRAFFIC MANAGEMENT AT _____ PER SQUARE FOOT		
853.1	2	PORTABLE BREAKAWAY BARRICADE TYPE III AT _____ EACH		
853.21	690	TEMPORARY BARRIER REMOVED AND RESET AT _____ PER FOOT		
853.23	360	TEMPORARY BARRIER (TL-3) AT _____ PER FOOT		
854.016	19,160	TEMPORARY PAVING MARKINGS - 6 INCH (PAINTED) AT _____ PER FOOT		
854.036	700	TEMPORARY PAVING MARKINGS - 6 INCH (TAPE) AT _____ PER FOOT		
856.12	30	PORTABLE CHANGEABLE MESSAGE SIGN AT _____ PER DAY		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
859.	7,200	REFLECTORIZED DRUM AT _____ PER DAY		
859.1	400	REFLECTORIZED DRUMS WITH SEQUENTIAL FLASHING WARNING LIGHTS AT _____ PER DAY		
862.506	15,100	6 INCH RECESSED WHITE LINE (MC, FD, WR) AT _____ PER FOOT		
862.512	100	12 INCH RECESSED WHITE LINE (MC, FD, WR) AT _____ PER FOOT		
863.506	14,980	6 INCH RECESSED YELLOW LINE (MC, FD, WR) AT _____ PER FOOT		
874.	10	STREET NAME SIGN AT _____ EACH		
874.4	27	TRAFFIC SIGN REMOVED AND STACKED AT _____ EACH		
904.3	340	5000 PSI, 3/4 INCH, 685 HP CEMENT CONCRETE AT _____ PER CUBIC YARD		
910.1	74,130	STEEL REINFORCEMENT FOR STRUCTURES - EPOXY COATED AT _____ PER POUND		

Project # 608163 Contract # 128112				
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
953.1	1	TEMPORARY SUPPORT OF EXCAVATION - CULVERT NO. 1 AT _____ LUMP SUM		
953.2	1	TEMPORARY SUPPORT OF EXCAVATION - CULVERT NO. 2 AT _____ LUMP SUM		
953.3	1	TEMPORARY SUPPORT OF EXCAVATION - CULVERT NO. 3 AT _____ LUMP SUM		
970.	3,690	DAMP-PROOFING AT _____ PER SQUARE FOOT		
983.522	250	NATURAL STREAMBED MATERIAL AT _____ PER CUBIC YARD		
986.	1,250	MODIFIED ROCKFILL AT _____ PER TON		
991.3	1	CONTROL OF WATER - LOCATION NO. 1 AT _____ LUMP SUM		
991.4	1	CONTROL OF WATER - LOCATION NO. 2 AT _____ LUMP SUM		
991.5	1	CONTROL OF WATER - LOCATION NO. 3 AT _____ LUMP SUM		

Project # 608163	Contract # 128112			
Location : WALES				
Description : Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road (1.5 Miles)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
991.6	1	CONTROL OF WATER - LOCATION NO. 4 AT _____ LUMP SUM		
991.7	1	CONTROL OF WATER - LOCATION NO. 5 AT _____ LUMP SUM		
995.011	1	CULVERT STRUCTURE, CULVERT NO. 1 AT _____ LUMP SUM		
995.021	1	CULVERT STRUCTURE, CULVERT NO. 3 AT _____ LUMP SUM		
996.03	1	ENDWALL STRUCTURE, WALL NO. 1 AT _____ LUMP SUM		
Total Qty:	318,402.9			

DOCUMENT B00853

SCHEDULE OF PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES (DBES)

PRIME BIDDER: _____

DATE OF BID OPENING: _____ PROJECT NO.: 608163

FEDERAL AID PROJECT NO. STP/HSI-0032(043)X

PROJECT LOCATION: WALES

Name, Address, and Phone Number(s) of DBE	Name of Activity	(a)† DBE Contractor Activity Amount *Construction Work*	(b) DBE Other Business Amount *Services, Supplies, Material*	(c) Total amount eligible for credit under rules in Section 6 of Document 00719 - DBE Special Provisions
Total Bid Amount	TOTALS:	$	$	$
$	DBE Percentage of Total Bid:	%	%	%

†*Column (a) must be at least one-half of the DBE participation goal. Attach additional sheets as necessary.*

Is MassDOT Document B00855 (Joint Check Approval) being submitted for any of the above? ☐ Yes ☐ No ☐ Not Known at This Time

Will any of the contractors listed above be using a third party (i.e. manufacturer) to deliver materials or perform any portion of work by a third party? ☐ Yes ☐ No

CERTIFICATION: I HEREBY DECLARE, TO THE BEST OF MY KNOWLEDGE, THAT **I HAVE READ THE SPECIAL PROVISIONS FOR PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES - DOCUMENT 00719.** BOTH THIS SCHEDULE AND THE RELEVANT AND ACCOMPANYING LETTER(S) OF INTENT ARE IN FULL COMPLIANCE WITH THE PROVISIONS OF, AND IN ACCORDANCE WITH, TITLE 49 CODE OF FEDERAL REGULATIONS, PART 26 (49 CFR Part 26).

SIGNATURE:_____ DATE_____

NAME AND TITLE (*PRINT*):_____

EMAIL ADDRESS: _____TEL NO.:_____

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT B00854

DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION
LETTER OF INTENT
(To be completed by the DBE – Page 1 of 2)

TO: _____ (Prime Bidder)

FROM: _____ (DBE Firm)

RE: PROJECT NO.: 608163 FEDERAL AID PROJECT NO.: STP/HSI-0032(043)X

PROJECT LOCATION: WALES

DATE OF BID OPENING: _____

I, _____, authorized signatory of the above-referenced DBE firm hereby declare:
Print Name

1. My company is currently certified as a Disadvantaged Business Enterprise (DBE) by the Massachusetts Supplier Diversity Office ("SDO"), formerly known as the State Office of Minority and Women Business Assistance (SOMWBA), as a: (check all applicable, see Section 1 of the Special Provisions For Participation By Disadvantaged Business Enterprises, MassDOT Document 00719 additional guidance is available at Title 49, Code of Federal Regulations, Part 26.55 (49 CFR Part 26.55)):

   ( ) CONTRACTOR ( ) REGULAR DEALER ( ) BROKER
   ( ) MANUFACTURER ( ) TRUCKING OPERATIONS ( ) PROFESSIONAL SERVICES

2. My firm has the ability to manage, supervise and perform the activity described on page 2 of this Letter of Intent. If you are awarded the contract, my company intends to enter into a contract with your firm to perform the items of work or other activity described on the following sheet for the prices indicated.

3. There have been no changes affecting the ownership, control or independence of my company since my last certification review on _____ ___, 20___. If any such change is planned or occurs prior to my company's completion of this proposed work, I will give prior written notification to your firm and to the Massachusetts Department of Transportation ("MassDOT") Office of Civil Rights and SDO.

4. I have read the MassDOT proposal for the Project which may be entitled "Project Contract Documents and Special Provisions" or the draft "Contract" which includes MassDOT Document 00719, and acknowledge that my company will comply with that document and the requirements of 49 CFR Part 26.

5. For the purpose of obtaining subcontractor approval from MassDOT, my firm will provide to you:

   A. ***The following construction work:***
      (i) a resume, stating the qualifications and experience, of the superintendent or foreperson who will supervise on site-work;
      (ii) a list of equipment owned or leased by my firm for use on this project; and
      (iii) a list of all projects (public or private) upon which my firm is currently performing, is committed to perform, or intends to make a commitment to perform. I shall also include, for each project: the name and telephone number of a contact person for the contracting authority, person, or organization; the dollar value of the work; a description of the work; and my firm's work schedule for the project.

   B. ***The following services, materials or supplies***:
      (i) a written agreement and invoices for the materials or supplies, and any other documents evidencing the terms of providing such items;
      (ii) information concerning brokers fees and commissions for providing services or materials; and
      (iii) a statement concerning whether my firm intends or will be required to use a joint check arrangement; and any other documents that may be required by MassDOT.

_____ Date_____
DBE Company Authorized Signature

DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION
LETTER OF INTENT
(To be completed by the DBE – Page 2 of 2)

DATE OF BID OPENING: _____

PROJECT NUMBER: 608163

FEDERAL AID PROJECT NUMBER: STP/HSI-0032(043)X

PROJECT LOCATION: WALES

PRIME BIDDER: _____

DBE COMPANY NAME: _____

Item number if applicable	NAICS Code	Description of Activity with notations such as Services, or Brokerage, Installation Only, Material Only, or Complete	Quantity	Unit Price	Amount
			TOTAL AMOUNT:		

Please give full explanations, attach additional sheets if necessary.

I HEREBY VERIFY THAT _____ WILL SOLELY
(DBE company name)
PERFORM THE WORK, OR PROVIDE THE SERVICES OR MATERIALS, AS DESCRIBED ABOVE.

DBE AUTHORIZED SIGNATURE: _____

NAME AND TITLE (PRINT):_____

TELEPHONE NUMBER: _____FAX NUMBER: _____

EMAIL ADDRESS: _____

Rev'd 9/20/19

*** END OF DOCUMENT ***

DOCUMENT B00855

DBE JOINT CHECK ARRANGEMENT APPROVAL FORM

(to be submitted by Prime Contractor)

Contract No: 128112 **Project No.** 608163 **Federal Aid No.:** STP/HSI-0032(043)X

Location: WALES **Bid Opening Date:** _____

Project Description: Reconstruction & Improvements on Monson Road, from the Monson T.L. to Reed Hill Road

We have received the attached request for the use of a joint check arrangement from _____ _____ , a DBE on the above- referenced Contract and _____ _____, a Material Supplier/Vendor for the subject Contract. The DBE has complied with the requirements of 49 CFR Part 26.55(c)(1). In particular, the DBE has:

- a written agreement with the material supplier/vendor;
- applied for credit with the subject material supplier and has supplied the vendor's response;
- shown that it will place all orders to the subject material supplier/vendor;
- made and retains all decision-making responsibilities concerning the materials; and
- provided a Joint Check Agreement that is acceptable to MassDOT;

As the Contractor for the Project, we agree to issue joint checks (made payable to the Material Supplier/Vendor and the DBE) for payment of sums due pursuant to invoices from the Supplier/Vendor and DBE.

Contractor:

_____ _____

Company Name Signature
Duly Authorized

_____

Printed Name

_____ _____

Date Title

SubContractor:

_____ _____

Company Name Signature –
Duly Authorized

_____

Printed Name

_____ _____

Date Title

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT B00856

JOINT VENTURE AFFIDAVIT

(All Firms)

- All Information Requested By This Schedule Must Be Answered. Additional Sheets May Be Attached.
- If, there is any change in the information submitted, the Joint Venture parties must inform MassDOT Pre-Qualifications Office (and, if one of the companies is a DBE, the Director of Contract Compliance, Office of Civil Rights) *prior* to such change, in writing, either directly or through the Prime Contractor if the Joint Venture is a subcontractor.
- If the Joint Venture Entity will be the bidder on a prime Contract, it must bid and submit all required documents (insurance, worker's compensation, bonds, etc.) in the name of the Joint Venture Entity.

I. Name of Joint Venture: _____

Type of Entity if applicable (Corp., LLC):_____Filing State _____

Address of joint venture: _____

_____

Phone No(s) for JV Entity: _____E-mail:_____

Contact Person(s)_____

Tax ID/EIN of Joint Venture: _____Vendor Code:_____

II. Identify each firm or party to the Joint Venture:

Name of Firm: _____

Address: _____

Phone : _____E-mail:_____

Contact person(s) _____

Name of Firm: _____

Address: _____

Phone: _____E-mail:_____

Contact Person(s)_____

III. Describe the role(s) of the each party to the Joint Venture:

_____

_____

IV. Attach a copy of the Joint Venture Agreement. The proposed Joint Venture Agreement should include specific details including, but not limited to: (1) the contributions of capital and equipment; (2) work items to be performed by each company's forces, (3) work items to be performed under the supervision of any DBE Venturer; (4) the commitment of management, supervisory and operative personnel employed by the DBE to be dedicated to the performance of the Project; and (5) warranty, guaranty, and indemnification clauses.

V. Attach any applicable Corporate or LLC Votes, Authorizations, etc.

VI. Ownership of the Joint Venture:

A. What is the percentage(s) of each company's ownership in the Joint Venture?

ownership percentage(s): _____

ownership percentage(s): _____

B. Specify percentages for each of the following (provide narrative descriptions and other detail as applicable):

1. Sharing of profit and loss: _____

2. Capital contributions:

(a) Dollar amounts of initial contribution: _____

(b) Dollar amounts of anticipated on-going contributions: _____

(c) Contributions of equipment (specify types, quality and quantities of equipment to be provided by each firm): _____

_____

4. Other applicable ownership interests, including ownership options or other agreements, which restrict or limit ownership and/or control:

_____

_____

5. Provide copies of all other written agreements between firms concerning bidding and operation of this Project or projects or contracts.

6. Identify all current contracts and contracts completed during the past two (2) years by either of the Joint Venture partners to this Joint Venture:

_____

_____

VII. Control of and Participation in the Joint Venture. Identify by name and firm those individuals who are, or will be, responsible for and have the authority to engage in the following management functions and policy decisions. (Indicate any limitations to their authority such as dollar limits and co-signatory requirements.):

A. Joint Venture check signing:

_____

_____

B. Authority to enter Contracts on behalf of the Joint Venture:

_____

_____

C. Signing, co-signing and/or collateralizing loans:

_____

_____

D. Acquisition of lines of credit:

E. Acquisition and indemnification of payment and performance bonds:

F. Negotiating and signing labor agreements:

G. Management of contract performance. *(Identify by name and firm only)*:

1. Supervision of field operations:
2. Major purchases:
3. Estimating:
4. Engineering:

VIII. Financial Controls of Joint Venture:

A. Which firm and/or individual will be responsible for keeping the books of account?

B. Identify the "Managing Partner," if any, and describe the means and measure of their compensation:

C. What authority does each firm have to commit or obligate the other to insurance and bonding companies, financing institutions, suppliers, subcontractors, and/or other parties participating in the performance of this Contract or the work of this Project?

IX. Personnel of Joint Venture: State the approximate number of personnel (by trade) needed to perform the Joint Venture's work under this Contract. Indicate whether they will be employees of the majority firm, DBE firm, or the Joint Venture.

	Firm 1 (number)	Firm 2 (number)	Joint Venture (number)
Trade			
Professional			
Administrative/Clerical			
Unskilled Labor			

Will any personnel proposed for this Project be employees of the Joint Venture?: _____

If so, who: _____

A. Are any proposed Joint Venture employees currently employed by either firm?

Employed by Firm 1: _____ Employed by firm 2 _____

B. Identify by name and firm the individual who will be responsible for Joint Venture hiring: ____

_____

X. Additional Information. Please state any material facts and additional information pertinent to the control and structure of this Joint Venture.

_____

_____

XI. AFFIDAVIT OF JOINT VENTURE PARTIES. The undersigned affirm that the foregoing statements and attached documents are correct and include all material information necessary to identify and explain the terms and operations of our Joint Venture and the intended participation of each firm in the undertaking. Further, the undersigned covenant and agree to provide to MassDOT current, complete and accurate information regarding actual Joint Venture work, payments, and any proposed changes to any provisions of the Joint Venture, or the nature, character of each party to the Joint Venture. We understand that any material misrepresentation will be grounds for terminating any Contract awarded and for initiating action under Federal or State laws concerning false statements.

Firm 1	Firm 2
Signature Duly Authorized	Signature Duly Authorized
Printed Name and Title	Printed Name and Title
Date	Date

*** END OF DOCUMENT ***