INLAND WETLANDS
COMMISSION
Telephone (203) 563-0180
Fax (203) 563-0284

TOWN HALL
238 Danbury Road
Wilton, Connecticut 06897

APPLICATION FOR AN INTERMEDIATE REGULATED ACTIVITY

For Office Use Only:	WET# ________
Filing Fee $ ________	Wilton Land Record Map# ________
Date of Submission ________	Volume # ________ Page # ________
Date of Acceptance ________	Assessor's Map # ________ Lot# ________

APPLICANT INFORMATION:

Applicant Town of Wilton (Frank Smeriglio)

Address 238 Danbury Road
Wilton, CT 06897

Telephone (203) 563-0152

Email Frank.Smeriglio@wiltonct.org

Agent (if applicable) CHA (Scott Young)

Address 101 East River Drive
East Hartford, CT 06108

Telephone (860) 885-1053

Email syoung@chacompanies.com

PROJECT INFORMATION:

Property Address Bridge No. 04975 - Lovers Lane over Comstock Brook

Acres of altered Wetlands On-Site 0.37 Acres +/-

Linear Feet of Watercourse 85 Feet +/-

Linear Feet of Open Water N/A

Sq. Ft. of proposed and/or altered impervious coverage 376 S.F. +/-increase in impervious area

Site Acreage 0.39 Acres +/-

Cu. Yds. of Material Excavated 14 C.Y. +/-

Cu. Yds. of Material to be Deposited 14 C.Y. +/-

Acres of altered upland buffer 0.39 Acres +/-

Sq. Ft. of disturbed land in regulated area 16, 740 S.F. +/-

APPLICATION REQUIREMENTS:

Is The Site Within a Public Water Supply Watershed Boundary? NO ✓ YES* ☐

Is The Site Within 500 Feet of a Town Boundary? NO ✓ YES* ☐

* If the answer is yes, then the applicant is responsible for notifying the appropriate water authority and/or adjoining community's Wetlands Department. Instructions for notification are available at the office of the commission.

Project Description and Purpose: Replacment of Bridge No. 04975, Lovers Lane over Comstock Brook. Please refer to the attached narrative for additional information.

In addition, the applicant shall provide nine (9) collated copies of the following information as well as an electronic submission via email to mike.conklin@wiltonct.org & elizabeth.larkin@wiltonct.org **

- [x] A. Written consent from the owner authorizing the agent to act on his/her behalf
- [x] B. A Location Map at a scale of 1" = 800'
- [x] C. *A Site Plan showing existing and proposed features at a scale not to exceed 1" = 40'*
- [ ] D. Sketch Plans depicting the alternatives considered
- [x] E. Names and addresses of adjoining property owners
- [x] F. A narrative describing, in detail

  a. the proposed activity
  b. the alternatives considered
  c. impacts
  d. proposed mitigation measures

- [x] G. Soils Report prepared by a Certified Soil Scientist and Wetlands Map prepared by a Registered Land Surveyor
- [x] H. Description of the chemical and physical characteristics of fill material to be used in the Regulated Area
- [x] I. Description and maps detailing the watershed of the Regulated Area
- [x] J. One original application and eight (8) copies

****Application materials shall be collated and copies of documents more than two pages in length shall be double sided.**

See Section 7 of the Wetlands and Watercourses Regulations of the Town of Wilton for a more detailed description of applications requirements.

The Applicant or his/her agent certifies that he is familiar with the information provided in this application and is aware of the penalties for obtaining a permit through deception, inaccurate or misleading information.

By signing this application, permission is hereby given to necessary and proper inspections of the subject property by the Commissioners and designated agents of the Commission or consultants to the Commission, at reasonable times, both before and after a final decision has been rendered.

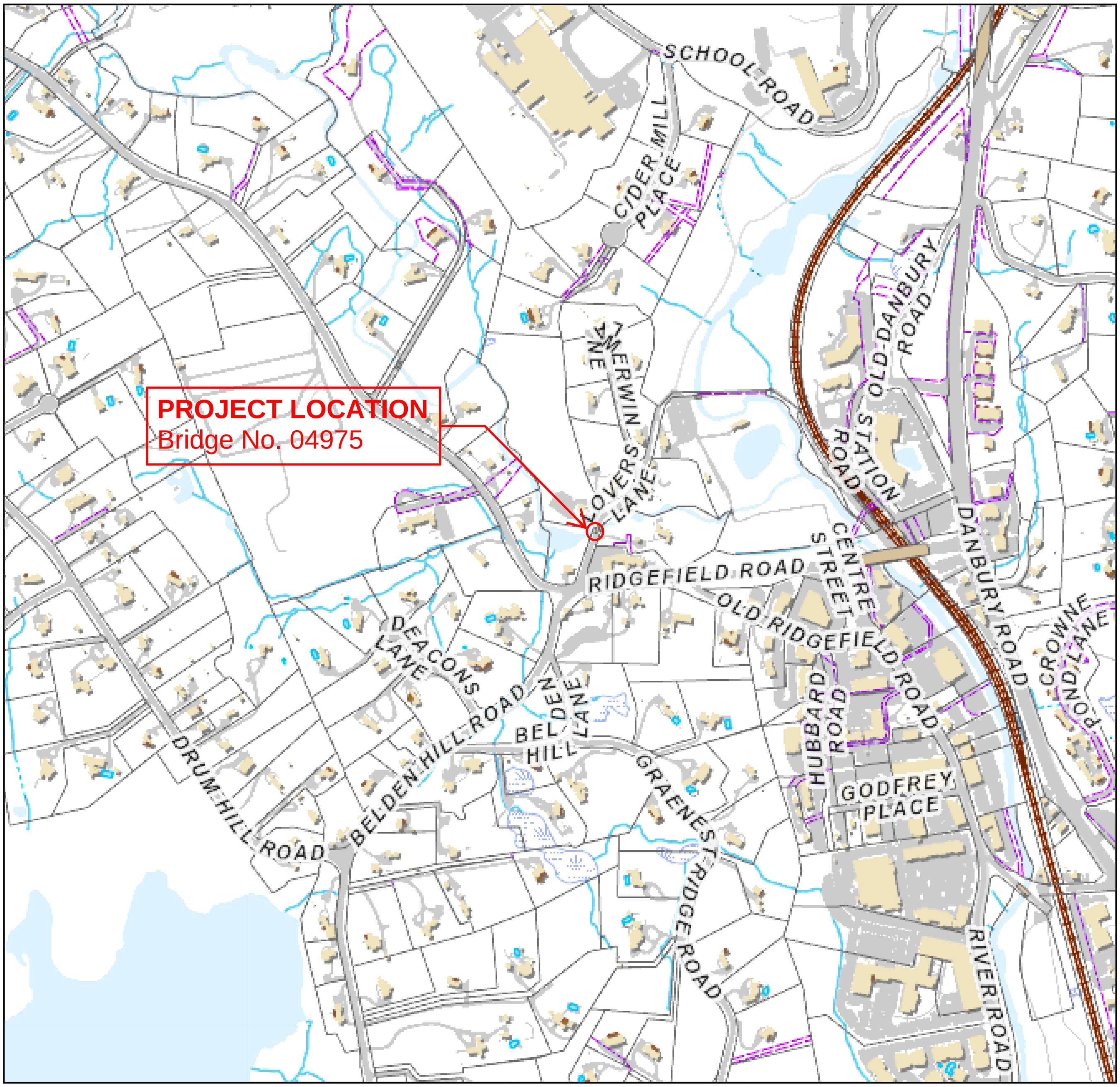
Applicant's Signature: [signature] Date: 8/18/2022

Agent's Signature (if applicable): Scott G Young Date: 8/18/2022

Town of Wilton

Geographic Information System (GIS)

Date Printed: 3/8/2022



MAP DISCLAIMER - NOTICE OF LIABILITY

This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of Wilton and its mapping contractors assume no legal responsibility for the information contained herein.

Zoning Effective: July 28, 2017

Planimetrics Updated: 2014

Approximate Scale: 1 inch = 800 feet

0 800 Feet

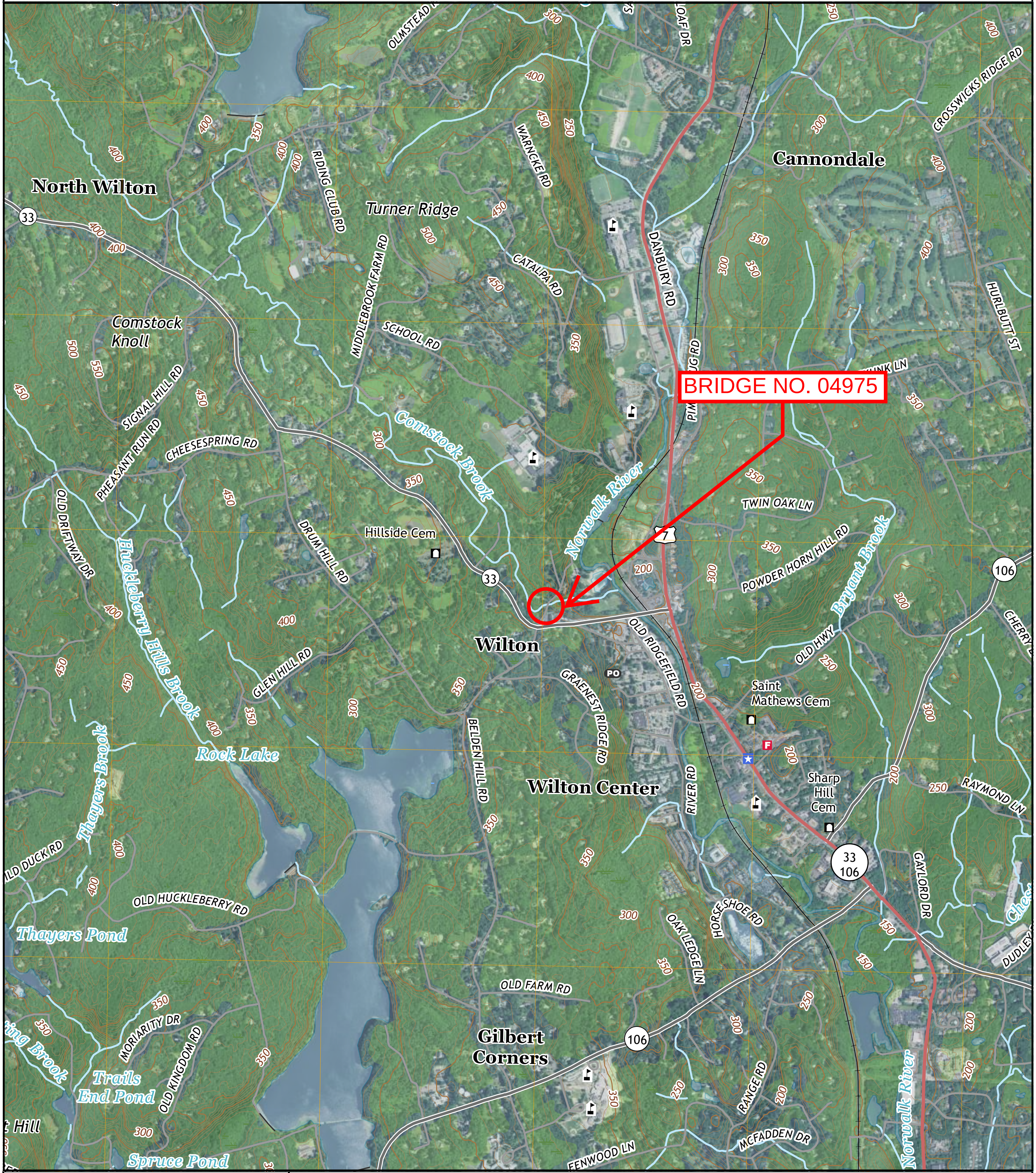
N W E S

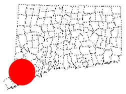
Attachment B-1: USGS Location Map

101 East River Drive, 1st Floor East Hartford, CT 06108
T 860.290.4100 • www.chacompanies.com

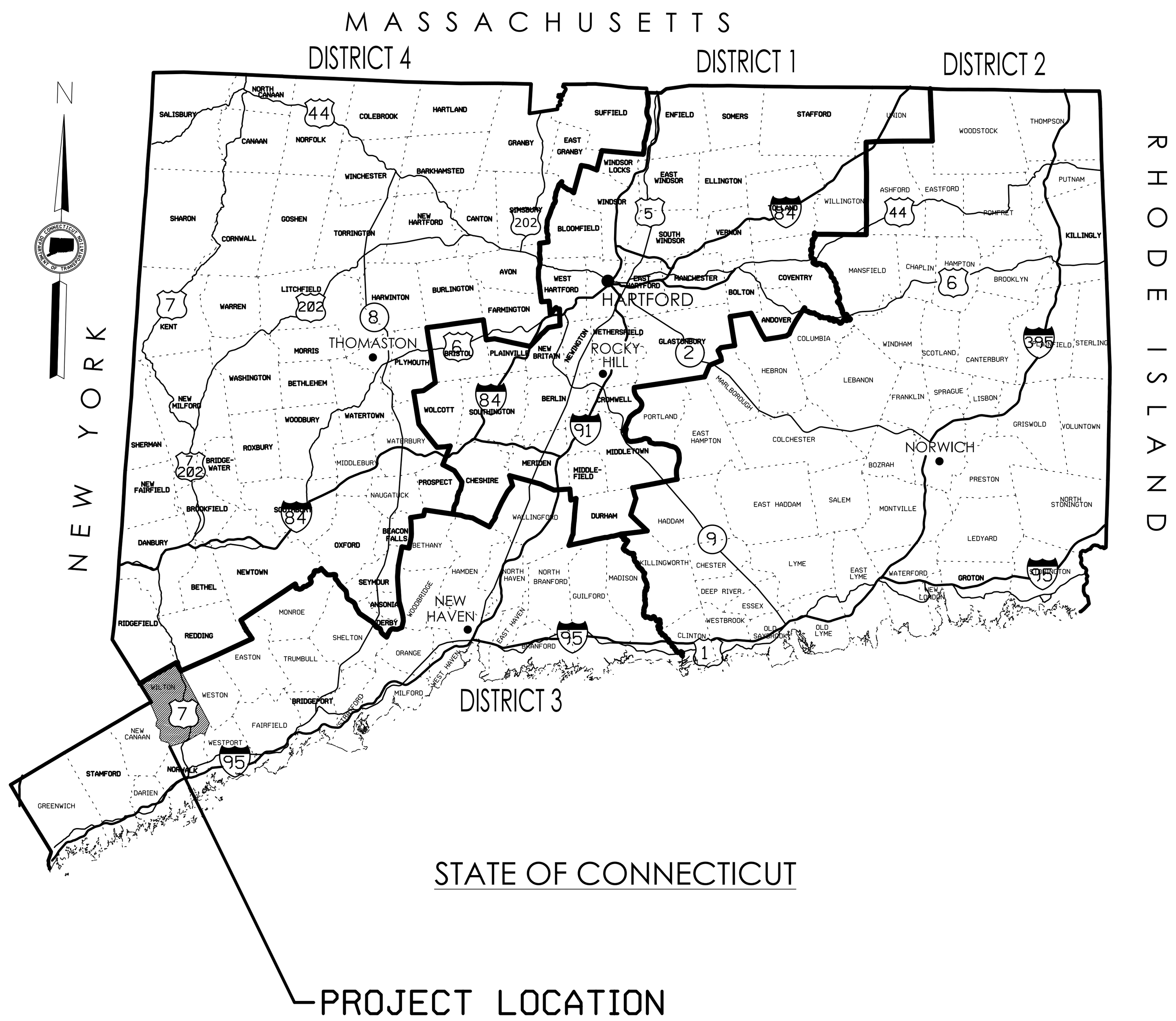
USGS QUADRANGLE MAP

BRIDGE NO. 04975 IN WILTON, CT
LOVERS LANE OVER COMSTOCK BROOK

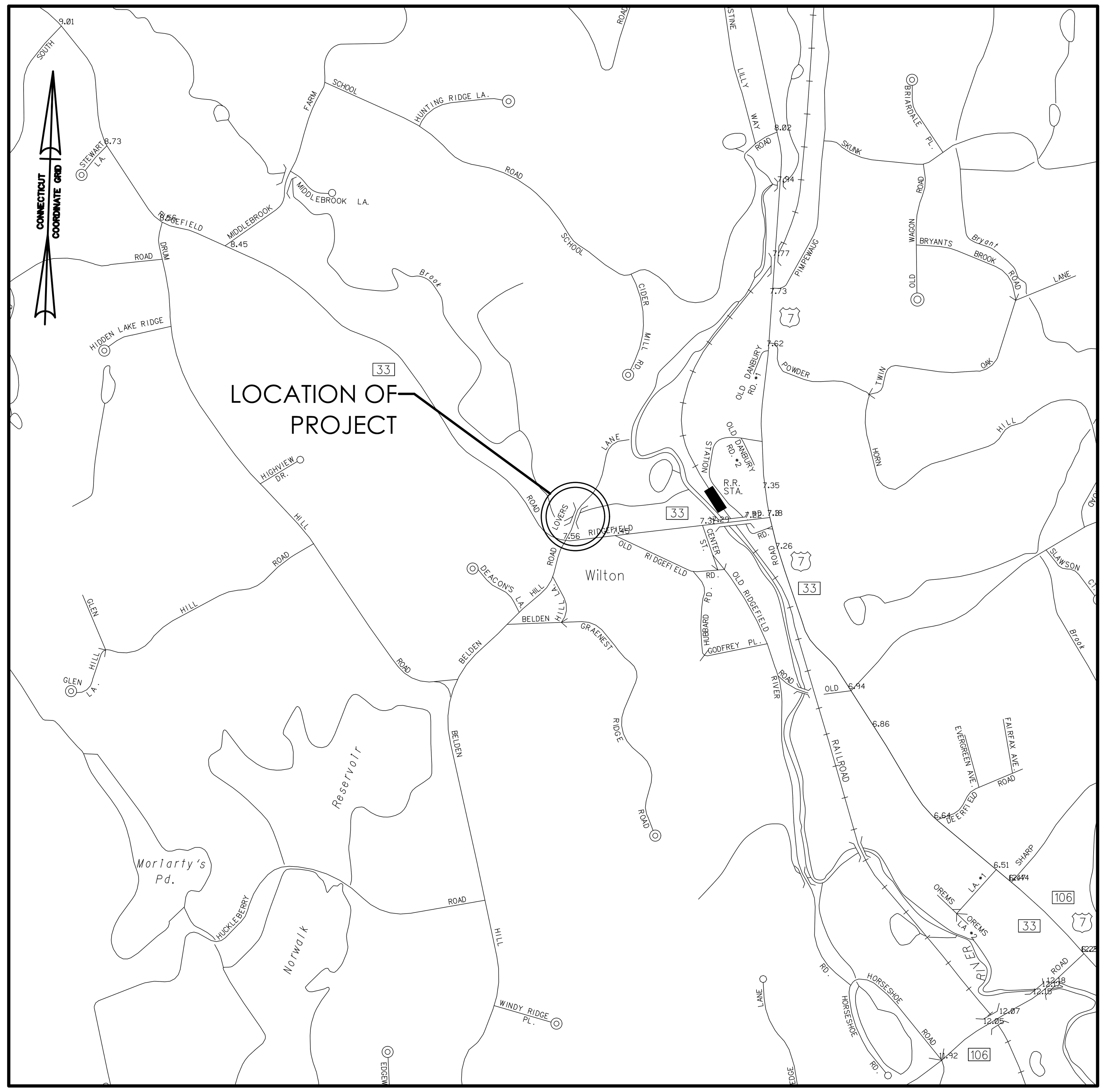


N **USGS QUAD MAP** **#107** NORWALK NORTH, CONNECTICUT	 Created: 2019	**1 INCH = 2,000 FEET** 0 1,000 2,000 4,000 6,000 Feet

ENVIRONMENTAL PERMIT PLANS
STATE PROJECT NO. 0161-0142
REPLACEMENT OF BRIDGE NO. 04975
LOVERS LANE OVER COMSTOCK BROOK
TOWN OF WILTON



STATE OF CONNECTICUT



LOCATION PLAN
1" = 1000'

LIST OF DRAWINGS

DRAWING NO.	DRAWING TITLE
PMT-01	TITLE SHEET
PMT-02	GENERAL SITE PLAN
PMT-03	WETLAND/WATERCOURSE IMPACT PLAN
PMT-04	100-YEAR FLOOD IMPACT PLAN
PMT-05	ELEVATION & SECTION PLAN
PMT-06	STAGING AND WATER HANDLING PLAN - 1
PMT-07	STAGING AND WATER HANDLING PLAN - 2
PMT-08	PERMIT PLANTING PLAN

GENERAL NOTES:

1. THESE PLANS ARE INTENDED ONLY FOR ENVIRONMENTAL PERMITTING PURPOSES. THESE PLANS HOLD AUTHORITY FOR ALL ACTIVITIES CONCERNING THE REGULATED AREA. FOR DETAILED PLANIMETRIC INFORMATION AND PAYMENT REFER TO THE APPLICABLE CONTRACT DOCUMENTS.
2. THE DEPARTMENT OF TRANSPORTATION WILL ONLY SUBMIT REVISIONS TO DEEP AND USACE FOR CHANGES TO THE DESIGN THAT WILL AFFECT REGULATED AREAS.
3. FOR A DESCRIPTION OF THE WATERCOURSES, WETLANDS AND WETLAND SOILS, SEE RELEVANT SECTIONS OF THE PERMIT APPLICATION.
4. 400 FOOT GRID BASED ON CONNECTICUT COORDINATE SYSTEM N.A.D. 1983; VERTICAL DATUM BASED ON NAVD 1988.
5. ALL CONSTRUCTION ACTIVITIES WILL BE CONDUCTED IN ACCORDANCE WITH THE CONNECTICUT DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS FOR ROADS, BRIDGES AND INCIDENTAL CONSTRUCTION, FORM 818, SECTION 1.10 AND WILL ALSO FOLLOW REQUIRED BEST MANAGEMENT PRACTICES (BMP'S) AND SEDIMENT AND EROSION CONTROL MEASURES IN ACCORDANCE WITH THE 2002 EROSION & SEDIMENTATION CONTROL GUIDELINES AND THE 2004 STORMWATER QUALITY MANUAL.
6. IT IS IMPORTANT THAT PROPER EROSION AND SEDIMENTATION CONTROLS BE INSTALLED AND MAINTAINED THROUGHOUT THE DURATION OF THIS PROJECT. CARE SHOULD BE EXERCISED SO AS NOT TO INCREASE TURBIDITY LEVELS. AS A BEST MANAGEMENT PRACTICE, ANY UNCONFINED INSTREAM WORK WITHIN COMSTOCK BROOK SHOULD BE RESTRICTED TO THE PERIOD FROM JUNE 1 TO SEPTEMBER 30, INCLUSIVE.

DESIGNED BY:
FUSS & O'NEILL

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB

SIGNATURE/
BLOCK:

STATE OF CONNECTICUT
TOWN OF WILTON

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: TITLE SHEET

DRAWING NO. PMT-01
SHEET NO.

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PLOTTED DATE: 4/14/2022

LEGEND

- 100YR — FEMA 100-YEAR FLOOD (CALCULATED)
- OHW — ORDINARY HIGH WATER (OHW)
- STATE/ FEDERAL WETLANDS
- SF — SEDIMENTATION CONTROL SYSTEM

A PARTIAL TAKE REQUIRED.
B EASEMENT TO SLOPE FOR THE SUPPORT OF THE HIGHWAY REQUIRED.
C EASEMENT TO SLOPE FOR THE SAFETY OF THE HIGHWAY REQUIRED
D EASEMENT TO INSTALL MBR AND MAINTAIN GUIDE RAILING AND END ANCHORAGE REQUIRED.
E TEMPORARY CONSTRUCTION EASEMENT REQUIRED.
F RIGHT TO GRADE AND CONSTRUCT DRIVEWAY REQUIRED.
G RIGHT TO INSTALL SEDIMENTATION CONTROL SYSTEM REQUIRED.
H RIGHT TO REMOVE STONE WALL REQUIRED
I RIGHT TO REMOVE AND RESET TIMBER CURBING REQUIRED.
J RIGHT TO INSTALL LANDSCAPING REQUIRED.

ROADWAY PLAN
SCALE: 1" = 20'-0"

SEE SHEET PMT-08 FOR PLANTING PLAN

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB
HORIZONTAL SCALE 1" = 20' (0, 20', 40')
SIGNATURE/ BLOCK:
STATE OF CONNECTICUT
TOWN OF WILTON
PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVER'S LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: GENERAL SITE PLAN
DRAWING NO. PMT-02
SHEET NO.

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PLOTTED DATE: 4/14/2022

WETLAND/ WATERCOURSE IMPACT PLAN

LEGEND

- 100YR — FEMA 100-YEAR FLOOD (CALCULATED)
- OHW — ORDINARY HIGH WATER (OHW)
- STATE/ FEDERAL WETLANDS
- SF — SEDIMENTATION CONTROL SYSTEM
- TEMPORARY WETLAND/WATERCOURSE IMPACTS
- PERMANENT WETLAND/WATERCOURSE IMPACTS

WETLAND IMPACT TABLE

	WETLAND IMPACTS	WATERCOURSE IMPACTS	TOTAL
PERMANENT IMPACTS	50 SF (0.0002 AC)	0 SF (0 AC)	50 SF (0.0002 AC)
TEMPORARY IMPACTS	220 SF (0.007 AC)	310 SF (0.03 AC)	530 SF (0.037 AC)
TOTAL IMPACTS	270 SF (0.0072 AC)	310 SF (0.03 AC)	580 SF (0.0372 AC)

UPLAND REVIEW AREA IMPACT TABLE

	IMPACTS
PERMANENT IMPACTS	9,370 SF (0.215 AC)
TEMPORARY IMPACTS	7,370 SF (0.169 AC)
TOTAL IMPACTS	16,740 SF (0.384 AC)

NOTE:
THE CONTRACTOR SHALL NOT WORK WITHIN THE LIMITS OF THE WETLANDS AND WATERCOURSE WITH THE EXCEPTION OF THOSE AREAS DELINEATED AS TEMPORARY OR PERMANENT IMPACTS TO THE WETLANDS AND WATERCOURSE. ALL DISTURBED AREAS SHALL BE RESTORED.

SEE SHEET PMT-08 FOR PLANTING PLAN

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB

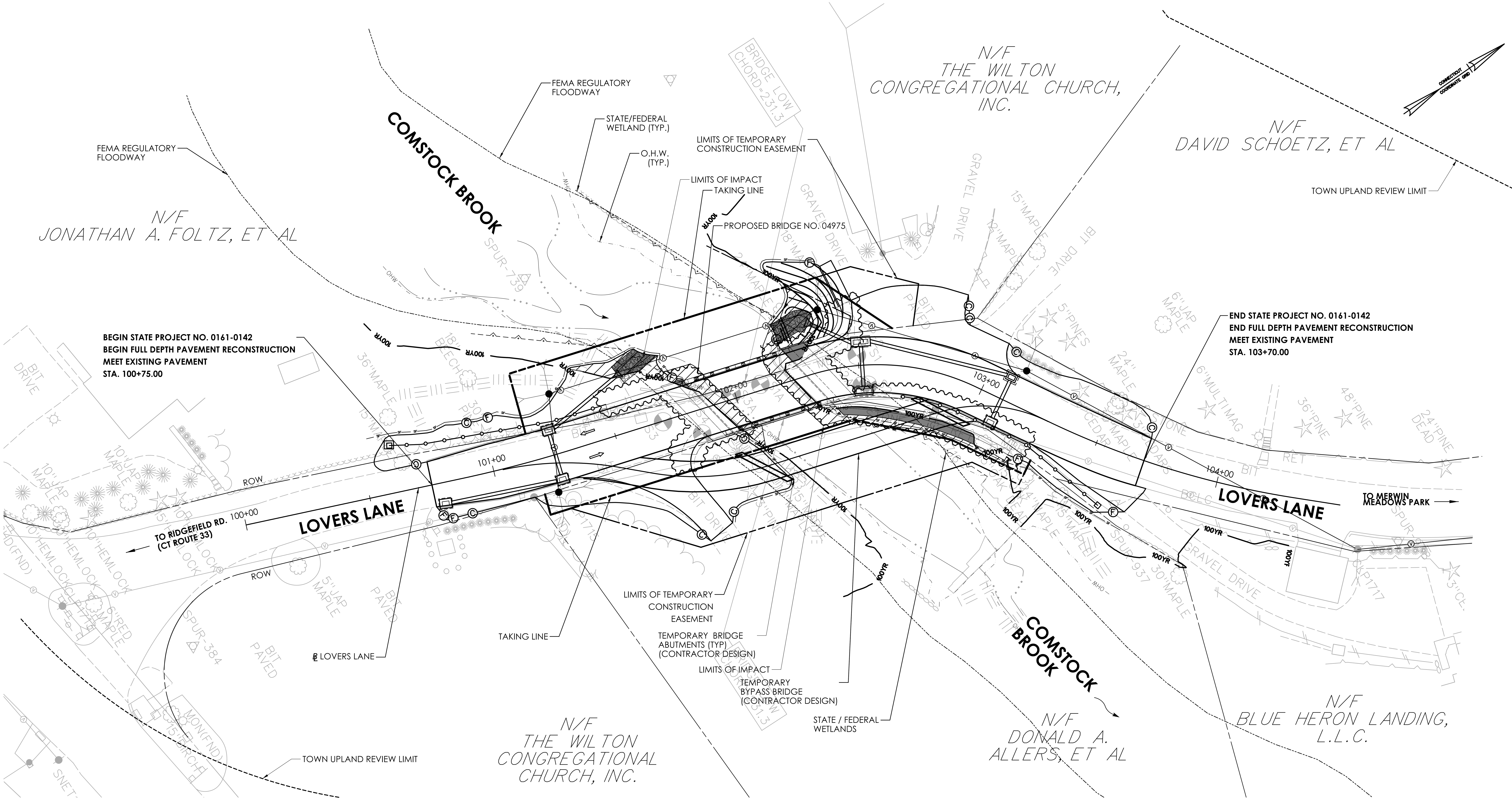
HORIZONTAL SCALE 1"=20 (0, 20, 40)

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
TOWN OF WILTON

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: WETLAND/ WATERCOURSE IMPACT PLAN

DRAWING NO. PMT-03
SHEET NO.



LEGEND

—— 100YR ——	FEMA 100-YEAR FLOOD (CALCULATED)
— OHW — · — OHW —	ORDINARY HIGH WATER (OHW)
— — —	STATE/ FEDERAL WETLANDS
—— SF ——	SEDIMENTATION CONTROL SYSTEM
(solid shading)	PERMANENT IMPACTS
(hatched)	TEMPORARY IMPACTS

100 YEAR FLOOD IMPACT PLAN

SCALE: 1" = 20'-0"

100-YEAR FLOODPLAIN IMPACTS CUT AND FILL	
VOLUME IMPACTS	
EXCAVATION IN FEMA FLOODPLAIN	FILL IN FEMA FLOODPLAIN
14 CY	14 CY

SEE SHEET PMT-08 FOR PLANTINGS PLAN

ENVIRONMENTAL PERMIT PLANS

PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB

0 20' 40' HORIZONTAL SCALE 1" = 20'

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT

TOWN OF WILTON

PROJECT NUMBER: 0161-0142

PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVER'S LANE OVER COMSTOCK BROOK

TOWN(S): WILTON

DRAWING TITLE: 100 YEAR FLOOD IMPACT PLAN

DRAWING NO. PMT-04

SHEET NO.

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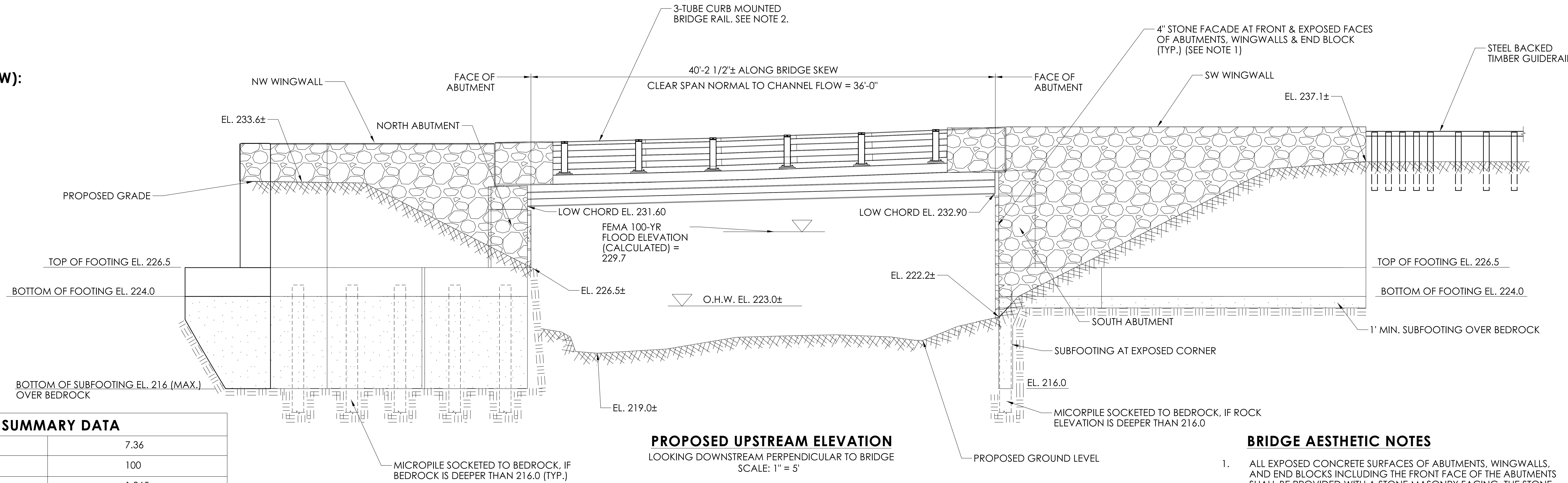
PLOTTED DATE: 4/14/2022

BANKFULL WIDTH (BFW):

BFW = 30 FT
1.2 x BFW = 36 FT
36 FT PROPOSED HYDRAULIC SPAN



PROPOSED UPSTREAM ELEVATION

LOOKING DOWNSTREAM PERPENDICULAR TO BRIDGE
SCALE: 1" = 5'

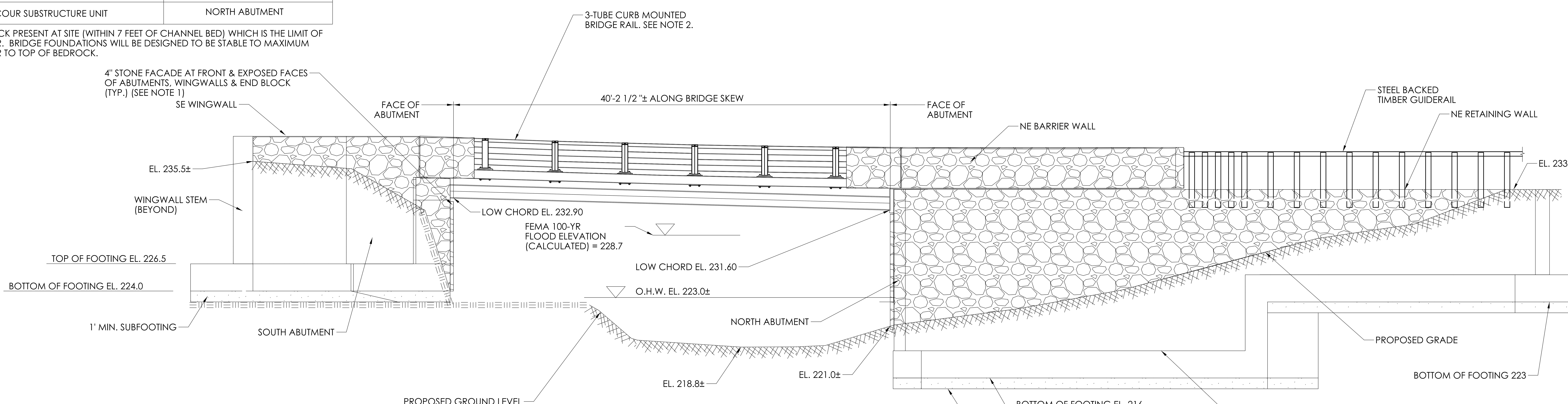
HYDRAULIC SUMMARY DATA

DRAINAGE AREA (SQ. MILE)	7.36	
DESIGN FREQUENCY (YEARS)	100	
DESIGN DISCHARGE (CFS)	1,865	
AVERAGE DAILY FLOW ELEVATION (FT)	221.9	
	UPSTREAM	DOWNSTREAM
100-YEAR DESIGN WATER SURFACE ELEVATION (FT)	229.8	229.4
MAXIMUM SCOUR ELEVATION (FT)	NOT CALCULATED[1]	
WORST CASE SCOUR SUBSTRUCTURE UNIT	NORTH ABUTMENT	

SHALLOW BEDROCK PRESENT AT SITE (WITHIN 7 FEET OF CHANNEL BED) WHICH IS THE LIMIT OF POTENTIAL SCOUR. BRIDGE FOUNDATIONS WILL BE DESIGNED TO BE STABLE TO MAXIMUM POTENTIAL SCOUR TO TOP OF BEDROCK.

BRIDGE AESTHETIC NOTES

1. ALL EXPOSED CONCRETE SURFACES OF ABUTMENTS, WINGWALLS, AND END BLOCKS INCLUDING THE FRONT FACE OF THE ABUTMENTS SHALL BE PROVIDED WITH A STONE MASONRY FACING. THE STONE PATTERN SHALL BE A "NEW ENGLAND SMALL ROUNDS" OR "NUTMEG MEDIUM ROUNDS" PATTERN FROM O&G MASON PRODUCTS OR AN APPROVED EQUAL.
2. THE BRIDGE RAILS, POSTS AND HARDWARE SHALL BE METALLIZED TO A COLOR APPROVED BY THE TOWN.



PROPOSED DOWNSTREAM ELEVATION

LOOKING UPSTREAM PERPENDICULAR TO BRIDGE
SCALE: 1" = 5'

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04875 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: ELEVATION & SECTION PLAN

DRAWING NO. PMT - 05
SHEET NO.

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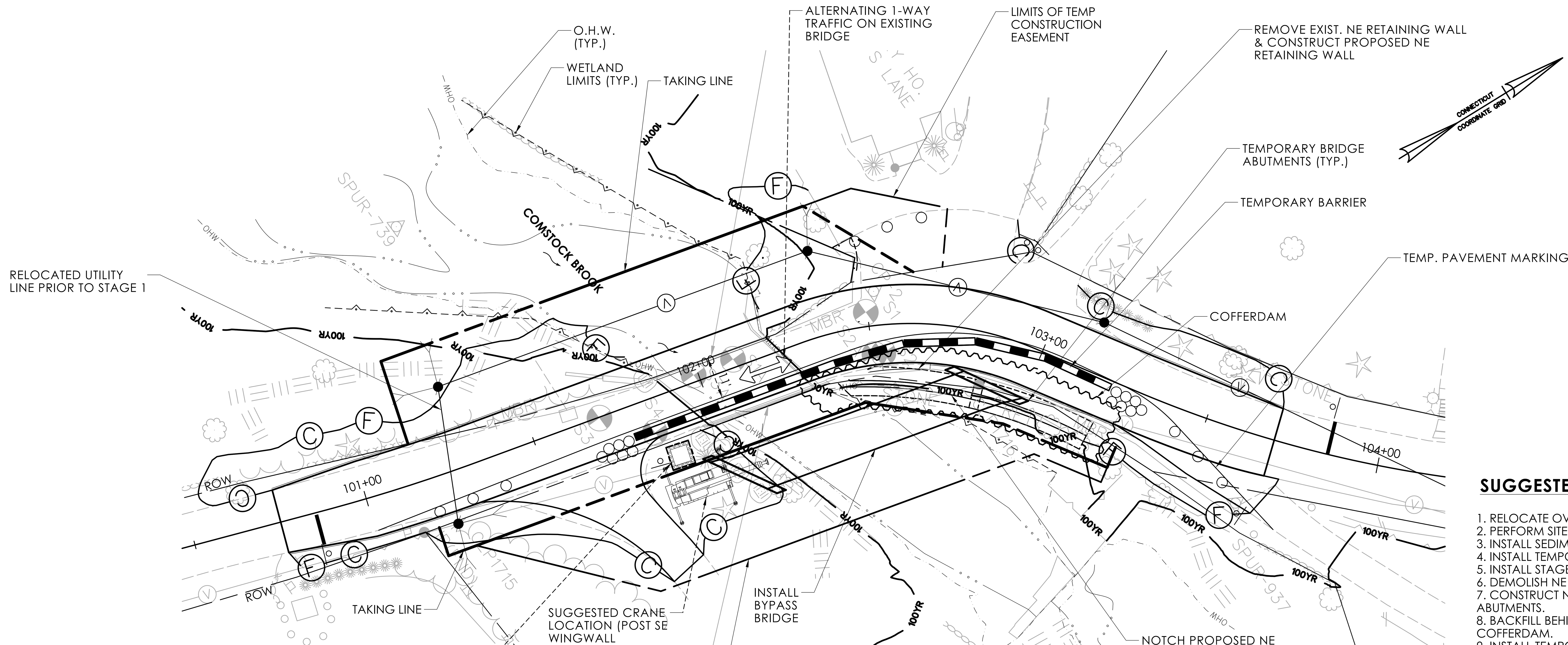
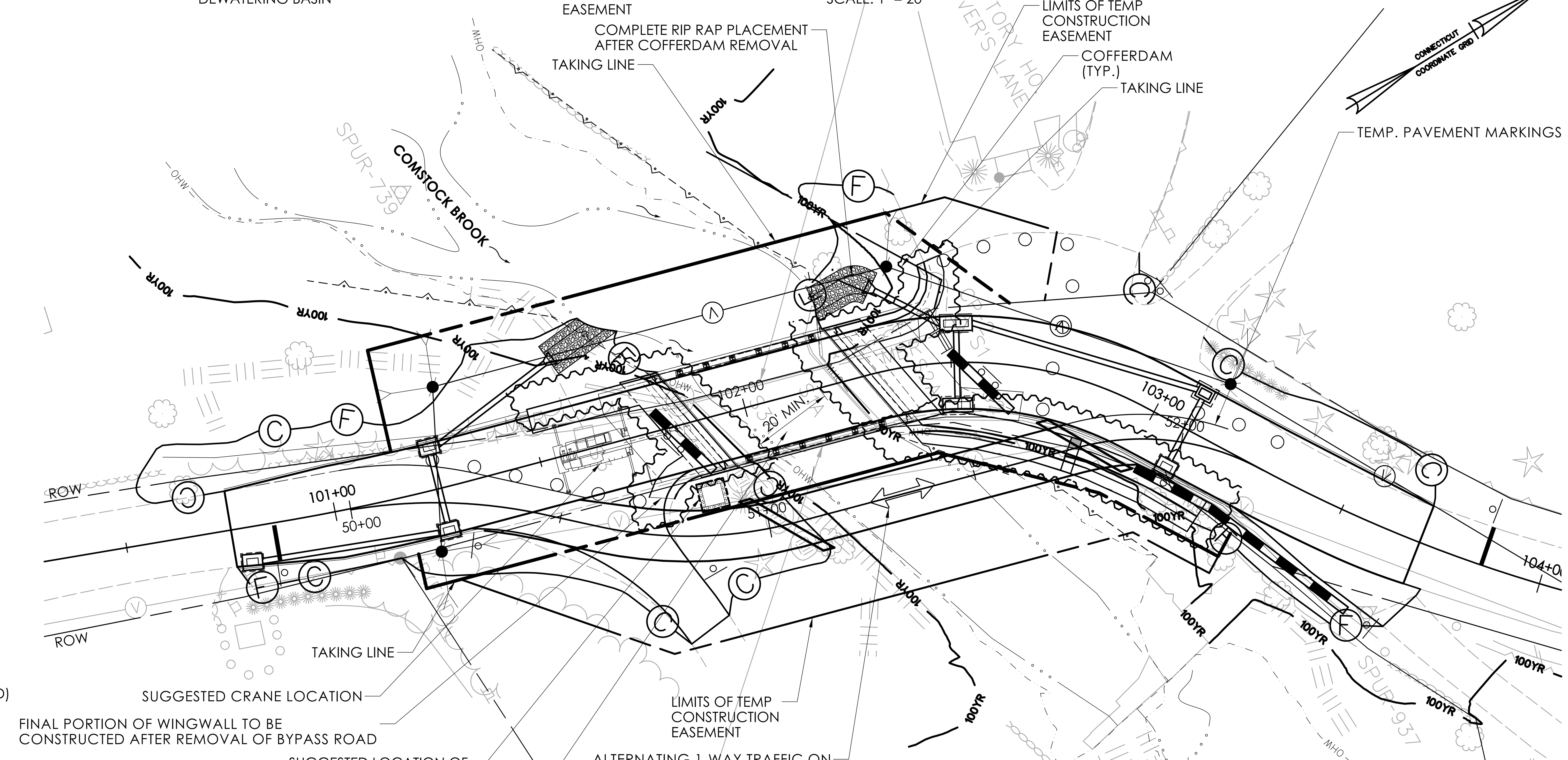
PLOTTED DATE: 4/14/2022



STAGE 1 PLAN
SCALE: 1" = 20'

SUGGESTED STAGE 1 CONSTRUCTION SEQUENCE

1. RELOCATE OVERHEAD UTILITY PRIOR TO STAGE 1.
2. PERFORM SITE CLEARIING AND GRUBBING ACTIVITIES.
3. INSTALL SEDIMENTATION CONTROL SYSTEM.
4. INSTALL TEMPORARY TRAFFIC CONTROL FEATURES.
5. INSTALL STAGE 1 TEMPORARY COFFERDAM ALONG NE RETAINING WALL.
6. DEMOLISH NE RETAINING WALL.
7. CONSTRUCT NEW NE RETAINING WALL. CONSTRUCT TEMPORARY BYPASS BRIDGE ABUTMENTS.
8. BACKFILL BEHIND NE RETAINING WALL AND REMOVE STAGE 1 TEMPORARY COFFERDAM.
9. INSTALL TEMPORARY BYPASS BRIDGE (CONTRACTOR DESIGN).



STAGE 2 PLAN
SCALE: 1" = 20'

SUGGESTED STAGE 2 CONSTRUCTION SEQUENCE

1. SHIFT TRAFFIC ONTO TEMPORARY ROAD AND BRIDGE.
2. INSTALL STAGE 2 TEMPORARY COFFERDAMS.
3. REMOVE EXISTING ABUTMENTS AND WINGWALLS, PERFORM STRUCTURE EXCAVATION AND CONSTRUCT PROPOSED ABUTMENTS & WINGWALLS.
4. BACKFILL BEHIND ABUTMENTS UP TO APPROACH SLAB ELEVATION.
5. REMOVE STAGE 2 TEMPORARY COFFERDAMS.
6. INSTALL BEARINGS, BEAMS, APPROACH SLABS, AND DECK.
7. INSTALL BRIDGE RAILING AND END BLOCKS.
8. COMPLETE ROADWAY WORK AND REOPEN BRIDGE TO TRAFFIC.
9. REMOVE TEMPORARY BYPASS BRIDGE AND ABUTMENTS.
10. RESTORE DISTURBED AREAS WITH TURF ESTABLISHMENT AND PLANTING.

LEGEND

100YR	FEMA 100-YEAR FLOOD (CALCULATED)
OHW	ORDINARY HIGH WATER (OHW)
	STATE/ FEDERAL WETLANDS
SF	SEDIMENTATION CONTROL SYSTEM

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB
SIGNATURE/ BLOCK:

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: STAGING AND WATER HANDLING PLAN - 1
DRAWING NO. PMT - 06
SHEET NO.

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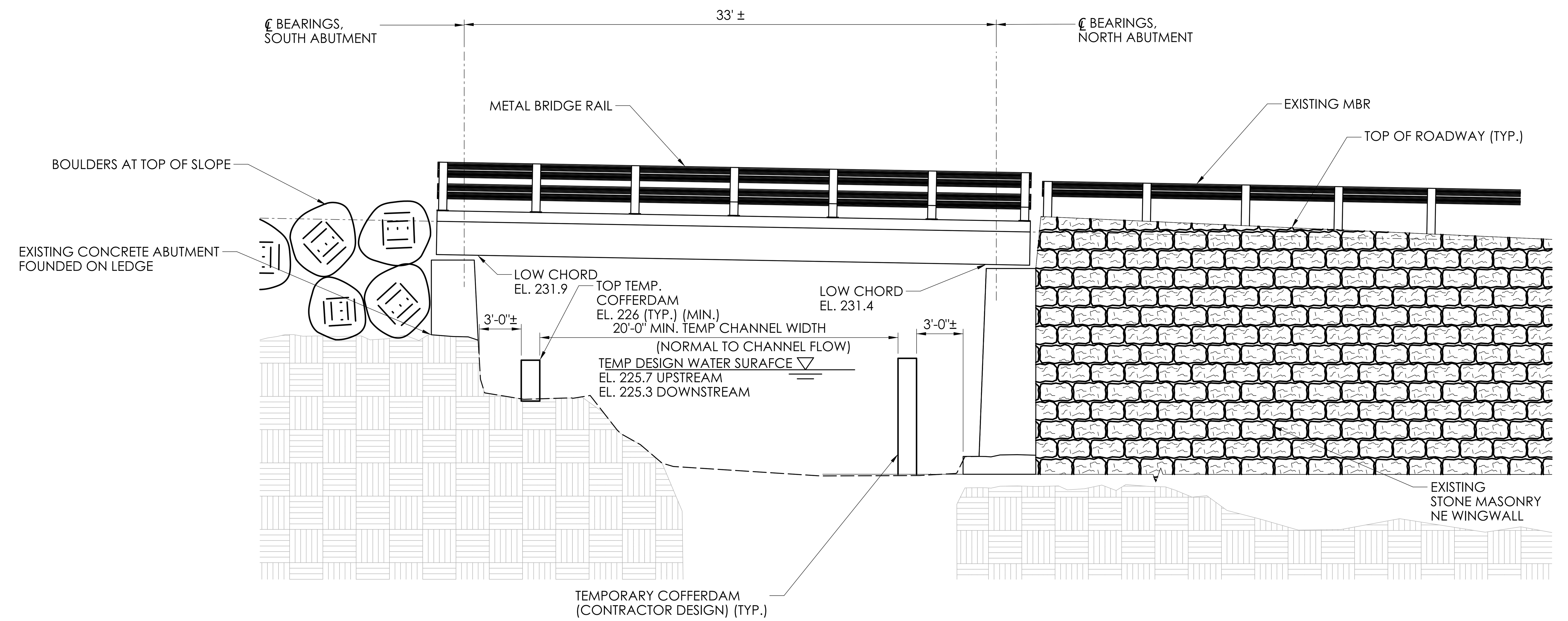
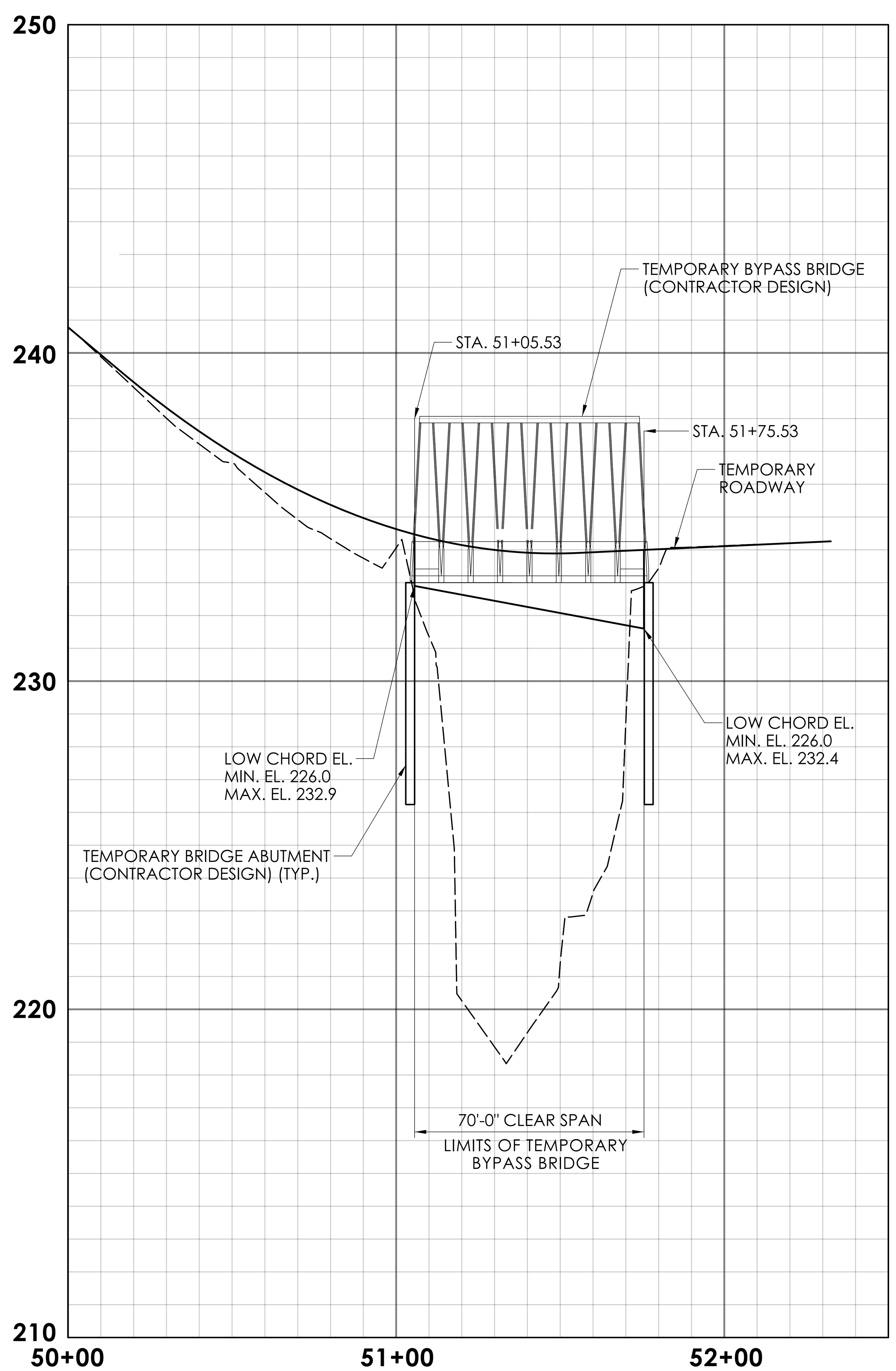


EXISTING BRIDGE EAST ELEVATION (DOWNSTREAM)

SCALE: 1" = 5'



TEMPORARY ROADWAY PROFILE

COFFERDAM AND DEWATERING NOTES

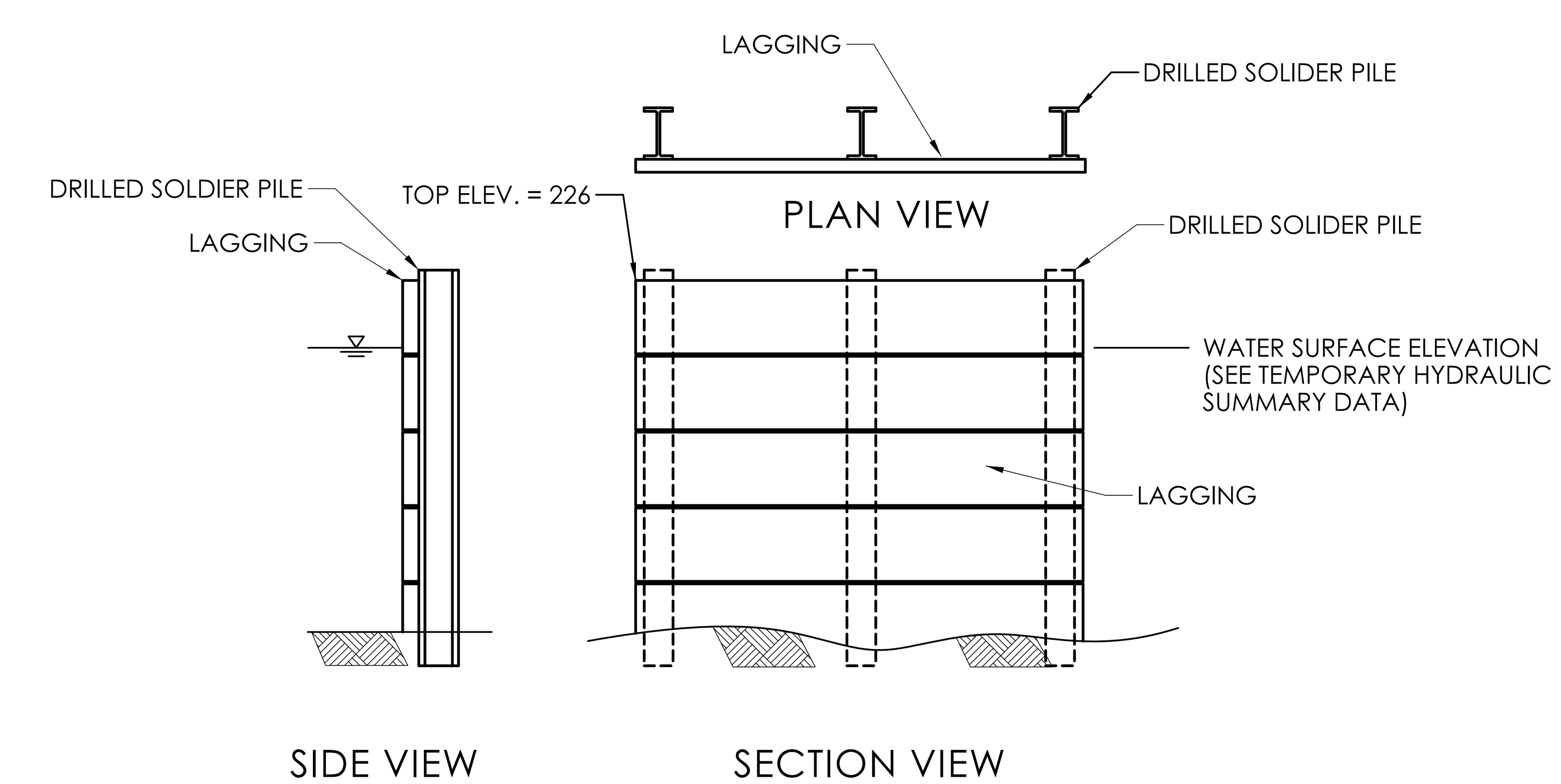
1. THE CONTRACTOR SHALL MAINTAIN WATER FLOW AND FISH PASSAGE THROUGH SITE DURING CONSTRUCTION OF THE NEW STRUCTURE.

2. EQUIPMENT SHALL NOT BE PERMITTED IN THE WATERCOURSE WHEN COFFERDAM IS NOT IN PLACE.

3. A PUMP DISCHARGE BASIN/SILT BAG SHALL BE ESTABLISHED OUTSIDE OF THE WETLAND LIMITS AND WITHIN THE RIGHT OF WAY IF POSSIBLE. THE LOCATION OF THE DEWATERING BASIN IS APPROXIMATE. THE EXACT POSITION MAY VARY BASED ON THE PUMPING DESIGN SUBMISSION AND APPROVED BY THE ENGINEER. DEWATER WORK AREAS BY PUMPING TO DEWATERING BASIN.

4. TEMPORARY COFFERDAM SHALL CONSIST OF SOLIDER PILES AND LAGGING OR ANY OTHER APPROVED SYSTEM THAT THE CONTRACTOR ELECTS TO USE WHICH WILL SAFELY CONVEY WATER FLOWS THROUGH THE CONSTRUCTION AREA, SHALL BE ABLE TO SUPPORT CONSTRUCTION ACTIVITY AND EXCAVATION, AND SHALL CONFORM TO PERMITS.

5. TEMPORARY COFFERDAM AND DEWATERING SHALL BE PAID FOR UNDER THE ITEM "COFFERDAM AND DEWATERING", SEE SPECIAL PROVISIONS.



COFFERDAM

NOT TO SCALE

TEMPORARY HYDRAULICS SUMMARY DATA	
AVERAGE DAILY FLOW (CFS)	13
AVERAGE SPRING FLOW (CFS)	26
2-YEAR FREQUENCY DISCHARGE (CFS)	500
TEMPORARY DESIGN DISCHARGE (CFS)	500
TEMPORARY DESIGN FREQUENCY	2 YEAR FLOW
TEMPORARY WATER SURFACE ELEVATION (FT)	225.7 UP, 225.3 DOWN

TIME-OF-YEAR BMP NOTE:

ANY "UNCONFINED" INSTREAM WORK WITHIN THE BROOK SHALL BE RESTRICTED TO THE PERIOD FROM JUNE 1 TO SEPTEMBER 30, INCLUSIVE.

ENVIRONMENTAL PERMIT PLANS

PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA   CHECKED BY: SB

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: STAGING AND WATER HANDLING PLAN - 2

DRAWING NO. PMT-07
SHEET NO.

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PLOTTED DATE: 4/14/2022

SCHEMATIC PLANTING PLAN
SCALE: N.T.S.

PERMIT PLANT LIST

BOTANICAL NAME	COMMON NAME	SIZE	QTY.	SPACING	WETLAND INDICATOR
ACER RUBRUM	RED MAPLE	8-10 FT TREE	8	FIELD LOCATED	FAC & FACU
CLETHRA ALNIFOLIA	SWEET PEPPERBUSH	3 GAL. CONT.	10	FIELD LOCATED	FAC+
CORNUS AMOMUM	SILKY DOGWOOD	3 GAL. CONT.	10	FIELD LOCATED	FACW
ILEX VERTICILLATA	WINTERBERRY HOLLY	3 GAL. CONT.	8	FIELD LOCATED	FACW+
CONTROL AND REMOVAL OF INVASIVE VEGETATION			±6,000 SF		
CONSERVATION SEEDING FOR SLOPES			±6,000 SF		
WETLAND GRASS ESTABLISHMENT			±230 SF		

LEGEND

- 100YR — FEMA 100-YEAR FLOOD (CALCULATED)
- OHW — ORDINARY HIGH WATER (OHW)
- STATE/ FEDERAL WETLANDS
- SF — SEDIMENTATION CONTROL SYSTEM
- CONTROL AND REMOVAL OF INVASIVE VEGETATION
- PROPOSED TREE
- PROPOSED SHRUBS
- EXISTING TREE TO BE REMOVED

NOTES

1. DISTURBED AREAS BELOW THE WETLAND LIMIT SHALL BE SEEDED WITH WETLAND GRASS ESTABLISHMENT. DISTURBED AREAS ABOVE THE WETLAND LIMIT SHALL BE SEEDED WITH CONSERVATION SEEDING FOR SLOPES, OR OTHER SEED MIX AS SPECIFIED. ALL DISTRUBED AREAS SHALL BE RESTORED.

2. ALL PLANT MATERIAL SHALL BE STRAIGHT SPECIES. NO VARIETIES OR CULTIVARS WILL BE ACCEPTED.

3. NO PLANTINGS TO BE PLACED IN MOW AREA.

4. PROJECT AREA TO BE TREATED FOR INVASIVES AND PROPERLY PREPARED FOR FINAL PLANTING, SEEDING, AND RESTORATION.

ENVIRONMENTAL PERMIT PLANS
PLAN DATE: APRIL 8, 2022

DESIGNER/DRAFTER: JA CHECKED BY: SB

0 20 40
HORIZONTAL SCALE 1"=20

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
TOWN OF WILTON

PROJECT NUMBER: 0161-0142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: PERMIT PLANTING PLAN

DRAWING NO. PMT-08
SHEET NO.

LASTED SAVED BY: DWhittemore FILE NAME: J:\DWG\P2016\0182\E10\0055_0144\Highways\Contract_Plans\HW_MSH_Br04528_0055_0144_PLN.dgn
PLOTTED DATE: 4/14/2022

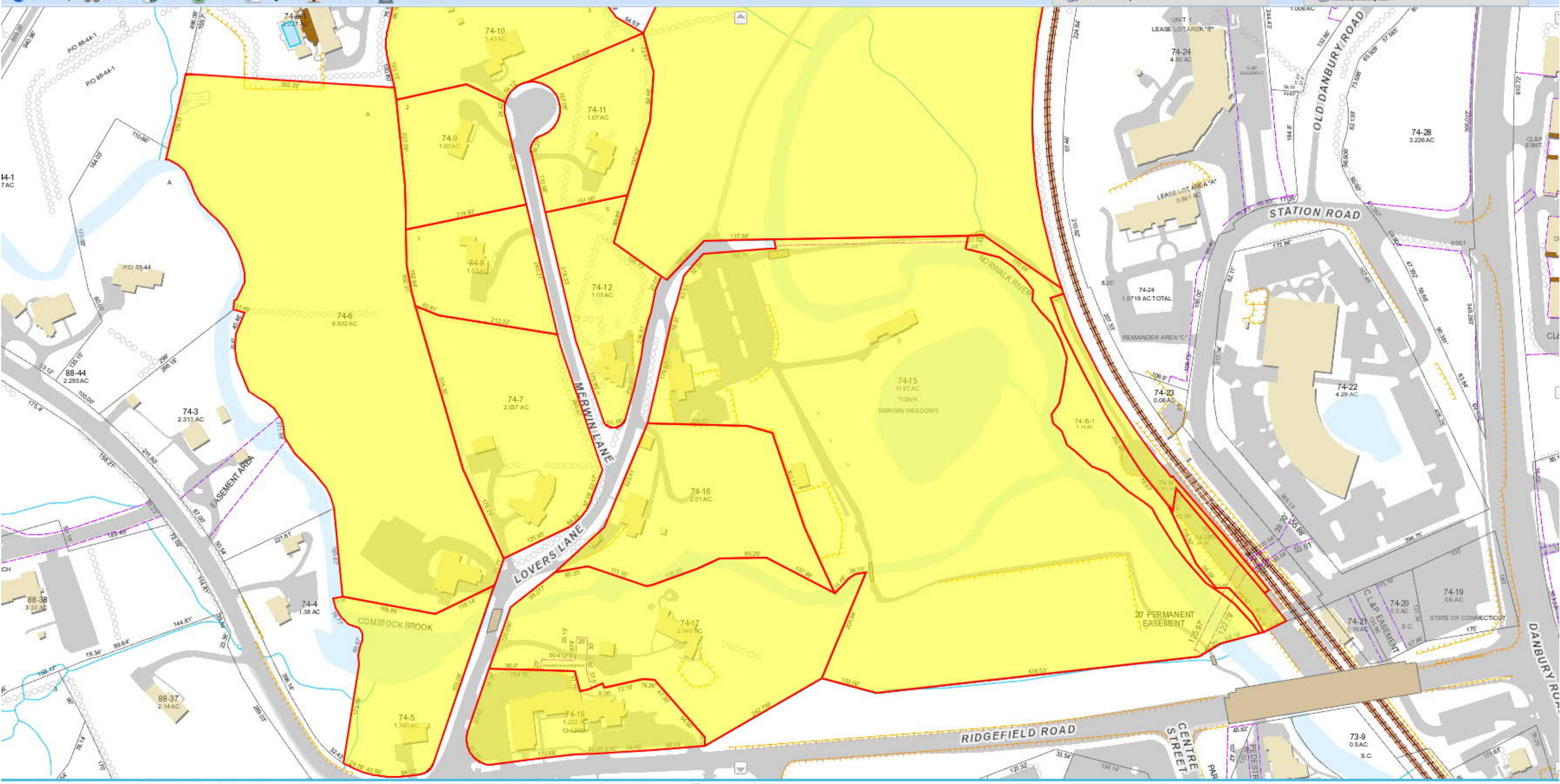
Attachment E: Names and Addresses of Abutting Property Owners

Abutters List

74-5 Jonathan A. Foltz Isabel Foltz 80 Ridgefield Road Wilton, CT 06897	74-18 Wilton Congregational Church 70 Ridgefield Road Wilton, CT 6897
74-6 Wilton Congregational Church 70 Ridgefield Road Wilton, CT 06897	
74-7 David Schoetz Adrienne Schoetz 19 Lovers Lane Wilton, CT 06897	
74-8 Dennis W. Anastos Tereasa M. Anastos 23 Merwin Lane Wilton, CT 06897	
74-9 Joan H. Holmes 25 Merwin Lane Wilton, CT 06897	
74-10 Michael S. Craig Juliet Craig 27 Merwin Lane Wilton, CT 06897	
74-11 Piotr Grzywacz 29 Merwin Lane Wilton, CT 06897	
74-12 48 West Norwalk Road, LLC 33 Lovers Lane Wilton, CT 06897	
74-13, 74-14, 74-15 Town of Wilton 238 Danbury Road Wilton, CT 06897	
74-16 Blue Heron Landing, LLC 26 Lovers Lane Wilton, CT 06897	
74-15-1, 7-29 State of Connecticut 450 Capitol Avenue Hartford, CT 06106	
74-17 Donald A. Allers Eileen P. Allers 10 Lovers Lane Wilton, CT 06897	

wilton.mapxpress.net/ags_map/

Reset Map | Search | Print | Select | Legend | GIS Home | Town Hall | Base Maps / Air Photos | Map Layer



Zoom In | Zoom Out | Prev Extent | Next Extent | Pan | Parcel Information | Simple Measure | Path Measure | Area Measure

Scale: 1 in = 150 ft

CT State Plane NAD 1983 - X,Y 810482, 633966

Attachment F: Project Narrative
State Construction Project Number: 161-142
Town: Wilton
Bridge Number: 04975 - Lovers Lane over Comstock Brook

Project Need and Description:
Bridge No. 04975 was originally constructed in 1930. The single span structure is 33' long and has a roadway curb-to-curb width of 16'-6". The bridge is located approximately 400' north from the intersection of Lovers Lane with CT-33 (Ridgefield Road). The existing bridge superstructure is comprised of a concrete deck with bituminous concrete wearing surface supported by six concrete encased steel girders. The bridge superstructure is supported by concrete abutments with the south abutment founded on ledge and the north abutment is supported by footings of unknown depth, size and bearing stratum. The bridge provides the only ingress and egress to approximately nine residential properties north of the structure on Lovers Lane and Merwin Lane as well as access to the Merwin Meadows Park. The estimated Average Daily Traffic (ADT) on the bridge is 508 vehicles based on traffic counts performed by the Town in June 2019. Comstock Brook flows under the bridge from west to east. A weir is located approximately 80-ft downstream of the bridge resulting in a ponded area at the bridge due to the downstream dam.

A complete bridge replacement is necessary due to condition of the existing bridge. The existing roadway width over the bridge is inadequate for the average daily traffic and does not meet current federal, state and town standards. The load carrying capacity of the superstructure is unknown. The existing metal bridge rail system does not meet current crash test and safety standards. The substructure is in poor condition due to extensive concrete deterioration and the bridge is considered to be scour critical based on CTDOT's most recent inspection report dated November 16, 2021.

Maintenance and Protection of Traffic during construction of the proposed bridge will involve the use of a temporary bridge installed east of the existing bridge to accommodate an alternating one-way traffic operation with temporary signalization. The proposed work is anticipated to take one construction season and will begin in the spring of 2023.

Mapping:
Site maps are included with this application in Attachments B and C.

Proposed Project:
The proposed project will include:
- The complete removal of the existing bridge including superstructure, wingwalls and abutments
- Full Replacement with a new prestressed concrete deck unit superstructure, supported by new cast-in-place concrete abutments and wingwalls, founded on bedrock
- Installation of an open bridge rail system meeting current standards
- Increased Span Length = 36 feet (normal to flow)
- Increased Roadway Curb-to-Curb Width = 22 feet
- Stone masonry facing on exposed concrete surfaces for improved aesthetics
- Modifications and improvements to existing roadway drainage system
- Full depth pavement reconstruction on both approaches to the bridge and new timber guiderail systems on the bridge's approaches

- Installation of a temporary bridge east of the existing bridge will provide a crossing for vehicular and pedestrian traffic.

Construction is anticipated to begin in the Spring of 2023 and be completed in Fall of 2023.

Inland Wetlands and Watercourses:

A wetlands delineation was conducted in November of 2019. The Wetland Delineation Report prepared by the Hidden Garden and Connsoil, LLC is attached for review. Wetlands were found on both east and west sides of Comstock Brook, upstream and downstream of the bridge. The project site does not cross Natural Diversity Database screening area per December 2021 mapping. Comstock Brook at Bridge No. 04975 is located in the Comstock Brook subregional watershed basin (# 7301), which is part of the regional Norwalk watershed basin (#73). Comstock Brook flows west to east, terminating into the Norwalk River, east of the project. The watershed area of Comstock Brook draining to the bridge is approximately 7.4 square miles. It makes up the majority of the Town of Wilton and can be characterized as mostly deciduous forest with a notable portion of turf grass in the northern portion and developed area. There is no notable storage within the watershed. According to the National Wetlands Inventory, Comstock Brook is classified as a riverine habitat R5UBH, and has a constant flow of water.

The CT DEEP Fisheries Unit has reviewed the subject project and provided the following guidance: The proposed condition is to maintain existing pool habitat condition. The following fisheries resources of the area (including: Blacknose Dace, Creek Chub, Common Shiner, wild Brook Trout, Tessellated Darter, White Sucker, catadromous American Eel) shall have a pool habitat maintained through project area created by downstream dam. TOY restriction from June 1st to September 30th for unconfined instream work. Best management practices, including proper erosion and sedimentation controls, will be incorporated throughout project.

Per the CT DPH Drinking Water Section GIS Map Viewer, the project area is not within a Drinking Water Watershed area nor Aquifer Protection Area. A notification letter of the subject project was emailed to the CT Department of Public Health Drinking Water Section was on September 17, 2019. Please see attached correspondence. A response from the DPH was never returned.

Floodplain:

Bridge No. 04975 falls within FEMA floodplain Zone AE, a regulatory floodway with FEMA Elevations: 230 FT (upstream); 229 FT (downstream) according to FEMA FIRM Flood Panels (09001C0379F and 09001C0383F Effective Date 6/18/2010).

Stormwater (ground disturbance):

Ground disturbance is anticipated to be less than one acre, due to bridge widening and planned water-handling. Temporary water-handling cofferdams will be installed around the existing abutments to allow for their removal as well as construction of the new abutment and wingwalls. Installation of the temporary bridge may result in temporary ground disturbance; the pedestrian bridge will be removed after construction is complete and the area restored to previous conditions. Tree removal is necessary for construction of the temporary bridge abutments and relocation of utilities- Please refer to the permit planting plan which shows tree removals and restoration plan upon completion of construction (PMT-08).

Additional Information:

Residential land use R-2 surrounds the bridge and Merwin Meadows Park is located at the end of Lovers Lane to the northeast of the project area. Lovers Lane is the only road providing automotive access to park. The Norwalk River Valley Trail accessible from the Merwin Meadows Park parking lot and from Danbury Road (Route 33). School Road crosses through the northern tip of the park, but does not provide a designated parking lot or access to the trail system that goes through the park. A train station is located to the southeast of Merwin Meadows Park on Route 33 and a foot trail leads to the park. The trail runs through the park. According to CT DEEP Natural Diversity Data Base December 2021 mapping for Wilton, Connecticut, the project area is not within any critical habitat, and does not contain any state or federal endangered species.

Alternatives Considered:

A meeting was held with the Town of Wilton on April 9th, 2019 to understand the town's needs and requirements and discuss potential rehabilitation/replacement alternatives. The Town concurred with evaluating only bridge replacement alternatives. Although alternates are typically required, none of them would achieve compliance with the Flood Management requirements as well as needed safety improvements while providing access to the homes and park. The existing alignment of the bridge is being maintained and a larger opening is being provided to comply with US Army Corps of Engineers design and permitting standards as the existing opening or smaller openings do not achieve compliance.

Attachment F-2: Project Notification to CT DPH Drinking Water Section

Dubina, Stephany

From:	Stephany Dubina
Sent:	Tuesday, September 17, 2019 2:32 PM
To:	dph.sourceprotection@ct.gov
Cc:	Byrnes, Marc P; 'Andrew.H.Davis@ct.gov'; Thomas Lopata; Bhardwaj, Priti S.
Subject:	State Project Nos. 161-142 and 161-143 - Bridges 04975 and 05501 - Town of Wilton
Attachments:	02_2019_09_17_04975_letter_to_DPH.pdf; 02_2019_09_17_05501_letter_to_DPH.pdf

Good Afternoon,

Please find the attached evaluation request packages for the newly assigned CT DOT State Administered Federal Local Bridge Program (FLBP) projects in the Town of Wilton.

Sincerely,

Stephany Dubina | Assistant Project Engineer
sdubina@cmeengineering.com
CME
101 East River Drive, First Floor, East Hartford, CT 06108
T 860.290.4100 ext. 1105 www.cmeengineering.com

Architecture

Engineering

Planning

Land Surveying

Environmental Services

September 16, 2019

Mr. Eric McPhee
Connecticut Department of Public Health
Drinking Water Section
Source Water Protection Unit
410 Capitol Avenue
Hartford, Connecticut 06134

Sent via email: dph.sourceprotection@ct.gov

Subject: **State Administered Bridge Program**
Bridge Replacement Project in Wilton

Dear Mr. McPhee:

In providing Consultant Liaison Engineering services for the Connecticut Department of Transportation, CME Associates, Inc. assists in the administration of federal and state funding allocations to municipalities for local bridge rehabilitation projects under the Federal Local Bridge Program.

One of the responsibilities in providing liaison engineering services is to ensure that public health is protected as the subject project commences and progresses to completion. Enclosed please find a location map, description and photograph sheets for the following bridge project:

Temporary Project No.:	161-142
Bridge No.:	04975
Municipality:	Wilton
Location:	Lovers Lane
Feature Crossed:	Comstock Brook
Scope:	Replacement of existing Bridge

We request your evaluation of potential project impacts to nearby aquifer protection areas and recommendations of any public drinking water source protection measures that should be implemented. If you require additional information or have any questions, please contact our office. We would appreciate receiving your response as soon as possible.

Sincerely,

Digitally signed by Thomas J. Lopata
DN: C=US, E=tlopata@cmeengineering.com, O=CME Associates, CN=Thomas J. Lopata
Date: 2019.09.16 16:17:24-04'00'

Thomas J. Lopata, P.E.
Project Engineer, Federal Local Bridge Program

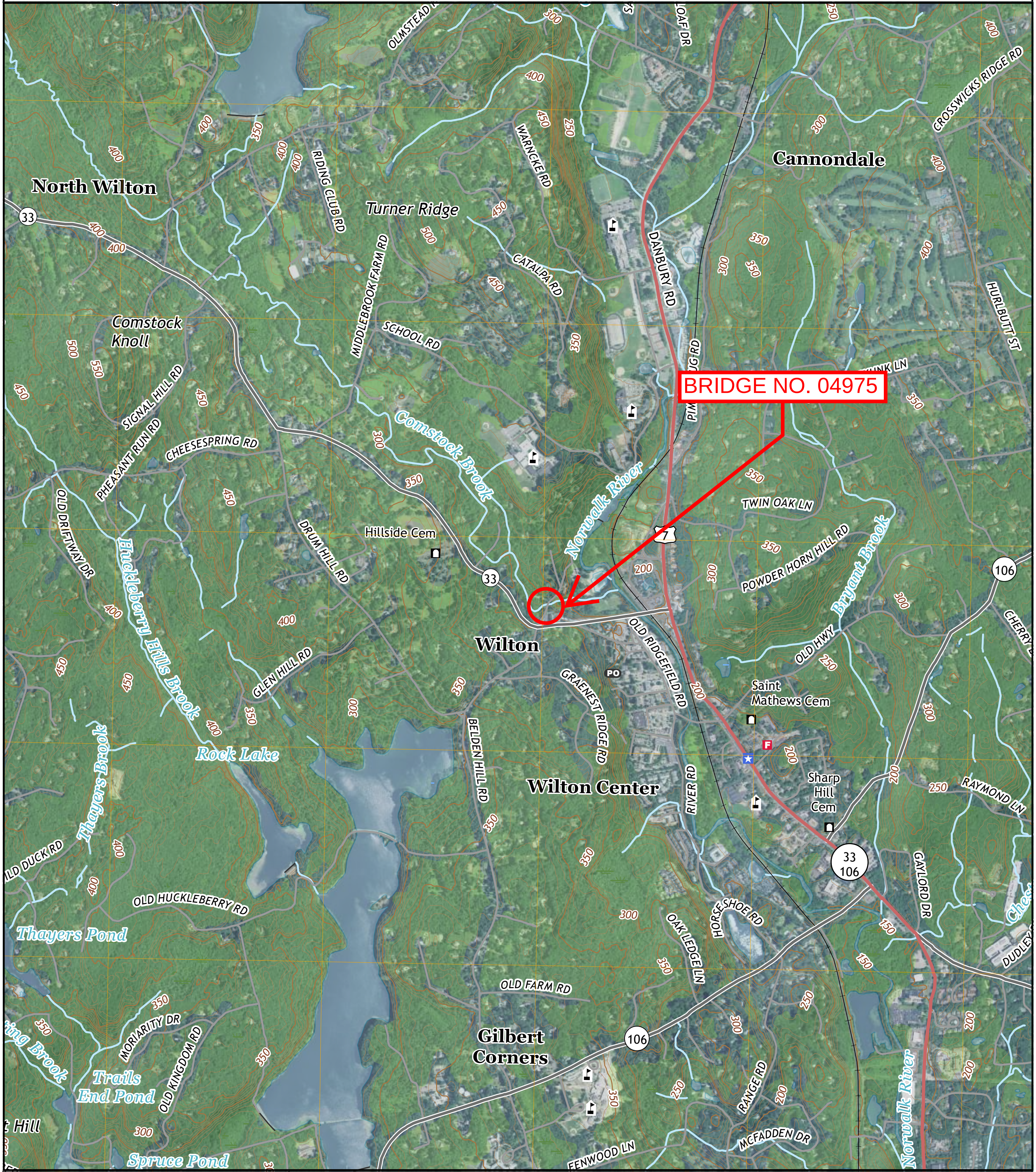
Enclosures

cc: Kimberly C. Lesay – Andrew H. Davis
Priti S. Bhardwaj – Marc P. Byrnes

Engineers
Designers
Consultants
Planners
Scientists
CME
101 East River Drive, 1st Floor East Hartford, CT 06108
T 860.290.4100 • www.cmeengineering.com

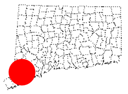
USGS QUADRANGLE MAP

BRIDGE NO. 04975 IN WILTON, CT
LOVERS LANE OVER COMSTOCK BROOK



N

USGS QUAD MAP #107
NORWALK NORTH, CONNECTICUT



1 INCH = 2,000 FEET

0 | 1,000 | 2,000 | 4,000 | 6,000 Feet

PROJECT DESCRIPTION
State Project Number: 161-142
Town/City: Wilton
Bridge Number: 04975 Lovers Lane over Comstock Brook

Project Need and Description:

Bridge No. 04975, Lovers Lane over Comstock Brook, in Wilton, Connecticut was originally constructed in 1930. This single span bridge is comprised of a steel structure, a concrete cast in place deck which has been repaved since the last inspection. The substructure consists of girders, and concrete gravity abutments and stone masonry wingwalls. The bridge is located approximately 250-feet northeast of Ridgefield Road (Route 33) in Wilton, Connecticut. The bridge features a skew of 26 degrees with a span of 33’-0” measured between the centerline of bearings and an overall length of 37’-0”. The out-to-out width of the bridge is 18’-2” and the bridge’s curb-to-curb width is 16’-6”. The two-lane roadway is classified as an Urban Local Road and the average daily traffic count is 393 vehicles with 7% truck traffic as reported in the Connecticut Department of Transportation (DOT) Routine and Underwater Inspection dated November 16, 2017.

A full replacement of Bridge No. 04975 is recommended based on current ratings. The bridge is structurally deficient, not meeting current safety standards. There is heavy rusting on the bottom flanges, and the encasement at girder 4 has hollow areas and cracks up to 15-feet long and 0.25-inch wide. The southern abutment is stone masonry with a concrete bridge seat, which has hairline cracks with efflorescence and rust stains. The northern abutment is concrete and has hairline cracks with efflorescence. There is moderate erosion along the southeast wingwall, with an erosion and scour critical rating appraisal rating of 3, meaning the bridge is scour critical. The superstructure has an overall rating of 5, meaning it is in fair condition and the substructure has an overall rating of 4, meaning it is in poor condition, as reported in the DOT Routine and Underwater Inspection dated November 16, 2017.

Mapping:

Site maps are attached.

Photos:

Site photos are attached.

Proposed Project:

Bridge No. 04975 is currently in the preliminary engineering phase under the DOT Federal Local Bridge State Administered Program for structures requiring major rehabilitation or replacement. The project scope has not yet been finalized; however, it is anticipated that a full replacement of the bridge will be necessary.

Inland Wetlands and Watercourses:

According to the National Wetlands Inventory, Comstock Brook is classified as a riverine habitat R5UBH, and has a constant flow of water. There is an approximate drainage area of 7.37 square miles here. Bridge

No. 04975 is located in the Comstock Brook subregional watershed basin (# 7301), which is part of the regional Norwalk watershed basin (#73). Comstock Brook flows west to east, terminating into the Norwalk River, east of the project. A wetland delineation will be performed to determine the presence of state and federal wetlands located within the project area.

Floodplain:

The Project site falls within FEMA floodplain with mapped floodway according to FEMA FIRM Flood Panels (09001C0379F and 09001C0383F Effective Date 6/18/2010) with an approximate 100-year water surface elevation of 229.7 feet).

Stormwater (ground disturbance):

Ground disturbance is anticipated to be less than one acre.

Additional Information:

Residential land use R-2 surrounds the bridge and Merwin Meadows Park is located at the end of Lovers Lane to the northeast of the project area. Lovers Lane is the only road providing automotive access to park. The Norwalk River Valley Trail accessible from the Merwin Meadows Park parking lot and from Danbury Road (Route 33). School Road crosses through the northern tip of the park, but does not provide a designated parking lot or access to the trail system that goes through the park. A train station is located in to the southeast of Merwin Meadows Park on Route 33 and a foot trail leads to the park. The trail runs through the park. According to CT DEEP Natural Diversity Data Base June 2019 mapping for Wilton, Connecticut, the project area is not within any critical habitat, and does not contain any state or federal endangered species.

Bridge No. 04975 Site Location, Town of Wilton GIS mapping.

Bridge No. 04975, the Norwalk River Valley Trail System, and Merwin Meadows Park, Google Maps.

West upstream elevation.

Southern approach to bridge.

Condition of superstructure.

Abutment No. 2.

Downstream dam face.

THE HIDDEN GARDEN
AND CONNSOIL, LLC
Cynthia Rabinowitz

WETLAND DELINEATION REPORT
LOCAL BRIDGE 161-142
LOVER'S LANE OVER COMSTOCK BROOK
TOWN OF WILTON, CONNECTICUT

Prepared for

CME ASSOCIATES, INC.
33 WILBUR CROSS WAY, SUITE 105

Prepared by

CYNTHIA RABINOWITZ
HGCONNSOIL,LLC.

PO BOX 365
BETHLEHEM, CT 06751
Cynthia.rabinowitz@gmail.com

11/16/2019

Introduction

Wetland delineation services were conducted in accordance with the contract between CME Associates, Inc. and HGConnsoil, LLC, dated October 2, 2019. The scope of services are: field delineation of boundaries for State of Connecticut wetland; Federal wetland; Ordinary High Water Level; provision of ACOE data forms documenting Federal delineation transect; Functions and Values Assessment form (ACOE Highway Methodology); and site photographs.

A sketch of the approximate location of these boundaries was provided to CME Associates, Inc. on October 27, 2019 and is attached to this document as Appendix A. The sketch is not to scale and is to be used as guidance as to approximate flagging locations for survey crew use only.

Important Note

The wetland boundaries and ordinary highwater boundary are not flagged along the south east side of the river because of steepness and inaccessibility. All jurisdictional boundaries are designated at the toe of the steep slope, by professional judgment.

Wetland sketch is provided in Appendix A, page 3.

ACOE data forms are provided in Appendix B, page 4.

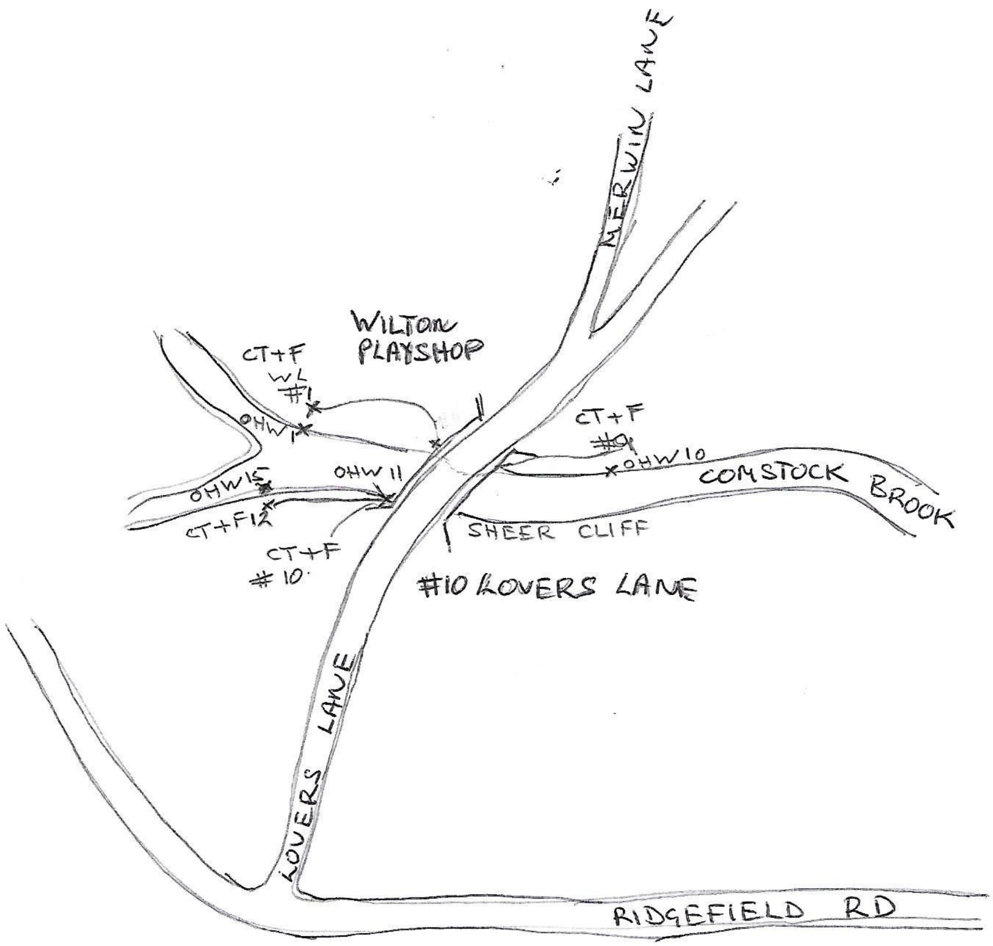
Functions and Values Assessment form is provided in Appendix C, page 10.

Site Photographs are provided in Appendix D, page 11.

APPENDIX A

BRIDGE 161-142 WILTON

LOVERS LANE OVER COMSTOCK BROOK



NOT TO SCALE

APPENDIX B

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Federal Local Bridge Project 161-143 City/County: Wilton/Fairfield Sampling Date: 11/2/2019

Applicant/Owner: Town of Wilton State: CT Sampling Point: T1 - UL

Investigator(s): Cynthia Rabinowitz Section, Township, Range: ____

Landform (hillside, terrace, etc.): river terrace Local relief (concave, convex, none): concave Slope %: 0

Subregion (LRR or MLRA): LRR R Lat: 41.195855 Long: -73.437829 Datum: ____

Soil Map Unit Name: CANTON / CHARLTON NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation X , 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	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____ No X	

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 ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Plot located between WL Flag #1 + #2

VEGETATION – Use scientific names of plants. Sampling Point: T1 - UL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	90	Yes	FAC
2. *Tsuga canadensis*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Euonymus alatus*	75	Yes	UPL
2. *Berberis thunbergii*	1	No	FACU
3.			
4.			
5.			
6.			
7.			
	76	=Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		=Total Cover	
Woody Vine Stratum (Plot size:)			
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: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	90	x 3 =	270
FACU species	11	x 4 =	44
UPL species	75	x 5 =	375
Column Totals:	176 (A)		689 (B)

Prevalence Index = B/A = 3.91

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - 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 or equal to 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 T1 - UL

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 %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3	100						fine sandy loam
2-9	10YR 4/3	100						coarse sand, loose structure
9-11	10YR 5/4	100						coarse sand, loose structure
11-16	10YR 3/3	100						fine sandy loam
16-18	10YR 3/3	100						sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked 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)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L**)
___ 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)
___ Marl (F10) (**LRR K, L**)

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**)
___ 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 (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: roots
Depth (inches): 18

Hydric Soil Present? Yes ___ No X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Federal Local Bridge Project 161-143 City/County: Wilton/Fairfield Sampling Date: 11/2/2019

Applicant/Owner: Town of Wilton State: CT Sampling Point: T1-WL

Investigator(s): Cynthia Rabinowitz Section, Township, Range: ____

Landform (hillside, terrace, etc.): river terrace Local relief (concave, convex, none): concave Slope %: 0

Subregion (LRR or MLRA): LRR R Lat: 41.195855 Long: -73.437829 Datum: ____

Soil Map Unit Name: FLUVAQUENT NWI classification: RIVERINE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation X , 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**	
Hydric Soil Present?	Yes ___ No X	**within a Wetland?**	Yes ___ No X
Wetland Hydrology Present?	Yes X No ___	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)	___ Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	x Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

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)
- x 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:
Plot is located between Wetland Flag #1 and #2. The jurisdictional wetland is a floodplain above ordinary high water. Below ordinary high water is a "beach" area comprising rocks with sandy gravelly material towards the floodplain.

VEGETATION – Use scientific names of plants. Sampling Point: T1-WL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Euonymus alatus*	100	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	100	=Total Cover	
Herb Stratum (Plot size: 10)			
1. *Alliaria petiolata*	5	Yes	FACU
2. *Persicaria spp.*	5	Yes	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10	=Total Cover	
Woody Vine Stratum (Plot size:)			
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: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	5	x 4 =	20
UPL species	100	x 5 =	500
Column Totals:	105 (A)		520 (B)

Prevalence Index = B/A = 4.95

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - 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 or equal to 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.)
Too late in season to identify Persicaria to species level. Stems withered and seed heads incomplete and dry.

SOIL

Sampling Point T1-WL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100						fine sandy loam
4-12	10YR 4/3	100						coarse material, sand and gravel, with loose structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked 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)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L**)
___ 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)
___ Marl (F10) (**LRR K, L**)

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**)
___ 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 (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: rocks

Depth (inches): 12

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015. THIS PLOT IS LOCATED (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)PLOT IS LOCATED ON AN ALLUVIAL TERRACE APPROXIMATELY 10 INCHES ABOVE ORDINARY HIGH WATER. HYDRIC SOIL NOT PRESENT BUT BASED ON GEORMOPHIC LOCATION AND SURFACE CHARACTERISTICS, PROFESSIONAL JUDGMENT WAS USED TO DETERMINE THAT THE PLOT IS WITHIN THE FLOODPLAIN OF THE BROOK AND RECEIVES FREQUENT FLOODING, BASED ON SEASONAL FLUCTUATIONS. THE PLOT IS CONSIDERED A JURISDICTIONAL WETLAND UNDER STATE OF CONNECTICUT REGULATIONS. ALTHOUGH NOT A FEDERAL WETLAND BY VIRTUE OF PRESENCE OF HYDROPHYTIC VEGETATION AND HYDRIC SOIL, THE AREA IS SUBJECT TO FLOODING AND, IN THE OPINION OF THIS DELINEATOR, SHOULD BE CONSIDERED AN AREA OF CONCERN UNDER FEDERAL REGULATIONS.

APPENDIX C

Wetland Function-Value Evaluation Form

Total area of wetland______ Human made?______ Is wetland part of a wildlife corridor? YES or a "habitat island"?______

Adjacent land use RESIDENTIAL Distance to nearest roadway or other development 40 ft.

Dominant wetland systems present RIVERINE Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? ADJACENT TO RIVER CHANNEL

How many tributaries contribute to the wetland? NONE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. BRIDGE 161-142
Latitude 41.195855 Longitude -73.437829
Prepared by: CHR Date 11/2/2019
Wetland Impact:
Type______ Area______
Evaluation based on:
Office______ Field ✓
Corps manual wetland delineation completed? Y ✓ N______

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		7, 2	7	
Floodflow Alteration		✓	3	3	Area too small
Fish and Shellfish Habitat		✓			Freshwater river adjacent to wetland may support fish or shellfish. WL-no.
Sediment/Toxicant Retention	✓		1, 2, 10, 13	10	Function limited by small size of WL
Nutrient Removal		✓			
Production Export		✓			
Sediment/Shoreline Stabilization		✓			
Wildlife Habitat		✓			
Recreation		✓			
Educational/Scientific Value		✓			
Uniqueness/Heritage		✓			
Visual Quality/Aesthetics		✓			
ES Endangered Species Habitat		✓			
Other					

Notes:

APPENDIX D

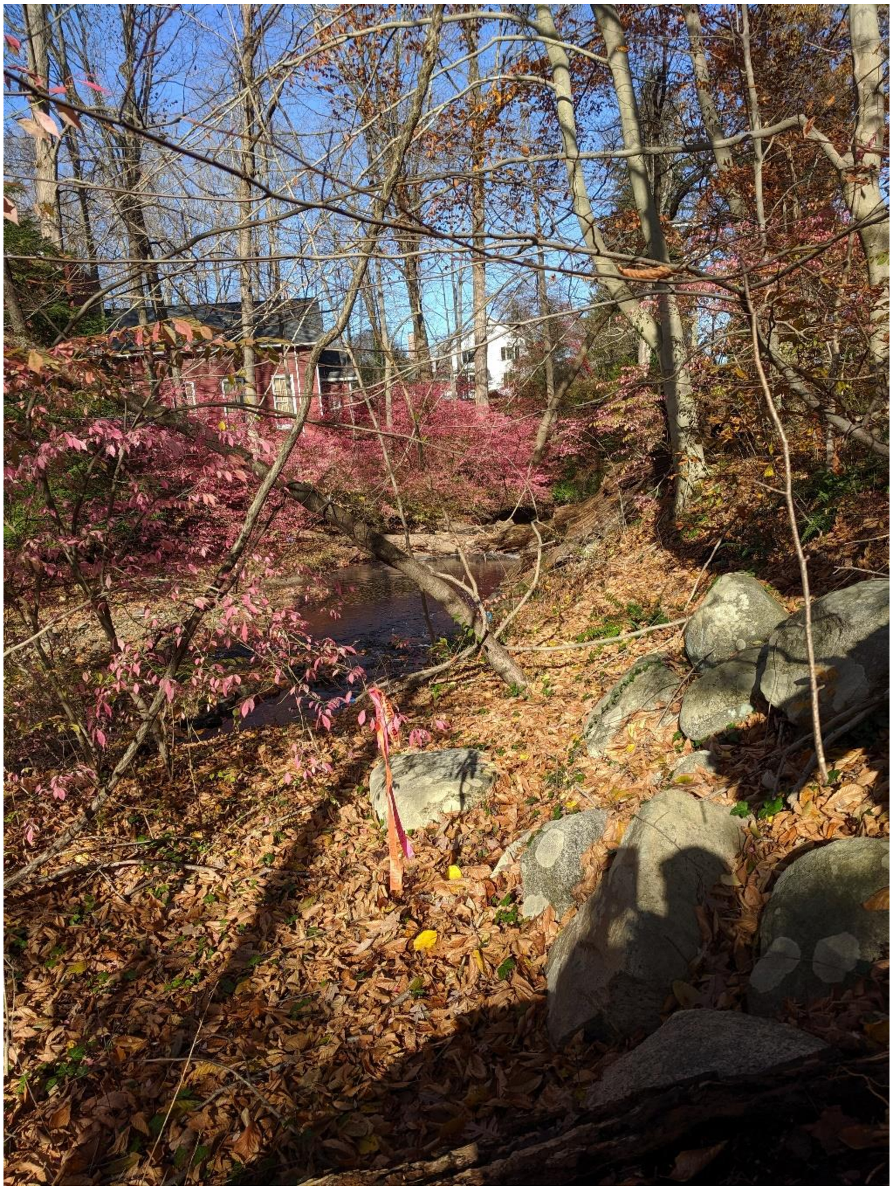


Photo 1: taken from west of bridge towards road showing upland above small floodplain along north side of river (building in background is Wilton Playshop)

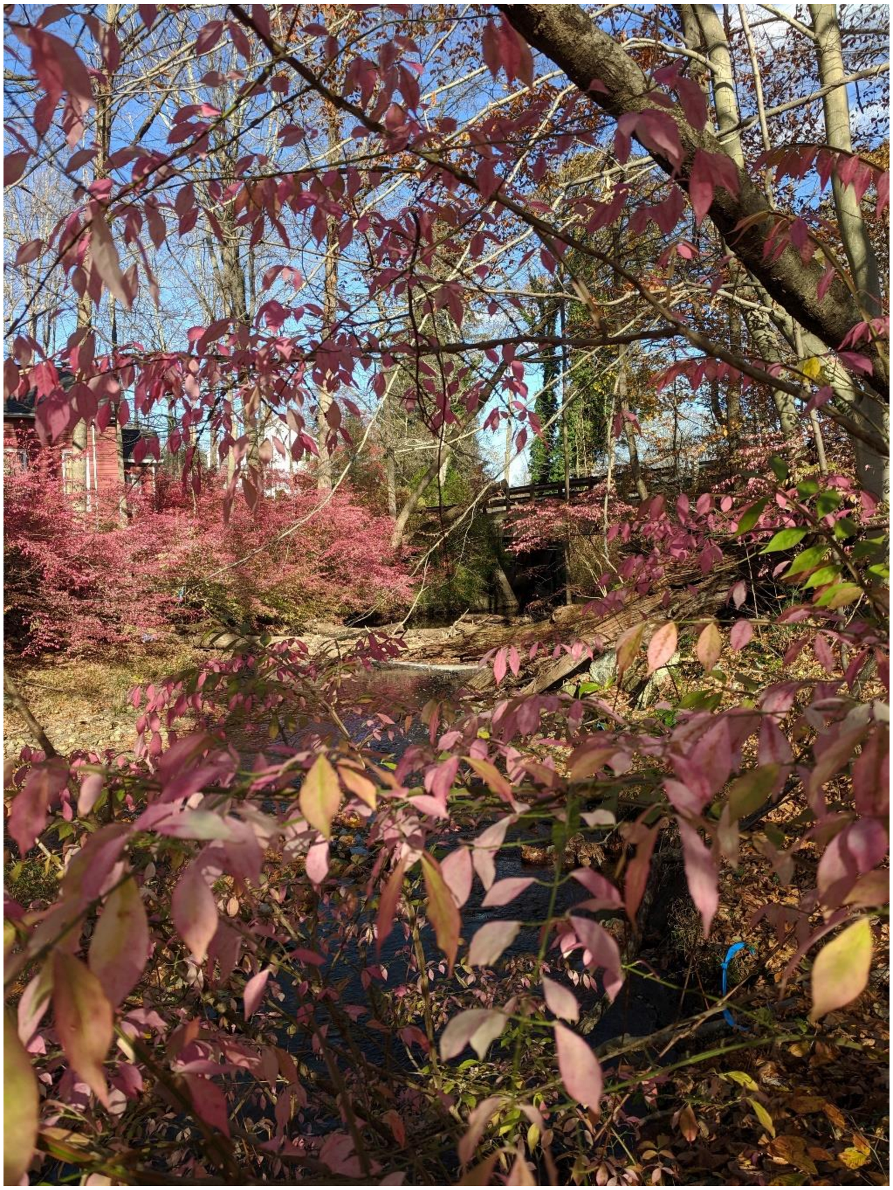


Photo 2: taken from west downstream towards bridge

Photo 3: taken from the bridge looking downstream to the east; steep bank on right side of river (south) is inaccessible and was not delineated.

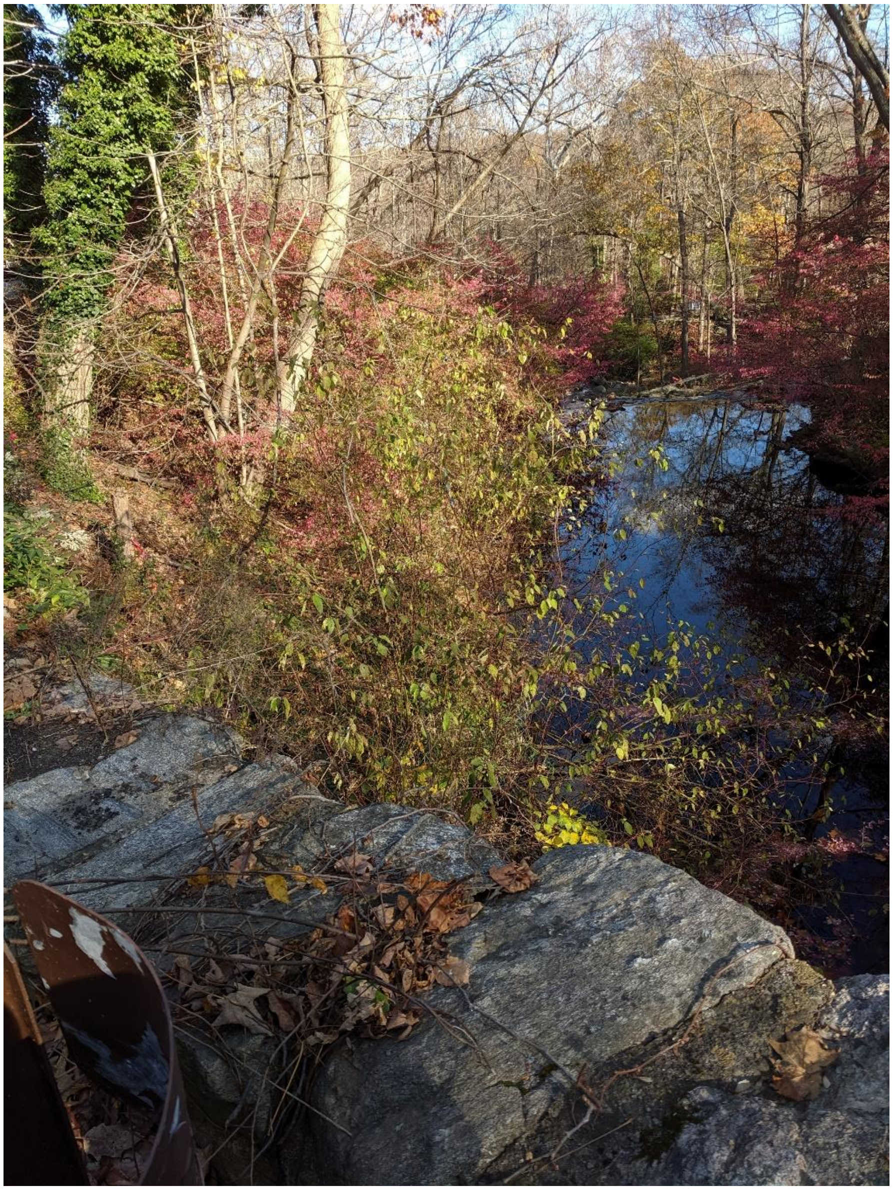


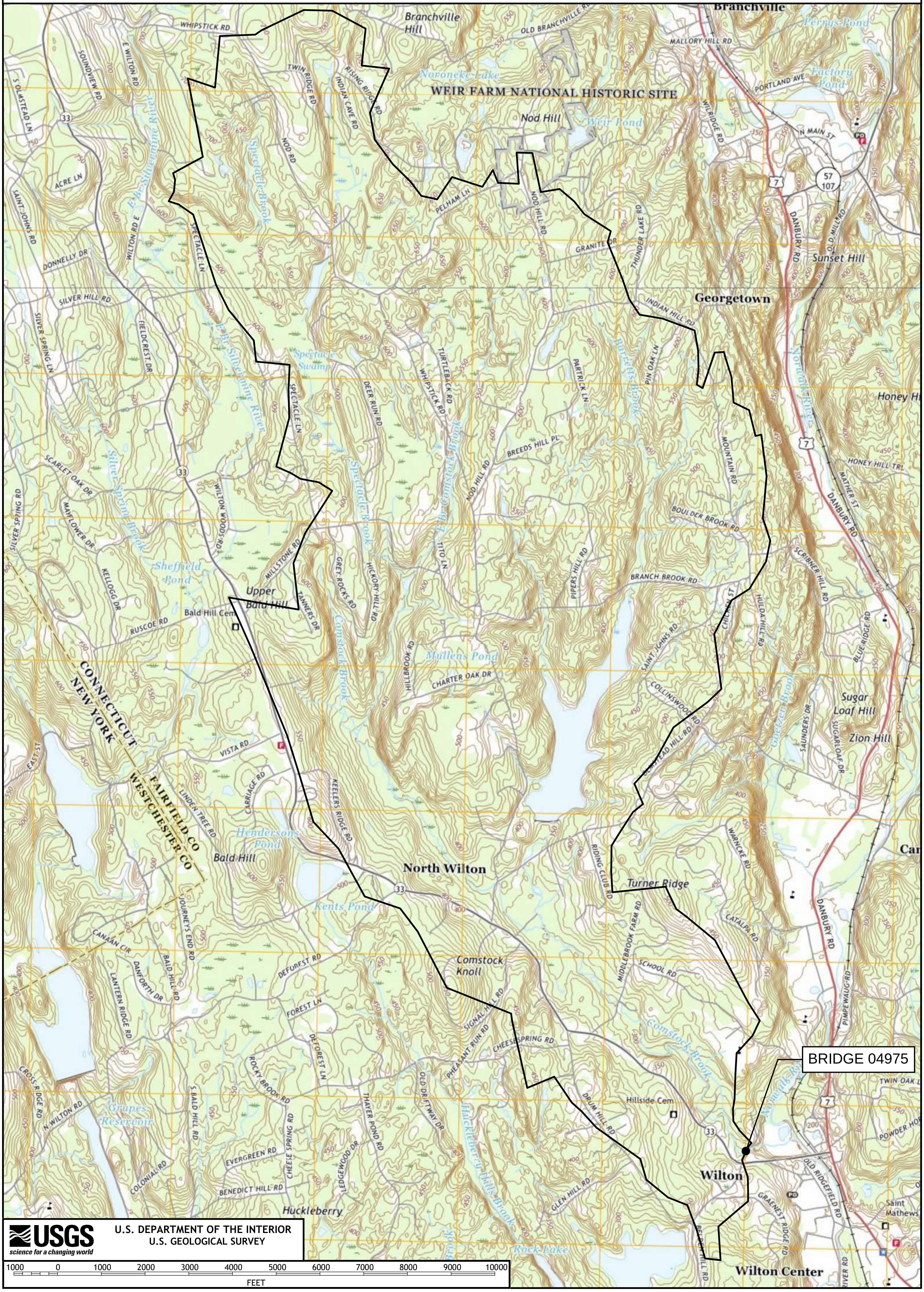
Photo 4; taken from the bridge looking upstream towards the east. Upland along river at left (north) is very thickly vegetated.

Attachment I: Drainage Area Map

DRAINAGE AREA MAP: USGS QUAD

BRIDGE NO. 04975 **IN** WILTON**, CT**

LOVERS LANE **OVER** COMSTOCK BROOK



Attachment H: Description of Fill Material in the Regulated Area

State Construction Project Number: 161-142
Town: Wilton
Bridge Number: 04975 - Lovers Lane over Comstock Brook

All fill material used on the project within the Regulated Area will conform to the requirements of the Connecticut Department of Transportation Standard Specifications for Roads, Bridges, Facilities, and Incidental Construction, Form 818, dated January 2022 and Special Provisions. Excess fill materials not used during construction will be removed upon completion of the project.

Lovers Lane over Comstock Brook Town of Wilton, CT

Final Design Drainage Report

March 2022

Connecticut Department of Transportation
Project No. 161 - 142

Prepared by: **VN Engineers, Inc.**
116 Washington Avenue
North Haven, CT 06473
(203) 234-7862

Prepared for: **Fuss & O'Neill Inc.**
146 Hartford Road
Manchester, CT 06040
(860) 646-2469

DESIGNED BY:

VN ENGINEERS, INC.
116 WASHINGTON AVE.
NORTH HAVEN, CT 06473
(203) 234-7862

STATE OF CONNECTICUT
ROBERT S. GOMEZ
No. 23842
LICENSED
PROFESSIONAL ENGINEER

Digitally signed by Robert Gomez
Date: 2022.03.17 09:23:17-04'00'

Table of Contents

Appendices

Executive Summary

The proposed drainage design for State Project No. 161-142: Lovers Lane over Comstock Brook in Wilton, Connecticut has been designed in accordance with the ConnDOT Drainage Manual (ConnDOTDM). OpenRoads Designer Subsurface Utility Design and Analysis (SUDA) was used to perform the gutter flow analysis, storm system sizing calculations, and gather the resulting HGL profiles. This information was used to determine the appropriate catch basin inlet locations and pipe sizes for the additional flows anticipated with the widening of Lovers Lane. Outlet protection is provided via a Type C Modified Riprap Apron designed in accordance with the ConnDOTDM criteria at both outlet locations. The proposed drainage system design does meet the current ConnDOTDM criteria for allowable design spread.

The proposed water quality treatment provisions will include the installation of four (4) feet sumps within each of the catch basins to promote the removal of sediment and pollutants prior to discharging to the downstream Comstock Brook.

The project will add approximately three hundred & seventy-six (376) square feet of impervious surface area, and the majority of which is from the widened bridge deck. This additional impervious surface translates to about 0.056 CFS of additional stormwater runoff into Comstock Brook for a 10-year storm event. Based on the project hydrology report, the 10-year flow is 1,050 CFS for Comstock Brook. Thus, the impact of 0.056 CFS increase from this project is minimal compared to the overall streamflow.

The increased bridge deck width allows for safer vehicular travel by accommodating two vehicles to pass each other on the bridge.

1.0 Introduction

State Project No. 161-142 includes the replacement of Bridge No. 04975, a single span structure on Lovers Lane over Comstock Brook in the Town of Wilton, CT. The new bridge design will include a prestressed concrete deck unit superstructure with 22-foot-wide roadway width. The existing drainage system, which includes one catch basin and an outlet pipe, will be replaced to accommodate the new bridge.

2.0 Drainage Areas

The drainage areas analyzed include the uphill areas along Lovers Lane that contribute runoff to the existing and proposed drainage systems. See Appendix C for the drainage area maps.

Existing Conditions

An existing catch basin located at STA 101+62 captures runoff from Lovers Lane and connects to a 12-inch HDPE pipe that outlets to Comstock Brook. This existing catch basin appears to be in good working condition. Additional runoff not captured by the existing catch basin drains off the side of Lovers Lane and the bridge via sheet flow.

From a field survey conducted in August 2021, the existing 12-inch HDPE outlet pipe appears to be in good condition with no noticeable structural deficiencies. The pipe was dry during inspection with no internal water accumulation. See Appendix H for the site survey photos.

Proposed Conditions

As part of the proposed geometric improvements, the low point along Lovers Lane will be maintained to match the existing roadway conditions. Three (3) new Type ‘C’ catch basins will be installed at STA 100+79 RT, STA 101+25 RT, STA 101+25 LT on the south side of the bridge. This system will outlet through a new pipe located at the existing outfall location. A new 15-inch HDPE Corrugated Interior Pipe will be utilized.

Additionally, four (4) new catch basins will be installed on the north side of the bridge as part of this project. A Type ‘C’ Type 2 catch basin will be installed at STA 102+52 RT, a Type ‘C-L’ Type 2 catch basin at STA 102+52 LT, a Type ‘C’ catch basin at STA 103+08 LT, and a Type ‘C’ catch basin at STA 103+08 RT. This proposed system will outlet to a new outfall location located on the north side of Comstock Brook. A new 15-inch HDPE Corrugated Interior Pipe will be utilized.

Both Type 2 catch basins located at the sag location will be utilizing a 3.0% road cross slope to increase the inception & inlet capacity and to increase the efficiency of the overall drainage system. All other proposed catch basins on both sides of the bridge will be place at an “On-Grade” location and will utilize a 2.0% road cross slope.

The existing catch basin located on the south side of the bridge and existing 12-inch HDPE outlet pipe to Comstock Brook will be removed. For reference, see Appendix J for the location of the proposed drainage elements.

Outlet Conditions

The existing outlet was evaluated from a field survey conducted in August 2021. No erosion / sedimentation and scour were detected. The existing outlet contains sporadic stones that serve some purpose for dissipating any energy coming out of the existing 12-inch HDPE pipe. For the new 15-inch HDPE outlet pipe south of Comstock Brook, new outlet protection will be designed and installed in accordance with the ConnDOTDM criteria. Based on the proposed drainage systems modeling, a Type C modified riprap apron will be utilized. The proposed riprap apron will improve the existing conditions at the site. See Appendix A for the ConnDOTDM outlet protection design criteria.

For the new 15-inch HDPE outlet pipe north of Comstock Brook, new outlet protection will be designed and installed in accordance with the ConnDOTDM criteria. Based on the proposed drainage systems modeling, a Type C modified riprap apron will be utilized for the north side outfall location. See Appendix A for the ConnDOTDM outlet protection design criteria.

3.0 Modeling Parameters

Design Approach

The drainage design for State Project No. 161-142 has been developed to meet the requirements in the ConnDOTDM and was modeled in OpenRoads Designer Subsurface Utility Design and Analysis (SUDA). The OpenRoads Designer SUDA software uses the GVF-Rational method for calculations. The existing drainage information and flow patterns were obtained from the project survey, online GIS mapping obtained from the CTECO website, and verified through field reviews.

The modeling of the proposed drainage system includes gutter flow analysis, evaluating spread conditions, and positioning catch basins to meet the allowable spread requirements, to the maximum extent practical. The storm drainage system and hydraulic grade line (HGL) calculations were performed for this system to determine the proposed pipe sizes, as well as to determine the adequacy of the existing pipe to remain. The existing and proposed systems were analyzed to the outfall.

Design Criteria

The following lists the design criteria and sources used in developing the proposed drainage design. See Appendix A for the applicable excerpts from the ConnDOT Drainage Manual and Appendix B for the rainfall data.

- Design Storm and Spread Criteria (Lovers Lane): The drainage system is designed to meet the spread criteria for Town Roads, ADT < 3000 and Speed "any" mph. The drainage systems are designed for the 10-year event and spread criteria and sag conditions are analyzed for the 5-year event. According to ConnDOTDM Table 11-2.
- Rainfall Data is derived from NOAA Atlas 14 for Wilton, CT.
- Runoff Coefficients: All pavement drainage areas use 0.90. Grass drainage areas use 0.30. Wooded drainage areas use 0.20. See ConnDOTDM Tables 6-4 and 6-5.
- Time of Concentration: 5 minutes for pavement, 10 minutes for grassed areas (minimum for design according to ConnDOTDM Section 6.9.6).

- Manning's roughness coefficient (n): A Manning's n of 0.025 was used for high density polyethelyne (HDPE) pipe with a corrugated interior. A value of 0.012 was used for reinforced concrete pipe (RCP). A value of 0.016 was used for the pavement. This value represents "rough texture" pavement. See ConnDOTDM Table 11-3.
- Hydraulic Grade Line (HGL) was designed such that a minimum 1 foot of freeboard below the grate elevation is maintained for the 10-year design storm event.
- All proposed pipes exceed the requirements for minimum slope outlined in ConnDOTDM Table 11-7.
- All outlets are assumed to have tailwater. The tailwater elevation was derived from the FEMA Flood Insurance Study Flood Profiles for a 10-year storm event. See Appendix I.
- Outlet Protection: Outlet protection was designed in accordance with ConnDOTDM section 11.13.

Based on the RSR, the proposed roadway lane width is eleven (11) feet, which includes a ten (10) foot travel lane with a one (1) foot unstriped shoulder. From this design basis, the required travel lane width including the stormwater runoff spread at the sag location is ten (10) feet. Based on the current ConnDOTDM criteria for allowable design spread, the sag condition was analyzed for a the 5-year design storm event. This is because water can escape over the curb line and down the embankment to Comstock Brook.

4.0 Conclusion

The proposed drainage design for State Project No. 161-142: Lovers Lane over Comstock Brook in Wilton, Connecticut has been designed in accordance with the ConnDOT Drainage Manual (ConnDOTDM). OpenRoads Designer Subsurface Utility Design and Analysis (SUDA) was used to perform the gutter flow analysis, storm system sizing calculations, and gather the resulting HGL profiles. This information was used to determine the appropriate catch basin inlet locations and pipe sizes for the additional flows anticipated with the widening of Lovers Lane. Outlet protection is provided via a Type C Riprap Apron designed in accordance with the ConnDOTDM criteria at both outlet locations. The proposed drainage system design does meet the current ConnDOTDM criteria for allowable design spread.

The proposed water quality treatment provisions will include the installation of four (4) feet sumps within each of the catch basins to promote the removal of sediment and pollutants prior to discharging to the downstream Comstock Brook. The project will add approximately three hundred & seventy-six (376) square feet of impervious surface area, and the majority of which is from the widened bridge deck. This additional impervious surface translates to about 0.056 CFS of additional stormwater runoff into Comstock Brook for a 10-year storm event. Based on the project hydrology report, the 10-year flow is 1,050 CFS for Comstock Brook. Thus, the impact of 0.056 CFS increase from this project is minimal compared to the overall streamflow.

The increased bridge deck width allows for safer vehicular travel by accommodating two vehicles to pass each other on the bridge.

Appendices

Table 6-2 Frequency Factors For Rational Formula

Recurrence Interval (years)	C_f
25	1.1
50	1.2
100	1.25

6.9.6 Procedures

The results of using the rational formula to estimate peak discharges are very sensitive to the parameters that are used. The designer must use good engineering judgment in estimating values that are used in the method. Following is a discussion of the different variables used in the rational method.

Time Of Concentration

The time of concentration is the time required for water to flow from the hydraulically most remote point of the drainage area to the point under investigation. Use of the rational formula requires the time of concentration (t_c) for each design point within the drainage basin. The duration of rainfall is then set equal to the time of concentration and is used to estimate the design average rainfall intensity (I).

Appendix C (Travel Time Estimation) at the end of this chapter describes the method based on the NRCS Technical Release No. 55 (2nd Edition). This method shall be used for the rational method. Note: under certain circumstances, where tributary areas are very small or completely paved, the computed time of concentration would be very short. For design purposes the minimum time of concentration for paved areas shall be 5 minutes and 10 minutes for grassed areas.

Common Errors

Two common errors should be avoided when calculating t_c. First, in some cases runoff from a portion of the drainage area which is highly impervious may result in a greater peak discharge than would occur if the entire area were considered. In these cases, adjustments can be made to the drainage area by disregarding those areas where flow time is too slow to add to the peak discharge. Sometimes it is necessary to estimate several different times of concentration to determine the design flow that is critical for a particular application.

Second, when designing a drainage system, the overland flow path is not necessarily perpendicular to the contours shown on available mapping. Often the land will be graded and swales will intercept the natural contour and conduct the water to the streets which reduces the time of concentration.

Rainfall Intensity

The rainfall intensity (I) is the average rainfall rate mm/h (in/h) for a duration equal to the time of concentration for a selected return period. Once a particular return period has been selected for design and a time of concentration calculated for the drainage area, the rainfall intensity can be determined from Rainfall-Intensity-Duration curves. The rainfall intensity can be determined from rainfall-intensity-duration Table B-2 which can be found in Appendix B.

Runoff Coefficient

The runoff coefficient C is the variable of the rational method least susceptible to precise determination and requires judgment and understanding on the part of the designer. While engineering judgment will always be required in the selection of runoff coefficients, a typical coefficient represents the integrated effects of many drainage basin parameters, the following discussion considers only the effects of soil groups, land use and average land slope.

Methods for determining the runoff coefficient are presented based on hydrologic soil groups and land slope (Table 6-3), land use (Table 6-4) and a composite coefficient for complex watersheds (Table 6-5).

Table 6-3 gives the recommended coefficient C of runoff for pervious surfaces by selected hydrologic soil groupings and slope ranges. From this table the C values for non-urban areas such as forest land, agricultural land, and open space can be determined. Soil properties influence the relationship between runoff and rainfall since soils have differing rates of infiltration. Infiltration is the movement of water through the soil surface into the soil. Based on infiltration rates, the NRCS has divided soils into four hydrologic soil groups as follows:

Group A Soils having a low runoff potential due to high infiltration rates. These soils consist primarily of deep, well drained sands and gravels.

Group B Soils having a moderately low runoff potential due to moderate infiltration rates. These soils consist primarily of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

Group C Soils having a moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impedes the downward movement of water or soils with moderately fine to fine texture.

Group D Soils having a high runoff potential due to very slow infiltration rates. These soils consist primarily of clays with high swelling potential, soils with permanently high water tables, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious parent material.

The NRCS has developed detailed soil surveys for all counties within Connecticut. From these documents, the designer can determine the nature and relative percentages of the soils within a given watershed. It is important to note that the level of effort required in the determination of soil types is commensurate with the size of the watershed and the design objectives. Normally, in the computation of discharge quantities for gutter flow analysis and related storm drainage design, a detailed evaluation of soil types is not necessary, as contributing areas adjoining highways are usually relatively small. However, in the design of cross culverts, channels or interceptor ditches the determination of soil types will provide valuable assistance to the design engineer in the evaluation of the runoff potential from a particular watershed.

The second factor for consideration in the determination of a runoff coefficient is land use. As unimproved areas are developed, the potential for increased runoff becomes greater due to the loss of vegetative cover, the reduction in retention by surface depressions and the increase in impervious surface area. Table 6-4 lists recommended ranges for the runoff coefficient value classified with respect to the general character of the tributary area. **The potential for future watershed development should be considered by the designer**.

The final element to be factored into the determination of runoff coefficients is the land slope. As the slope of the drainage basin increases, the selected C value should also increase. This is caused by the fact that as the slope of the drainage area increases, the velocity of overland and channel flow will increase allowing less opportunity for water to infiltrate the ground surface. Thus, more of the rainfall will become runoff from the drainage area.

In summary, it should be reiterated that in assigning a value to the runoff coefficient for use in the rational method, the engineer must rely heavily on experience and judgement.

Table 6-3 Recommended Coefficient Of Runoff For Pervious Surfaces By Selected Hydrologic Soil Groupings And Slope Ranges

Slope	A	B	C	D
Flat (0 - 1%)	0.04-0.09	0.07-0.12	0.11-0.16	0.15-0.20
Average (2 - 6%)	0.09-0.14	0.12-0.17	0.16-0.21	0.20-0.25
Steep (Over 6%)	0.13-0.18	0.18-0.24	0.23-0.31	0.28-0.38

Source: Storm Drainage Design Manual, Erie and Niagara Counties Regional Planning Board.

Table 6-4 Recommended Coefficient Of Runoff Values For Various Selected Land Uses

Description of Area		Runoff Coefficients
Business: Downtown areas		0.70-0.95
Neighborhood areas		0.50-0.70
Residential:	Single-family areas	0.30-0.50
	Multi units, detached	0.40-0.60
	Multi units, attached	0.60-0.75
	Suburban	0.25-0.40
Residential (0.5 ha (1.2 ac) lots or more)		0.30-0.45
Apartment dwelling areas		0.50-0.70
Industrial:	Light areas	0.50-0.80
	Heavy areas	0.60-0.90
Parks, cemeteries		0.10-0.25
Playgrounds		0.20-0.40
Railroad yard areas		0.20-0.40
Unimproved areas		0.10-0.30

Table 6-5 Coefficients For Composite Runoff Analysis

Surface		Runoff Coefficients
Street:	Asphalt	0.70-0.95
	Concrete	0.80-0.95
Drives and walks		0.75-0.85
Roofs		0.75-0.95

11.7 Design Frequency And Spread

The major considerations for selecting a design frequency and spread include highway classification, because it defines and reflects public expectations for finding water on the pavement surface. Ponding should be prevented on the traffic lanes of high-speed, high-volume highways, where it is not expected.

Highway speed is another major consideration, because at speeds greater than 70 km/h, (45 mi/h) even a shallow depth of water on the pavement can cause hydroplaning. Design speed is recommended for use in evaluating hydroplaning potential. When the design speed is selected, consideration should be given to the likelihood that legal posted speeds may be exceeded. It is clearly unreasonable and not cost effective to provide the same level of protection for low speed facilities as for high speed facilities.

Other considerations include inconvenience, hazards and nuisances to pedestrian traffic and buildings adjacent to roadways which are located within the splash zone. These considerations should not be minimized and, in some locations (such as commercial areas), may assume major importance.

The design criteria for various types of Connecticut roadways are outlined in Table 11-2.

Table 11-2 Pavement Drainage Design Criteria

ROADWAY	ADT	SPEED km/hr (mi/hr)	DESIGN FREQUENCY yr	ALLOWABLE DESIGN SPREAD
State Arterial Highways and Expressways	≥ 3000	≥ 80 (≥ 50)	10	shoulder
	≥ 3000	≤ 70 (≤ 45)	10	½ of lane
	< 3000	---	10	½ of lane
Sag Condition	any	any	50*	all except one lane width
State Collector Highways and State-owned service Roads	≥ 3000	≥ 80 (≥ 50)	10	shoulder
	≥ 3000	≤ 70 (≤ 45)	10	½ of lane
	< 3000	---	10	½ of lane
Sag Condition	any	any	25*	all except one lane width
Town Roads	≥ 3000	any	10	½ of lane
	< 3000		5	½ of lane
Sag Condition	≥ 3000	any	25	all except one lane width
	< 3000		10	
One Lane Ramps	any	any	10	0.3m (1 ft) of lane
Ramps > one lane	any	any	10	1m (3 ft) of lane

* Sag condition is defined as sag vertical curves where the water cannot escape over berms and down an embankment. The procedure is to design the drainage inlets and storm system for a 10 year frequency and then to impose the higher frequency storm on the inlets and storm system. If the higher frequency storm closes the facility to traffic then additional inlets or the storm system will have to be changed.

11.5 Hydrology

11.5.1 Introduction

The rational method is the most common method in use for the design of storm drains when the momentary peak flow rate is desired. Its use should be limited to systems with drainage areas of 81 ha (200 acres) or less. Drainage systems involving detention storage and pumping stations require the development of a runoff hydrograph. (See Chapters 6, 10 and 12 – Hydrology, Storage Facilities, and Pump Stations).

11.5.2 Rational Method

The Rational Equation is written as follows:

$$Q = 0.00278CIA = 0.00278\ (\sum CA)\ I \qquad (Q = CIA) \qquad \mathbf{(11.1)}$$

Where:
- Q = discharge, m^3/s (ft^3/s)
- C = runoff coefficient
- I = rainfall intensity, mm/h (in/h)
- A = drainage area, ha (ac)

11.5.3 Runoff Coefficient

The runoff coefficients for various types of surfaces are discussed in Chapter 6, with tables of appropriate values. The weighted C value is to be based on a ratio of the drainage areas associated with each C value as follows:

$$\text{weighted } C = [A_1C_1 + A_2C_2 + A_3C_3] / [A_1 + A_2 + A_3] \qquad \mathbf{(11.2)}$$

11.5.4 Rainfall Intensity

Rainfall intensity (I): Rainfall intensity is the intensity of rainfall in millimeters (inches) per hour for a duration equal to the time of concentration. Intensity is a rate of rainfall over an interval of time such that intensity multiplied by duration equals amount of rain, i.e., an intensity of 130 mm/h for a duration of 5 min indicates a total rainfall amount of 130 X 5/60 = 10.8 mm. See Chapter 6 Hydrology for a more complete discussion and data to be used for determining the intensity of rainfall.

11.5.5 Time of Concentration

The time of concentration is defined as the period required for water to travel from the most hydraulically distant point of the watershed to the point of the storm drain system under consideration. The designer is usually concerned about two different times of concentration: one for inlet spacing and the other for pipe sizing. There is a major difference between the two times.

- **Inlet Spacing**

The time of concentration (t_c) for inlet spacing is the time for water to flow from the hydraulically most distant point of the drainage area to the inlet, which is known as the inlet time. Usually this is the sum of the time required for water to move across the pavement or overland back of the curb to the gutter, plus the time required for flow to move through the length of gutter to the inlet. **For pavement drainage, when the total time of concentration to the upstream inlet is less than 5 min, a minimum t_c of 5 min should be used to estimate the intensity of rainfall**. The time of concentration for the second downstream inlet and each succeeding inlet should be determined independently, the same as the first inlet. In the case of a constant roadway grade and relatively uniform contributing drainage area, the time of concentration for each succeeding inlet could also be constant.

- **Pipe Sizing**

The time of concentration for pipe sizing is defined as the time required for water to travel from the most hydraulically distant point of the watershed to the point of the storm drain system under consideration. It generally consists of two components: (1) the time to flow to the inlet which can consist of overland and channel or gutter flow and (2) the time to flow through the storm drain to the point under consideration.

Travel time within the storm drain pipes can be estimated by the relation:

$$t_t = L / 60V \qquad \textbf{(11.3)}$$

Where: t_t = travel time, min
L = length of pipe in which runoff must travel, m (ft)
V = estimated or calculated normal velocity, m/s (ft/s)

Methods for determining time of concentration are further described in Chapter 6 Hydrology.

To summarize, the time of concentration for any point on a storm drain is the inlet time for the inlet at the upper end of the line plus the time of flow through the storm drain from the upper end of the storm drain to the point in question. In general, where there is more than one source of runoff to a given point in the storm drainage system, the longest t_c is used to estimate the intensity (I). There could be exceptions to this generality, for example where there is a large inflow area at some point along the system, the t_c for that area may produce a larger discharge than the t_c for the summed area with the longer t_c. The designer should be cognizant of this possibility when joining drainage areas and determine which drainage area governs. To determine which drainage area controls, compute the peak discharge for each t_c. Note that when computing the peak discharge with the shorter t_c, not all the area from the basin with the longest t_c will contribute runoff. One way to compute the contributing area, A_c, is as follows:

$$\mathbf{A_c = A\ [t_{c1} / t_{c2}]} \qquad \textbf{(11.4)}$$

Where: $t_{c1} < t_{c2}$ and A is the area of the basin with the longest t_c.

In municipal areas, a minimum time of concentration of 5 min is recommended for calculation of runoff from paved areas and 10 min. for areas mostly grass. All other areas should be calculated on a case by case basis.

11.5.6 Detention Storage

Reduction of peak flows can be achieved by the storage of runoff in detention basins, storm drains, swales and channels, and other detention storage facilities. Stormwater is then released to the downstream conveyance facility at a reduced flow rate. The concept should be considered for use in highway drainage design where existing downstream conveyance facilities are inadequate to handle peak flow rates from highway storm drainage facilities, where the highway would contribute to increased peak flow rates and aggravate downstream flooding problems, and as a technique to reduce the right-of-way, construction, and operation costs of outfalls from highway storm drainage facilities. See Chapter 10, Storage Facilities.

11.9 Gutter Flow Calculations

11.9.1 Introduction

Gutter flow calculations are necessary in order to relate the quantity of flow (Q) in the curbed channel to the spread of water on the shoulder, parking lane, or pavement section. The nomograph on Figure 11-1 can be utilized to solve uniform cross slope channels, composite gutter sections and V shape gutter sections. Figure 11-3 is also very useful in solving composite gutter section problems. Computer programs such as the FHWA HEC 12 program is also very useful for this computation as well as inlet capacity. Example problems for each gutter section are shown in the following sections.

11.9.2 Manning's n For Pavements

Table 11-3 Manning's n For Streets and Pavement Gutters

Type of Gutter or Pavement	Manning's n
Concrete gutter, troweled finish	0.012
Asphalt Pavement:	
Smooth texture	0.013
Rough texture	0.016
Concrete gutter-asphalt pavement	
Smooth	0.013
Rough	0.015
Concrete pavement	
Float finish	0.014
Broom finish	0.016
For gutters with small slope, where sediment may accumulate, increase above n values by:	0.002
Reference: USDOT, FHWA, HDS-3 (1961)	

11.9.3 Uniform Cross Slope Procedure

The nomograph in Figure 11-1 is used with the following procedures to find gutter capacity for uniform cross slopes:

CONDITION 1: Find spread (T), given gutter flow (Q).

Step 1 Determine input parameters, including longitudinal slope (S), cross slope (S_x), gutter flow (Q) and Manning's n.

Step 2 Draw a line between the S and S_x scales and note where it intersects the turning line.

Appendix A – Recommended Manning's n Values*

Type of Conduit	Wall Description	Manning's n
Concrete Pipe	Smooth walls	0.010-0.013
Concrete Boxes	Smooth walls	0.012-0.015
Corrugated Metal Pipes and Boxes, Annular or Helical Pipe (n varies barrel size) See HDS5	68 mm by 13 mm (2-2/3 by ½ inch) corrugations	0.022-0.027
	150 mm by 25 mm 6 by 1 inch) corrugations	0.022-0.025
	125 mm by 25 mm (5 by 1 inch) corrugations	0.025-0.026
	75 mm by 25 mm (3 by 1 inch) corrugations	0.027-0.028
	150 mm by 50 mm (6 by 2 inch) structural plate	0.033-0.035
	230 mm by 64 mm 9 by 2-1/2 inch) structural plate	0.033-0.037
Corrugated Metal Pipes, Helical Corrugations, Full Circular Flow	68 mm by 13 mm (2-2/3 by ½ inch) corrugations	0.012-0.024
Spiral Rib Metal	Smooth walls	0.012-0.013
Plastic Pipe	Corrugated polyethylene, smooth	0.009-0.015
	Corrugated polyethylene, corrugated	0.018-0.025
	Polyvinyl chloride (PVC), smooth	0.009-0.011

* Note 1: The values indicated in this table are recommended Manning's n design values. Actual field values for older existing pipelines may vary depending on the effects of abrasion, corrosion, deflection and joint conditions. Concrete pipe with poor joints and deteriorated walls may have n values of 0.014 to 0.018. Corrugated metal pipe with joint and wall problems may also have higher n values and, in addition, may experience shape changes which could adversely affect the general hydraulic characteristics of the culvert.

Note 2: For further information concerning Manning n values for selected conduits, consult Hydraulic Design of Highway Culverts, Federal Highway Administration, HDS No. 5, page 163.

11.11 Storm Drains

11.11.1 Introduction

After the preliminary locations of inlets, connecting pipes and outfalls with tailwaters have been determined, the next logical step is the computation of the rate of discharge to be carried by each reach of the storm drain, and the determination of the size and gradient of pipe required to convey this discharge. This is done by starting at the upstream reach, calculating the discharge and sizing the pipe, then proceeding downstream, reach by reach to the point where the storm drain connects with other drains or the outfall. For manholes where the pipe size is increased, the downstream crown should be lower than the upstream crown by the amount of the energy loss in the manhole.

The rate of discharge at any point in the storm drain is not necessarily the sum of the inlet flow rates of all inlets above that section of storm drain. It is generally less than this total. The time of concentration is most influential and as the time of concentration grows larger, the rainfall intensity to be used in the design grows smaller. In some cases, where a relatively large drainage area with a short time of concentration is added to the system, the peak flow may be larger using the shorter time even though the entire drainage area is not contributing. The prudent designer will be alert for unusual conditions and determine which time of concentration controls for each pipe segment. See Section 11.5.5 for a discussion on time of concentration.

For ordinary conditions, storm drains should be sized on the assumption that they will flow full or practically full under the design discharge but will not flow under pressure head. The Manning's formula is recommended for capacity calculations. In locations such as depressed roadway sections and underpasses where ponded water can be removed only through the storm drain system, a higher design frequency should be analyzed to ensure the roadway stays open to traffic (see Table 11-2 for design criteria). The main storm drain downstream of the depressed section should be designed by computing the hydraulic grade line and keeping the water surface elevations below the grates and/or established critical elevations for the check storm.

11.11.2 General Guidelines

The following items must be considered during the design of a storm drain system.

- Storm drains shall be designed for "just-full" condition. The head waters in structures shall be limited to 0.3 meters (1 ft) below the top of grate, taking into consideration the possible effect of headwater in the next downstream structure.
- Underdrain pipes of 100 and 150 mm (4 in and 6 in) size should be laid in straight segments or gradual curves if possible. Where bends of underdrain are necessary to enter a structure they should be no greater than 30 degrees.
- Long skew crossings of storm drain laterals under pavement should be avoided.
- All roadway drainage, including the side and slope ditches shall be carried to a suitable outlet, preferably an existing stream. Where outletting to an existing stream is impractical, or where no stream is available, appropriate drainage rights must be obtained.
- The discharge of effluent from sanitary sewers, cesspools, septic tanks, discharge of cooling water or industrial wastes into a State maintained roadway drainage system will not be permitted.
- Private connections to State drainage systems are only allowed after issuance of an encroachment permit accompanied by a special connection agreement.

- Roadway drainage shall not be outletted into existing drainage systems which are privately owned or those maintained by towns or cities except in the case where an independent outlet is not feasible due to excessive cost or other reasons. Where outletting into such a system, an agreement must be entered into with the municipality. A deeded right to drain must be secured from owners of private systems.
- All existing metal pipes to be abandoned under the travelway are to be removed. Concrete pipes to be abandoned should be plugged at the ends.
- State drainage systems shall not be outletted into municipal systems which carry both storm water and sanitary sewage, nor will any such municipal system carrying both storm water and sanitary sewage be outletted into State systems.
- Diversion of watershed area should be avoided if possible. However, in all cases where drainage is diverted from one watershed area to another, as is frequently the case in incised highways, the designer shall note the diversions in the computations and on the preliminary plans to better allow the reviewers and right of way negotiators to make proper provisions for the lawful disposal of the drainage from this area at the outlet locations.
- Utility conflicts may require design changes. New installations should be kept at least 0.3 meters (1 ft) from any utilities.
- The pertinent plans and computations for drainage systems on a project which originate or terminate on an adjacent project shall be furnished for review by the designer of the project being reviewed. The area used for runoff computation shall be shown on topographical maps also to be supplied.
- Each outlet must be carefully designed with erosion protection as needed and carried down steep slopes to lesser slopes where outlet erosion will not occur. Riprap shall be designed at all outlets not flowing over exposed rock or into deep watercourses or ponds. (See Section 11.14.)
- Storm drainage systems will be designed for the watershed which naturally drains to it. In many urban areas the existing drainage systems are inadequate and it is impossible to provide inlet capacity for the overflow, however, the trunk line system should be designed to allow the municipality to upgrade their contributing system at a future date.
- Minimum size pipe for storm drainage is 300 mm (12 in).
- Slotted drain shall be outletted into catch basins.

11.11.3 Outlets

All proposed storm drains have an outlet point where the flow is discharged. The designer should consider at least the following aspects that may affect the hydraulic design of a storm drainage system.

- The flowline elevation of the outfall should be equal to, or higher than the recipient. If this is not the case, excavation may be required to ensure positive gravity flow, or in severe cases pump stations may be required.
- Where practical, the outlet should be positioned in the outfall channel so that it is pointed in a downstream direction. This will reduce turbulence and the potential for erosion.
- When the outlet is located in a manner to allow the discharge to impinge on the opposite bank of a channel, that bank should be evaluated to determine the need for riprap.

11.11.9 Minimum Grades

All storm drains should be designed such that velocities of flow will not be less than 0.9 m/s (3 ft/s) at design flow. For very flat grades the general practice is to design components so that flow velocities will increase progressively throughout the length of the pipe system. The storm drainage system should be checked to be sure there is sufficient velocity in all of the drains to deter settling of particles. Minimum slopes required for a velocity of 0.9 m/s (3 ft/s) can be calculated by the Manning's formula or use values given in Table 11-7.

$$S = \frac{(nV)^2}{R^{4/3}} \qquad \textbf{(11.18)}$$

Table 11-7

Minimum Slopes Necessary To Ensure 0.9 m/s (3 ft/s)
In Storm Drains Flowing Full

Pipe Size, mm (in)		Full Pipe, m^3/s (ft^3/s)		Minimum Slopes m/m (ft/ft) n = 0.012	n = 0.013	n = 0.024
200	(8)	0.030	(1.05)	0.0064	0.0075	0.0256
250	(10)	0.046	(1.64)	0.0048	0.0056	0.0190
300	(12)	0.067	(2.36)	0.0037	0.0044	0.0149
375	(15)	0.104	(3.68)	0.0028	0.0032	0.0111
450	(18)	0.150	(5.30)	0.0022	0.0026	0.0087
525	(21)	0.204	(7.22)	0.0018	0.0021	0.0071
600	(24)	0.267	(9.43)	0.0015	0.0017	0.0059
675	(27)	0.338	(11.93)	0.0013	0.0015	0.0051
750	(30)	0.417	(14.73)	0.0011	0.0013	0.0044
825	(33)	0.505	(17.82)	0.00097	0.0011	0.0039
900	(36)	0.601	(21.21)	0.00086	0.0010	0.0034
1050	(42)	0.817	(28.86)	0.00070	0.00082	0.0028
1200	(48)	1.067	(37.70)	0.00059	0.00069	0.0023
1350	(54)	1.351	(47.71)	0.00050	0.00059	0.0020
1500	(60)	1.668	(58.90)	0.00044	0.00051	0.0017
1650	(66)	2.018	(71.27)	0.00038	0.00045	0.0015
1800	(72)	2.402	(84.82)	0.00034	0.00040	0.0014

11.13 Outlet Protection

11.13.1 Assessment of Erosion Potential

A field investigation of all proposed outlet locations or existing outlets to be used in a drainage design of a proposed project should be conducted to determine the erosion resistance of the soils at the outlet, the character of the downstream flow path, and any other site constraints that must be addressed by the proposed design.

Barring any unusual conditions, as determined during the field investigation, the criteria outlined in this section should be used to determine the level of outlet protection required. When severe conditions are present, it is the responsibility of the designer to provide outlet protection as needed to safeguard against erosion damage.

Pipe outlets are points of critical erosion potential. Stormwater which is transported through closed conveyance systems at design capacity generally reaches a velocity which exceeds the permissible or erosion resistant velocity of the receiving channel or overland area. To prevent scour at stormwater system outlets, a flow transition structure is needed which will absorb the initial impact of the flow and reduce the flow velocity to a level which will not erode the receiving channel or overland area.

11.13.2 Types of Outlet Protection

The most commonly used device for outlet protection is a riprap lined apron. Where practical, they are constructed at a zero grade or minimum slope to slow the outlet velocity. The type and length of the riprap lined apron is related to the outlet flow rate and the tailwater level and whether there is a defined channel downstream.

If the tailwater depth is less than half the outlet pipe rise, it shall be classified as a **Minimum Tailwater Condition**. If the tailwater depth is greater than or equal to half the outlet pipe rise, it shall be classified as a **Maximum Tailwater Condition**.

There are three types of riprap aprons to be used for outlet protection. They are designated as Type A, B and C. Type A riprap aprons would be used under minimum tailwater conditions while Type B riprap aprons would be used for maximum tailwater conditions as defined above, where the pipe outlets overland with no defined channel. Type C riprap aprons would be used when there is a well defined channel downstream of the outlet. The use of a Type C riprap apron on channels that are designated as watercourses or wetlands is discouraged due to potential wetland and fisheries impacts. See Section 11.13.3, Design Criteria, and Section 11.13.5 for the design of riprap aprons.

Where the flow rate proves to be excessive for the economical or practical use of an apron, preformed scour holes may be used. There are two types of preformed scour holes. Type 1 preformed scour holes are depressed one-half the pipe rise and Type 2 preformed scour holes are depressed the full pipe rise. See Section 11.13.3, Design Criteria and Section 11.13.6 for the design of preformed scour holes.

In most cases, a riprap apron or preformed scour hole will provide adequate outlet protection, however where design and site conditions warrant, structurally lined outlet protection or energy dissipators can be investigated. In such instances, coordination with the Hydraulics and Drainage Section early in the design phase is recommended. The design of energy dissipators is presented in HEC-14, “Hydraulic Design of Energy Dissipators For Culverts and Channels.”

11.13.3 Design Criteria

The design of riprap outlet protection applies to the immediate area or reach downstream of the pipe outlet and does not apply to continuous rock linings of channels or streams. For pipe outlets at the top of exit slopes or on slopes greater than 10%, the designer should assure that suitable safeguards are provided beyond the limits of the localized outlet protection to counter the highly erosive velocities caused by the reconcentration of flow beyond the initial riprap apron. Outlet protection shall be designed according to the following criteria:

- Riprap outlet protection shall be used at all outlets not flowing over exposed rock or into deep watercourses and ponds.
- In situations not covered by the above noted criteria and where the exit velocity is ≤ 4.27 mps (14 fps), a riprap apron shall also be used. For Type A and B riprap aprons, the type of riprap specified is dependent on the outlet velocity (see Section 11.13.6) and can be determined from Table 11.5. For Type C aprons, the type of riprap specified is determined by the procedures in HEC-15 and HEC-11 depending on the design discharge. See Chapter 7, Channels.
- The type of riprap apron and dimensions are determined by the guidelines outlined in Sections 11.13.2 and 11.13.5, respectively.
- When the outlet velocity is > 4.27 mps (14 fps), the designer should first investigate methods to reduce the outlet velocity. This may be accomplished by any one or combination of the following: increasing the pipe roughness, increasing the pipe size and/or decreasing the culvert slope. When this is not possible or economical, a number of outlet protection or energy dissipation design options are available. These are presented in detail in HEC-14. In most instances, however, a preformed scour hole design should be used, as it generally can provide the necessary degree of protection at an economical cost. The design of a preformed scour hole is presented in Section 11.13.6.

The design criteria of this section should be applicable to most outlet situations. However, recognizing that design and site conditions can vary significantly depending on the project or location on a particular project, it is the responsibility of the designer to ensure that the criteria is suitable to the site or to provide an alternate design which will adequately protect the outlet area from scour and erosion. These situations should be documented in the drainage design report.

Table 11.11 Allowable Outlet Velocities for Type A and B Riprap Aprons

Outlet Velocity - mps (fps)	Riprap Specification
0-2.44 (0-8)	Modified
2.44-3.05 (8-10)	Intermediate
3.05-4.27 (10-14)	Standard

11.13.4 Tailwater Depth

The depth of tailwater immediately at the pipe outlet is required for the design of outlet protection and must be determined for the design flow rate. Manning’s equation may be used to determine tailwater depth. See Sections 8.3.5 and 8.3.6 for additional information on how to determine the tailwater depth.

11.13.5 Apron Dimensions

Length

The length of an apron (L_a) is determined using the following empirical relationships (Equations 11.9 and 11.10) that were developed for the U.S. Environmental Protection Agency (1976) and modified by ConnDOT for use in Connecticut. Tables 11-12 and 11-13 show the various lengths of Type A, B and C riprap aprons based on discharge and pipe size. The tables also show the minimum and maximum lengths of aprons to be computed using Equations 11.31 and 11.32. When the table indicates that the required apron length would exceed the maximum shown, a preformed scour hole should be used in lieu of the riprap apron. As previously stated, the design of a preformed scour hole is presented in Section 11.13.6.

Type A Riprap Apron (Minimum Tailwater Condition) **TW < 0.5 R_p**

$$L_a = \frac{3.26(Q-0.142)}{S_P^{1.5}} + 3.05 \qquad \left(L_a = \frac{1.80(Q-5)}{S_P^{1.5}} + 10 \right) \qquad \textbf{(11.31)}$$

Type B Apron (Maximum Tailwater Condition) **TW ≥ 0.5 R_p**

$$L_a = \frac{5.44(Q-0.142)}{S_P^{1.5}} + 3.05 \qquad \left(L_a = \frac{3.0(Q-5)}{S_P^{1.5}} + 10 \right) \qquad \textbf{(11.32)}$$

Type C Riprap Apron - The length of a Type C Riprap Apron shall be determined using the formula for a Type B Riprap Apron.

L_a = length of apron, m (ft)
S_p = inside diameter for circular sections or maximum inside pipe span for non-circular sections, m (ft)
Q = pipe (design) discharge, cms (cfs)
TW = tailwater depth, m (ft)
R_p = maximum inside pipe rise, m (ft)
Note: $S_p = R_p$ = inside diameter for circular sections

Width

For Type A or B Riprap Aprons, when there is no well defined channel downstream of the apron, the width of the apron at the pipe outlet, W_1, should be at least three times the maximum inside pipe span and the width, W_2 of the outlet end of the apron, as shown in Figure 11-13, should be as follows:

Type A Riprap Apron (Minimum Tailwater Condition)

$W_1 = 3S_p$ (min.)

$W_2 = 3S_p + 0.7L_a$ for TW < 0.5 R_p **(11.33)** and

Type B Riprap Apron (Maximum Tailwater Condition)

$W_1 = 3S_p$ (min.)
$W_2 = 3S_p + 0.4L_a$ for $TW \geq 0.5 R_p$ **(11.34)**

W_1 =width of apron at pipe outlet or upstream apron limit
W_2 =width of apron at terminus or downstream apron limit

Type C Riprap Apron

For a Type C Riprap Apron when there is a well defined channel downstream of the outlet, the bottom width of the apron should be at least equal to the bottom width of the channel and the lining should extend on the channel side slopes at least 0.3m (1 ft) above the tailwater depth (TW) or at least two-thirds of the vertical conduit dimension ($0.7 R_p$) above the invert, whichever is greater. (In all cases, the overall width of the apron shall be a minimum of $3S_p$). See Figure 11-13.

Additional guidelines:

- The type of apron to be used and length should be called out on the construction plans.
- The side slopes of the Type C riprap apron should be 2H:1V or flatter.
- The bottom grade should be level or minimum slope, where practical, for energy dissipation. Where the use of a flat apron is impractical, a preformed scour hole should be considered.
- Granular fill shall be placed between the riprap and the underlying soil to prevent soil movement into and through the riprap. Additionally, an appropriately sized geotextile (separation) can be used when field conditions dictate as determined by the engineer.
- The location of outlets and outlet protection should be carefully considered to minimize rights-of-way and wetland impacts.

11.13.6 Preformed Scour Hole

The preformed scour hole is an excavated hole or depression which is lined with rock riprap of a stable size to prevent scouring. The depression (F) provides both vertical and lateral expansion downstream of the culvert outlet to permit dissipation of excessive energy and turbulence. Equations 11.35 and 11.36 are used to determine the median stone size (d_{50}) required for the lining of the two types of preformed scour holes presented below. The first type, Type 1, represented by Equation 11.35, is depressed one-half the pipe rise and the second type, Type 2, represented by Equation 11.36, is depressed the full pipe rise. A significant reduction in stone size is achieved by the excavation. Therefore, the scour hole depressed the full pipe rise would require a smaller stone size, however the dimensions of the hole would be larger. The type that provides the most economical and practical design given the site conditions should be selected. The dimensions of a preformed scour hole are determined by the set of Equations 11.37 and Figure 11-15.

Empirical Preformed Scour Hole Equations:

Type 1: Scour Hole Depression = one-half pipe rise, m (ft)

$$d_{50} = (0.0276\ R_p^2\ /TW)\ (Q/R_p^{2.5})^{1.333} \qquad \left(d_{50} = (0.0125R_p^2/TW)\ (Q/R_p^{2.5})^{1.333} \right) \qquad \textbf{(11.35)}$$

Type 2: Scour Hole Depression = full pipe rise, m (ft)

$$d_{50} = (0.0181\ R_p^2\ /TW)\ (Q/R_p^{2.5})^{1.333} \qquad \left(d_{50} = (0.0082R_p^2/TW)\ (Q/R_p^{2.5})^{1.333} \right) \qquad \textbf{(11.36)}$$

d_{50} = median stone size required, m (ft)

For variables S_p, R_p, TW and Q, see Section 11.13.5.

Type 1 and 2 preformed scour hole dimensions (See Figure 11-15)

$C = 3S_p + 6F$	Basin Length m (ft)	
$B = 2S_p + 6F$	Basin Inlet and Outlet Width m (ft)	**(11.37)**
$F = 0.5R_p$ (Type 1) or R_p (Type 2)	Basin Depression m (ft)	

Table 11-14 solves the above set of equations for Type 1 and 2 preformed scour holes for various pipe sizes.

The type of riprap required is as follows:

Modified	d_{50} < 0.13m (0.42 ft)
Intermediate	0.13m (0.42 ft) < d_{50} < 0.20m (0.67 ft)
Standard	0.20m (0.67 ft) < d_{50} < 0.38m (1.25 ft)
Special Design	0.38m (1.25 ft) < d_{50}

Reference: Report No. FHWA-RD-75-508 (“Culvert Outlet Protection Design: Computer Program Documentation”)

OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		***USE***						
6	12	11								
7		13	***12***							
8		14	13	***12***		***MINIMUM***				
9			14	13						
10			15	13						
11			16	14				***LENGTH***		
12				14						
14				16	***14***					
16				17	15	***14***			***OUTLINED***	
18				18	16	15				
20					17	15	***14***			
22		***USE***			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40				***PREFORMED***			20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					***SCOUR***			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							***HOLE***			29
130										30

Table 11-12.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		***USE***						
5.5	12	11								
6		12	***12***			***MINIMUM***				
7		14	13	**12**						
8			15	13						
8.5			16	14				***LENGTH***		
9				14						
10				15	***14***					
11				16	15					
12				17	15	***14***			***OUTLINED***	
13				18	16	15				
14					17	15	***14***			
16		***USE***			18	16	15	***14***		
18						18	16	15		
20						19	17	16		
22						20	18	16		
24							19	17	***16***	
26							20	18	17	***16***
28				***PREFORMED***			21	19	17	16
30							21	19	18	17
32							22	20	18	17
35								21	19	18
40								23	21	19
45								25	23	21
48					***SCOUR***			26	24	22
50									24	22
55									26	23
60									27	25
63									28	26
65										26
75							***HOLE***			29
80										30

Table 11-13.1 - Length - L_a (feet)
Type B or C Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

OUTLET PROTECTION
OUTLET VELOCITY > 14 feet/sec or Length of Apron exceeds limits shown on Tables 11-12.1 and 11-13.1

Preformed Scour Hole										
(See Figure 11-15)	PIPE DIAMETER OR SPAN (in)									
	12	**15**	**18**	**24**	**30**	**36**	**42**	**48**	**54**	**60**
Type 1										
B	5	6	8	10	13	15	18	20	23	25
C	6	8	9	12	15	18	21	24	27	30
d	Depends on riprap type(see Figure 11-15)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = 0.5\ S_p$	0.5	0.625	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Type 2										
B	8	10	12	16	20	24	28	32	36	40
C	9	11	14	18	23	27	32	36	41	45
d	Depends on riprap size (see Figure 11-15)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = S_p$	1.0	1.3	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Table 11-14.1 - Dimensions of Preformed Scour Hole (Feet)

11.13.7 Design Procedure for Riprap Outlet Protection

Outlet protection consists of the construction of an erosion resistant section between a conduit outlet and a stable downstream channel. Erosion at an outlet is chiefly a function of soil type and the velocity of the conduit discharge. Therefore, in order to mitigate erosion, an adequate design must stabilize the area at the conduit outlet and reduce the outlet velocity to a velocity consistent with a stable condition in the downstream channel.

This section presents a generalized procedure for the design of riprap outlet protection. Although each project will be unique, the design outlined below will normally be applicable.

Step 1. Assess the Erosion Potential at the Outlet and other Critical Site Factors

For all proposed outlet locations including existing outlet locations to be used on the project:

A. A field investigation should be conducted to determine the erosion resistance of the soils at the outlet, the character of the downstream flow path, and any other site constraints that must be addressed by the proposed design.

B. Prepare a site description and a sketch (channel cross section, where appropriate) for the outlet location.

C. Ensure that field survey limits extend far enough to adequately show the proposed outlet protection design, downstream flow path, drainage right-of-way and any other important topographic features on the design plans

Step 2. Determine Tailwater Conditions at the Outlet

A. See Section 11.13.4 and Sections 8.3.5 and 8.3.6 for further information on how to determine the tailwater depth.

B. If the pipe outlet discharges into a well-defined channel, estimate the existing velocity in the receiving channel using Manning's Equation (Equation 7.6, Section 7.4.11). See Section 8.3.8 regarding Maximum Velocity.

Step 3. Calculate the Outlet Velocity for the Design Discharge

Culvert outlet velocity is one of the primary indicators of erosion potential and will serve in most instances to define the outlet protection required.

The continuity equation Q=AV (Equation 7.5, Section 7.4.11) can be utilized in all situations to compute the average velocity at any point within a conduit. For conduits flowing partly full, however, the location of the water surface and consequently the area of flow cannot always be easily determined.

The following procedure for the calculation of outlet velocity will produce results, which, though approximate, will be adequate for most design purposes.

A. Determine the design discharge for the conduit based on the design return frequency.

B. See Step 2 A. for the tailwater (TW) acting at the outlet pipe.

C. Calculate the outlet velocity.

Step 4. Evaluate the Outlet Velocity

If the outlet velocity is considered excessive for site conditions or exceeds 4.27 mps (14 fps), the designer should investigate methods to reduce the outlet velocity. These may include any one or combination of the following:

- increasing the pipe roughness
- increasing the pipe size
- decreasing the culvert slope

It should also be noted that the above methods may be employed at velocities less than 4.27 mps (14 fps) when it desired to reduce the size of riprap required at the outlet.

For instance, a 450-mm (18-inch) pipe has a design discharge of 0.3 cms (10 cfs) and an outlet velocity of 3.66 mps (12 fps). Table 11.11 indicates that standard riprap would be required at the outlet, however, it may be more practical to employ the above methods for reducing the exit velocity, so that modified or intermediate riprap can be used in lieu of standard riprap.

Step 5. Select an Appropriate Type of Outlet Protection Design

Review Section 11.13.2 describing the Types of Outlet Protection and the Design Criteria in Section 11.13.3, which will be used in the selection of the type and size of the outlet protection. The type of outlet protection and design criteria presented in these Sections are summarized below:

TYPE	OUTLET VELOCITY mps (fps)	TAILWATER DEPTH	COMMENT
Type A Riprap Apron	≤ 4.27 (14)	≤ ½ pipe rise (minimum condition)	Outlet has no well-defined channel downstream
Type B Riprap Apron	≤ 4.27 (14)	≥ ½ pipe rise (maximum condition)	Outlet has no well-defined channel downstream
Type C Riprap Apron	≤ 4.27 (14)	all	Outlet has a well-defined channel downstream
Preformed Scour Hole	≥ 4.27 (14)	all	May be used for lower exit velocities as dictated by Tables 8-6 and 8-7
Structurally Lined Energy Dissipaters	≥ 4.27 (14)	all	See HEC-14 To be used only with prior approval from Hydraulics and Drainage Section.

Table 11-15 Summary of Outlet Protection Types and Selection Criteria

A. If the outlet velocity, tailwater depth and site conditions indicate that a Type A, B or C Riprap Apron may be used, check Tables 11-12 and 11-13 to see if a Riprap Apron can be used based on the pipe size and discharge.

B. If a Riprap Apron is adequate, Tables 11-12 and 11-13 will specify the length of apron required. Proceed to **Step 6**.

C. If the Tables do not show an apron length, this indicates that the designer should proceed to **Step 7,** using a preformed scour hole design instead of a riprap apron.

For example, a project has two outlets.

Outlet No.1 is a 450-mm (18-inch) RCP with an outlet velocity of 2.74 mps (9 fps) and a design discharge of 0.275 cms (9.7 cfs) that outlets onto a flat area with a tailwater depth (TW) less than 200 mm (8 in).

Outlet No.2 is a 600-mm (24-inch) RCP with an outlet velocity of 3.35 mps (11 fps) and a design discharge of 0.500 cms (17.7 cfs) that outlets into a drainage channel with a tailwater depth (TW) of 500 mm (20 in).

Initially, the design parameters indicate that a Type A Riprap Apron and a Type C Riprap Apron would be appropriate for Outlet No. 1 and 2, respectively.

Next, Table 11-12 is checked for Outlet No. 1 with the design discharge and shows that a Type A Riprap Apron could be used with a required length of 4.5-m (15-ft.). Table 11-13 is checked for Outlet No. 2 and shows that the design discharge falls outside the limit for the use of a Type C Riprap Apron and that a preformed scour hole design should be used.

Step 6. Riprap Apron Dimensions

The designer has determined in **Step 5** that a riprap apron is appropriate at the outlet location. Riprap apron dimensions are discussed in Section 11.13.5 and are determined as follows:

A. The length of apron (L_a) is determined from Tables 11-12 and 11-13 or Equations 11.31 and 11.32. **It should be noted, however, that the Tables are required to determine the minimum and maximum length of apron that can be used for a given pipe size and discharge.** The length of apron is shown on Figures 11-13 and 11-14.

B. The width of the upstream (W_1) and downstream W_2) apron limit for the Type A and B Riprap Apron are computed using Equations 11.33 and 11.34, respectively, or as shown on Figure 11-13. The width of a Type C Riprap Apron (W_3) is determined as described in Section 11.13.5 or as shown on Figure 11-14.

Step 7. Preformed Scour Hole Design

The designer has determined in **Step 5** that the outlet velocity, Tables 11-12 and 11-13 or site conditions dictate that a preformed scour hole is required for outlet protection. The design is discussed in Section 11.13.6 and summarized as follows:

A. Compute the median stone size (d_{50}) required for both the Type 1 and 2 Preformed Scour Holes using Equations 11.35 and 11.36, respectively.

B. Compute the scour hole dimensions for both types using the set of equations labeled 11.37 or Figure 11-15.

C. Compare the values computed in Steps 7A and 7B for the two preformed scour hole types and select the one that provides the most economical and practical design given the site conditions.

Step 8. Special Design

In unusual cases where neither a riprap apron nor preformed scour hole can be used, and a special design is required, HEC-14 can be used to design an alternative energy dissipater. These designs, however, require prior approval from the Hydraulics and Drainage Section.

Step 9. Prepare Outlet Protection Computation Form

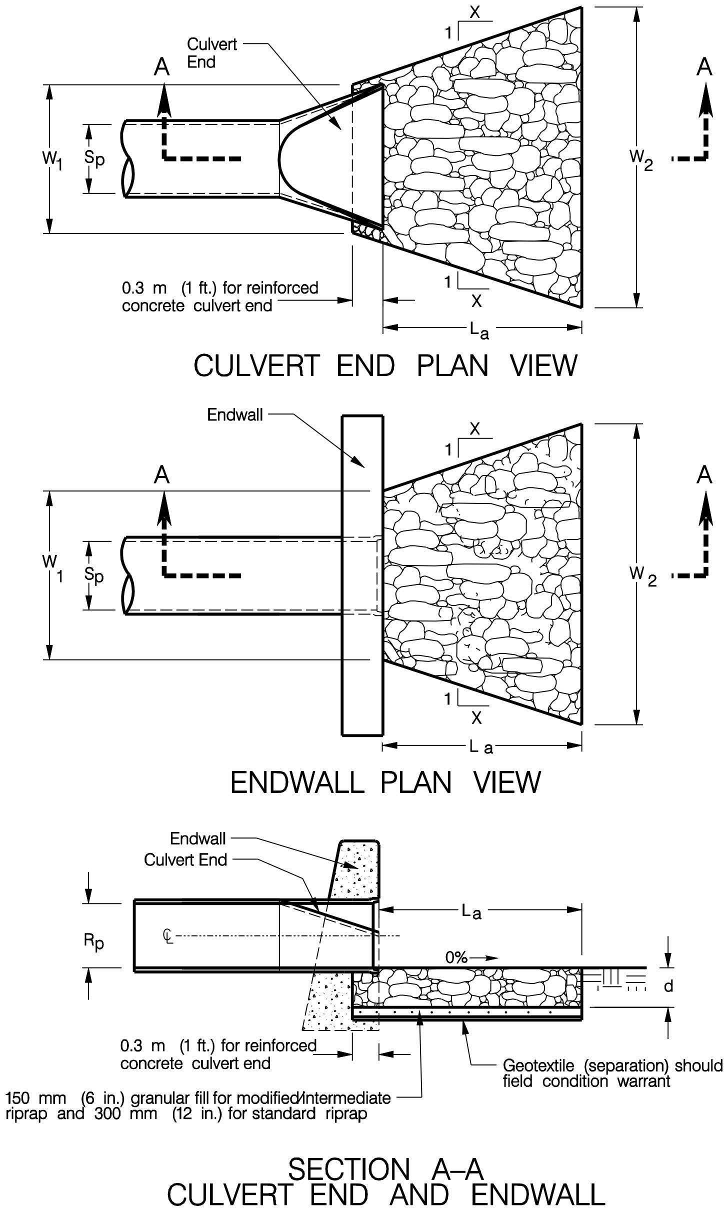
See Appendix A for form.

Step 10. Project Plans

The following information is required on the project plans for outlet protection:

TYPE	**PLANS**	**DETAILS**
Type A, B & C Riprap Apron	Call out apron type (A,B,C), riprap type & length of apron (L_a). Show apron limits.	Include detail(s) similar to Figures 11-13 & 11-14
Preformed Scour Hole Type 1 & Type 2	Call out type & riprap size. Show limits.	Include a detail similar to Figure 11-15.

Table 11-16 Outlet Protection Plan Requirements



LEGEND

S_p = Max. inside pipe span (non–circular sections); Inside pipe diameter (circular sections)

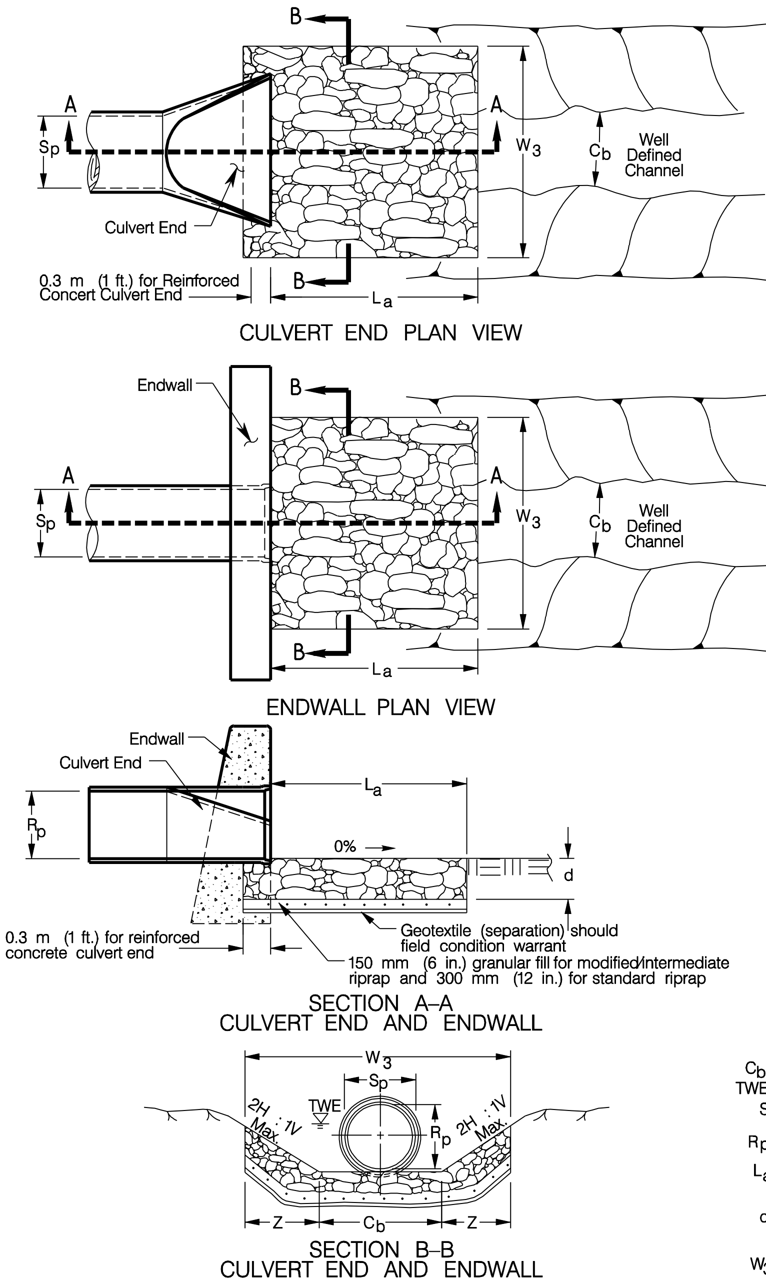
R_p = Max. inside pipe rise (non–circular sections); Inside pipe diameter (circular sections)

L_a = Length of riprap apron measured from the end of culvert end section or face of endwall

d = 300 mm (12 in.) Modified Riprap; 450 mm (18 in.) Intermediate Riprap; 900 mm (36 in.) Standard Riprap

	X	W_1	W_2
Type A Riprap Apron	3	$3S_p$	$3S_p + 0.7$ La
Type B Riprap Apron	5	$3S_p$	$3S_p + 0.4$ La

Figure 11-13 Type A and B Riprap Apron
(to be used where there is no defined channel downstream of the outlet)



LEGEND

Z	Channel Side Slope
2	2H : 1V
3	3H : 1V
4	4H : 1V
5	5H : 1V
6	6H : 1V

C_b = Channel Bottom

TWE = Tailwater elevation

S_p = Max. Inside Pipe Span (Non–Circular Sections); Inside Pipe Diameter (Circular Sections)

R_p = Max. Inside Pipe Rise (Non–Circular Sections); Inside Pipe Diameter (Circular Sections)

L_a = Length of riprap apron measured from the end of culvert end section or face of endwall

d = 300 mm (12 in.) Modified Riprap; 450 mm (18 in.) Intermediate Riprap; 900 mm (36 in.) Standard Riprap

W_3 = Use Whichever is Greater: 3S; 2(Z) (TWE + 0.3 m) + C_b; 2(Z) (0.7 Rp) + C_b

Figure 11-14 Type C Riprap Apron
(to be used where there is a well defined channel downstream of the outlet)

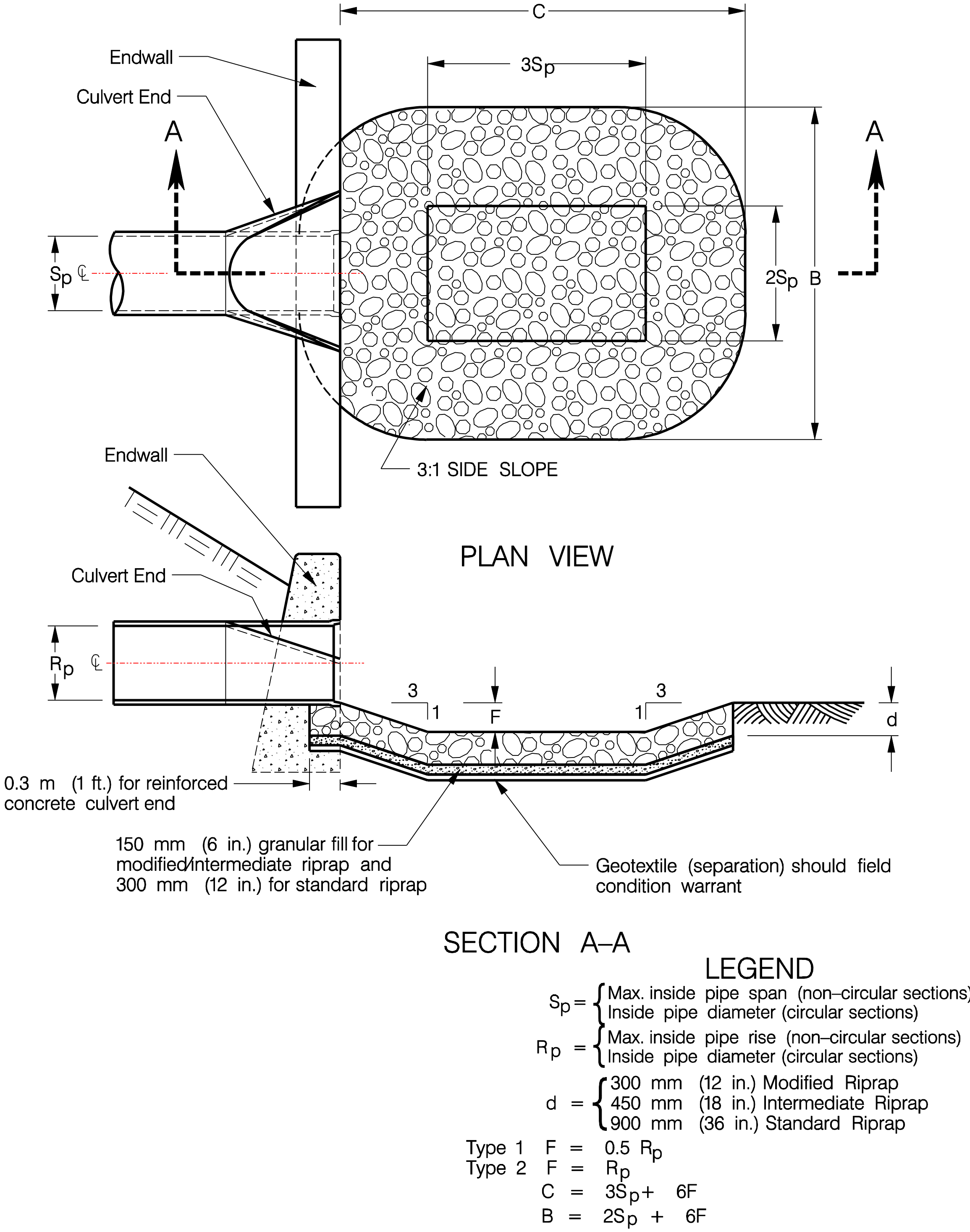


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

NOAA Atlas 14, Volume 10, Version 3
Location name: Wilton, Connecticut, USA*
Latitude: 41.1959°, Longitude: -73.4376°
Elevation: 222.75 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.36 (3.36-5.56)	5.08 (3.92-6.48)	6.26 (4.81-8.02)	7.25 (5.54-9.31)	8.60 (6.37-11.4)	9.62 (7.00-13.0)	10.7 (7.52-14.9)	11.8 (7.94-16.8)	13.4 (8.66-19.6)	14.6 (9.24-21.8)
10-min	3.08 (2.38-3.94)	3.60 (2.78-4.59)	4.44 (3.41-5.68)	5.14 (3.92-6.60)	6.09 (4.51-8.10)	6.82 (4.95-9.22)	7.57 (5.33-10.5)	8.36 (5.63-11.9)	9.47 (6.13-13.9)	10.3 (6.55-15.5)
15-min	2.42 (1.87-3.08)	2.82 (2.18-3.60)	3.48 (2.68-4.46)	4.03 (3.08-5.17)	4.78 (3.54-6.35)	5.35 (3.88-7.24)	5.94 (4.18-8.26)	6.56 (4.42-9.36)	7.43 (4.81-10.9)	8.11 (5.13-12.1)
30-min	1.69 (1.31-2.16)	1.97 (1.52-2.51)	2.42 (1.86-3.10)	2.80 (2.14-3.60)	3.32 (2.45-4.40)	3.71 (2.69-5.01)	4.11 (2.89-5.70)	4.53 (3.05-6.45)	5.08 (3.29-7.46)	5.51 (3.49-8.24)
60-min	1.09 (0.841-1.39)	1.27 (0.976-1.61)	1.55 (1.19-1.99)	1.79 (1.37-2.30)	2.12 (1.57-2.82)	2.38 (1.72-3.20)	2.63 (1.84-3.64)	2.89 (1.94-4.11)	3.23 (2.09-4.74)	3.48 (2.20-5.21)
2-hr	0.700 (0.544-0.886)	0.823 (0.638-1.04)	1.02 (0.793-1.30)	1.19 (0.918-1.52)	1.42 (1.06-1.88)	1.60 (1.17-2.15)	1.78 (1.26-2.47)	1.98 (1.34-2.80)	2.26 (1.47-3.30)	2.49 (1.58-3.69)
3-hr	0.536 (0.418-0.676)	0.634 (0.494-0.801)	0.796 (0.617-1.01)	0.930 (0.718-1.18)	1.12 (0.834-1.47)	1.25 (0.919-1.69)	1.40 (0.998-1.94)	1.56 (1.06-2.21)	1.80 (1.17-2.62)	2.00 (1.27-2.96)
6-hr	0.338 (0.265-0.424)	0.403 (0.316-0.506)	0.511 (0.399-0.642)	0.600 (0.465-0.757)	0.722 (0.543-0.948)	0.813 (0.601-1.09)	0.910 (0.654-1.26)	1.02 (0.694-1.44)	1.19 (0.777-1.72)	1.33 (0.847-1.95)
12-hr	0.208 (0.164-0.258)	0.249 (0.196-0.310)	0.317 (0.249-0.396)	0.373 (0.291-0.468)	0.451 (0.341-0.588)	0.509 (0.377-0.677)	0.570 (0.412-0.785)	0.642 (0.437-0.895)	0.748 (0.490-1.07)	0.837 (0.535-1.22)
24-hr	0.122 (0.097-0.151)	0.148 (0.118-0.184)	0.191 (0.151-0.237)	0.227 (0.178-0.282)	0.275 (0.210-0.357)	0.312 (0.233-0.412)	0.350 (0.255-0.481)	0.396 (0.271-0.549)	0.465 (0.306-0.663)	0.523 (0.336-0.759)
2-day	0.068 (0.055-0.084)	0.084 (0.067-0.104)	0.111 (0.088-0.136)	0.132 (0.105-0.164)	0.162 (0.124-0.210)	0.184 (0.139-0.243)	0.208 (0.153-0.286)	0.238 (0.163-0.327)	0.283 (0.186-0.400)	0.321 (0.207-0.462)
3-day	0.049 (0.040-0.060)	0.061 (0.049-0.075)	0.080 (0.064-0.099)	0.096 (0.076-0.119)	0.118 (0.091-0.152)	0.134 (0.101-0.177)	0.152 (0.112-0.208)	0.173 (0.119-0.238)	0.207 (0.136-0.292)	0.235 (0.152-0.337)
4-day	0.040 (0.032-0.048)	0.049 (0.039-0.060)	0.064 (0.051-0.079)	0.077 (0.061-0.094)	0.094 (0.073-0.121)	0.107 (0.081-0.140)	0.121 (0.089-0.165)	0.138 (0.095-0.189)	0.164 (0.108-0.231)	0.186 (0.120-0.267)
7-day	0.027 (0.022-0.033)	0.033 (0.027-0.040)	0.042 (0.034-0.052)	0.050 (0.040-0.061)	0.061 (0.047-0.078)	0.069 (0.052-0.090)	0.078 (0.057-0.105)	0.088 (0.061-0.120)	0.104 (0.069-0.145)	0.117 (0.076-0.166)
10-day	0.022 (0.018-0.027)	0.026 (0.021-0.032)	0.033 (0.027-0.040)	0.039 (0.031-0.048)	0.047 (0.037-0.060)	0.053 (0.040-0.069)	0.060 (0.044-0.079)	0.067 (0.046-0.090)	0.078 (0.052-0.108)	0.087 (0.056-0.123)
20-day	0.016 (0.013-0.019)	0.018 (0.015-0.022)	0.022 (0.018-0.026)	0.025 (0.020-0.030)	0.030 (0.023-0.037)	0.033 (0.025-0.042)	0.037 (0.027-0.048)	0.040 (0.028-0.054)	0.046 (0.031-0.063)	0.050 (0.032-0.070)
30-day	0.013 (0.011-0.015)	0.015 (0.012-0.017)	0.017 (0.014-0.021)	0.020 (0.016-0.024)	0.023 (0.018-0.029)	0.026 (0.019-0.032)	0.028 (0.021-0.036)	0.031 (0.021-0.041)	0.034 (0.023-0.047)	0.037 (0.024-0.051)
45-day	0.011 (0.009-0.013)	0.012 (0.010-0.014)	0.014 (0.011-0.017)	0.016 (0.013-0.019)	0.018 (0.014-0.022)	0.020 (0.015-0.025)	0.022 (0.016-0.028)	0.023 (0.016-0.031)	0.026 (0.017-0.035)	0.027 (0.018-0.038)
60-day	0.009 (0.008-0.011)	0.010 (0.008-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.012-0.019)	0.017 (0.013-0.021)	0.018 (0.013-0.023)	0.019 (0.014-0.026)	0.021 (0.014-0.029)	0.022 (0.015-0.031)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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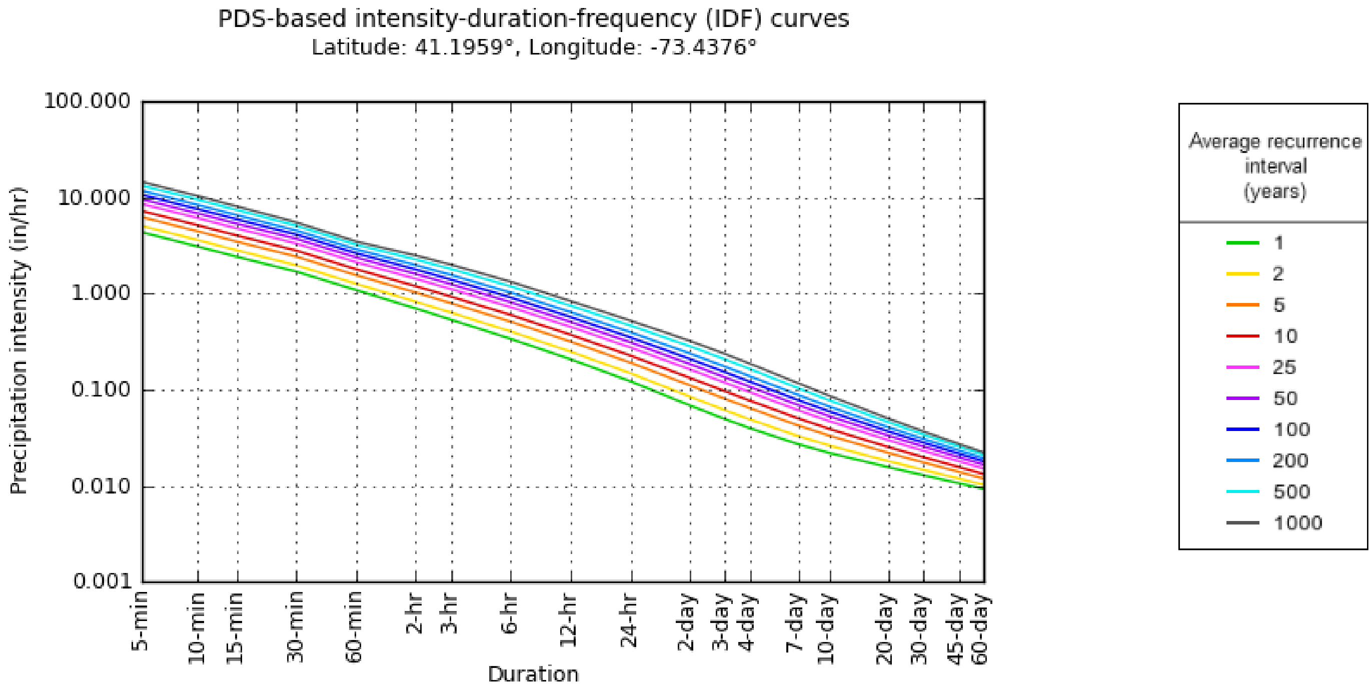
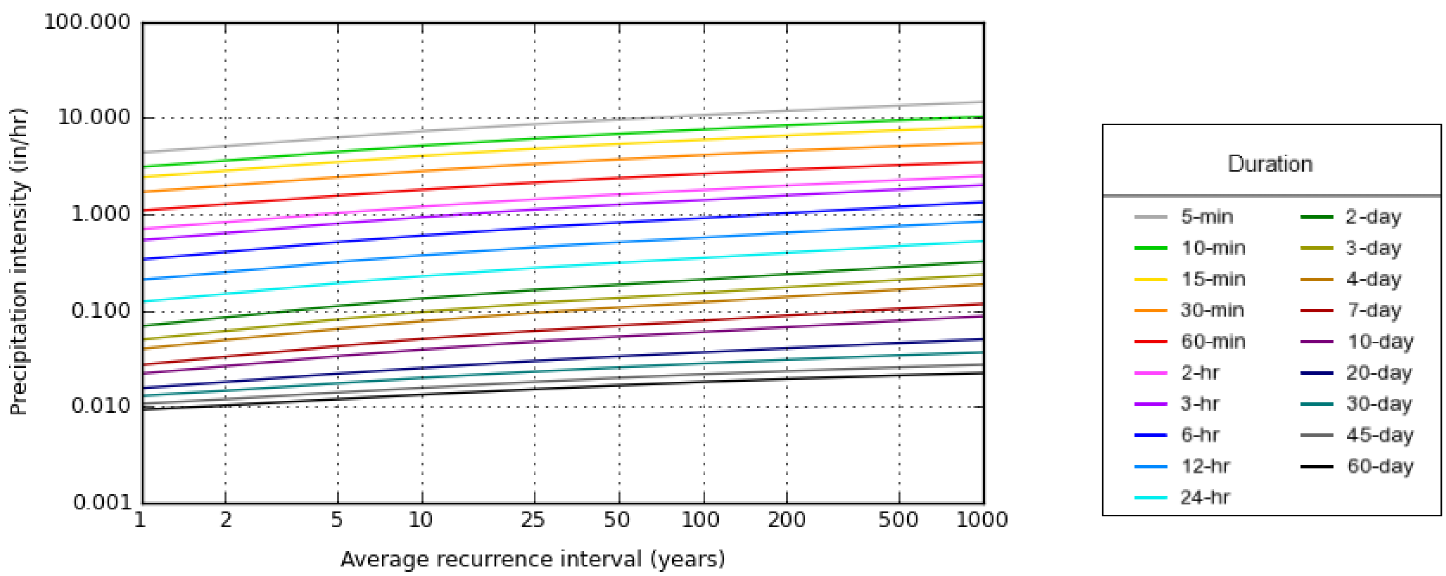
PF graphical





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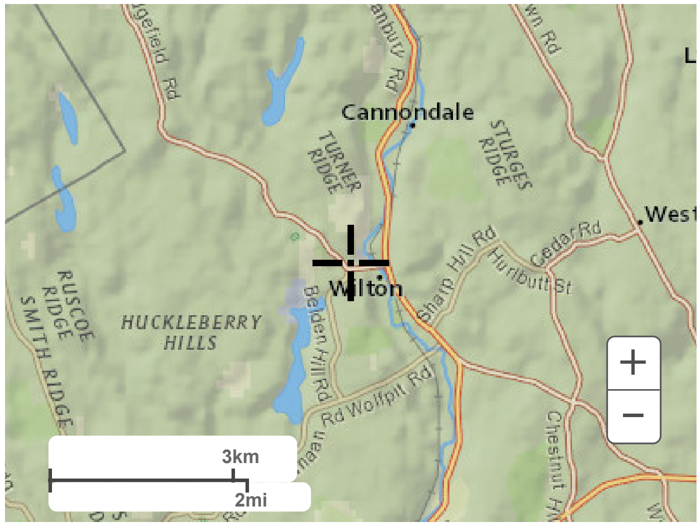
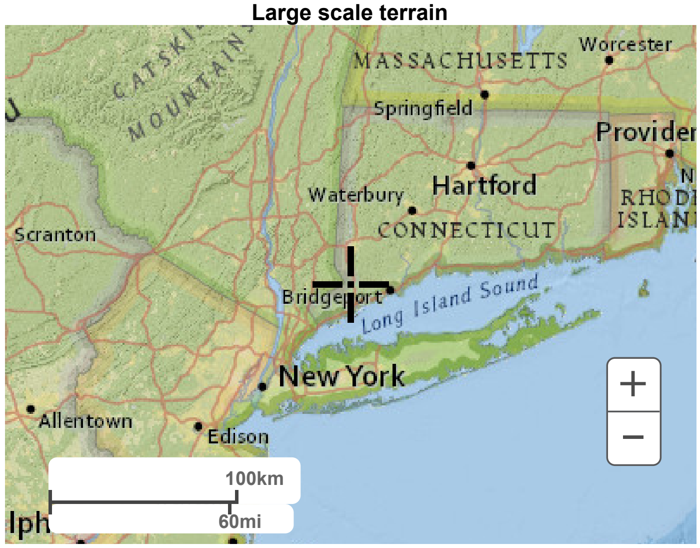
Maps & aerials

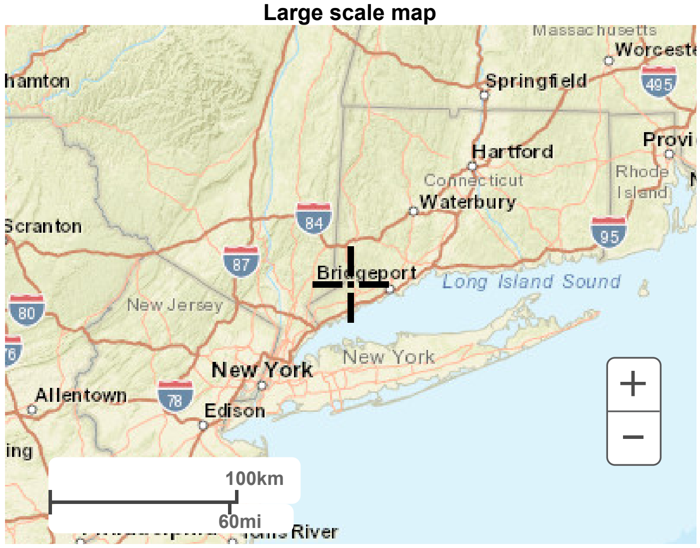
Small scale terrain



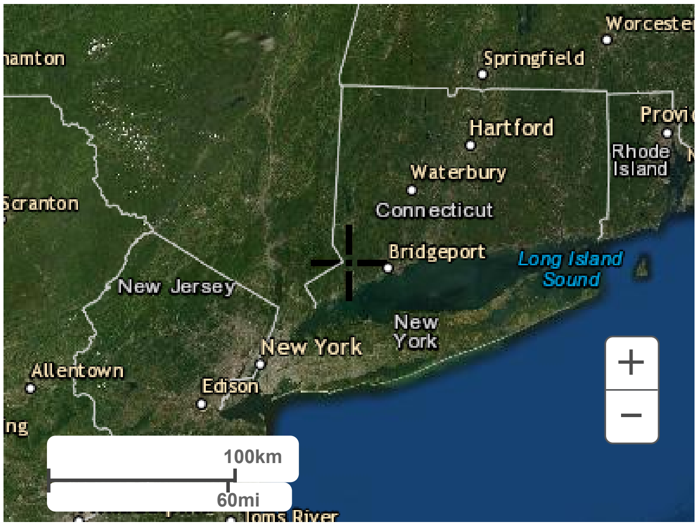
Large scale terrain



Large scale map



Large scale aerial



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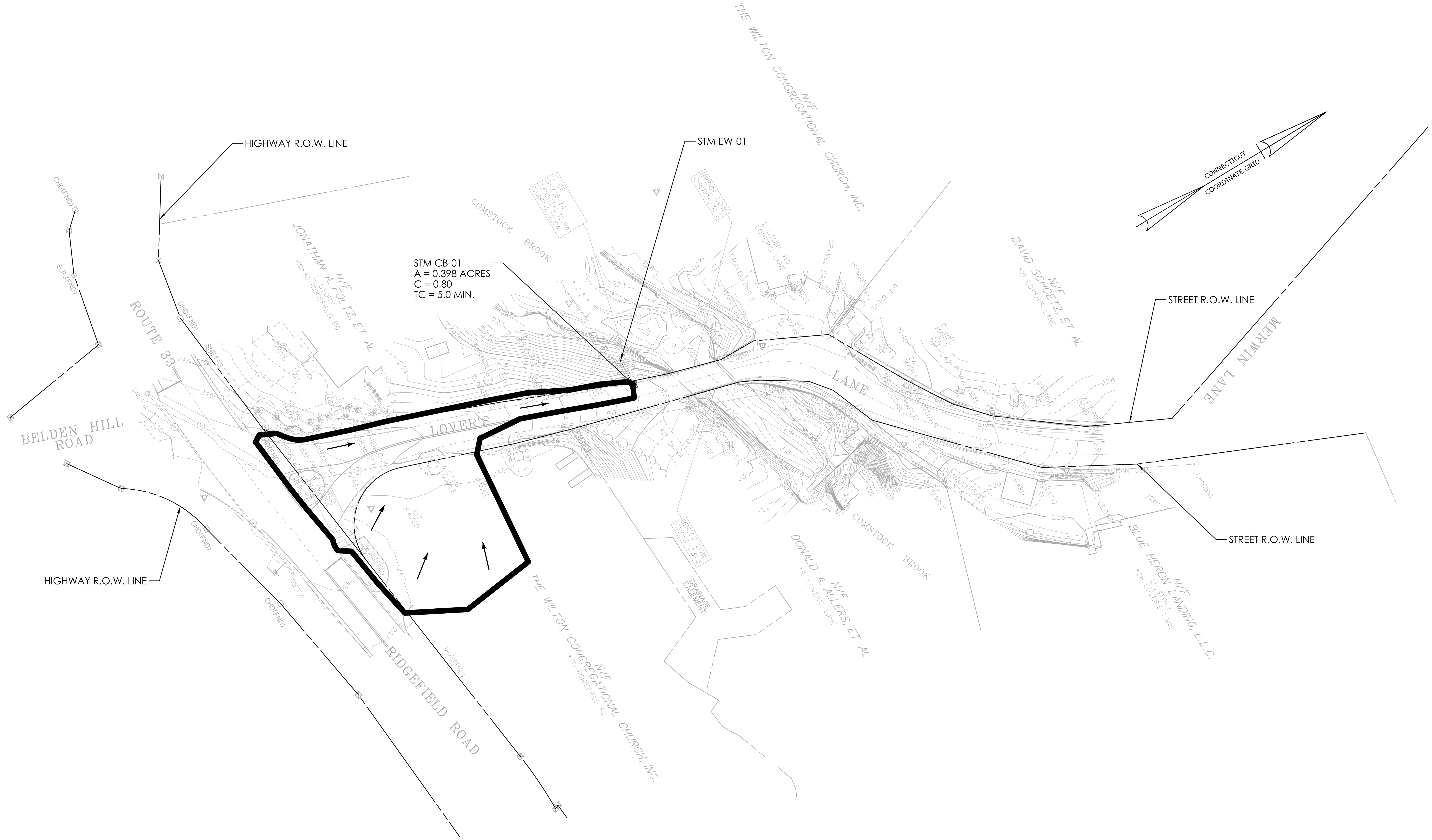
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Appendix C: Drainage Maps



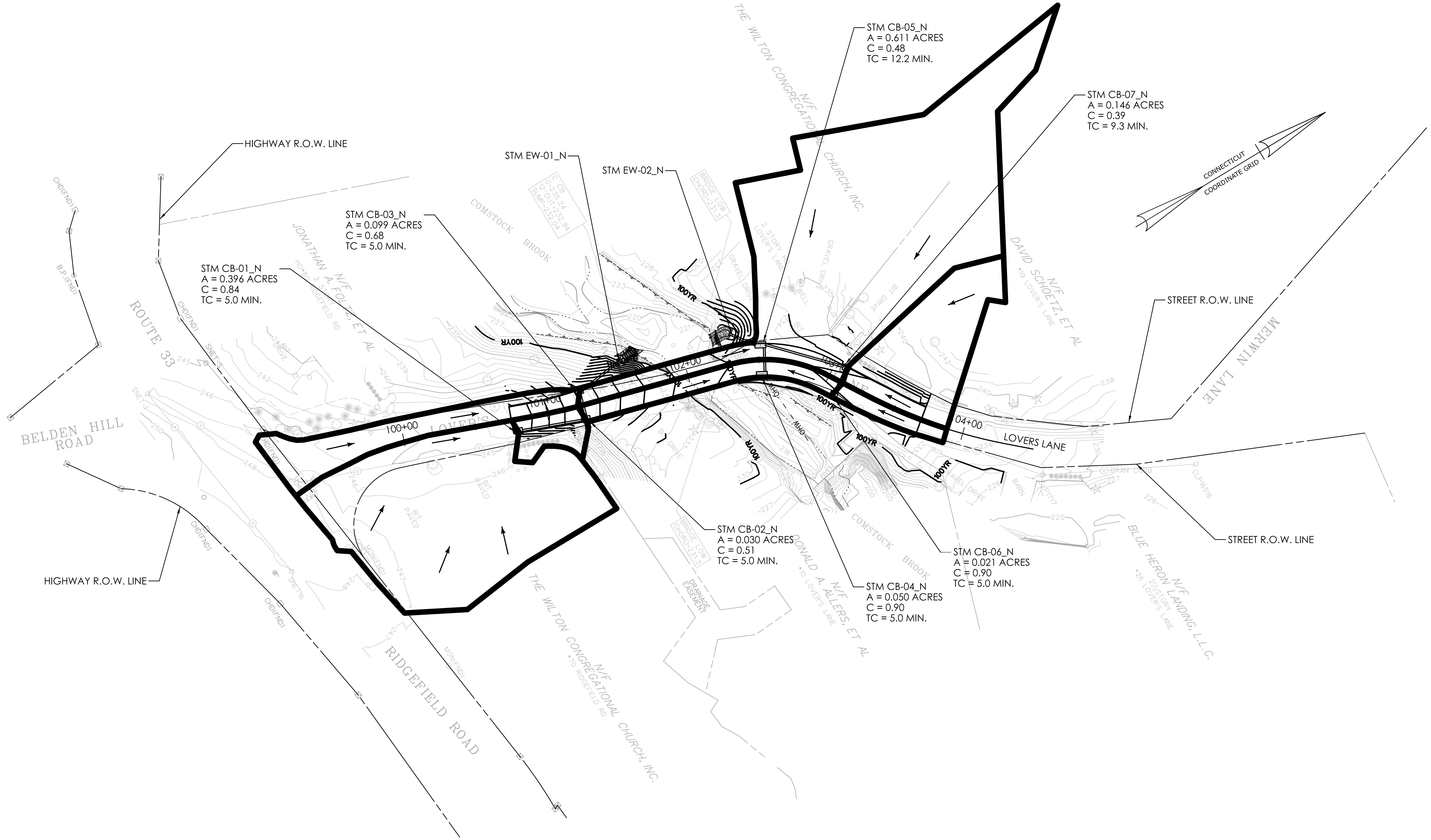
NOTE:

SEE SHEET REF-01 FOR ADDITIONAL CONTOUR INFORMATION.

DESIGNER/DRAFTER:	CHECKED BY:
HORIZONTAL SCALE 1" = 40' (0, 40', 80')	SIGNATURE/ BLOCK:
STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	
PROJECT NUMBER: 161-142	DRAWING NO. DRN-01
PROJECT DESCRIPTION: REHABILITATION OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK	SHEET NO.
TOWN(S): WILTON	
DRAWING TITLE: EXISTING DRAINAGE MAP	

LASTED SAVED BY: LCafaro **FILE NAME:** I:\Projects\221-125\Hydro\Base Models\Proposed Models\HW_CB_162_142_Proposed_Drainage_Plans.dgn
PLOTTED DATE: 11/5/2021


A STM CB-01
A = 0.398 ACRES
C = 0.80
TC = 5.0 MIN.
230
250
SPN: 161-142
Project: Rehabilitation of Bridge No. 049758 Lovers Lane over Comstock Brook
Existing Drainage Conditions
Location: Wilton, CT
REF-01
SCALE: 1" = 40'
DATE: 8/16/2021

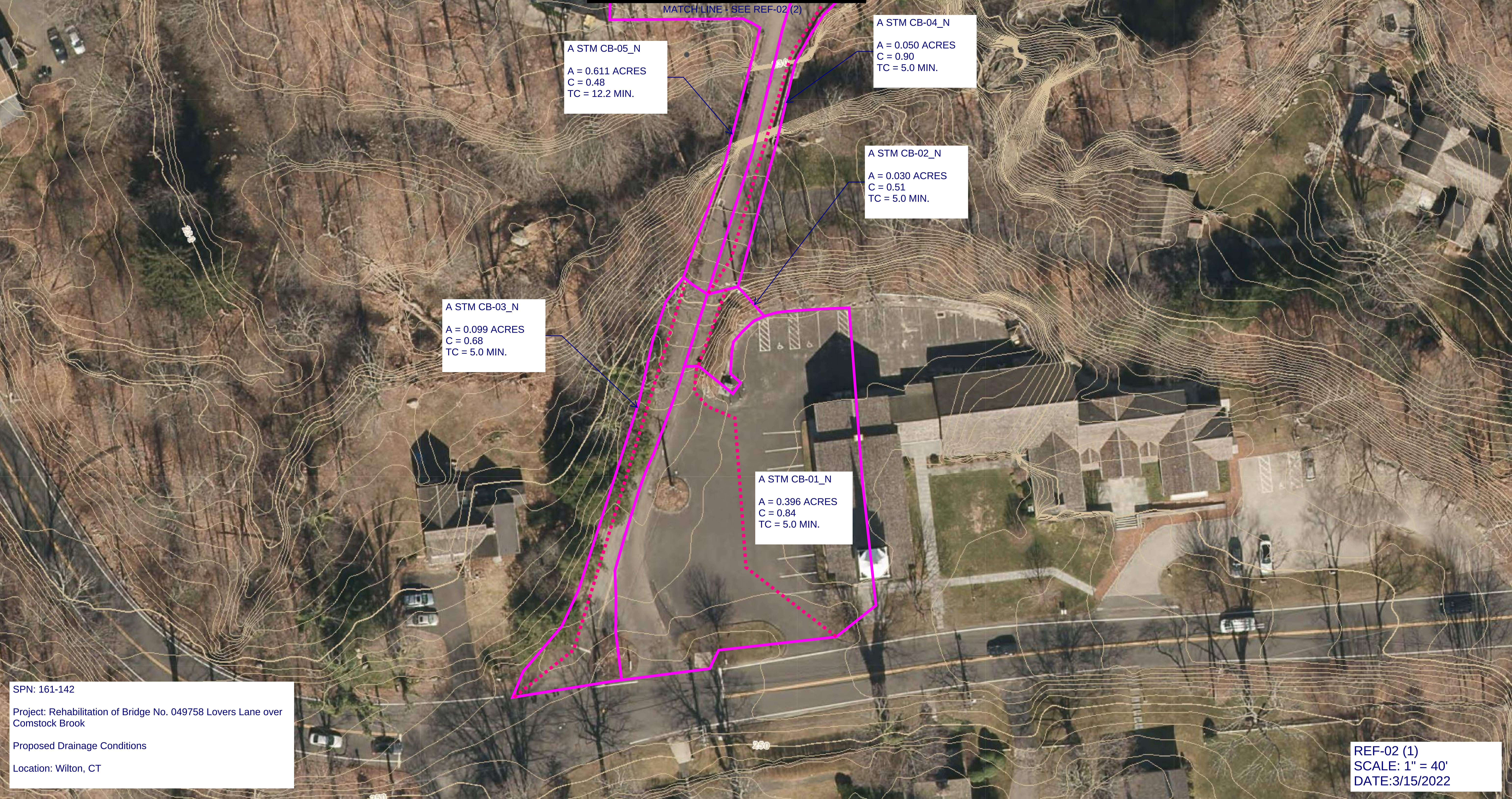


NOTE:

SEE SHEET REF-02 FOR ADDITIONAL CONTOUR INFORMATION.

DESIGNER/DRAFTER:	CHECKED BY:	HORIZONTAL SCALE 1" = 40' (0, 40', 80')	SIGNATURE/ BLOCK:
STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	PROJECT NUMBER: 161-142		DRAWING NO. DRN-02
	PROJECT DESCRIPTION: REHABILITATION OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK		SHEET NO.
	TOWN(S): WILTON		
	DRAWING TITLE: PROPOSED DRAINAGE MAP		

LASTED SAVED BY: LCofaro FILE NAME: I:\Projects\221-125\Hydro\Base Models\Proposed Models\HW_CB_162_142_Proposed_Drainage_Plans.dgn
PLOTTED DATE: 3/16/2022


MATCH LINE - SEE REF-02 (2)
A STM CB-05_N
A = 0.611 ACRES
C = 0.48
TC = 12.2 MIN.
A STM CB-04_N
A = 0.050 ACRES
C = 0.90
TC = 5.0 MIN.
A STM CB-02_N
A = 0.030 ACRES
C = 0.51
TC = 5.0 MIN.
A STM CB-03_N
A = 0.099 ACRES
C = 0.68
TC = 5.0 MIN.
A STM CB-01_N
A = 0.396 ACRES
C = 0.84
TC = 5.0 MIN.
250
SPN: 161-142
Project: Rehabilitation of Bridge No. 049758 Lovers Lane over Comstock Brook
Proposed Drainage Conditions
Location: Wilton, CT
REF-02 (1)
SCALE: 1" = 40'
DATE:3/15/2022


A STM CB-07_N
A = 0.146 ACRES
C = 0.39
TC = 9.3 MIN.
A STM CB-05_N
A = 0.611 ACRES
C = 0.48
TC = 12.2 MIN.
A STM CB-06_N
A = 0.021 ACRES
C = 0.90
TC = 5.0 MIN.
A STM CB-04_N
A = 0.050 ACRES
C = 0.90
TC = 5.0 MIN.
MATCH LINE - SEE REF-02 (1)
SPN: 161-142
Project: Rehabilitation of Bridge No. 049758 Lovers Lane over Comstock Brook
Proposed Drainage Conditions
Location: Wilton, CT
REF-02 (2)
SCALE: 1" = 40'
DATE: 3/15/2022

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	8/17/2021
Checked by	JW	**Date**	8/17/2021
Job No.	221-125		
Location	Lovers Lane Wilton		

Existing Composite Drainage Runoff Coefficents

Subarea	Area	Area	Runoff	Product
ID	**SQFT**	**acres**	**Coeff.**	
STM CB-01		**A**	**C**	**CA**
Impervious	14354	0.330	0.90	0.297
Pervious (Grass)	2997	0.069	0.30	0.021
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.398**	**Sum:**	**0.317**

Area-Weighted Runoff Coefficient (sum CA/sum A) = **0.80**

Notes:

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 08/17/21	Job No. 221-125
	Checked by JW	Date 08/17/21	
For LOVERS LANE WILTON			

USDA NRCS Existing Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-01**			
Description:	**Inflow to STM CB-01**			
Sheet Flow	1			
Surface Description	Asphalt			
Manning's Roughness Coefficient, n	0.016			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	247.7			
Downstream Elevation (ft)	245.0			
Land Slope, s (ft/ft)	0.027			
Travel Time, Tt (min)	1.4			
Shallow Concentrated Flow	2			
Surface Description	Paved			
Flow Length, L (ft)	153			
Upstream Elevation (ft)	245.0			
Downstream Elevation (ft)	235.2			
Watercourse Slope, s (ft/ft)	0.064			
Average Velocity, V (ft/s)	5.14			
Travel Time, Tt (min)	0.5			
Total Time of Concentration, Tc, min:	**1.9**	**Use 5 min.**		
Total Time of Concentration, Tc, hrs:	**0.03**			

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	9/24/2021
Checked by	JW	**Date**	9/24/2021
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	Area	Area	Runoff	Product
ID	**SQFT**	**acres**	**Coeff.**	
A STM CB-01_N		**A**	**C**	**CA**
Impervious	15587	0.358	0.90	0.322
Pervious (Grass)	1646	0.038	0.30	0.011
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.396**	**Sum:**	**0.333**

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.84

Notes:

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	Date	9/24/2021
Checked by	JW	Date	9/24/2021
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	Area	Area	Runoff	Product
ID	SQFT	acres	Coeff.	
A STM CB-02_N		A	C	CA
Impervious	451	0.010	0.90	0.009
Pervious (Grass)	867	0.020	0.30	0.006
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.030**	Sum:	**0.015**

Area-Weighted Runoff Coefficient (sum CA/sum A) = **0.51**

Notes:

VN ENGINEERS, INC.

YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	Date	9/24/2021
Checked by	JW	Date	9/24/2021
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	Area	Area	Runoff	Product
ID	SQFT	acres	Coeff.	
A STM CB-03_N		A	C	CA
Impervious	2753	0.063	0.90	0.057
Pervious (Grass)	1564	0.036	0.30	0.011
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		0.099	Sum:	0.068

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.68

Notes:

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	3/7/2022
Checked by	JW	**Date**	3/8/2022
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea ID	Area SQFT	Area acres	Runoff Coeff.	Product
A STM CB-04_N		**A**	**C**	**CA**
Impervious	2164	0.050	0.90	0.045
		0.000	0.30	0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.050**	**Sum:**	**0.045**

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.90

Notes:

VN ENGINEERS, INC.

YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	9/24/2021
Checked by	JW	**Date**	9/24/2021
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	**Area**	**Area**	**Runoff**	**Product**
ID	**SQFT**	**acres**	**Coeff.**	
A STM CB-05_N		**A**	**C**	**CA**
Impervious	8998	0.207	0.90	0.186
Pervious (Gravel)	2820	0.065	0.50	0.032
Pervious (Woods)	12902	0.296	0.20	0.059
Pervious (Grass)	1899	0.044	0.30	0.013
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
	Sum:	**0.611**	**Sum:**	**0.291**

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.48

Notes:

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	3/7/2022
Checked by	JW	**Date**	3/8/2022
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	Area	Area	Runoff	Product
ID	**SQFT**	**acres**	**Coeff.**	
A STM CB-06_N		**A**	**C**	**CA**
Impervious	899	0.021	0.90	0.019
		0.000	0.30	0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.021**	**Sum:**	**0.019**

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.90

Notes:

VN ENGINEERS, INC.
YOUR DBE/WBE SOLUTION!

Calcs. by	LRC	**Date**	3/15/2022
Checked by	JW	**Date**	3/15/2022
Job No.	221-125		
Location	Lovers Lane Wilton		

Proposed Composite Drainage Runoff Coefficents

Subarea	**Area**	**Area**	**Runoff**	**Product**
ID	**SQFT**	**acres**	**Coeff.**	
A STM CB-07_N		**A**	**C**	**CA**
Impervious	1725	0.040	0.90	0.036
Pervious (Woods)	4656	0.107	0.20	0.021
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
		0.000		0.000
Sum:		**0.146**	**Sum:**	**0.057**

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.39

Notes:

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by	LRC	Date	09/24/21	Job No. 221-125
	Checked by	JW	Date	09/24/21	
For LOVERS LANE WILTON					

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-01_N**			
Description:	**Inflow to STM CB-01_N**			
Sheet Flow	1			
Surface Description	Asphalt			
Manning's Roughness Coefficient, n	0.016			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	247.0			
Downstream Elevation (ft)	246.3			
Land Slope, s (ft/ft)	0.008			
Travel Time, Tt (min)	2.3			
Shallow Concentrated Flow	2			
Surface Description	Paved			
Flow Length, L (ft)	75			
Upstream Elevation (ft)	246.3			
Downstream Elevation (ft)	242.6			
Watercourse Slope, s (ft/ft)	0.048			
Average Velocity, V (ft/s)	4.48			
Travel Time, Tt (min)	0.3			
Total Time of Concentration, Tc, min:	**2.6**	**Use 5 min.**		
Total Time of Concentration, Tc, hrs:	**0.04**			

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 09/24/21	Job No. 221-125
	Checked by JW	Date 09/24/21	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-02_N**			
Description:	**Inflow to STM CB-02_N**			
Sheet Flow	1			
Surface Description	Asphalt			
Manning's Roughness Coefficient, n	0.016			
Flow Length, L, ft (Max=100')	47			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	242.6			
Downstream Elevation (ft)	238.7			
Land Slope, s (ft/ft)	0.082			
Travel Time, Tt (min)	0.5			
Total Time of Concentration, Tc, min:	**0.5**	**Use 5 min.**		
Total Time of Concentration, Tc, hrs:	**0.01**			

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 09/24/21	Job No. 221-125
	Checked by JW	Date 09/24/21	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-03_N**			
Description:	**Inflow to STM CB-03_N**			
Sheet Flow	1			
Surface Description	Asphalt			
Manning's Roughness Coefficient, n	0.016			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	247.8			
Downstream Elevation (ft)	245.0			
Land Slope, s (ft/ft)	0.028			
Travel Time, Tt (min)	1.4			
Shallow Concentrated Flow	2			
Surface Description	Paved			
Flow Length, L (ft)	116			
Upstream Elevation (ft)	245.0			
Downstream Elevation (ft)	238.7			
Watercourse Slope, s (ft/ft)	0.054			
Average Velocity, V (ft/s)	4.73			
Travel Time, Tt (min)	0.4			
Total Time of Concentration, Tc, min:	**1.8**	**Use 5 min.**		
Total Time of Concentration, Tc, hrs:	**0.03**			

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 09/24/21	Job No. 221-125
	Checked by JW	Date 09/24/21	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-04_N**			
Description:	**Inflow to STM CB-04_N**			
Sheet Flow	1			
Surface Description	Asphalt			
Manning's Roughness Coefficient, n	0.016			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	238.7			
Downstream Elevation (ft)	233.8			
Land Slope, s (ft/ft)	0.049			
Travel Time, Tt (min)	1.1			
Shallow Concentrated Flow	2			
Surface Description	Paved			
Flow Length, L (ft)	24			
Upstream Elevation (ft)	233.8			
Downstream Elevation (ft)	233.6			
Watercourse Slope, s (ft/ft)	0.008			
Average Velocity, V (ft/s)	1.85			
Travel Time, Tt (min)	0.2			
Total Time of Concentration, Tc, min:	**1.3**	**Use 5 min.**		
Total Time of Concentration, Tc, hrs:	**0.02**			

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 09/24/21	Job No. 221-125
	Checked by JW	Date 09/24/21	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-05_N**
Description:	**Inflow to STM CB-05_N**

Sheet Flow	1			
Surface Description	Woods			
Manning's Roughness Coefficient, n	0.400			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	265.0			
Downstream Elevation (ft)	257.0			
Land Slope, s (ft/ft)	0.080			
Travel Time, Tt (min)	11.7			

Shallow Concentrated Flow	2	3		
Surface Description	Unpaved	Paved		
Flow Length, L (ft)	135	81		
Upstream Elevation (ft)	257.0	257.0		
Downstream Elevation (ft)	236.0	233.6		
Watercourse Slope, s (ft/ft)	0.156	0.289		
Average Velocity, V (ft/s)	6.36	10.93		
Travel Time, Tt (min)	0.4	0.1		

Total Time of Concentration, Tc, min:	**12.2**
Total Time of Concentration, Tc, hrs:	**0.20**

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 03/09/22	Job No. 221-125
	Checked by JW	Date 03/09/22	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-06_N**				
Description:	**Inflow to STM CB-06_N**				
Sheet Flow		1			
Surface Description		Asphalt			
Manning's Roughness Coefficient, n		0.016			
Flow Length, L, ft (Max=100')		60			
2-year, 24-hour Rainfall, P_2, (inches)		3.56			
Upstream Elevation (ft)		234.8			
Downstream Elevation (ft)		233.9			
Land Slope, s (ft/ft)		0.015			
Travel Time, Tt (min)		1.2			

Total Time of Concentration, Tc, min:	**1.2**	**Use 5 min.**
Total Time of Concentration, Tc, hrs:	**0.02**	

VN ENGINEERS, INC. YOUR DBE/WBE SOLUTION!	Calcs. by LRC	Date 03/15/22	Job No. 221-125
	Checked by JW	Date 03/15/22	
For LOVERS LANE WILTON			

USDA NRCS Proposed Time of Concentration Worksheet

Drainage Area ID:	**A STM CB-07_N**			
Description:	**Inflow to STM CB-07_N**			
Sheet Flow	1			
Surface Description	Grass			
Manning's Roughness Coefficient, n	0.300			
Flow Length, L, ft (Max=100')	100			
2-year, 24-hour Rainfall, P_2, (inches)	3.56			
Upstream Elevation (ft)	247.0			
Downstream Elevation (ft)	238.9			
Land Slope, s (ft/ft)	0.081			
Travel Time, Tt (min)	9.2			
Shallow Concentrated Flow	2			
Surface Description	Unpaved			
Flow Length, L (ft)	32			
Upstream Elevation (ft)	238.9			
Downstream Elevation (ft)	233.9			
Watercourse Slope, s (ft/ft)	0.154			
Average Velocity, V (ft/s)	6.34			
Travel Time, Tt (min)	0.1			
Total Time of Concentration, Tc, min:	**9.3**			
Total Time of Concentration, Tc, hrs:	**0.16**			

Appendix E: Modeling Output

Existing Catch Basin Data - 5 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Local CA (acres)	Total Inlet CA (acres)	Elevation (CB Bottom) (ft)	Total Rational Flow to Inlet (cfs)	Flow (Captured) (cfs)	Capacity (Inlet) (cfs)	Efficiency (At Design Spread) (%)	Depth (Gutter) (ft)	Spread / Top Width (ft)	Bypassed Rational Flow (cfs)	Bypassed CA (acres)	Intercepted CA (acres)	Capture Efficiency (Calculated) (%)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)
STM CB-01	101+62	-4.98	C" CB - 6in Conc or Stone Curb"	235.24	235.24	0.40	0.80	0.08	6.25	0.32	0.32	231.87	2.01	0.96	1.78	24.90	0.11	5.59	1.05	0.17	0.15	47.90	233.54	233.38

Existing Catch Basin Data - 10 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Local CA (acres)	Total Inlet CA (acres)	Elevation (CB Bottom) (ft)	Total Rational Flow to Inlet (cfs)	Flow (Captured) (cfs)	Capacity (Inlet) (cfs)	Efficiency (At Design Spread) (%)	Depth (Gutter) (ft)	Spread / Top Width (ft)	Bypassed Rational Flow (cfs)	Bypassed CA (acres)	Intercepted CA (acres)	Capture Efficiency (Calculated) (%)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)
STM CB-01	101+62	-4.98	C" CB - 6in Conc or Stone Curb"	235.24	235.24	0.40	0.80	0.08	7.24	0.32	0.32	231.87	2.33	1.04	1.78	24.9	0.12	5.91	1.28	0.18	0.14	44.80	233.56	233.40

Proposed Catch Basin Data - 5 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Local CA (acres)	Total Inlet CA (acres)	Elevation (CB Bottom) (ft)	Total Rational Flow to Inlet (cfs)	Flow (Captured) (cfs)	Capacity (Inlet) (cfs)	Efficiency (At Design Spread) (%)	Depth (Gutter) (ft)	Spread / Top Width (ft)	Bypassed Rational Flow (cfs)	Bypassed CA (acres)	Intercepted CA (acres)	Capture Efficiency (Calculated) (%)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)
STM CB-01_N	100+79	8.94	C" CB - 6in Conc or Stone Curb"	242.62	242.62	0.40	0.84	0.08	6.25	0.33	0.33	234.62	2.09	1.03	1.78	30.60	0.12	6.14	1.07	0.17	0.16	49.00	239.19	239.05
STM CB-02_N	101+25	10.72	C" CB - 6in Conc or Stone Curb"	238.73	238.73	0.03	0.51	0.08	6.25	0.02	0.19	230.90	1.17	0.71	1.79	28.60	0.10	4.79	0.46	0.07	0.11	60.80	235.66	235.46
STM CB-03_N	101+25	-10.74	C" CB - 6in Conc or Stone Curb"	238.74	238.74	0.10	0.68	0.08	6.25	0.07	0.07	230.00	0.42	0.33	1.79	27.50	0.07	3.23	0.09	0.02	0.05	78.20	234.92	234.71
STM CB-04_N	102+52	11.00	C" CB - DblGrt Typ2 - 6in Conc or Stone Curb"	233.65	233.65	0.05	0.90	0.08	6.25	0.05	0.12	226.40	0.75	0.75	2.54	100.00	0.14	4.61	0.00	0.00	0.12	100.00	230.91	230.85
STM CB-05_N	102+52	-11.00	C-L" CB - DblGrt Typ2"	233.65	233.65	0.61	0.48	0.20	4.06	0.29	0.32	226.00	1.31	1.31	2.54	100.00	0.19	6.19	0.00	0.00	0.32	100.00	230.87	230.68
STM CB-06_N	103+08	11.00	C" CB - 6in Conc or Stone Curb"	233.91	233.91	0.02	0.90	0.08	6.25	0.02	0.02	226.80	0.12	0.10	1.28	40.00	0.05	2.61	0.01	0.00	0.02	89.50	231.28	231.23
STM CB-07_N	103+08	-11.00	C" CB - 6in Conc or Stone Curb"	233.91	233.91	0.15	0.39	0.16	4.59	0.06	0.06	227.10	0.26	0.21	1.28	40.00	0.07	3.54	0.06	0.01	0.04	77.70	231.11	231.04

Proposed Catch Basin Data - 10 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Local CA (acres)	Total Inlet CA (acres)	Elevation (CB Bottom) (ft)	Total Rational Flow to Inlet (cfs)	Flow (Captured) (cfs)	Capacity (Inlet) (cfs)	Efficiency (At Design Spread) (%)	Depth (Gutter) (ft)	Spread / Top Width (ft)	Bypassed Rational Flow (cfs)	Bypassed CA (acres)	Intercepted CA (acres)	Capture Efficiency (Calculated) (%)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)
STM CB-01_N	100+79	8.94	C" CB - 6in Conc or Stone Curb"	242.62	242.62	0.40	0.84	0.08	7.24	0.33	0.33	234.62	2.43	1.12	1.78	30.60	0.13	6.49	1.31	0.18	0.15	46.00	239.22	239.07
STM CB-02_N	101+25	10.72	C" CB - 6in Conc or Stone Curb"	238.73	238.73	0.03	0.51	0.08	7.24	0.02	0.20	230.90	1.42	0.81	1.79	28.60	0.10	5.16	0.62	0.08	0.11	56.70	235.70	235.49
STM CB-03_N	101+25	-10.74	C" CB - 6in Conc or Stone Curb"	238.74	238.74	0.10	0.68	0.08	7.24	0.07	0.07	230.00	0.49	0.37	1.79	27.50	0.07	3.41	0.12	0.02	0.05	75.70	234.98	234.75
STM CB-04_N	102+52	11.00	C" CB - DblGrt Typ2 - 6in Conc or Stone Curb"	233.65	233.65	0.05	0.90	0.08	7.24	0.05	0.13	226.40	0.96	0.96	2.54	100.00	0.16	5.23	0.00	0.00	0.13	100.00	231.00	230.95
STM CB-05_N	102+52	-11.00	C-L" CB - DblGrt Typ2"	233.65	233.65	0.61	0.48	0.20	4.70	0.29	0.32	226.00	1.53	1.53	2.54	100.00	0.20	6.75	0.00	0.00	0.32	100.00	230.96	230.76
STM CB-06_N	103+08	11.00	C" CB - 6in Conc or Stone Curb"	233.91	233.91	0.02	0.90	0.08	7.24	0.02	0.02	226.80	0.14	0.12	1.28	40.00	0.06	2.75	0.02	0.00	0.02	87.60	231.29	231.24
STM CB-07_N	103+08	-11.00	C" CB - 6in Conc or Stone Curb"	233.91	233.91	0.15	0.39	0.16	5.32	0.06	0.06	227.10	0.31	0.23	1.28	40.00	0.08	3.74	0.08	0.01	0.04	75.40	231.13	231.05

Existing Pipe Data - 5 Year Storm Event

Label	Start Node	Start Invert (ft)	Stop Node	Stop Invert (ft)	Length (Unified) (ft)	Slope (%)	Diameter (in)	Material	Manning's "n"	Flow (cfs)	Velocity (Avg.) (ft/s)	Depth (Critical) (ft)	Depth (Normal) (ft)	Depth (Out) (ft)	Froude Number (Normal)	Capacity Full (cfs)	Flow/Capacity (Design) (%)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM PIPE-01	STM CB-01	232.94	STM EW-01	229.07	18.00	21.52	12.00	Corrugated HDPE (Smooth Interior)	0.012	0.96	12.14	0.41	0.16	0.16	6.486	17.9	5.4	233.51	231.43	233.35	229.23

Existing Pipe Data - 10 Year Storm Event

Label	Start Node	Start Invert (ft)	Stop Node	Stop Invert (ft)	Length (Unified) (ft)	Slope (%)	Diameter (in)	Material	Manning's "n"	Flow (cfs)	Velocity (Avg.) (ft/s)	Depth (Critical) (ft)	Depth (Normal) (ft)	Depth (Out) (ft)	Froude Number (Normal)	Capacity Full (cfs)	Flow/Capacity (Design) (%)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM PIPE-01	STM CB-01	232.94	STM EW-01	229.07	18.00	21.52	12.00	Corrugated HDPE (Smooth Interior)	0.012	1.04	12.43	0.43	0.16	0.17	6.51	17.90	5.80	233.53	231.50	233.37	229.23

Proposed Pipe Data - 5 Year Storm Event

Label	Start Node	Start Invert (ft)	Stop Node	Stop Invert (ft)	Length (Unified) (ft)	Slope (%)	Diameter (in)	Material	Manning's "n"	Flow (cfs)	Velocity (Avg.) (ft/s)	Depth (Critical) (ft)	Depth (Normal) (ft)	Depth (Out) (ft)	Froude Number (Normal)	Capacity Full (cfs)	Flow/Capacity (Design) (%)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM PIPE-01_N	STM CB-01_N	238.62	STM CB-02_N	235.75	48.00	6.11	15.00	Concrete	0.012	1.03	7.72	0.40	0.21	0.21	3.60	17.29	5.90	239.16	236.88	239.02	235.96
STM PIPE-02_N	STM CB-02_N	234.90	STM CB-03_N	234.70	20.00	1.00	15.00	Concrete	0.012	1.73	4.72	0.52	0.42	0.43	1.50	7.00	24.70	235.62	235.46	235.42	235.13
STM PIPE-03_N	STM CB-03_N	234.00	STM EW-01_N	230.00	36.00	11.76	15.00	Corrugated HDPE (Corrugated Interior)	0.025	2.05	7.08	0.57	0.36	0.36	2.47	11.52	17.80	234.79	231.14	234.57	230.36
STM PIPE-04_N	STM CB-07_N	230.80	STM CB-05_N	230.50	56.00	0.49	15.00	Concrete	0.012	0.28	2.17	0.21	0.20	0.36	1.02	4.91	5.80	231.08	230.87	231.01	230.86
STM PIPE-05_N	STM CB-04_N	230.40	STM CB-05_N	230.25	20.00	0.71	15.00	Concrete	0.012	0.75	3.30	0.34	0.30	0.60	1.26	5.91	12.70	230.90	230.88	230.84	230.85
STM PIPE-06_N	STM CB-05_N	230.00	STM EW-02_N	229.68	20.00	1.61	15.00	Corrugated HDPE (Corrugated Interior)	0.025	2.05	3.44	0.57	0.61	0.57	0.88	4.26	48.10	230.80	230.47	230.61	230.25
STM PIPE-07_N	STM CB-06_N	231.10	STM CB-07_N	230.90	20.00	1.00	15.00	Concrete	0.012	0.10	2.07	0.12	0.11	0.20	1.36	7.00	1.50	231.27	231.11	231.22	231.10

Proposed Pipe Data - 10 Year Storm Event

Label	Start Node	Start Invert (ft)	Stop Node	Stop Invert (ft)	Length (Unified) (ft)	Slope (%)	Diameter (in)	Material	Manning's "n"	Flow (cfs)	Velocity (Avg.) (ft/s)	Depth (Critical) (ft)	Depth (Normal) (ft)	Depth (Out) (ft)	Froude Number (Normal)	Capacity Full (cfs)	Flow/Capacity (Design) (%)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM PIPE-01_N	STM CB-01_N	238.62	STM CB-02_N	235.75	48.00	6.11	15.00	Concrete	0.012	1.12	7.93	0.42	0.22	0.22	3.62	17.29	6.50	239.19	236.94	239.04	235.97
STM PIPE-02_N	STM CB-02_N	234.90	STM CB-03_N	234.70	20.00	1.00	15.00	Concrete	0.012	1.91	4.86	0.55	0.45	0.46	1.49	7.00	27.30	235.66	235.50	235.45	235.16
STM PIPE-03_N	STM CB-03_N	234.00	STM EW-01_N	230.00	36.00	11.76	15.00	Corrugated HDPE (Corrugated Interior)	0.025	2.28	7.30	0.60	0.38	0.38	2.47	11.52	19.80	234.84	231.21	234.60	230.38
STM PIPE-04_N	STM CB-07_N	230.80	STM CB-05_N	230.50	56.00	0.50	15.00	Concrete	0.012	0.32	2.25	0.22	0.22	0.46	1.03	4.91	6.50	231.09	230.96	231.02	230.96
STM PIPE-05_N	STM CB-04_N	230.40	STM CB-05_N	230.25	20.00	0.71	15.00	Concrete	0.012	0.96	3.54	0.38	0.34	0.69	1.27	5.91	16.20	230.99	230.97	230.93	230.94
STM PIPE-06_N	STM CB-05_N	230.00	STM EW-02_N	229.68	20.00	1.61	15.00	Corrugated HDPE (Corrugated Interior)	0.025	2.44	3.59	0.63	0.68	0.63	0.86	4.26	57.20	230.88	230.55	230.68	230.30
STM PIPE-07_N	STM CB-06_N	231.10	STM CB-07_N	230.90	20.00	1.00	15.00	Concrete	0.012	0.12	2.15	0.13	0.11	0.22	1.37	7.00	1.70	231.28	231.13	231.23	231.12

Existing Catch Basin Spread Data - 5 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Inlet Location	Cross Slope (%)	Spread / Top Width (ft)	Depth (Gutter) (ft)	Required Spread Condition Treatment	Provided Clear Roadway Width (ft)	Lane Width (ft)	Roadway Width (ft)
STM CB-01	101+62	-4.98	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	5.59	0.11	1/2 Lane	12.41	9.00	18.00

Existing Catch Basin Spread Data - 10 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Inlet Location	Cross Slope (%)	Spread / Top Width (ft)	Depth (Gutter) (ft)	Required Spread Condition Treatment	Provided Clear Roadway Width (ft)	Lane Width (ft)	Roadway Width (ft)
STM CB-01	101+62	-4.98	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	5.91	0.12	1/2 Lane	12.09	9.00	18.00

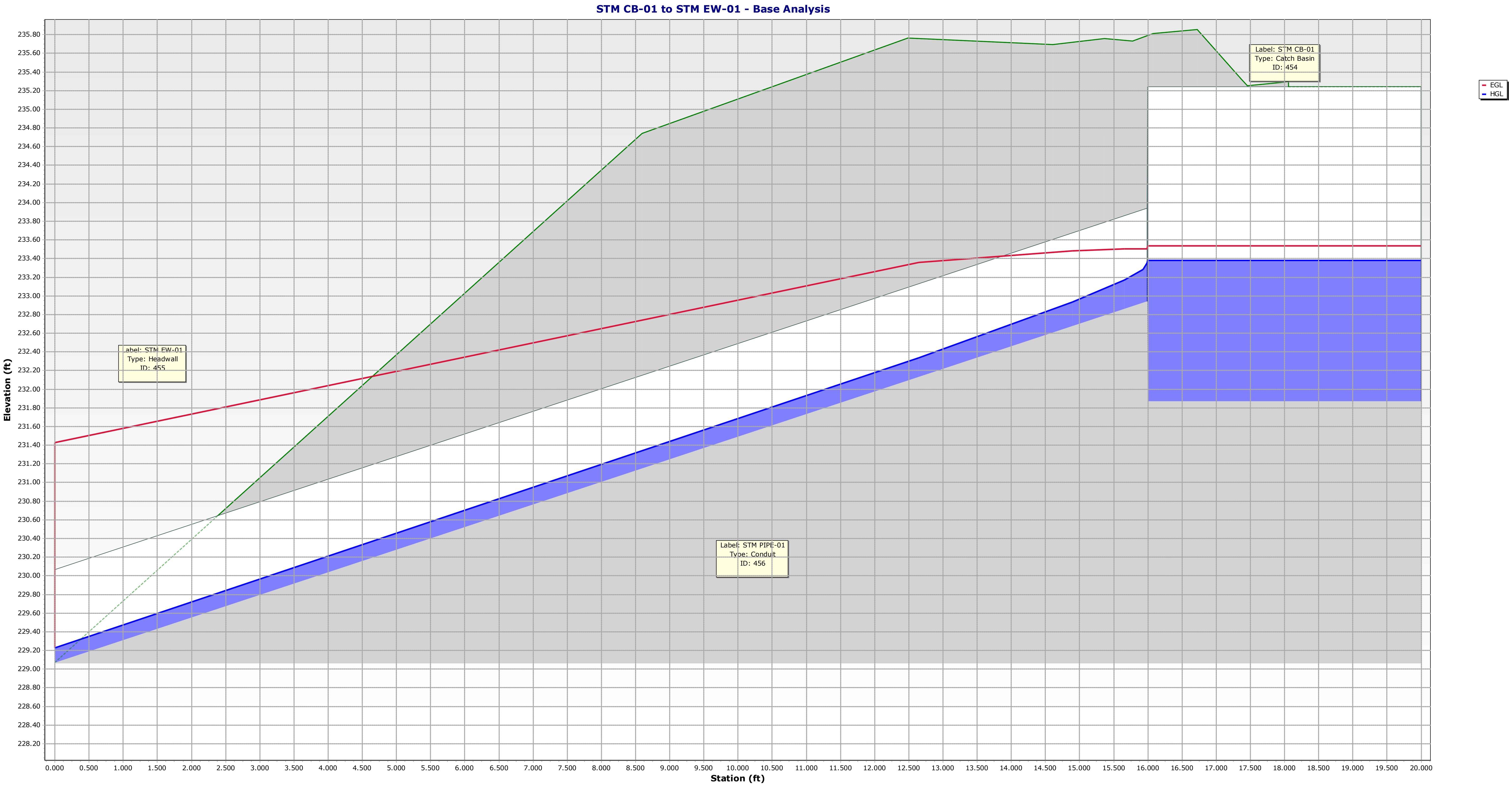
Proposed Catch Basin Spread Data - 5 Year Storm Event

Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Inlet Location	Cross Slope (%)	Spread / Top Width (ft)	Depth (Gutter) (ft)	Required Spread Condition Treatment	Provided Clear Roadway Width (ft)	Lane Width (ft)	Roadway Width (ft)
STM CB-01_N	100+79	8.94	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	6.14	0.12	1/2 Lane	15.86	11.00	22.00
STM CB-02_N	101+25	10.72	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	4.79	0.10	1/2 Lane	13.98	11.00	22.00
STM CB-03_N	101+25	-10.74	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	3.23	0.07	1/2 Lane	13.98	11.00	22.00
STM CB-04_N	102+52	11.00	C" CB - DblGrt Typ2 - 6in Conc or Stone Curb"	In Sag	3.00	4.61	0.14	Full Lane	11.21	11.00	22.00
STM CB-05_N	102+52	-11.00	C-L" CB - DblGrt Typ2"	In Sag	3.00	6.19	0.19	Full Lane	11.21	11.00	22.00
STM CB-06_N	103+08	11.00	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	2.61	0.05	1/2 Lane	15.86	11.00	22.00
STM CB-07_N	103+08	-11.00	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	3.54	0.07	1/2 Lane	15.86	11.00	22.00

Proposed Catch Basin Spread Data - 10 Year Storm Event

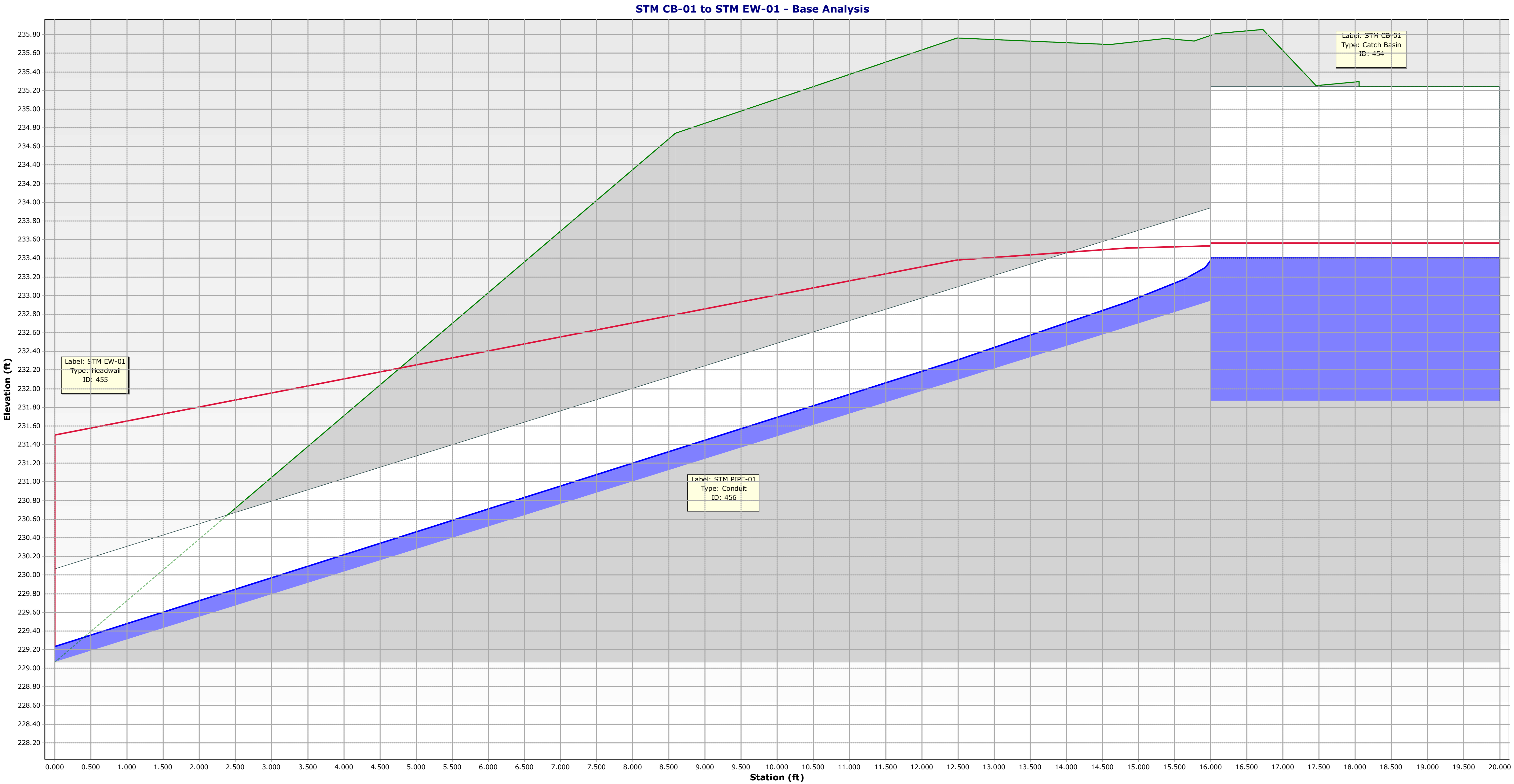
Label	Baseline Station (ft)	Baseline Offset (ft)	Inlet	Inlet Location	Cross Slope (%)	Spread / Top Width (ft)	Depth (Gutter) (ft)	Required Spread Condition Treatment	Provided Clear Roadway Width (ft)	Lane Width (ft)	Roadway Width (ft)
STM CB-01_N	100+79	8.94	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	6.49	0.13	1/2 Lane	15.51	11.00	22.00
STM CB-02_N	101+25	10.72	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	5.16	0.10	1/2 Lane	13.43	11.00	22.00
STM CB-03_N	101+25	-10.74	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	3.41	0.07	1/2 Lane	13.43	11.00	22.00
STM CB-04_N	102+52	11.00	C" CB - DblGrt Typ2 - 6in Conc or Stone Curb"	In Sag	3.00	5.23	0.16	Full Lane	10.03	11.00	22.00
STM CB-05_N	102+52	-11.00	C-L" CB - DblGrt Typ2"	In Sag	3.00	6.75	0.20	Full Lane	10.03	11.00	22.00
STM CB-06_N	103+08	11.00	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	2.75	0.06	1/2 Lane	15.51	11.00	22.00
STM CB-07_N	103+08	-11.00	C" CB - 6in Conc or Stone Curb"	On Grade	2.00	3.74	0.08	1/2 Lane	15.51	11.00	22.00

Existing 5-Year Storm Profile Run



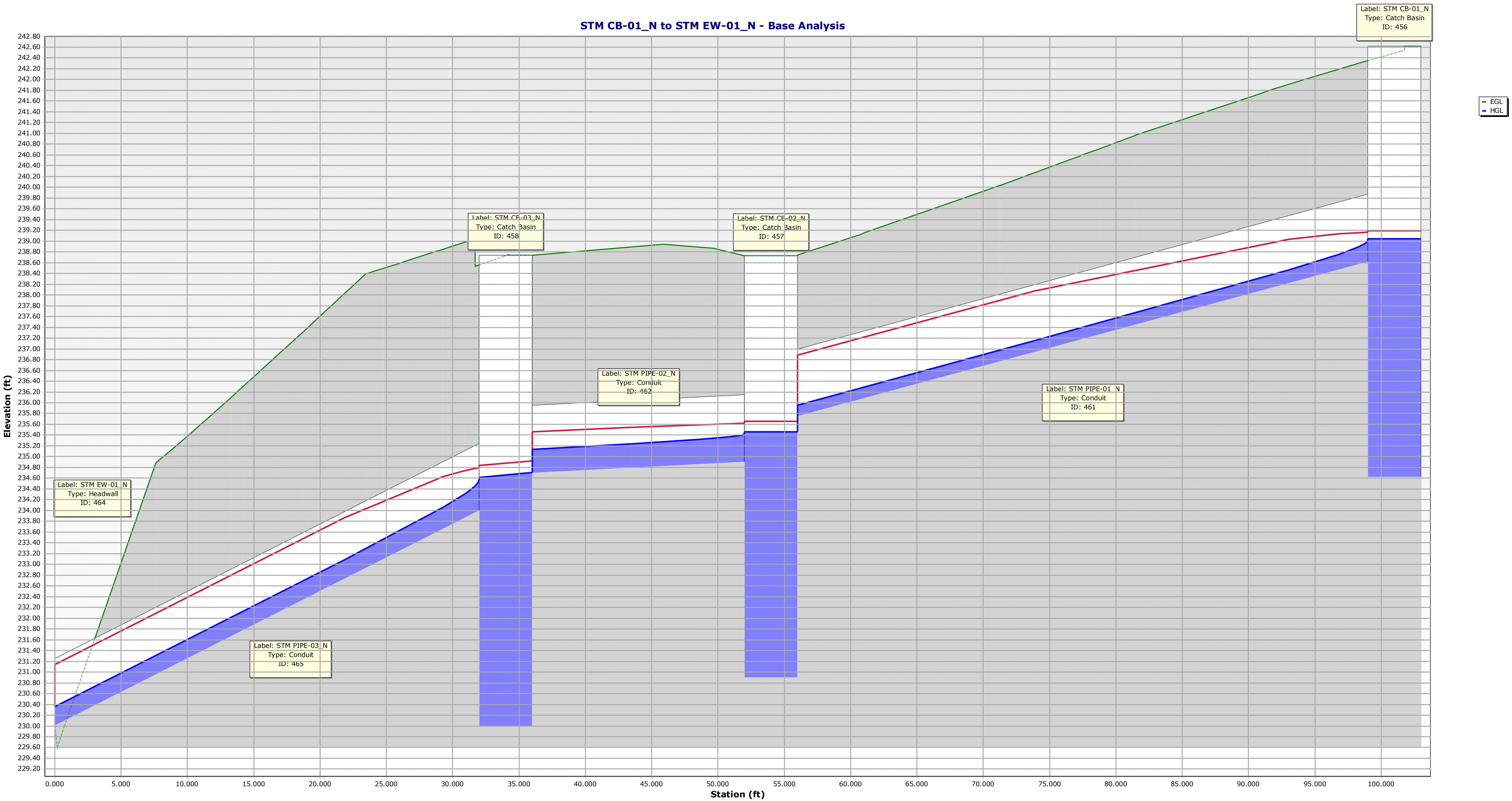
Note: Tailwater Elevation used is 227.50', derived from
the FEMA Flood Insurance Study

Existing 10-Year Storm Profile Run



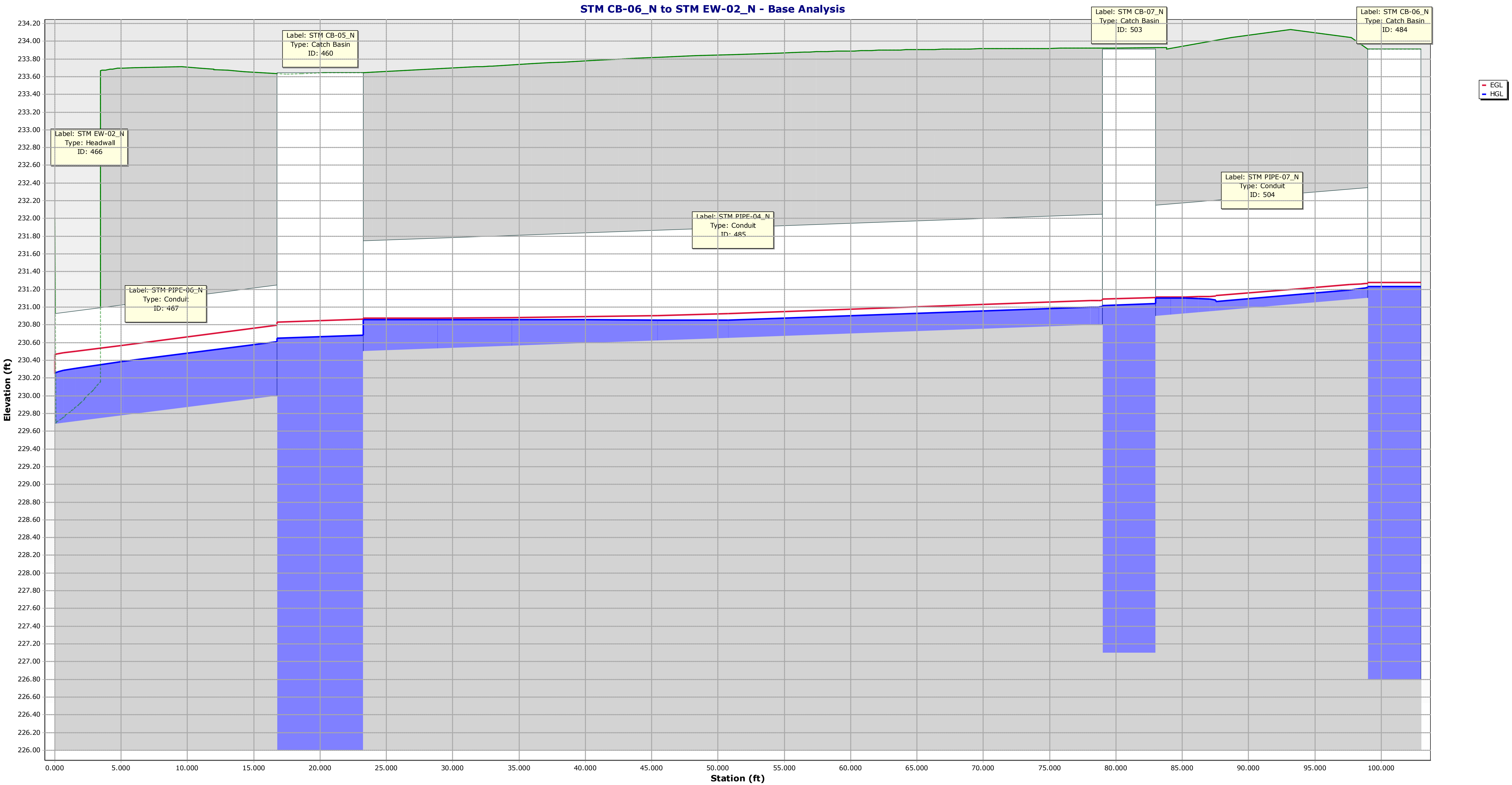
Note: Tailwater Elevation used is 227.50', derived from the FEMA Flood Insurance Study

Proposed 5-Year Storm Profile Run



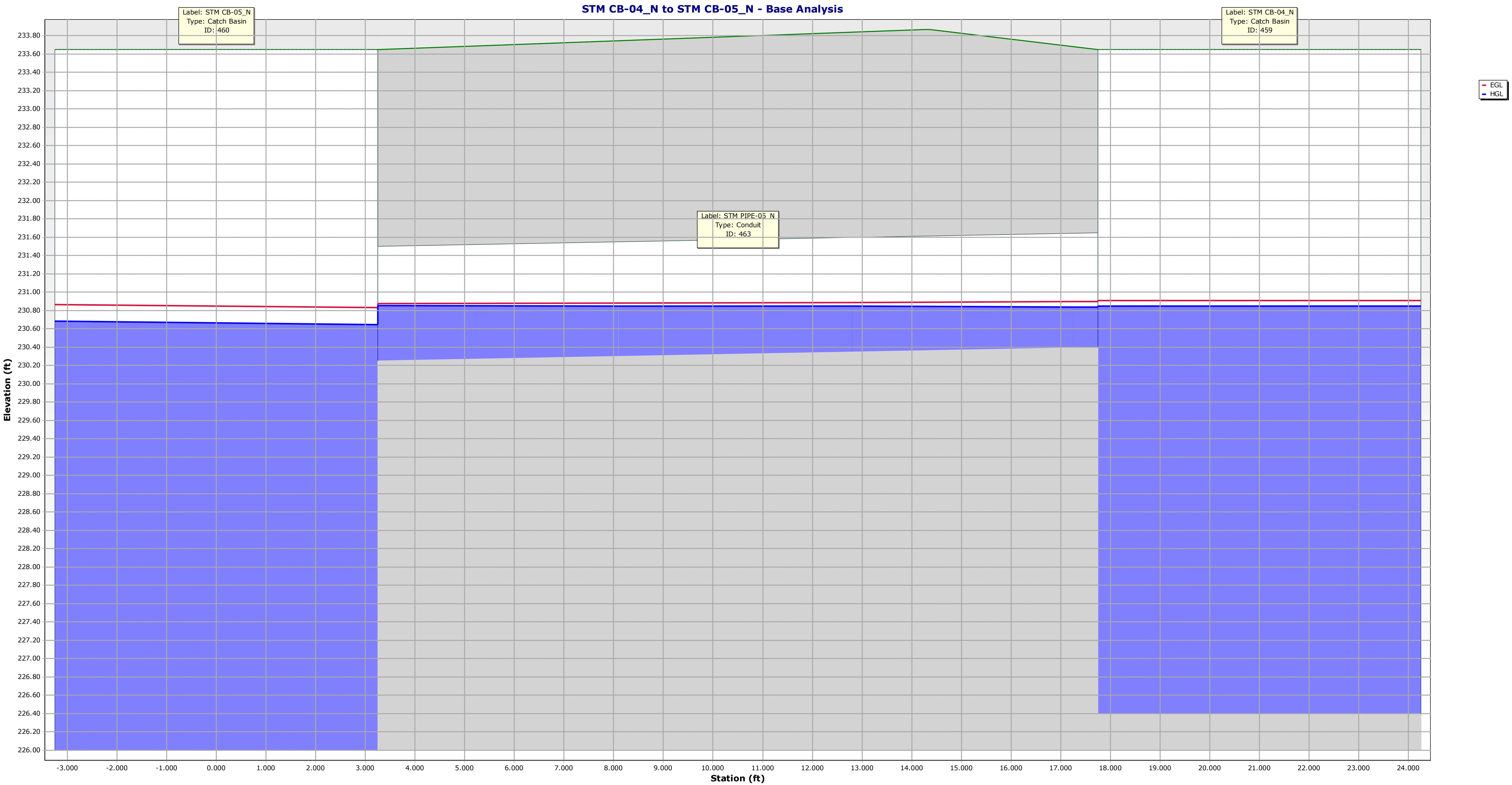
Note: Tailwater Elevation used is 227.50', derived from the FEMA Flood Insurance Study

Proposed 5-Year Storm Profile Run



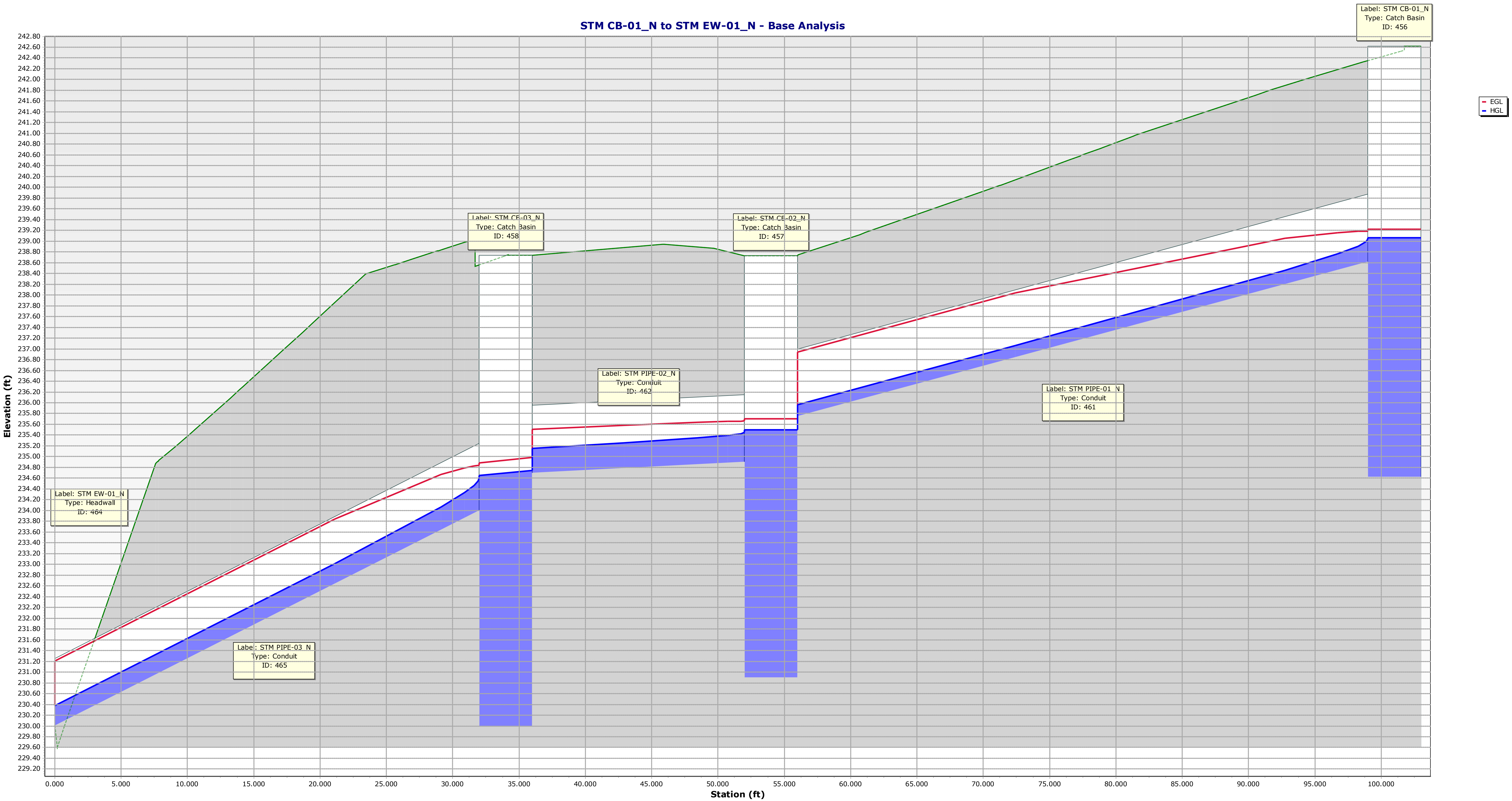
Note: Tailwater Elevation used is 227.50', derived from
the FEMA Flood Insurance Study

Proposed 5-Year Storm Profile Run



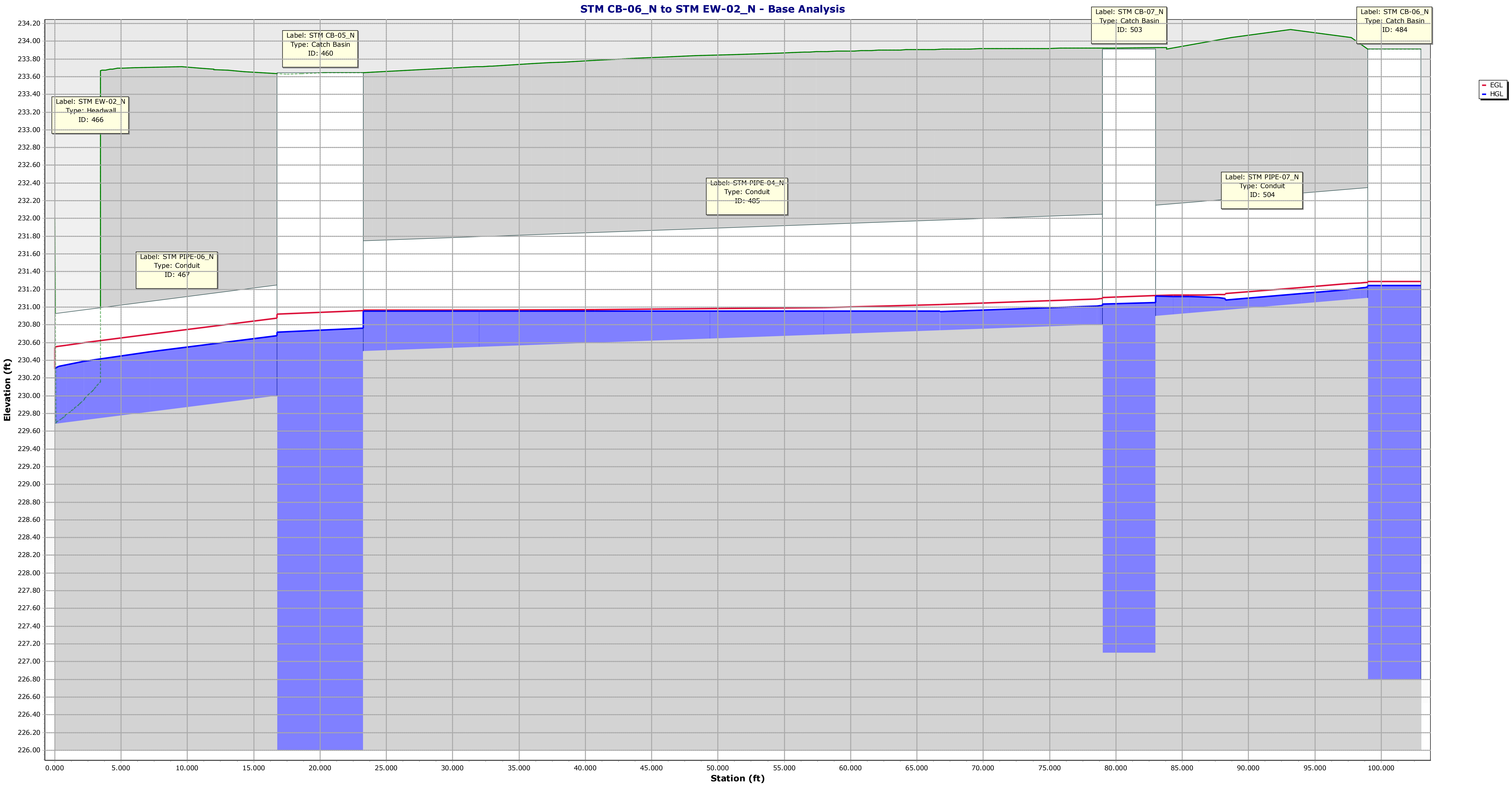
Note: Tailwater Elevation used is 227.50', derived from the FEMA Flood Insurance Study

Proposed 10-Year Storm Profile Run



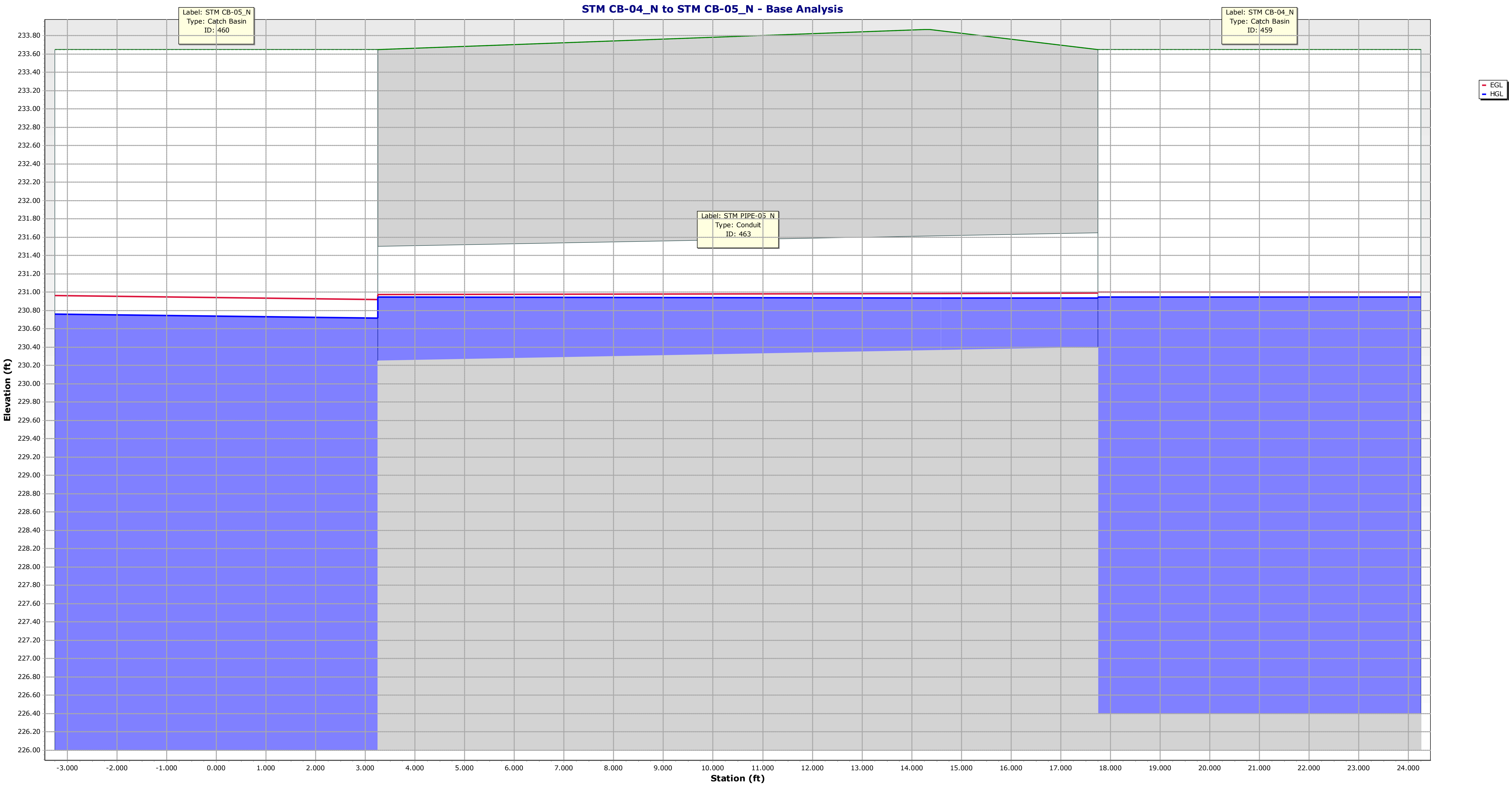
Note: Tailwater Elevation used is 227.50', derived from the FEMA Flood Insurance Study

Proposed 10-Year Storm Profile Run



Note: Tailwater Elevation used is 227.50', derived from
the FEMA Flood Insurance Study

Proposed 10-Year Storm Profile Run



Note: Tailwater Elevation used is 227.50', derived from the FEMA Flood Insurance Study

Appendix F: Highway Geometry Plans

Highway Geometry Plans are from the RSR Report, for the most up to date drainage layout refer to Appendix J

NOTES

ROADWAY FUNCTIONAL CLASSIFICATION: LOCAL URBAN STREETS

POSTED SPEED LIMIT: 25 MPH

DESIGN SPEED: 30 MPH

EXISTING ROADWAY SECTION:
(2) - 9'± LANES
NO SHOULDERS
CROSS SLOPE, 0%-2%

PROPOSED ROADWAY SECTION:
(2) - 10' LANES
2' SHOULDERS
CROSS SLOPE, 2% CROWN

PROPOSED STRUCTURE:
DECK UNITS
PROFILE: MATCH EXISTING ±

CURVE DATA
LOVERS LANE

CURVE #1	CURVE #2	CURVE #3
DELTA 05°16'34.7"	DELTA 42°57'48.0"	DELTA 16°35'39.9"
	D 63°39'43.1"	D 16°22'12.8"
T 23.039'	T 35.419'	T 51.042'
L 46.045'	L 67.487'	L 101.370'
R 500.000'	R 90.000'	R 350.000'
PI N 632774.9759	PI N 632924.6451	PI N 632986.2865
PI E 810765.2477	PI E 810807.1390	PI E 810908.1235
PI STA 101+10.16	PI STA 102+65.55	PI STA 103+80.51

REV. | DATE | REVISION DESCRIPTION

REHABILITATION STUDY REPORT

DESIGNER/DRAFTER: DGW/RAC CHECKED BY: JDL

0 20' 40' HORIZONTAL SCALE 1" = 20'

SIGNATURE/BLOCK:

CME ASSOCIATES, INC.
33 Wilbur Cross Way, Mansfield, CT 06268
101 East River Drive, East Hartford, CT 06108
1 Tara Blvd, Nashua, NH 03062
860-290-4100 | www.cmeengineering.com

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 161-142
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: ROADWAY PLAN ALTERNATE 1A

DRAWING NO. -
SHEET NO.

LASTED SAVED BY: rcutler FILE NAME: T:\CTDOT_CONNECT_DDE\CT_Projects\161-142_Wilton\Highways\HW_161-142_Sheets_Alt1A.dgn
PLOTTED DATE: 6/18/2020

Appendix G: ConnDOT Drainage Manual Checklist

Project No.	161-142
Roadway	Lovers Lane
Town	Wilton
Date	3/9/2022
Designed By	John Wang, PE, LEED AP
Signature of Engineer	John Wang, PE, LEED AP

Final Design Checklist (Plans 85% to 90% Complete)
Allow a 4-5 week review time.

The Final Design Submission should include the following:

a. Disposition of Semi-Final Design comments with written responses justifying comments not incorporated.
☐ Included ☐ Not Included ☒ Not Applicable

b. Final Drainage Report and Final Plans.
☒ Included ☐ Not Included ☐ Not Applicable

c. Final scour report.
☐ Included ☐ Not Included ☒ Not Applicable

d. Final floodway analysis report.
☐ Included ☐ Not Included ☒ Not Applicable

e. Final SCEL report.
☐ Included ☐ Not Included ☒ Not Applicable

f. Final hydraulic design report.
☐ Included ☐ Not Included ☒ Not Applicable

Provide justification for items **Not Included**. Justification should correspond to the designated letter.

Appendix H: Site Photos

Photo 1: Existing Outlet Pipe to be Removed

Photo 2: Outlet Pipe dry during field survey

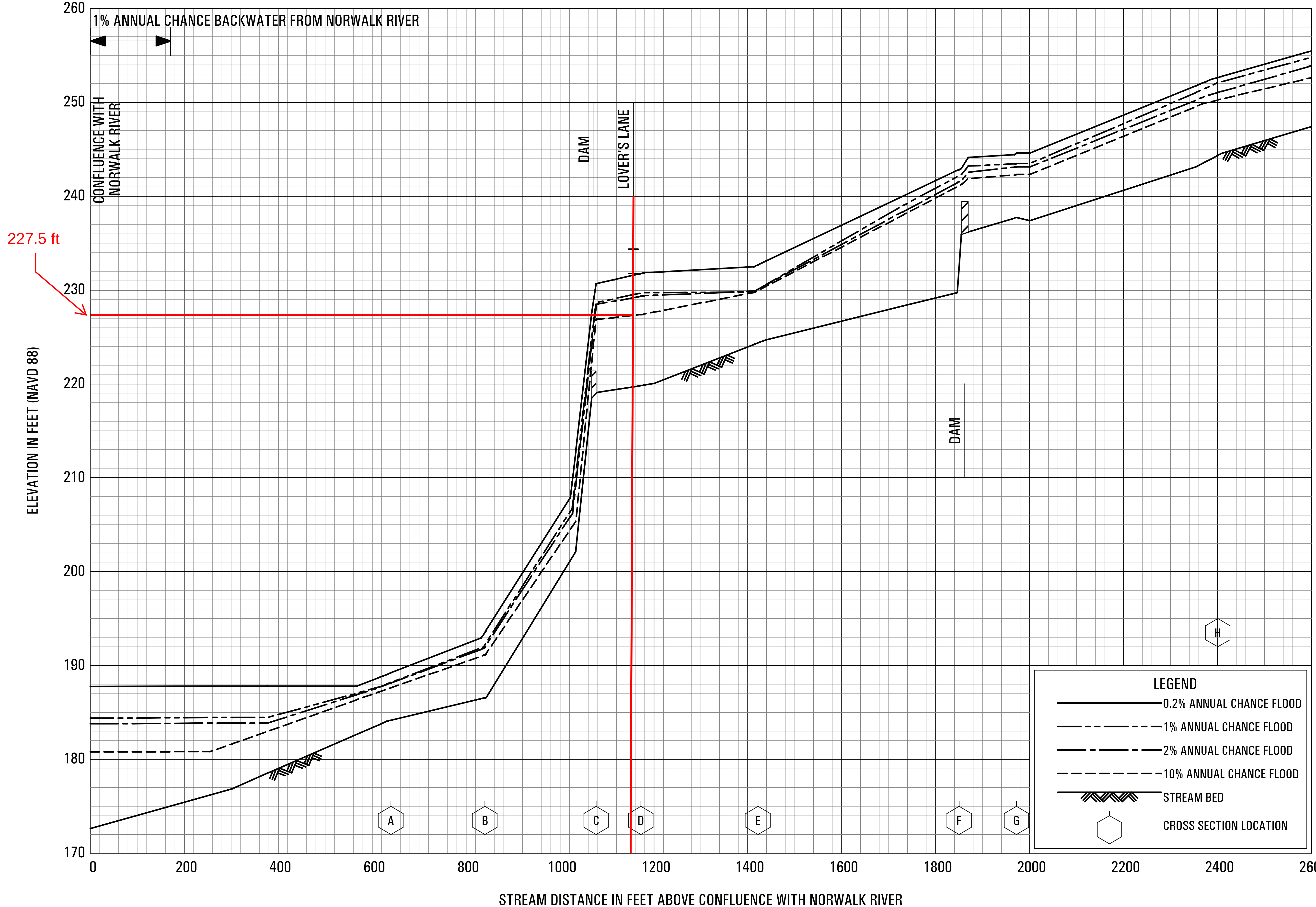
Photo 3: Existing Outlet Location (South Side of Bridge)

Photo 4: Comstock Brook

Photo 5: Existing Type 'C' Catch Basin

Photo 6: Lovers Lane

Appendix I: FEMA Flood Insurance Study Profiles



FLOOD PROFILES

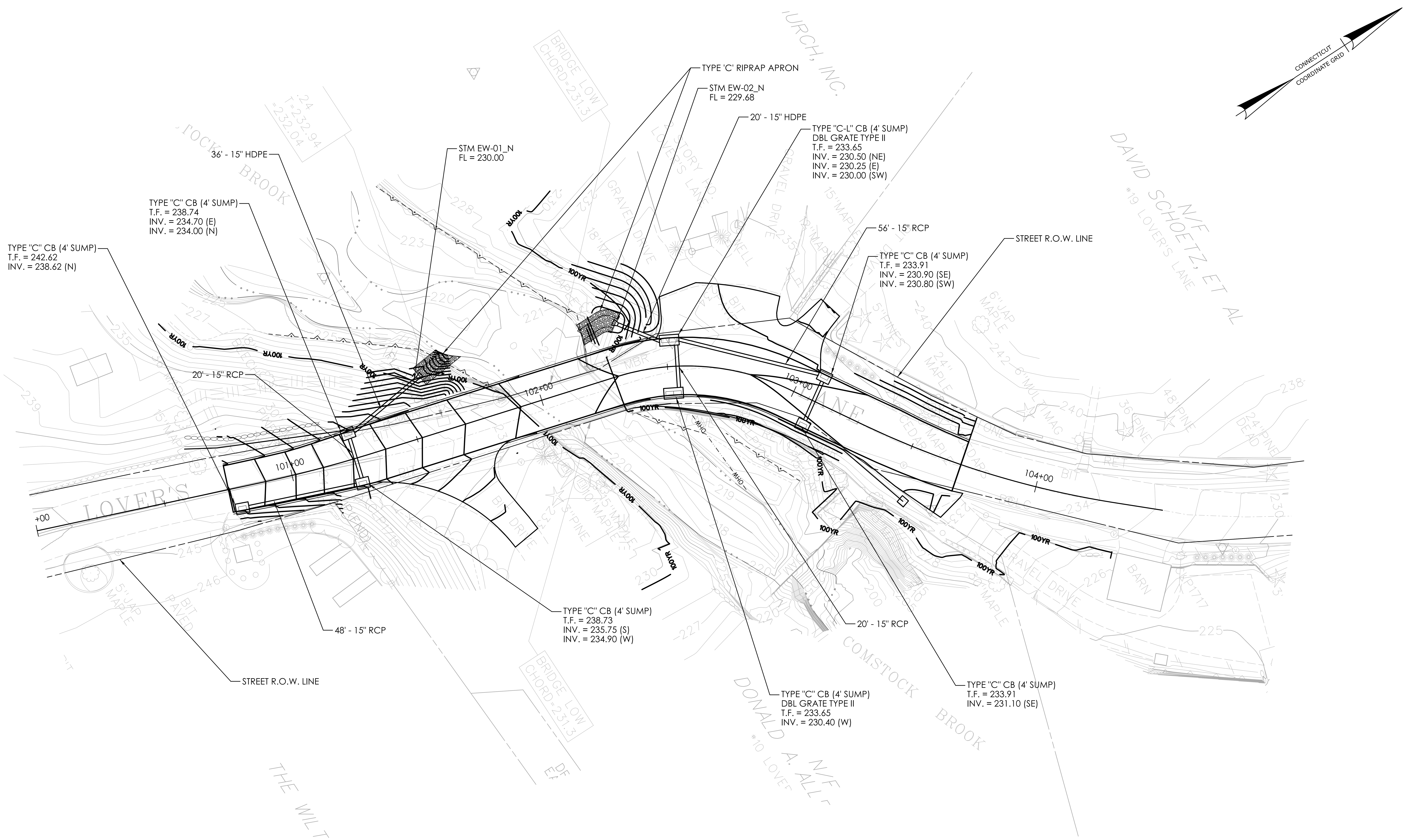
COMSTOCK BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FAIRFIELD COUNTY, CT

(ALL JURISDICTIONS)

Appendix J: Proposed Drainage Plan



DESIGNER/DRAFTER:	CHECKED BY:	HORIZONTAL SCALE 1" = 20' (0, 20', 40')	SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 161-142
PROJECT DESCRIPTION: REHABILIATION OF BRIDGE NO. 04975 LOVERS LANE OVER COMSTOCK BROOK
TOWN(S): WILTON
DRAWING TITLE: PROPOSED DRAINAGE

DRAWING NO. DRN-03
SHEET NO.

REV. | DATE | REVISION DESCRIPTION

LASTED SAVED BY: LCafaro FILE NAME: I:\Projects\221-125\Hydro\Base Models\Proposed Models\3.0% Cross Slope at Sag Location - With Flanking Basins\HW_CB_161_142_Proposed_Drainage_Plans_20Scale.dgn
PLOTTED DATE: 3/16/2022

June 27, 2022

Environmental Affairs
238 Danbury Rd
Wilton, CT 06897

RE: Rehabilitation of Lovers Lane Bridge over the Comstock Brook

Dear Environmental Affairs,

We understand that work is proposed on our property as part of the Lovers Lane Bridge reconstruction project. We allow the Town and State to submit a Wilton Inland Wetlands Commission application depicting improvements on our property specifically related to this project.

Please note, conducting the improvements on our property is contingent upon obtaining permit approvals and completing final construction documents.

Donald & Eileen Allers
don.allers@mac.com
10 Lovers Lane
Wilton, CT 06897

WILTON CONGREGATIONAL CHURCH
Lighting the Way

70 Ridgefield Road • PO Box 215 • Wilton, CT 06897
Office: (203) 762-5591 • Fax: (203) 762-5851
office@wiltoncongregational.org
wiltoncongregational.org

May 26, 2022

Environmental Affairs
238 Danbury Road
Wilton, CT 06897

RE: Rehabilitation of Lovers Lane Bridge over the Comstock Brook

Dear Environmental Affairs,

We understand that work is proposed on our property as part of the Lovers Lane Bridge reconstruction project. We allow the Town and the State to submit a Wilton Inland Wetlands Commission application depicting improvements on our property.

Please note, conducting the improvements on our property is contingent upon obtaining permit approvals and completing final construction documents. We understand easements and/or partial property acquisition for the construction project will be required to complete the project.

Thank you,

Jerry Sprole
Chairman of the Executive Board
Wilton Congregational Church

RECEIVED
MAY 27 2022
WILTON DEPT. OF PUBLIC WORKS

JONATHAN & ISABEL FOLTZ
80 Ridgefield Road
Wilton, CT 06897
(203) 834-0449
E-mail: jafoltz@aol.com

May 6, 2022

Environmental Affairs
238 Danbury Road
Wilton, CT 06897

RE: Rehabilitation of Lovers Lane Bridge over the Comstock Brook

Dear Environmental Affairs,

We are aware that work is proposed on our property as part of the Lovers Lane Bridge reconstruction project. We grant permission to the Town and State to submit a Wilton Wetlands Commission application depicting improvements on our property.

Permission to perform the proposed improvements is contingent upon obtaining permit approvals and completing final construction documents. We understand that the plan may change based on the input of various governmental bodies and that the bridge reconstruction will require easements and/or partial property acquisition.

Sincerely yours,

Jonathan and Isabel Foltz

August 15, 2022

Environmental Affairs
238 Danbury Road
Wilton, CT. 06897

RE: Rehabilitation of Lovers Lane Bridge over The Comstock Brook

Dear Environmental Affairs,

We understand that work is proposed on our property as part of the Lovers Lane Bridge reconstruction project. We allow the Town and the State to submit a Wilton Inland Wetlands Commission application depicting improvements on our property specifically related to this project.

Please note, conducting the improvements on our property is contingent upon obtaining permit approvals and completing final construction documents.

Thank You,

, Mgr

Blue Heron Landings LLC
26 Lovers Lane
Wilton, CT 06897

RECEIVED
AUG 11 2022
WILTON DEPT. OF PUBLIC WORKS