Central Street Bridge Reconstruction and
Central Pond / Sawmill Brook Restoration Project

Manchester-by-the-Sea, MA

Environmental Notification Form

Town of Manchester-by-the-Sea

September 30, 2019

Tighe&Bond
Engineers | Environmental Specialists

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Engineers | Environmental Specialists

M-1476011-01-06
September 30, 2019

Secretary of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street – Suite 900
Boston, MA 02114

Re : **Environmental Notification Form (ENF)**
Central Street Bridge Reconstruction and Central Pond / Sawmill Brook Restoration Project
Manchester-by-the-Sea, Massachusetts

Dear Secretary Beaton:

On behalf of the Town of Manchester-by-the-Sea, Tighe & Bond is submitting this Environmental Notification Form (ENF) for the Central Street Bridge Reconstruction and Central Pond / Sawmill Brook Restoration Project in the Town of Manchester-by-the-Sea, Essex County, Massachusetts. The proposed project includes removal of an obsolete tide gate, reconstruction of the Central Street bridge, replacement of retaining walls, and restoration of Central Pond / Sawmill Brook. The project is being funded with a combination of grants from the Massachusetts Environmental Trust, the Massachusetts Municipal Vulnerability Preparedness program, MassDOT, and local funds.

Manchester-by-the-Sea experiences frequent coastal and inland flooding due to storm surge, sea level rise, and extreme precipitation. The Sawmill Brook watershed is particularly vulnerable to flooding and erosion due to hydraulic restrictions from undersized culverts, a narrow, channelized stream system, and tide gate at the mouth of the Brook. These problems will be magnified in coming years due to climate change impacts on inland and coastal flooding. The proposed multi-phase bridge replacement and stream restoration project is intended to stabilize sources of erosion, restore marsh, riparian, and fish habitat, reduce flooding, and enhance coastal resiliency.

The project meets several ENF review thresholds for wetlands, waterways, and tidelands. No mandatory EIR thresholds are triggered by the proposed project. Enclosed with this submittal are the ENF form, a project narrative and alternatives analysis, project figures and plans, and other required materials. The ENF is being submitted for publication in the October 9, 2019 edition of the Environmental Monitor. Should you have any questions or require additional information, please contact me by phone at (413) 875-1622 or by email at ETully@TigheBond.com.

Very truly yours,

TIGHE & BOND, INC.

Emily R. Tully
Environmental Planner

Copy: Greg Federspiel, Town Administrator, Manchester-by-the-Sea
Refer to the Distribution and Circulation List

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SECTION 1

Section 1
Required Forms

- ENF
- Filing and Circulation List
- Form of Public Notice

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: _____

MEPA Analyst: _____

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **Central Street Bridge Reconstruction and Central Pond / Sawmill Brook Restoration Project**		
Street Address: **Central Street, east of Elm Street**		
Municipality: **Manchester-by-the-Sea**	Watershed: **North Coastal (Sawmill Brook)**	
Universal Transverse Mercator Coordinates: **Zone 19, 354502.7 E, 4715179.3 N**	Latitude: **42.575316** Longitude: **-70.772875**	
Estimated commencement date: **Central Street Bridge Reconstruction: Spring 2021** **Sawmill Brook Restoration: Spring 2021**	Estimated completion date: **Central Street Bridge Reconstruction: Summer 2022** **Sawmill Brook Restoration: Winter 2021/2022**	
Project Type: **Bridge reconstruction including tide gate removal, pond restoration**	Status of project design: **Central Street Bridge Reconstruction: 25%** **Sawmill Brook Restoration: 60%**	
Proponent: **Town of Manchester-by-the-Sea, c/o Greg Federspiel, Town Administrator**		
Street Address: **10 Central Street**		
Municipality: **Manchester-by-the-Sea**	State: **MA**	Zip Code: **01944**
Name of Contact Person: **Emily Tully**		
Firm/Agency: **Tighe & Bond, Inc.**	Street Address:**53 Southampton Road**	
Municipality: **Westfield**	State: **MA**	Zip Code: **01085**
Phone: **(413) 875-1622**	Fax: **(413) 562-5317**	E-mail: **etully@tighebond.com**

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)? ☐Yes ☒**No**

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☐Yes ☐No
a Special Review Procedure? (see 301CMR 11.09)	☐Yes ☐No
a Waiver of mandatory EIR? (see 301 CMR 11.11)	☐Yes ☐No
a Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☐No

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?
11.03(3)(b)(1)(a) – alteration of coastal bank, 11.03(3)(b)(1)(f) – alteration of one half or more acres of any other wetlands

Which State Agency Permits will the project require?
MassDOT Chapter 85 Review, MassDEP Wetland Protection Act Order of Conditions (if local order is superseded), MassDEP Chapter 91 License, MassDEP 401 WQC, MHC PNF and Historical Review

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:
The Town has received the following grants from State agencies: 2014: CZM Coastal Resiliency Grant, Sawmill Brook Culvert & Green Infrastructure Analysis ($188,900); 2017: MET Grant, Central Street Bridge & Sawmill Brook Restoration Feasibility Study ($49,490); 2018: MVP Action Grant, Alternatives Analysis & Design for Sawmill Brook/Central Pond Restoration ($88,180); 2018: MassDOT Small Bridge Grant, Central Street Bridge Improvements ($500,000)

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage*	**2.92 ac**		
New acres of land altered		**0.17**	
Acres of impervious area	**0.53**	**0.00**	**0.53**
Square feet of new bordering vegetated wetlands alteration		**N/A**	
Square feet of new other wetland alteration**		**Temporary: 124,595 sf** **Permanent: 7,600 sf**	
Acres of new non-water dependent use of tidelands or waterways		**N/A**	
STRUCTURES			
Gross square footage	**N/A**	**N/A**	**N/A**
Number of housing units	**N/A**	**N/A**	**N/A**
Maximum height (feet)	**N/A**	**N/A**	**N/A**
TRANSPORTATION			
Vehicle trips per day	**N/A**	**N/A**	**N/A**
Parking spaces	**N/A**	**N/A**	**N/A**
WASTEWATER			
Water Use (Gallons per day)	**N/A**	**N/A**	**N/A**
Water withdrawal (GPD)	**N/A**	**N/A**	**N/A**
Wastewater generation/treatment (GPD)	**N/A**	**N/A**	**N/A**
Length of water mains (miles)	**N/A**	**N/A**	**N/A**
Length of sewer mains (miles)	**N/A**	**N/A**	**N/A**
Has this project been filed with MEPA before? ☐ Yes (EEA #_____) ☒**No**			
Has any project on this site been filed with MEPA before? ☐ Yes (EEA #_____) ☒**No**			

*** The Project Site consists of Central Street Bridge, Central Pond, and lands immediately adjacent thereto as illustrated on Figure 3 in Appendix A.**

**** "Other" wetland alteration consists of temporary impacts to Coastal Bank (2,055 lf), Land Under Water (72,405 sf), Riverfront Area (52,190 sf), and Land Subject to Coastal Storm Flowage (50,635 sf, within the 200 ft Riverfront Area) from construction-period work on the bridge, tide gate removal, retaining wall repair and replacement, and pond/brook restoration, and permanent impacts to Land Under Water (7,600 sf) associated with installation of rip-rap for wall erosion control.**

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site

The Town of Manchester-by-the Sea experiences a high frequency of flooding in the downtown area and throughout the Sawmill Brook watershed due to storm surge, sea level rise, and extreme precipitation. The Sawmill Brook watershed is particularly vulnerable to flooding and erosion due to a complex combination of hydraulic restrictions, increased stormwater runoff from developed areas, a highly channelized stream system, poor infiltration conditions, and a tide gate at the mouth of the brook.

Sawmill Brook and its tributaries drain nearly 75% of the Town of Manchester-by-the-Sea. The brook follows a circuitous route flowing north, east, and then south through the Town, converging with Cat Brook and then Causeway Brook, passing through Central Pond, then below Central Street via a small bridge, then through a concrete tide gate structure before it discharges to Manchester Harbor. Sawmill Brook contains numerous fish species and has been identified by the Massachusetts Division of Marine Fisheries (DMF) as one of the region's only suitable spawning grounds for rainbow smelt, which is a diadromous fish listed as a Federal Species of Concern.

The Central Street Bridge spans Sawmill Brook at the mouth of Manchester Harbor on Central Street (Route 127), a Town-controlled roadway. The crossing consists of the bridge, a tide gate, and wingwalls. The bridge features a 16-foot span mortared stone masonry circular arch with stone masonry wingwalls and headwalls. Timber cribs functioning as weirs are imbedded into the bottom of the stream bed. A concrete and iron tide gate abuts the bridge to the south. A stone masonry wingwall abuts the bridge in the southwest quadrant, functioning as a seawall. Deterioration of the stone arch, water seepage paths, damming conditions caused by the tide gate, separation and settlement of culvert arch stones, and concrete degradation were observed during a site inspection in August of 2018.

The tide gate serves as a major hydraulic restriction for Sawmill Brook. When closed, it reduces tidal fluctuations within Sawmill Brook and Central Pond, although it is overtopped during very high tides. When the tide gate is closed and water is impounded underneath the bridge, the hydrostatic pressure of water forces seepage through the wingwall. The gate and bridge design have been identified as contributing factor to upstream flooding due to significant hydraulic restriction when large precipitation events and high tide elevations are concurrent. Upstream of the bridge, Central Pond is contained within channel walls constructed of a variety of materials. Immediately upstream of the bridge, the walls are of rubble stone masonry construction that appear to have generally good alignment but are missing mortar in areas. As you move upstream into the ponding area, the wall conditions are deteriorating.

Describe the proposed project and its programmatic and physical elements:

The proposed project includes addressing failing infrastructure, reducing flooding and increasing resiliency, and improving habitat conditions by undertaking the following work:

- **Removal of the tide gate structure to restore the unrestricted flow of Sawmill Brook into Manchester Harbor and remove tidal flow restriction/mixing**
- **Demolition of the existing 16-foot span Central Street Bridge and construction of a concrete arch bridge with an approximate span of 20 feet**
- **Repair, replacement, and stabilization of stone retaining walls along Central Pond**
- **Restoration of Central Pond / Sawmill Brook**

Jurisdictional wetland resource areas impacted by the proposed project as protected under the Massachusetts Wetlands Protection Act include Coastal Bank, Land Under Water, Riverfront Area, Land Subject to Coastal Storm Flowage, and Buffer Zone. Land Under Water is also regulated by MassDEP under Section 401 (314 CMR 9.00) and by the United States Army Corps of Engineers (ACOE) under Section 404 of the Clean Water Act and associated Massachusetts General Permits. The area also contains flowed and filled tidelands and is subject to Chapter 91, as regulated under 310 CMR 9.00.

The project has been designed and will be constructed using best management practices to avoid or minimize adverse impacts to resource areas during and post-construction. Please refer to the ENF Narrative for additional project details.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

As the existing Central Street bridge is in deteriorating condition and is physically associated with the tide gate and adjacent Central Pond / Sawmill Brook, off-site alternatives would not meet project goals and were therefore not considered. On site alternative actions and methods were assessed during project planning, and generally included:

- **The No Action alternative, which will not meet the project goals of addressing failing infrastructure, reducing flooding, increasing resiliency, and improving habitat conditions.**
- **Central Street Bridge and Tide Gate alternatives considered include:**
    - **Rehabilitation of the existing bridge and culvert and removal of the tide gate, which would result in improved hydraulic capacity, habitat restoration, improvements in aesthetics and water quality, and a reduction in upstream flooding, but would not improve public safety.**
    - **Replacement of the existing culvert with a bridge and removal of the tide gate (preferred), which would improve pedestrian, bicycle, and automobile safety on Central Street bridge, improve aesthetics and water quality, reduce upstream flooding, restore habitat, improve hydraulic capacity, and restore fish passage.**
    - **Alternative bridge superstructure options from construction phasing, traffic impact, abutting constraints and cost perspectives, before selecting the proposed arch bridge design**.
- **Central Pond / Sawmill Brook restoration alternatives considered include:**
    - **Maintaining a low level impoundment at Central Pond, which would maximize the water feature but would likely require high construction and maintenance costs with relatively low ecological benefits.**
    - **Restoration of Sawmill Brook to an unrestricted tidal stream (preferred) through augmentation of in-stream vegetation, selective dredging of the central channel, and bank stabilization, which would require relatively low construction and maintenance costs while providing high ecological benefits.**
    - **Restoration of Sawmill Brook to low level pools impounded by low level riffle structures, which would fall between the tidal stream and pond alternatives in terms of construction and maintenance costs. Feedback received during project planning indicated that this alternative would be uncharacteristic of more natural streams in the area and should be avoided.**

Additional information on project alternatives is provided in the ENF narrative.

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

The project has been designed to avoid, minimize, and mitigate environmental impacts associated with the proposed tidegate removal, bridge reconstruction, stone wall improvements, and restoration activities. Construction-period mitigation measures include the use of erosion and sediment controls, limiting footprints of work to the minimum necessary to meet project goals, and use of sediment filter bags at pump discharges to collect sediment, should pumping be necessary.

The project is anticipated to result in ecological benefits, including restoration of a more natural tidal regime to the Central Pond area, restoration of marsh and riparian habitat, and re-establishment of fish passage through the removal of the tide gate, improvements in habitat value through Sawmill Brook stream restoration, and reduction in streambank erosion and increase in flood storage through retaining wall redesign.

Additional details are presented in the ENF narrative.

If the project is proposed to be constructed in phases, please describe each phase:

The project consists of three general phases:

- **Removal of the tide gate structure, demolition of the existing Central Street Bridge and reconstruction with a concrete arch culvert with an approximate span of 20 feet**
- **Repair, replacement, and stabilization of stone retaining walls along Central Pond**
- **Restoration of Central Pond / Sawmill Brook**

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:

Is the project within or adjacent to an Area of Critical Environmental Concern?

☐Yes (Specify_____) ☒**No**

if yes, does the ACEC have an approved Resource Management Plan?___ Yes ___ No;

if yes, describe how the project complies with this plan.

Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;

if yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.

RARE SPECIES:

Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species?

☐Yes ☒**No**

HISTORICAL /ARCHAEOLOGICAL RESOURCES:

Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

☒**Yes** ☐No

The Central Street Bridge is referenced in the Manchester Village National Register of Historic Places registration form as non-contributing to the Manchester Village Historic District (National Register Information System ID 89002156) and as appearing to be of modern construction. As the bridge is located within a Historic District, a Project Notification Form was sent to the Massachusetts Historic Commission (MHC) and the project has been discussed with the Manchester-by-the-Sea Historic District Commission (HDC), which has issued a letter of support for the project (provided in Appendix E).

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources?

☒**Yes** ☐No

The Central Street Bridge is listed as non-contributing to the Manchester Village Historic District on the National Register of Historic Places inventory, and, as such, the proposed project is not anticipated to affect known historical properties. The DPW will continue to work with MHC and the Manchester-by-the-Sea HDC to ensure that the furnishings of the reconstructed bridge will be consistent with the setting of the historic district. Please refer to the Historical and Archaeological Resources Section of the ENF narrative and Appendix E for additional information.

WATER RESOURCES:

Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site?

☐Yes ☒**No**

if yes, identify the ORW and its location.

Are there any impaired water bodies on or within a half-mile radius of the project site?

☒**Yes** ☐No;

if yes, identify the water body and pollutant(s) causing the impairment.

Waterbody Segment ID	Waterbody Name	Massachusetts Year 2014 Integrated List of Waters Category	Impairment
MA93-19	Manchester Harbor	4A – TMDL is completed Final Pathogen TMDL for North Coastal Watershed	Fecal Coliform
MA93-29	Cat Brook	5 – Waters Requiring a TMDL	Fecal Coliform pH, Low

Waterbody Segment ID	Waterbody Name	Massachusetts Year 2014 Integrated List of Waters Category	Impairment
MA93-47	Causeway Brook	4A – TMDL is completed Final Pathogen TMDL for North Coastal Watershed	Fecal Coliform

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ☐Yes ☒**No**

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:

The proposed roadway improvements are considered redevelopment under the MassDEP Stormwater Management Standards, and the design will comply with the MassDEP Stormwater Management Standards to the extent practicable, as required for redevelopment projects. The overall proposed bridge reconstruction and brook / pond improvements project will not include creation of additional impervious area, addition of any new point source discharges, or expansion of a drainage system for increased collection. Construction-period stormwater impacts will be addressed through implementation of appropriate erosion and sediment controls. Stormwater Management Standards will be addressed in the Wetlands Protection Act Notice of Intent that will be filed with the Town of Manchester-by-the-Sea Conservation Commission.

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan?

☐Yes ☒**No**

if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):

Is there an Activity and Use Limitation (AUL) on any portion of the project site?

☐Yes ☒**No**

if yes, describe which portion of the site and how the project will be consistent with the AUL:

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN?

☐Yes ☒**No**

if yes, please describe:

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:

The project will generate solid waste (concrete and stone materials) during removal of the existing bridge and tidegate structure, stone wall improvements, and bridge reconstruction activities. There are no known hazardous building construction materials, waste sites, or reportable release sites identified within the project limits. Prior to construction, a pre-demolition hazardous building materials assessment will be conducted by licensed personnel to quantify what elements of the structures can be recycled, reused, or require disposal.

Will your project disturb asbestos containing materials? ☐Yes ☒**No**

if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment:

The Proponent is committed to reducing air quality and emissions impacts from construction-period traffic, through the use of ultra-low sulfur diesel fuel and anti-idling requirements.

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? ☐Yes ☒**No**

if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River? Yes ___ No ___ ;

if yes, specify name of river and designation: _____;

if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River. Yes ___ No ___ ;

if yes, describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.
2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.
3.. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
4 Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.
5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) ☐ Yes ☒ **No**; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	0.00	0.00	0.00
Internal roadways	0.35	0.00	0.35
Parking and other paved areas	0.18	0.00	0.18
Other altered areas	0.55	+0.17	0.73
Undeveloped areas	1.84	-0.17	1.66
Total: Project Site Acreage	**2.92**	**0.00**	**2.92**

B. Has any part of the project site been in active agricultural use in the last five years? ☐ Yes ☒ **No**; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use? ☐ Yes ☒ **No**; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ☐ Yes ☒ **No**; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ☐ Yes ☒ **No**; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ☐ Yes ☒ **No**; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? ☐ Yes ☒ **No**; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title: **Manchester-by-the-Sea Open Space and Recreation Plan**
Date: **August 2014 - 2021**

B. Describe the project's consistency with that plan with regard to:

1) economic development

The goals of the Manchester-by-the-Sea Open Space and Recreation Plan (OSRP) address economic development in the form of protection of open space as an economic benefit, due to open space providing increased ecological diversity, water quality improvements, increases in the taxable value of land adjacent to protected open space, and lower costs of maintenance. The proposed bridge reconstruction, tide gate removal, wall repairs, and restoration of Sawmill Brook will result in improved wildlife habitat and decrease the likelihood of flooding, and may therefore result in indirect economic improvements.

2) adequacy of infrastructure
One of the goals of the OSRP related to infrastructure is to categorize Town infrastructure improvements needed for safer biking and walking. The reconstruction of the deteriorated Central Street Bridge and associated roadway improvements will be designed to improve safety and functionality for vehicular traffic as well as pedestrians and cyclists.

3) open space impacts
The overarching goals of the OSRP include protection of the Town's natural resources for the purposes of clean drinking water, wildlife habitat, and passive recreation. The proposed reconstruction of the existing bridge with a greater capacity than the existing culvert, removal of the tidegate to restore the unrestricted flow of Sawmill Brook into Manchester Harbor, stone wall improvements, and restoration of Sawmill Brook will improve habitat conditions for rainbow smelt, and will therefore meet the OSRP goal of protecting and improving Town natural resources and wildlife habitat.

4) compatibility with adjacent land uses
The proposed project is anticipated to result in benefits to adjacent residential, commercial, and governmental land uses through the replacement of failing infrastructure, improvement in stormwater management and resiliency, and improved habitat conditions, which meets the OSRP goal of protecting and improving Town natural resources and wildlife habitat. The project also reduces storm flooding for events up to and including the 25-year event.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA: **Metropolitan Area Planning Commission (MAPC)**
Title: **MetroFuture: Making a Greater Boston Region** Date: **May 2008 – 2038**

D. Describe the project's consistency with that plan with regard to:
1) economic development
The proposed project does not have a direct economic development component, although it will fund construction jobs, decrease flooding, improve habitat, and replace failing infrastructure, which may result in indirect economic benefits.

2) adequacy of infrastructure
The project will increase the resiliency and functionality of the Central Street Bridge, which will allow for the continued use of existing infrastructure, and will meet the MetroFuture Plan goal of concentrating population and job growth in areas already well served by infrastructure, while retaining the sense of character and historic resources of the municipality. Additionally, the increased capacity provided by the larger replacement bridge and removal of the tidegate will improve climate change resiliency, meeting the MetroFuture goal of preparation for natural disasters and climate change.

3) open space impacts
One of the overarching MetroFuture plan goals is the protection of natural resources resulting from a strong "environmental ethic", with associated objectives related to the improvement of ecological condition of wetlands, retainment of regional biodiversity, and healthy populations of native plants and animals with fewer invasive species. The proposed project will not adversely impact open space access or resources, the increased capacity of the reconstructed bridge and removal of the tidegate will improve habitat connectivity, and Sawmill Brook restoration will result in ecological benefits and potential improvements to smelt spawning habitat.

4) compatibility with adjacent land uses
The proposed project is anticipated to result in benefits to adjacent land uses through providing improved resiliency, decreased flooding, and improved habitat, which meet the MetroFuture goals of improvement of ecological conditions of wetlands and minimizing stormwater runoff.

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **rare species or habitat**? ☐ Yes ☒ **No**

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ☐ Yes ☒ **No**.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

5. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? ☒ **Yes** ☐ No;

if yes, specify, in quantitative terms:

- **301 CMR 11.03(3)(b)(1)(a) - alteration of Coastal Bank: the project is anticipated to result in 2,055 lf of temporary impacts to Coastal Bank**
- **301 CMR 11.03(3)(b)(1)(f) – alteration of one half or more acres of any other wetlands: the project is anticipated to result in 1.37 acres of impacts (1.20 temporary, 0.17 permanent) to Land Subject to Coastal Storm Flowage, Riverfront Area, and Land Under Water**

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? ☒ **Yes** ☐ No; if yes, specify which permit:

- **Order of Conditions (Manchester-by-the-Sea Conservation Commission)**
- **Chapter 91 Waterways License**
- **401 Water Quality Certification**

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)?

☒**Yes** ☐No
if yes, has a Notice of Intent been filed?
☐Yes ☒**No**
if yes, list the date and MassDEP file number: _____;
if yes, has a local Order of Conditions been issued?
☐Yes ☐No
Was the Order of Conditions appealed?
☐Yes ☐No
Will the project require a Variance from the Wetlands regulations?
☐Yes ☒**No**

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:
As quantified below, the proposed project is anticipated to result in temporary impacts to Coastal Bank, Land Under Water, Riverfront Area, Land Subject to Coastal Storm Flowage, and the 100-foot Buffer Zone, and permanent impacts to Land Under Water. Land Subject to Coastal Storm Flowage is located within the 200 ft Riverfront Area. Temporary impacts are related to construction period impacts for access, staging, and work areas for both the bridge replacement and pond / stream restoration. The bridge project is located within the general footprint of the existing structure and headwalls except for the larger span and removal of the tide gate; accordingly, there are no new permanent impacts associated with the bridge replacement. Permanent impacts associated with the pond/stream restoration are related to targeted placement of a combination of boulders, planted coir logs, and woody materials in localized scour areas.

Additional information is provided in the ENF narrative.

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Coastal Wetlands		
Land Under the Ocean	**N/A**	**N/A**
Designated Port Areas	**N/A**	**N/A**
Coastal Beaches	**N/A**	**N/A**
Coastal Dunes	**N/A**	**N/A**
Barrier Beaches	**N/A**	**N/A**
Coastal Banks	**2,055**	**Temporary**
Rocky Intertidal Shores	**N/A**	**N/A**
Salt Marshes	**N/A**	**N/A**
Land Under Salt Ponds	**N/A**	**N/A**
Land Containing Shellfish	**N/A**	**N/A**
Fish Runs	**N/A**	**N/A**
Land Subject to Coastal Storm Flowage	**50,635**	**Temporary**
Inland Wetlands		
Bank (LF)	**N/A**	**N/A**
Bordering Vegetated Wetlands	**N/A**	**N/A**
Isolated Vegetated Wetlands	**N/A**	**N/A**
Land Under Water	**72,405 / 7,600**	**Temporary / Permanent**
Isolated Land Subject to Flooding	**N/A**	**N/A**
Bordering Land Subject to Flooding	**N/A**	**N/A**
Riverfront Area	**52,190**	**Temporary**

D. Is any part of the project:

1. proposed as a **limited project**?
   ☒ **Yes** ☐ No;
   if yes, what is the area (in sf)?**127,200**

   The bridge repair and improvement portion of the project is a limited project under 314 CMR 10.24(7)(c)(2) with enlargement necessary to eliminate a tidal restriction. The pond / brook restoration is proposed as a limited project under the ecological restoration project provisions of 310 CMR 10.24(8).

2. the construction or alteration of a **dam**?
   ☐ Yes ☒ **No**;
   if yes, describe:

3. fill or structure in a **velocity zone** or **regulatory floodway**?
   ☐ Yes ☒ **No**

4. dredging or disposal of dredged material?
   ☒ **Yes** ☐ No;
   if yes, describe the volume of dredged material and the proposed disposal site: **Less than 1,000 cubic yards of sediment will be removed for wall replacement. Sediment will be replaced where it originated. Excess sediment will be redistributed in the pond bottom and planted.**

5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**?
   ☐ Yes ☒ **No**

6. subject to a wetlands restriction order?
   ☐ Yes ☒ **No**;
   if yes, identify the area (in sf):

7. located in buffer zones?

☒ **Yes** ☐ No;
if yes, how much (in sf) **51,505 sf**

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw?
☒ **Yes** ☐ No

2. alter any federally-protected wetlands not regulated under state law?
☐ Yes ☒ **No**;
if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91?
☒ **Yes** ☐ No;

if yes, is there a current Chapter 91 License or Permit affecting the project site?
☐ Yes ☒ **No**;

if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:
MassGIS data was used to determine the extent of filled tidelands on the site. Based on a review of the Town's historic files, there are 2 existing Chapter 91 licenses in the vicinity of the project area:

- **License Plan #197 recorded January 17, 1922: license to build retaining walls and riprap slopes, and to fill solid, in Manchester Harbor**
- **License Plan #650 recorded April 12, 1926: license to build a pile pier and bulkhead and fill solid in extension of an existing pier in Manchester Harbor**

B. Does the project require a new or modified license or permit under M.G.L.c.91?
☒ **Yes** ☐ No

If yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current **0** Change **0** Total **0**

If yes, how many square feet of solid fill or pile-supported structures (in sf)? **The existing transportation facilities (sidewalk, roadway, bridge) consist of approximately 4,000 square feet and the existing retaining wall consists of approximately of 4,500 square feet of solid fill within Ch 91 jurisdiction.**

C. For non-water-dependent use projects, indicate the following:
Area of filled tidelands on the site: _____
Area of filled tidelands covered by buildings: _____
For portions of site on filled tidelands, list ground floor uses and area of each use: _____
Does the project include new non-water-dependent uses located over flowed tidelands?
☐ Yes ☒ **No**
Height of building on filled tidelands_____

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands?
☐ Yes ☒ **No**;

if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations?
☐ Yes ☒ **No**;

if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR?
☐ Yes ☒ **No**;

G. Does the project include dredging?
☒ **Yes** ☐ No;

if yes, answer the following questions:

What type of dredging? ☒ Improvement ☒ Maintenance ☒ Both
Removal of sediment deposition within Central Pond due to tide gate
What is the proposed dredge volume, in cubic yards (cy) **1,000**

What is the proposed dredge footprint **750** length (ft) **4** width (ft) **3** depth (ft);

Will dredging impact the following resource areas?
Intertidal ☒ **Yes** ☐ No; if yes, **3,000** sq ft
Outstanding Resource Waters ☐ Yes ☒ **No**; if yes, ___ sq ft
Other resource area (e.g. shellfish beds, eel grass beds) ☐ Yes ☒ **No**; if yes _ sq ft

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

The work is a restoration project that will benefit these areas impacted by past human activity.

If no to any of the above, what information or documentation was used to support this determination?
See attached figures in Appendix A.

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.

Sediment Characterization

Existing gradation analysis results? ☒ **Yes** ☐ No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ☒ **Yes** ☐ No; if yes, provide results.
A sediment characterization memorandum with gradation and chemical analysis results is provided in Appendix D.

Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? ☒ **Yes** ☐ No
If yes, check the appropriate option.
Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____

Sediment dredged as part of the pond/brook restoration project will be replaced where it originated to the extent possible; excess sediment will be redistributed in the pond bottom and planted.

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone?

☒ **Yes** ☐ No;

if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

The proposed project is consistent with CZM policies as follows:

Coastal Hazards Policy #1: The proposed project will not affect the beneficial functions of storm damage prevention and flood control provided by LSCSF and Coastal Bank. Within the project area, LSCSF and Coastal Bank are located adjacent to Sawmill Brook and Central Pond. Proposed project impacts to Coastal Bank and LSCSF are limited to retaining wall improvements and temporary construction period impacts for project access.

Coastal Hazards Policy #2: The proposed project includes reconstruction of an existing bridge, removal of an existing tide gate, and restoration of Central Pond / Sawmill Brook, which will generally occur within the existing disturbed footprint. Best Management Practices such as careful site planning, and nonstructural measures will be used to minimize impacts on water circulation and sediment transport during construction. The feasibility study performed under the FY 17 MET Grant indicated that Central Street Bridge can be widened, and the tide gate can be removed without causing adverse upstream impacts, and will likely result in additional flushing, which will improve water quality and reduce the rate of sedimentation.

Coastal Hazards Policy #3 & Growth Management Policy #1: The project will not exacerbate existing hazards or cause additional damage to buffer zones or natural resources as the project will occur within the overall footprint of existing disturbance. Increasing the safety of the existing bridge allows continued use of an existing facility. In addition, the project is anticipated to enhance the overall functions and values of the natural resources and their buffers in this area.

Growth Management Policy #2 & 3: The proposed project is located in an existing developed area of Manchester-by-the-Sea near the Manchester Harbor, with adjacent land uses including high density residential, commercial uses, and municipal uses such as the Fire Department, Police Station, and Town Hall. Replacing the failing infrastructure of the Central Street bridge, removing the tide gate, and restoring Central Pond will benefit the existing development center by improving safety, increasing the ability of rainbow smelt to utilize the spawning area, and improving the resiliency of existing infrastructure to storm events and sea level rise.

Habitat Policy #1: The proposed project has been designed to meet or exceed the standards of the Wetlands Protection Act and Chapter 91 Waterways Regulations, and will comply with all associated permits and regulations.

Public Access Policy #1: The Central Street bridge and Pond are located within flowed and filled tidelands subject to Chapter 91, the Massachusetts Public Waterfront Act, and the Public Trust Doctrine. The proposed bridge replacement, culvert removal, and pond restoration project is anticipated to result in improved public access through replacement of failing public infrastructure and improvements to the roadway that will occur during the bridge replacement that will enhance bicycle and pedestrian use of the roadway.

B. Is the project located within an area subject to a Municipal Harbor Plan?
☐ Yes ☒ **No**;

if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	_____	_____	_____
Withdrawal from groundwater	_____	_____	_____
Withdrawal from surface water	_____	_____	_____
Interbasin transfer	_____	_____	_____

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. _____

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? _____Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? _____

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_____	_____	_____	_____
Capacity of water treatment plant (gpd)	_____	_____	_____	_____

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	_____	_____	_____
Discharge of industrial wastewater	_____	_____	_____
TOTAL	_____	_____	_____

	Existing	Change	Total
Discharge to groundwater	_____	_____	_____
Discharge to outstanding resource water	_____	_____	_____
Discharge to surface water	_____	_____	_____
Discharge to municipal or regional wastewater facility	_____	_____	_____
TOTAL	_____	_____	_____

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	_____	_____	_____	_____

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	_____	_____	_____
Treatment	_____	_____	_____
Processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_____	_____	_____
Number of vehicle trips per day	_____	_____	_____
ITE Land Use Code(s):	_____	_____	_____

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

E. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

F. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

G. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ☒ **Yes** ☐ No ; if yes, specify which permit:
The project includes construction of a new bridge with a span length exceeding 10 feet. The bridge requires Chapter 85 review through the Massachusetts Department of Transportation (MassDOT).

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:
Central Street (Route 127) is a Town-accepted layout in the downtown area of Manchester-by-the-Sea. The roadway is functionally classified as an urban minor arterial with a 25-mph speed limit and a 2016 AADT of 4,900. The roadway within the project limits is not on the National Highway System (NHS). The roadway section to the east and west of the bridge is approximately 34.5 feet curb-to-curb with two travel lanes and a parking lane. The parking lane shifts from the south side of the road on the west of the bridge to the north side of the road on the east side of the bridge. Granite curbing and asphalt sidewalks of varying widths exist on both sides of the roadway.

Immediately west of the bridge site is the intersection of Central Street and Elm Street. Elm Street is a local road providing access to several residential and commercial properties. It is a dead-end road that is approximately 25 feet wide in the project area, with a 3-to-4-foot wide asphalt sidewalk. Immediately east of the bridge site is the intersection of Central Street with Church Street. Church Street is a local road that provides access to the Municipal Building (including the Police Department), public parking, a boat launch, and the wastewater treatment plant. Church Street is one-way with an exit farther east on Central Street, outside of the project area. There is no existing vehicular guardrail or barrier system on the existing structure. Existing concrete curbs and chain link fencing provide fall protection for pedestrians.

The overall functionality of the roadway is consistent with many older downtown urban corridors.

B. Will the project involve any:

1. Alteration of bank or terrain (in linear feet)? **No**
2. Cutting of living public shade trees (number)? **No**
3. Elimination of stone wall (in linear feet)? **No**

III. Consistency

Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:
The roadway portion of this project is an isolated bridge reconstruction and not part of larger corridor improvement. Conscious effort was made to minimize the overall footprint of the work to limit impacts and cost. The project includes Complete Streets elements from the Town's Complete Streets Policy to the extent practical.

The existing horizontal and vertical alignments were matched to the extent practicable, roadway function was matched, and drainage patterns were preserved. Minor improvements were made to curb line geometry though to improve overall traffic operation.

The proposed roadway section matches with the objectives of the Town of Manchester-by-the-Sea to have a more pedestrian friendly downtown village environment. The Town has taken a "complete streets" approach to the downtown area including recent corridor improvement studies. The proposed roadway cross-section is consistent with the overall plan for the area and will interface well with future improvements. The design includes new ADA compliant sidewalks and curb ramps to enhance the walkability and accessibility of downtown. The design also includes a curb extension ("bump-out") on the bridge to enhance pedestrian safety and provide traffic calming along the corridor. Given the limited right-of-way, bicycle accommodation is provided in the travel lane. A "take-the-lane" cycling approach is appropriate through the downtown due to low motor vehicle speeds and ample sight distance.

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	_____	_____	_____
Length of fuel line (in miles)	_____	_____	_____
Length of transmission lines (in miles)	_____	_____	_____
Capacity of transmission lines (in kilovolts)	_____	_____	_____

B. If the project involves construction or expansion of an electric generating facility, what are:
   1. the facility's current and proposed fuel source(s)?
   2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	_____	_____	_____
Carbon monoxide	_____	_____	_____
Sulfur dioxide	_____	_____	_____
Volatile organic compounds	_____	_____	_____
Oxides of nitrogen	_____	_____	_____
Lead	_____	_____	_____
Any hazardous air pollutant	_____	_____	_____
Carbon dioxide	_____	_____	_____

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ☐ Yes ☒ **No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ☐ Yes ☒ **No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Treatment, processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Recycling	_____	_____	_____
Treatment	_____	_____	_____
Disposal	_____	_____	_____

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos? ___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? ☒ **Yes** ☐ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ☐ Yes ☒ **No**; if yes, attach correspondence
Please refer to Appendix E for correspondence and additional information.

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ☒ **Yes** ☐ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ☒ **Yes** ☐ No; if yes, please describe:
The Central Street Bridge is located within the Manchester Village Historic District (National Register Information System ID 89002156) but is listed on the National Register of Historic Places registration form as non-contributing to the Manchester Village Historic District, as it "seems to be of modern vintage." In general, the bridge and tidegate are made of concrete and stone with concrete overlays and are thought to be of modern construction. The walls along Central Pond are constructed of a variety of materials and are failing in areas.

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ☐ Yes ☒ **No**; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:
The Central Street Bridge is listed as non-contributing to the Manchester Village Historic District on the National Register of Historic Places inventory, and, as such, the proposed project is not anticipated to affect known historical properties. The Manchester-by-the-Sea HDC has issued a letter of support for the project, and the Town will continue to work with MHC and the Manchester-by-the-Sea HDC to ensure that the furnishings of the reconstructed bridge will be consistent with the setting of the historic district. Please refer to the Historical and Archaeological Resources Section of the ENF narrative and Appendix E for additional information.

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:
The design intent at this time is that visible elements of the reconstructed Central Street Bridge structure and street furnishings will have a stone appearance in keeping with the aesthetic of the adjacent stone seawall. Similarly, replacement sections of stone walls along Central Pond will have a stone appearance consistent with the aesthetic of the adjacent walls to the extent possible. The Manchester-by-the-Sea HDC has issued a letter of support for the Central Street Bridge Reconstruction Project as the project is not anticipated to affect known historical properties, and the furnishings presented to the HDC appear to be generally consistent with the historic district setting. Decisions related to final finishes will be made during later stages of design development, in consultation with the Town and HDC.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name) **The Manchester Cricket** (Date) **October 9, 2019**

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)
	Greg Federspiel, Town Administrator		**Emily Tully, Environmental Planner**
	Name (print or type)		Name (print or type)
	Town of Manchester-by-the-Sea		**Tighe & Bond, Inc.**
	Firm/Agency		Firm/Agency
	10 Central Street		**53 Southampton Road**
	Street		Street
	Manchester-by-the-Sea, MA 01944		**Westfield, MA 01085**
	Municipality/State/Zip		Municipality/State/Zip
	(978) 526-2000		**(413) 875-1622**
	Phone		Phone

Address	Number of Copies
Executive Office of Energy & Environmental Affairs Attn. MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02114	1 Original 1 Copy 1 Copy on USB Copy of first 4 pages
MassDEP Commissioner's Office One Winter Street Boston, MA 02108	1
MassDEP Northeast Regional Office Attn: MEPA Coordinator 205B Lowell Street Wilmington, MA 01887	1
MassDOT Public/Private Development Unit 10 Park Plaza Boston, MA 02116	1
MassDOT District #4 Attn: MEPA Coordinator 519 Appleton Street Arlington, MA 02476	1
Massachusetts Historical Commission The MA Archives Building 220 Morrissey Boulevard Boston, MA 02125	1
Board of Underwater Archaeological Resources Attn: Victor Mastone, Director 251 Causeway Street, Suite 800 Boston, MA 02114	1
Metropolitan Area Planning Council 60 Temple Place, 6th floor Boston, MA 02111	1
Manchester-by-the-Sea Board of Selectmen c/o Gregory Federspiel, Town Administrator 10 Central Street Manchester-by-the-Sea, MA 01944	1
Manchester-by-the-Sea Planning Board c/o Sue Brown, Town Planner 10 Central Street Manchester-by-the-Sea, MA 01944	1
Manchester-by-the-Sea Conservation Commission c/o Chris Bertoni, Conservation Administrator 10 Central Street Manchester-by-the-Sea, MA 01944	1
Manchester-by-the-Sea Board of Board of Health c/o Leslie Nitkiewicz, Chairman 10 Central Street Manchester-by-the-Sea, MA 01944	1

Address	Number of Copies
Coastal Zone Management Attn: Project Review Coordinator 251 Causeway Street, Suite 800 Boston, MA 02114	1
Division of Marine Fisheries (North Shore) Attn: Environmental Reviewer 30 Emerson Avenue Gloucester, MA 01930	1
Tribal Historic Preservation Officer Wampanoag Tribe of Gay Head (Aquinnah) 20 Black Brook Road Aquinnah, MA 02535	1
Tribal Historic Preservation Officer Mashpee Wampanoag Tribe 483 Great Neck Road South Mashpee, MA 02649	1
Manchester-by-the-Sea Public Library 15 Union Street Manchester, MA 01944	1

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Suite 900
Boston, MA 02114
Telephone 617-626-1020

The following should be completed and submitted to a local newspaper:

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Central Street Bridge Reconstruction and Central Pond / Sawmill Brook Restoration Project

LOCATION: Central Street Bridge and Central Pond / Sawmill Brook, Manchester-by-the-Sea, Massachusetts

PROPONENT: Town of Manchester-by-the-Sea, c/o Greg Federspiel, Town Administrator

The undersigned is submitting an Environmental Notification Form ("ENF") to the Secretary of Energy & Environmental Affairs on or before: October 9, 2019

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA", M.G.L. c. 30, s.s. 61-62I). Copies of the ENF may be obtained from: Tighe & Bond, Inc., c/o Emily Tully, 53 Southampton Road, Westfield, MA 01085 (413-875-1622)

Copies of the ENF are also being sent to the Conservation Commission and Planning Board of Manchester-by-the-Sea where they may be inspected.

The Secretary of Energy & Environmental Affairs will publish notice of the ENF in the Environmental Monitor, will receive public comments on the project for 20 days, and will then decide, within ten days, if an environmental Impact Report is needed. A site visit and consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit or consultation session, should write to the Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Attention: MEPA Office, referencing the above project.

By: Town of Manchester-by-the-Sea (*Proponent)*

Tighe&Bond

SECTION 2

Section 2
Introduction

Project Name: Central Street Bridge Reconstruction and Central Pond / Sawmill Brook Restoration Project

Project Location: Central Street, Manchester-by-the-Sea, Massachusetts

Project Proponent: Town of Manchester-by-the-Sea

2.1 Project Summary/Overview

This Environmental Notification Form (ENF) is being submitted on behalf of the Town of Manchester-by-the-Sea for the proposed Central Street Bridge Replacement and Central Pond / Sawmill Brook Restoration Project.

The Town of Manchester-by-the-Sea is a vibrant coastal community with an abundance of natural coastal resources, a stable population, and thriving year-round and seasonal businesses. Flooding events have severely impacted these assets in the past, including economic loss from businesses closed due to floods and disrupted utilities, flood related safety concerns due to impassable roadways and restrained access for emergency vehicles, inoperable wastewater and stormwater systems, and environmental concerns due to loss of habitat from tidal restrictions and erosion by flood waters.

Historically and during recent years, property and infrastructure have been damaged, water quality and habitat of inland and coastal waterways have been degraded, and fish passage has been impeded in the watershed. Flooding and water quality problems will be magnified in coming years due to climate change related increased frequency and duration of storms, sea level rise, and the expansion of impervious areas from future development.

Flooding has been a particular problem within the Sawmill Brook watershed. Areas adjacent to the Brook have experienced both coastal and inland flooding due to man-made and natural causes. Flooding is most intense in the lower reaches of the Brook. There, undersized culverts and an improperly functioning tide gate have caused stream banks to overtop, leading to stream bank erosion. Based on watershed modeling developed as part of a Hazard Mitigation Plan, the greatest flood reductions would be accomplished by widening the opening at the Central Street Bridge, removing the tide gate there, restoring marsh and riparian wetlands, and restoring the stream channel within Central Pond. The restoration project must be permitted together with the tide gate removal and bridge improvements to avoid segmentation.

The Central Street tide gate, and related structures are in need of modification to provide better functionality with respect to drainage and fish passage. The tide gate and culvert at Central Street impede drainage from Sawmill Brook, especially during coastal storm events, resulting in localized flooding. The tide gate structure also overtops on spring high tides and storm surge tides. Discussions with the Massachusetts Division of Marine Fisheries (DMF) indicate a preference to remove or modify the tide gate to improve fish passage conditions for rainbow smelt.

The Sawmill Brook culvert under Central Street was observed as part of an in-water walk-through during the planning phases of the project to view existing conditions of the seawall, tide gate structure, culvert, and stream bed/weirs. The inspection report noted corrosion/erosion on the tide gate tracks and safety concerns due to the separation and settlement of culvert arch stones. Significant seepage was observed from the stone wall supporting the south side of Central Street, particularly when the tide gate was closed. The seepage can cause a loss of soils under the street. Repairs made to the wall using pneumatically applied concrete and non-shrink grout repointing have failed, particularly in the tidal zone.

The Central Street Bridge structure currently overtops during extreme storm events and is structurally deficient. Seepage through the seawall, due to hydrostatic pressure from the tide gate, is damaging the roadbed. Culvert arch stones are becoming unstable. The tide gate also obstructs fish passage. Collapsed retaining walls and eroding banks along Central Pond and direct discharge from stormwater outfalls contribute to sedimentation along the stream channels.

The tide gate and weir design at the Central Street Bridge have been identified by the DMF as an impediment to fish passage, notably impacting rainbow smelt (*Osmerus mordax*), a diadromous fish species listed as a federal Species of Concern. Sedimentation from flooding and stream bank erosion also impact spawning areas. Recently, the Sea Run Brook Trout Coalition has contacted the Town to express its interest in restoring trout populations to the Brook. DER has selected this Sawmill Brook project as a provisional Massachusetts Priority Project, due to the potential restoration benefits, and the level of commitment demonstrated by the local community to restore tidal and riparian ecosystems there.

The Town is planning a multi-phase project to address a number of these conditions, including replacement of the Sawmill Brook bridge, removal of the tidegate structure, repair and replacement of channel walls along Central Pond, and restoration of Sawmill Brook by undertaking the following work:

- **Removal of the tide gate.** This work will include demolition of the concrete tide gate structure, slide gate, catwalk, and associated infrastructure to restore the unrestricted flow of Sawmill Brook into Manchester Harbor.
- **Replacement of the Central Street Bridge.** The existing bridge, including the concrete beam span section on the downstream side and upstream stone arch culvert, with be demolished and replaced with a concrete arch culvert with a span of approximately 20 feet, which will have greater capacity than the existing structure. The visible elements of the replacement structure and street furnishings will have a stone appearance in keeping with the aesthetic of the adjacent stone sea wall.
- **Central Street roadway improvements.** The roadway portion of this project is an isolated bridge reconstruction and not part of larger corridor improvement. Conscious effort was made to minimize the overall footprint of the work to limit impacts and cost. The existing horizontal and vertical alignments were matched to the extent practicable, roadway function was matched, and drainage patterns were preserved. Minor improvements were made to curb line geometry to improve overall traffic operation.

  The proposed roadway section matches with the objectives of the Town of Manchester-by-the-Sea to have a more pedestrian friendly downtown village environment. The Town has taken a "complete streets" approach to the downtown area including recent corridor improvement studies. The proposed roadway cross-

section is consistent with the overall plan for the area and will interface well with future improvements. The design includes new ADA compliant sidewalks and curb ramps to enhance the walkability and accessibility of downtown. The design also includes a curb extension ("bump-out") on the bridge to enhance pedestrian safety and provide traffic calming along the corridor. Given the limited right-of-way, bicycle accommodation is provided in the travel lane. A "take-the-lane" cycling approach is appropriate through the downtown due to low motor vehicle speeds and ample sight distance.

- **Improvements to the stone walls along Central Pond.** The deteriorated conditions along the fringes of Central Pond will be improved through a combination of wall repairs, wall replacement, and stabilization of sloped banks with softer stream bioengineering techniques. The replacement sections of wall will have a stone appearance consistent with the aesthetic of the adjacent walls to the extent possible.
- **Sawmill Brook / Central Pond Restoration.** Sawmill Brook stream restoration is proposed to include natural establishment of a channel through the sediments in Central Pond through natural in-stream processes, adaptive management, and vegetation management.

A Site Locus Map (Figure 1), MassDEP Priority Resource Area Map (Figure 2), Existing Conditions Map (Figure 3), and FEMA Flood Zones Map (Figure 4) are provided in Appendix A. Photographs of the existing site are provided in Appendix B. Project plans showing existing and proposed conditions are provided in Appendix C.

2.2 MEPA Process

The project is subject to environmental review pursuant to Section 11.01(2)(a) of the MEPA regulations as it requires a State Agency Action (i.e., a permit and funding). The project meets the following ENF review thresholds:

- 301 CMR 11.03(3)(b)(1)(a): alteration of coastal bank
- 301 CMR 11.03(3)(b)(1)(f): alteration of one half or more acres of any other wetlands

No mandatory EIR thresholds are triggered by the proposed project.

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SECTION 3

Section 3
Existing Environment

3.1 General Project Area

Sawmill Brook and associated tributaries provides drainage for the central portion of the Town of Manchester-by-the-Sea. Sawmill Brook and its tributaries drain rocky uplands, expansive wetlands, and developed impervious areas, before discharging to Manchester Harbor through a narrow tide gate. Many areas of the Town are subject to flooding during extreme storm events due to the combination of storm surge, hydraulic restrictions from undersized culverts and the tide gate, stormwater runoff from impervious areas, the channelized stream system in the lower portion of the watershed, and poor infiltration conditions.

The mouth of Sawmill Brook drains through a narrow culvert and tide gate under Central Street. This location was the site of several sawmills and other historic hydro powered industries, documented as early as 1790. The seawall serves as the road bed for Central Street, along a Town controlled section of Route 127. The tide gate was added around 1900 to impound the Brook for a fire reservoir and to provide a winter skating pond. Installation of the tide gate resulted in the creation of Central Pond. The tide gate and culvert are currently not functioning properly, creating a hydraulic restriction during storm events and impeding the passage of fish such as rainbow smelt (*Osmerus mordax*), a federal Species of Special Concern.

3.2 Central Street Bridge and Tide Gate

The Central Street Bridge spans the Sawmill Brook at the mouth of Manchester Harbor on Central Street (Route 127). The crossing is constructed of three integrated parts including a bridge, tide gate and coastal wingwall. The bridge consists of a 16-foot span mortared stone masonry circular arch tidal bridge with stone masonry wingwalls and headwalls. Timber cribs functioning as weirs are imbedded into the bottom of the stream bed. A concrete and iron tide gate abuts the bridge to the south. The bridge was rebuilt around the mid 1900's and a tide gate was installed to control the Brook and create Central Pond just upstream. A stone and masonry wingwall abuts the bridge in the southwest quadrant, functioning as a seawall.

Tighe & Bond evaluated the bridge, tide gate, and seawall in June 2015. The passage under the bridge discharges flow from Sawmill Brook via a narrow, channelized reach, with 12-foot high granite walls and buildings abutting either side. The bridge has historically suffered due to the tide gate impound waters upstream of the bridge, causing seepage and loss of backfill material when large precipitation events and high tide elevations are concurrent. Multiple hydrologic and hydraulic models of the watershed and bridge indicate that the bridge opening is undersized to pass current design storm events without over-topping with concurrent tail water impacts due to storm surge.

In June of 2016, the bridge underwent interim repairs intended to temporarily stabilize the structure. The open joints were grouted using a pressure injection method and the void below the footing was formed and filled with cast-in-place concrete. An August 13, 2018 site visit confirmed the conditions observed in the 2015 site visit, including observed water seepage paths, damming conditions caused by the tide gate, separation and settlement of culvert arch stones, and concrete degradation.

The bridge is referenced in the Manchester Village National Register of Historic Places registration form as appearing to be of modern construction, and marks the entrance to downtown Manchester-by-the-Sea. Water, drainage, sewer, electric, and gas utilities are located within the roadbed over the arch bridge.

Downstream of the Central Street Bridge is the tide gate that consists of a concrete gravity weir surrounding the Sawmill Brook outlet. The Sawmill Brook passes through an opening in the weir restricted by a 6.5 by 5.5 foot cast iron slide gate controlled with an electric actuator. The actuator is located on a modern galvanized catwalk above the gate. The tide gate serves as a major hydraulic restriction for Sawmill Brook. When closed, it reduces tidal fluctuations within Sawmill Brook and Central Pond, although it is overtopped during very high tides. During rainstorms, it causes flooding within Central Pond.

The existing tide gate structure has a top of wall elevation just above mean higher high water level (MHHW), making this a significant obstruction to rainbow smelt passage on many high tides. Tidal water levels will rise over these walls on spring high tides (full moon or new moon) and during higher than predicted tides associated with atmospheric low pressure or wind setup, and such conditions will periodically allow rainbow smelt to swim over the walls when the tide gate is closed. This tide gate wall overtopping on spring high tides and storm surge tides does indicate that the tide gate is not effective in preventing seawater flooding.

Recent preliminary topographic survey indicates Central Street at this location is within about 1 foot of tidal flooding, based on recorded high tides from the storm of 1978 (NOAA Boston tide record at 93% height correction for Manchester). The frequency of tidal flooding of the roadway will be increasing based on the current mean sea level rise relative to land (including land subsidence) of 0.92 feet per 100 years recorded in Boston (NOAA), and also based on forecast predictions of an increasing rate of relative sea level rise (IPCC).

This tide gate is a bottom opening gate that is not suitable to partial opening for smelt passage due to the head pressure and high flow velocities associated with a limited gate opening needed to maintain the impoundment pond. Full opening of the gate during smelt migration is feasible, though velocities during rainfall events would need to be checked relative to smelt swimming speeds. Even with the tide gate open to allow for fish passage, there are two more weirs inside the stone arch culvert. Since the smelt are not able to jump up weirs, the tide will need to rise to at least 2/3 of mean high tide to allow smelt to swim upstream past these weirs. The Massachusetts Department of Ecological Restoration (DER) has selected this area as a provisional Massachusetts Priority Project due to the potential restoration benefits that can be realized in this location, and the level of commitment demonstrated by the community to accomplish these goals.

3.3 Central Pond / Sawmill Brook

The main area known as Central Pond extends upstream from Central Street Bridge to Knights Circle. The Pond is relatively flat, with a shallow gradient from ranging from 3 feet NAVD88 where Sawmill Brook enters Central Pond to 0.2 feet at the Central Street culvert inlet. Two main "islands" are present at low tide; one triangular feature at the entrance to the pond and one kidney shaped feature in the approximate center.

Historically, the flow of water through Central Pond has been restricted by the closed tide gate for significant portions of the year. The tide gate has been routinely opened during the spring to allow for fish passage and also during the winter and spring seasons to alleviate upstream flooding during periods of peak runoff. When the tide gate is closed the pond fluctuates an average of 4.25 to 4.90 feet from low to high tide. When the tide gate is open the depth ranges from 1.01 to 5.04 feet from low to high tide.

Sediment accumulation has been noted along the shoreline on the western bank of the Pond and to the north of the Pond, and eroded banks have been observed predominantly along the eastern bank of the pond, due to collapse of retaining walls. Granite block, poured concrete, brick, field stone and shale revetment and combinations of the above are the dominant structures found around Central Pond. The eastern shoreline is cut sharply into the Pond, with the wall defining the eastern bank boundary. The eastern shoreline is completely lined with wall structures ranging from 3-5 feet in height, with the tallest walls adjacent to Central Street along the channel that parallels Elm Street, and the lowest walls found on the south eastern shoreline along predominantly privately owned properties.

The western shoreline has a more gradual slope, and includes several shoals formed from finer sediments deposited as Sawmill Brook flows under low water flow, gathering in pockets along the shore. Several stormwater discharge outfalls along the western shore are also a source of sediment. Walls along the western shoreline vary from loose cobbles and revetment to low fieldstone. The western shoreline is almost entirely under private ownership with the exception of a Town-owned parcel on Elm Street.

Based on a field survey conducted on April 18, 2018, the worst wall conditions were observed in the south-eastern section of the Pond, extending from behind 19 Central Street to the Fire Station, where two wall sections have entirely collapsed, and approximately 400 feet is in need of extensive repair. Other areas of concern due to land subsidence behind the wall, erosion, lack of vegetation, and public access include the wall sections above the Fire Station to Knights Circle (approximately 400 feet), sections along the western shore, and the transition between the wall structure on a Town owned parcel on Elm Street to the rock rubble on the adjacent privately owned parcel, which is a high velocity location where the wider channel narrows to the channel above Central Street.

3.4 Wetland Resource Areas

3.4.1 Methodology of Resource Area Investigations

Tighe & Bond wetland scientists conducted an evaluation of wetland resource areas on April 18 and 19, 2019. Wetland resource areas regulated by the Massachusetts Wetland Protection Act (MA WPA) and the Manchester-by-the-Sea General Wetlands Bylaw (Article XVII) and regulations in the vicinity of the proposed work were delineated in accordance with 310 CMR 10.00 and MassDEP guidelines.

3.4.2 Description of Wetland Resource Areas

Wetland resource areas located within the vicinity of the proposed project include Land Under Water, Riverfront Area, Land Subject to Coastal Storm Flowage, Bordering Land Subject to Flooding, Bordering Vegetated Wetlands, Coastal Bank, and 100-foot buffer zone to Coastal Bank. These areas are depicted on Figures 2, 3, and 4 in Appendix A, site photographs in Appendix B, and on project plans in Appendix C, and are described in greater detail below.

Land Under Water Bodies and Waterways: Per 310 CMR 10.56(2), LUW is the land beneath any creek, river, stream, pond or lake. Said land may be composed of organic muck or peat, fine sediments, rocks or bedrock. Within the project area, LUW is associated with Sawmill Brook and Central Pond.

Riverfront Area: Riverfront Area is defined at 310 CMR 10.58(2)(a) as "the area of land between a river's mean annual high water line and a parallel line measured horizontally. The riverfront area may include or overlap other resource areas or their buffer zones. The Riverfront area does not have a buffer zone." Within the project area, Riverfront Area extends for 200 feet parallel to the mean annual high water line of Central Pond / Sawmill Brook.

Land Subject to Coastal Storm Flowage (LSCSF): LSCSF means land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater. According to the FEMA Flood Insurance Rate Map (FIRM) No. 25009C0434G (revised to reflect Letter of Map Revision (LOMR) effective 1/2/2017), the project area is within Zone A (north of the bridge) and Zone AE (south of the bridge, base flood elevation 10 feet NAVD); therefore, LSCSF is mapped within the project area limits of work.

Bordering Vegetated Wetlands (BVW): BVW is defined in 310 CMR 10.55(2) as freshwater wetlands bordering on creeks, river, streams, ponds, and lakes with areas where the soils are saturated and/or inundated such that they support a vegetational community consisting of 50% or more of wetland indicator plants. BVW was delineated west of Sawmill Brook, north of and outside of the project area.

Coastal Bank: Based on 310 CMR 10.30(2), Coastal Bank consists of the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of another wetland. Per Sheet C-01 within the Central Pond Restoration cross-section plan set, transects developed along the project site based on the MassDEP and CZM Coastal Manual show two Coastal Bank landforms are present west of Central Pond and Coastal Bank is present behind the retaining wall on the east side of Central Pond.

Buffer Zone: Under the MA WPA, areas extending 100 feet from certain areas subject to protection are considered Buffer Zone. In the vicinity of the project, buffer zone extends landward from Coastal Bank, and consists of developed land with residences, buildings, and parking areas on both sides of Central Pond.

3.5 Rare Species

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) Atlas, 14th Edition, effective August 1, 2017, was consulted during preparation of this application. According to this source, the proposed project area is not located within designated Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife and therefore will not require review pursuant to the Massachusetts Endangered Species Act.

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SECTION 4

Section 4
Alternatives Analysis

Several repair and improvement alternatives were considered for the Central Street bridge, tide gate, and Central Pond / Sawmill Brook, and the most feasible solution is presented as the proposed project in the ENF. Factors considered in the evaluation of alternatives include environmental impacts, cost, public safety, climate change resiliency, habitat conditions, and rainbow smelt spawning condition improvements.

As the existing Central Street bridge is in deteriorating condition and is physically associated with the tide gate and adjacent Central Pond / Sawmill Brook, off-site alternatives would not meet project goals and were therefore not considered. On-site alternatives considered for the project included a no action alternative, repair or replacement of the Central Street culvert/bridge in conjunction with tide gate removal, and alternatives for the restoration of Central Pond or Sawmill Brook.

4.1 No Action Alternative

The no action scenario would result in no immediate direct costs, but will result in increasing safety and functionality concerns over time, if deterioration of the bridge and tide gate is allowed to continue at the current pace. Impacts from flooding associated with the tide gate and lack of stormwater improvements would continue to negatively affect adjacent property owners and rainbow smelt spawning conditions. As the no action alternative does not meet project goals of addressing failing infrastructure, reducing flooding and increasing resiliency, and improving habitat conditions and possibility for rainbow smelt, it is not preferred.

4.2 Central Street Bridge and Tide Gate Alternatives

In both of the below alternatives, the existing tide gate is proposed to be removed as it has been identified by DMF as an impediment to fish passage, and the existing, deteriorated bridge is proposed to be rehabilitated or replaced to address public safety concerns.

4.2.1 Rehabilitate Bridge and Culvert, Remove Tide Gate

During a June 2015 in-water walk-through to view existing conditions, the Central Street bridge signs of advanced deterioration were observed, including separation of joints, cracked blocks, wall seepage, and foundation undermining. Emergency repairs were made in June 2016 to temporarily stabilize the existing arch barrel and footing, but continued deterioration due to water seepage, scour, settling, and stone separation is inevitable without major repairs or replacement. The existing tide gate and bridge at Central Street impede flow from Sawmill Brook, especially during coastal storm events, resulting in localized flooding.

Rehabilitating the existing bridge and culvert structure and removing the tide gate structure is anticipated to result in improved hydraulic capacity, habitat restoration, improvements to aesthetics and water quality, and a reduction in upstream flooding. Concerns with the rehabilitation and tide gate removal alternative include a change in hydrology, increased tidal range, a shift in species, and temporary water quality impacts.

4.2.2 Replace Culvert with Bridge, Remove Tide Gate (Preferred)

The Town has identified the existing narrow roadway width of the Central Street bridge as a safety issue with respect to pedestrian, bicycle, and automobile traffic. Although options to widen the roadway are limited due to abutting businesses, even a modest increase in roadway width may improve safety. Replacing the existing culvert with a precast concrete bridge structure and removing the existing tide gate is anticipated to result in improved hydraulic capacity, habitat restoration, improvements to aesthetics and water quality, improvements to roadway safety, and a reduction in upstream flooding. Concerns with the replacement alternative include temporary water quality impacts, a change in hydrology and increased tidal range relative to existing conditions, a shift in species, and temporary water quality impacts.

4.3 Central Pond / Sawmill Brook Restoration Alternatives

The goals of the proposed Central Pond / Sawmill Brook restoration portion of the project include improving conditions relative to:

- Flood mitigation
- Fish passage
- Aesthetics
- Channel conditions
- Wildlife habitat
- Wall stability
- Public access

During the feasibility study for restoration of Central Pond performed under a Massachusetts Environmental Trust (MET) grant, alternatives for the restoration of Central Pond were developed based on bank stabilization, stormwater drainage, stream bed improvements, wetland and riparian impacts and restoration, diadromous fish run and habitat improvement, and public access considerations. All potential alternatives provide for full passage tidal exchange.

4.3.1 Maintain Low Level Impoundment at Central Pond

In this alternative, Central Pond would be improved in order to maintain a permanent low level water impoundment with a cross-channel berm upstream of Central Street bridge where the channel expands. This alternative would maximize the water feature, but would likely require high construction and maintenance costs with a high level of permitting complexity and relatively low ecological benefits relative to restoration of Sawmill Brook as a tidal stream.

4.3.2 Restore Sawmill Brook to an Unrestricted Tidal Stream (Preferred)

Restoring Sawmill Brook to an unrestricted tidal stream would provide free flowing water in a continuous stream, and would require:

- Replacement of the retaining wall along the east side of the pond
- Spot treatment of areas susceptible to erosion along the west side of the pond with soft bank toe protection measures

- Planting of vegetation in the pond bottom to stabilize sediment and encourage establishment of a healthy plant community

This alternative would require relatively low construction and maintenance costs relative to Central Pond improvements, would have high ecological benefits in terms of maximizing fish passage, improving water quality, providing flood mitigation, providing diverse wildlife habitat, and resulting in a restored naturalized landscape.

4.3.3 Restore Sawmill Brook to Low Level Pools with Low Level Riffles

In this alternative, Sawmill Brook would be restored to low level pools impounded by low level riffle structures. The pool and riffle alternative would provide fish passage improvements, a naturalized landscape, flood mitigation, an increased water feature, and some sediment management, and is between the tidal stream and pond alternatives in terms of construction maintenance and maintenance costs. Permitting complexity for this alternative is anticipated to be complex, with high potential ecological benefits and moderate project complexity. Feedback received during project planning is that the results of this alternative would be uncharacteristic of more natural streams in the area and should be avoided.

4.4 Preferred Alternative

4.4.1 Project Details

The proposed condition improvements include removing the tide gate and replacing the existing Central Street Culvert with a 20-foot wide arch culvert. The proposed culvert would maintain the existing upstream and downstream invert elevations (-0.2 feet NAVD88, and -4 feet NAVD88, respectively), and provide a constant low chord elevation of 6 feet NAVD88.

Removal of the tide gate and enlargement of the culvert will improve fish passage and increase the hydraulic capacity of Sawmill Brook reducing upstream flooding. Removing the tide gate will also limit the hydraulic pressure behind the seawall and reduce safety concerns. Restoration of the seawall and guard rail will improve traffic safety. Stream restoration will improve habitat and aesthetics in the downtown area. The public location is also ideal for educational signage about Sawmill Brook's natural history.

The proposed restoration design for the Central Pond area of Sawmill Brook includes reestablishing the native salt marsh within the interior sections of the mud flats, replacing and repairing existing retaining walls along the eastern shore, and implementing bioengineered solutions to stabilize the western shoreline. The goal of the design is to take advantage of the natural in-stream processes to reestablish a channel through the sediments in Central Pond, followed by adaptive management, if needed. This process will begin, to some extent, with the removal of the tide gate in fall 2020. With this approach, the stream channel would stabilize naturally and reach equilibrium. Adaptive management would be employed to address issues that may arise, such as:

- Adjustment of the stream thalweg (low flow centerline) if the channel were to develop too close to the east or west embankments
- Active plantings of native species to revegetate the former pond to facilitate salt marsh establishment and/or invasive plant management
- Actively promote habitat enhancements if natural processes are not developing

Stream restoration will also improve fish passage and overall habitat value. The public will benefit from this project as it will fortify stream banks currently overtopping and eroding, provide more flood storage to lessen flood events, and create an aesthetically pleasing new habitat in the downtown area to enhance resident's opportunity to observe the natural environment.

Alternatives for embankment stabilization/restoration along the east and west sides of Central Pond are still under development and presently include segmental retaining walls consisting of mechanically stabilized earth walls and/or gravity walls and gabion walls. Poor wall drainage is likely one of the factors contributing to the existing wall failures, so improved drainage features will be included in the final selected option with the goal of improved wall performance and longevity. Living shoreline bioengineering is planned for sections on the western shore.

4.4.2 Project Phasing

The overall project consists of three general phases:

1. Removal of the tide gate structure, demolition of the existing Central Street Bridge and reconstruction with a concrete arch culvert with an approximate span of 20 feet
2. Repair, replacement, and stabilization of stone retaining walls along Central Pond
3. Central Pond / Sawmill Brook Restoration

Removal of the tide gate, demolition of the existing Central Street bridge, bridge reconstruction, and retaining wall repair and replacement are anticipated to occur prior to the Central Pond / Sawmill Brook restoration project.

4.5 Construction Methodology & Mitigation

The proposed project will be performed with measures to minimize potential construction disturbances. As noted below, in some instances specific construction means and methods will be determined by the contractor. Due to construction safety concerns, the contractor will be responsible for providing public safety protection measures, including safety signage and observation to ensure that the public stays at a safe distance from active equipment and does not enter potentially unsafe active work areas.

4.5.1 Erosion & Sedimentation Control

Best Management Practices (BMPs) will be implemented for the project to limit the footprint of project disturbance. BMPs will include:

- Sediment filter bags at pump discharges to collect sediment if sediment is mobilized by pumping, should pumping be necessary
- Erosion control barriers, such as compost filter tubes, or silt fence and straw bale barriers, between upland limits of work and sensitive resource areas
- Limiting footprints of work to the minimum necessary to meet project goals
- Project contractors will be required to maintain reserve supplies of erosion control barriers on-site to make repairs as necessary

Supplemental and/or alternative construction BMPs may be required during work, depending on site and weather conditions.

4.5.2 Site Access and Construction Staging

For the bridge reconstruction, access to the proposed work area will be from Central Street. Staging of equipment and materials will likely be handled in the municipal parking lot along Church Street. Should this happen, existing parking on Church Street will be impacted temporarily. Final location of staging and material handling will be further defined during later stages of design development.

For the pond project, access to the retaining wall and pond bottom will occur generally from the east side of the pond via existing paved parking areas. Plantings in the pond bottom will be performed by hand. Streambank stabilization measures required along the westerly portion of the pond may be installed by heavy machinery operating from anchored timber or composite mats in the pond bottom. Access permission may also be sought from private property owners on the west if needed. Areas disturbed for construction access will be restored to pre-construction conditions.

4.5.3 Site Stabilization

The areas of construction will remain in a stable condition at the close of each construction day via the use of appropriate erosion and sedimentation control measures. Erosion control measures will be inspected at the close of each construction day and maintained or reinforced as necessary. All erosion and sedimentation control measures will be inspected, cleaned, or replaced during construction and will remain in place until such time as stabilization of all areas that may impact jurisdictional areas is permanent. Upon completion of construction, the impoundment level will recover naturally when pumping ceased and disturbed upland areas will be loamed and seeded and mulched, paved, or otherwise stabilized as required to match pre-construction conditions.

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SECTION 5

Section 5
Regulatory Compliance

The proposed project has been designed to avoid environmental impacts when possible, minimize unavoidable impacts when practicable, and provide mitigation that is commensurate with the proposed alterations. Descriptions of the project's compliance with the regulatory requirements of the MA WPA, and other pertinent state and federal regulatory programs are provided in the following sections.

5.1 Local Permits

5.1.1 Massachusetts Wetlands Protection Act and Manchester-by-the-Sea Wetlands Bylaw Notice of Intent (NOI)

The project will require an Order of Conditions from the Town of Manchester-by-the-Sea Conservation Commission pursuant to the MA WPA and the Manchester-by-the-Sea Wetlands Bylaw and Regulations (Article 17). A Notice of Intent (NOI) will be submitted to the Town of Manchester-by-the-Sea Conservation Commission following submittal of the ENF.

Table 5-1 presents a summary of the resource area impacts from the proposed project. The figures in Appendix A and project plans in Appendix C also depict the proposed activities and Resource Areas.

Table 5-1
Summary of Temporary and Permanent Impacts to Wetland Resource Areas

Resource Area	Temporary Impacts (sf)		Permanent Impacts (sf)		Total Disturbance
	Central Pond Bridge Reconstruction	Central Pond / Sawmill Brook Restoration	Central Pond Bridge Reconstruction	Central Pond / Sawmill Brook Restoration	
Coastal Bank[1]	130	1,925	--	--	2,055
Land Under Water	2,005	70,400	--	7,600	80,005
Riverfront Area – Inner 100 ft	12,505	39,000	--	--	51,505
Riverfront Area – Outer 200 ft[2]	13,190	--	--	--	13,190
LSCSF[3]	11,635	39,000	--	--	50,635
Total[4]	**15,195**	**109,400**	**--**	**7,600**	**132,195**

[1] Coastal Bank impacts are given in linear feet (lf), not square feet (sf)

[2] Riverfront Area – Outer 200 ft impacts are inclusive of inner 100 ft impacts

[3] LSCSF is located within the 200 ft Riverfront Area

4 Total impacts do not include Coastal Bank

Wetland resource area impacts are primarily associated with temporary construction-period impacts during the bridge reconstruction and pond / brook restoration. Construction-period impacts to existing, disturbed buffer zone to Coastal Bank will result from all phases of the proposed project; the Coastal Bank buffer zone is located within LSCSF and Riverfront Area.

As the proposed bridge reconstruction is located within the overall footprint of the existing bridge and roadway, there are no anticipated permanent impacts associated with that phase of the project.

Temporary impacts to Land Under Water associated with the pond / brook restoration include impacts associated with plantings, and dredging for retaining wall repairs and reconstruction, with permanent impacts to Land Under Water associated with the installation of rip-rap wall erosion protection.

5.1.2 Town of Manchester Historic District Commission

The Central Street Bridge is located within the Manchester Village Historic District, which is listed in the National Register of Historic Places. Although the bridge is described on the nomination form as seeming to be of modern vintage, work within the Manchester Village Historic District requires review by the Manchester-by-the-Sea Historic District Commission (HDC) for aesthetic consistency with the District. An application with project plans, photos of the existing structure, and photos of sample materials proposed for use will be submitted to the HDC for review and approval.

5.1.3 Other Local Permits

Other local permits such as a street opening permit and trench permit may be required for the proposed bridge replacement work. The Town will coordinate with appropriate Town departments as necessary.

5.2 State Permits

5.2.1 Chapter 91 License

Based on a review of the jurisdictional tidelands mapping provided by MassGIS, the proposed project area is located within filled and flowed tidelands under Chapter 91 jurisdiction. There are two existing license plans in the vicinity of the project area for Manchester Harbor:

- License Plan #197, recorded January 17, 1922, authorized building retaining walls and riprap slopes and filling in Manchester Harbor
- License Plan #650, recorded April 12, 1926, authorized building a pile pier and bulkhead and filling for an extension of an existing pier in Manchester Harbor

Chapter 91 license applications will be submitted to MassDEP for review and approval for the restoration of Central Pond, retaining wall rehabilitation, bridge replacement, and tide gate removal.

5.2.2 401 Water Quality Certification

A Section 401 Water Quality Certification is triggered by the filing of a federal permit if the project results in a loss of 5,000 square feet cumulatively of Bordering or Isolated Vegetated Wetlands and Land Under Water, the amount of any proposed dredging is greater than 100 cubic yards (cy), or if any of the other thresholds listed in 314 CMR 9.04 are met. The proposed project is expected to result in more than 100 cy of dredging, and therefore a 401 Water Quality Certification will be submitted to MassDEP for review and approval.

The results of a sediment characterization study performed in the spring of 2018 as part of the Sawmill Brook Culvert Tide Gate Removal and Stream Restoration Feasibility funded by the MET (included in Appendix E) found that approximately 5,350 cubic yards of sediment are present within the Central Pond area. The sediment depth was found to range from 1 to over 6 feet in depth (beyond the limit of the probe used in the study). Based on grain size sampling results, the material in the pond area is predominantly dark brown silty sand. The channel below the Pond, for 100 -200 feet upstream of the Central Street Bridge, has a stony bottom, with cobbles, boulders and areas of gravel.

Laboratory analysis of three composite sediment samples collected in January 2018 in upstream, downstream, and pond locations during low tide conditions indicated the presence of low levels of metals, Polycyclic Aromatic Hydrocarbons (PAHs), and Polychlorinated Biphenyls (PCBs). With the exception of benzo(a)pyrene (2.10 mg/kg) and lead (167 mg/kg) in the downstream sediment sample, the detected concentrations of metals, PCBS, and PAH concentrations in the sediment samples collected in support of this feasibility evaluation were below the MassDEP Reportable Concentration (RCS-1) values in 310 CMR 40.000. The maximum concentration of total PCBs is below the RCS-1 values and Threshold Effects Concentration values (TECs). In sediment samples collected from the Downstream and Pond sediment samples, lead, mercury, and several PAHs were detected at concentrations above the established TEC.

Based on the preliminary sediment sampling results, since there were detections of benzo(a)pyrene above the MCP Method 1 soil standard in sediment samples collected from the Downstream location, upland reuse of sediment from this area would not be permitted in accordance with 314 CMR 9.07(9). It is anticipated that the reuse of sediment from other areas in the project site for salt-marsh restoration would be acceptable, since contaminant levels would potentially be below the Method 1 S1 soil standards, and consistent with the concentrations identified in the "Pond" sample, collected from the area of accumulated sediment in the eastern portion of Central Pond that is exposed during low tide when the Central Street tide gate remains open.

The preferred restoration alternative would minimize mechanical dredging of sediment deposits within Central Pond, and instead allow for restoration of a more natural sediment transport regime. Dredging will be limited to the footing excavations required for the replacement of the retaining wall. The flow of water through Central Pond has been restricted by the closed tide gate for significant portions of the year, with routine opening during the spring to allow for fish passage, and also during the winter and spring seasons to alleviate upstream flooding during periods of peak runoff. During these periods of unrestricted flow conditions, sediment transport is occurring, with the ultimate discharge location in Central Harbor. Planting of the pond bottom as part of the project will help stabilize sediment in-place, naturalizing the transport rate.

Based on a review of analytical data collected in 2012 in support of a harbor dredging project (NAE-2012-322 – Bulk Chemical Analysis – Town of Manchester, Manchester Harbor – Tier III Sediment Evaluation), the nature of sediment quality upstream of the Central Street tide gate is not significantly different with regard to the presence of heavy metals, notably lead and mercury. Levels of total PCBs were slightly higher in the Central Harbor sediment samples, while levels of PAHs were slightly higher in the upstream Central Pond samples.

When closed, the existing tide gate has created a condition where fine sediments settle during large flow events during both low and high tides, instead of allowing sediment to travel downstream during low tides as would have occurred if the tide gate was not in place. The existing system is in disequilibrium while the prevalence of fine-grained sediment within Central Pond is also indicative of a supply of fine sediment within the watershed. The proposed bridge replacement and tide gate removal at Central Street would restore a tidal ebb-and-flow similar to existing conditions observed during periods when the tide gate is left open. A review of data collected to date indicates that the restoration of natural flow conditions and sediment transport from Sawmill Brook into Central Harbor is unlikely to result in a deterioration of conditions with regard to concentrations of contaminants present in the sediment.

5.2.3 MassDOT Chapter 85 Review

The replacement of the Central Street bridge portion of the project qualifies for the application of the requirements of Massachusetts General Law (MGL) Chapter 85, Section 35 as a highway bridge structure (BRI) that meets the MGL definition of a bridge (a span in excess of 10 feet) but not the federal definition (a span in excess of 20 feet). A hydrologic and hydraulic analysis and scour analysis will be performed to ensure design compliance with MassDOT requirements, and a hydraulic design report will be submitted to MassDOT as part of the Chapter 85 review process.

5.2.4 Massachusetts Historical Commission PNF and Review

The project includes replacement of a deteriorated bridge over Sawmill Brook, removal of a tide gate, replacement and repair of deteriorated retaining walls, and restoration of a tidal pond, which are located within the Manchester Village Historic District (National Register Information System ID 89002156). The Central Street Bridge is referenced in the Manchester Village National Register of Historic Places registration form as non-contributing to the Historic District and appearing to be of modern construction.

A Project Notification Form (PNF) was submitted to MHC on January 15, 2018. Subsequent correspondence with MHC included a request for project plans and transmittal of the PNF to the Massachusetts Board of Underwater Archaeological Resources (BUAR), and the Tribal Historic Preservation Officers (THPOs) of the Mashpee Wampanoag Tribe and Wampanoag Tribe of Gay Head (Aquinnah). Per the MHC correspondence, approval and/or comments from the HDC are also required. Copies of the ENF will be distributed to the MHC, BUAR, and THPOs.

On April 4, 2019, the HDC sent a letter of support for the project to the Town Board of Selectmen (included in Appendix E), referencing that as the Central Street Bridge is listed as non-contributing on the National Register of Historic Places registration form, the project does not involve impacts to historic properties. The Town will continue to work with MHC and the Manchester-by-the-Sea HDC to ensure that the furnishings of the reconstructed bridge will be consistent with the setting of the historic district.

The design intent at this time is that visible elements of the reconstructed Central Street Bridge structure and street furnishings will have a stone appearance in keeping with the aesthetic of the adjacent stone seawall. Similarly, replacement sections of stone walls along Central Pond will have a stone appearance consistent with the aesthetic of the adjacent walls to the extent possible.

The Manchester-by-the-Sea HDC has issued a letter of support for the Central Street Bridge Reconstruction Project as the project is not anticipated to affect known historical properties, and the furnishings presented to the HDC appear to be generally consistent with the historic district setting. Decisions related to final finishes will be made during later stages of design development, in consultation with the Town and HDC.

5.3 Federal Permits

5.3.1 CZM Federal Consistency Review

The project is subject to Federal Consistency Review (MA Federal Consistency Rules, 301 CMR 20.00 and Coastal Zone Management Act, 16 U.S.C. § 14560) because it is being conducted by a non-federal entity within the Coastal Zone and requires a permit from a Federal Agency (Army Corps of Engineers). The proposed project complies with the CZM Policies[1] as follows:

Coastal Hazards Policy #1: *Preserve, protect, restore, and enhance beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage (LSCSF), salt marshes, and land under the ocean (LUTO).*

The proposed project will not affect the beneficial functions of storm damage prevention and flood control provided by LSCSF and Coastal Bank. Within the project area, LSCSF and Coastal Bank are located adjacent to Sawmill Brook and Central Pond. Proposed project impacts to Coastal Bank and LSCSF are limited to retaining wall improvements and temporary construction period impacts for project access.

Coastal Hazards Policy #2: *Ensure that construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Flood or erosion control projects must demonstrate no significant adverse effects on project site or adjacent or downcoast areas.*

As described in Section 4.5, the proposed reconstruction and restoration project will utilize erosion and sediment control BMPs such as careful site planning, and nonstructural measures to minimize impacts on resource areas and sediment transport during construction. The feasibility study performed under the FY 17 MET Grant indicated that Central Street Bridge can be widened, and the tide gate can be removed without causing adverse upstream impacts, and will likely result in additional flushing, which will improve water quality and reduce the rate of sedimentation.

[1] https://www.mass.gov/files/documents/2016/08/qc/czm-policy-guide-october2011.pdf

Coastal Hazards Policy #3: *Ensure that state and federally funded public works projects proposed for location within coastal zone will:*

- *Not exacerbate existing hazards or damage natural buffers or other natural resources.*
- *Be reasonably safe from flood and erosion-related damage.*
- *Not promote growth and development in hazard-prone or buffer areas, especially in velocity zones and Areas of Critical Environmental Concern.*
- *Not be used on Coastal Barrier Resource Units for new or substantial reconstruction of structures in a manner inconsistent with Coastal Barrier Resource/Improvement Acts.*

The project will not exacerbate existing hazards or cause additional damage to buffer zones or natural resources, and the project area is not located within an Area of Critical Environmental Concern. The work area has been limited to the extent feasible and does not promote growth and development in hazard-prone areas. The project is anticipated to enhance the functions and values of natural resources and their buffers in this area.

Coastal Hazards Policy #4: *Prioritize acquisition of hazardous coastal areas that have high conservation and/or recreation values and relocation of structures out of coastal high-hazard areas, giving due consideration to effects of coastal hazards at location to use/manageability of area.*

Not applicable.

Energy Policy #1 & #2: *For coastally dependent energy facilities, assess siting in alternative coastal locations. For non-coastally dependent energy facilities, assess siting in areas outside of coastal zone. Weigh environmental and safety impacts of locating energy facilities at alternative sites.*

Encourage energy conservation and use of renewable sources such as solar and wind power in order to assist in meeting energy needs of Commonwealth.

Not applicable.

Growth Management Policy #1, #2, & #3: *Encourage sustainable development that is consistent with state, regional, and local plans and supports quality and character of community.*

Ensure that state and federally funded infrastructure projects in coastal zone primarily serve existing developed areas, assigning highest priority to projects that meet needs of urban and community development centers.

Encourage revitalization and enhancement of existing development centers in coastal zone through technical assistance and financial support for residential, commercial, and industrial development.

The proposed project is located in an existing developed area of Manchester-by-the-Sea near the Manchester Harbor, with adjacent land uses including high density residential, commercial uses, and municipal uses such as the Fire Department, Police Station, and Town Hall. Replacing the failing infrastructure of the Central Street bridge, removing the tide gate, and restoring Central Pond will benefit the existing development center by improving safety, increasing the ability of rainbow smelt to utilize the spawning area, and improving the resiliency of existing infrastructure to storm events and sea level rise.

Habitat Policy #1 & #2: *Protect coastal, estuarine, and marine habitats—including salt marshes, shellfish beds, submerged aquatic vegetation, dunes, beaches, barrier beaches, banks, salt ponds, eelgrass beds, tidal flats, rocky shores, bays, sounds, and other ocean habitats—and coastal freshwater streams, ponds, and wetlands to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes.*

Advance restoration of degraded or former habitats in coastal and marine areas.

Coastal and coastal freshwater habitats will be protected by the proposed project. The project will comply with the Wetlands Protection Act, Chapter 91 Waterways Regulations, and Section 401 Water Quality Certification requirements. The proposed project includes removal of a tide gate to improve potential rainbow smelt spawning conditions, and restoration of Sawmill Brook.

Ocean Resources Policy #1, #2, & #3: *Support development of sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that review process regulating aquaculture facility sites (and access routes to those areas) protects significant ecological resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse effects on coastal and marine environment and other water-dependent uses.*

Except where such activity is prohibited by Ocean Sanctuaries Act, Massachusetts Ocean Management Plan, or other applicable provision of law, extraction of oil, natural gas, or marine minerals (other than sand and gravel) in or affecting coastal zone must protect marine resources, water quality, fisheries, and navigational, recreational and other uses.

Accommodate offshore sand and gravel extraction needs in areas and in ways that will not adversely affect marine resources, navigation, or shoreline areas due to alteration of wave direction and dynamics. Extraction of sand and gravel, when and where permitted, will be primarily for purpose of beach nourishment or shoreline stabilization.

Not applicable.

Ports and Harbors Policy #1, #2, #3, #4, & #5: *Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health and take full advantage of opportunities for beneficial re-use.*

Obtain widest possible public benefit from channel dredging; ensure that Designated Port Areas (DPAs) and developed harbors are given highest priority in allocation of resources.

Preserve and enhance capacity of DPAs to accommodate water-dependent industrial uses and prevent exclusion of such uses from tidelands and any other DPA lands over which an EEA agency exerts control by virtue of ownership or other legal authority.

For development on tidelands and other coastal waterways, preserve and enhance immediate waterfront for vessel-related activities that require sufficient space and suitable facilities along water's edge for operational purposes.

Encourage, through technical and financial assistance, expansion of water-dependent uses in DPAs and developed harbors, re-development of urban waterfronts, and expansion of physical and visual access.

Not applicable.

Protected Areas Policy #1 & #2: *Preserve, restore, and enhance coastal Areas of Critical Environmental Concern, which are complexes of natural and cultural resources of regional or statewide significance.*

Protect state designated scenic rivers in coastal zone.

Not applicable.

Protected Areas Policy #3: *Ensure that proposed developments in or near designated or registered historic places respect preservation intent of designation and that potential adverse effects are minimized.*

The Central Street Bridge is located within the Manchester Village Historic District, and is described on the National Register of Historic Places nomination form for the District as seeming to be of modern vintage. The Proponent will continue to coordinate with MHC and the Manchester HDC regarding aesthetic consistency.

Public Access Policy #1: *Ensure that development (both water-dependent or non-water-dependent) of coastal sites subject to state waterways regulation will promote general public use and enjoyment of water's edge, to an extent commensurate with Commonwealth's interests in flowed and filled tidelands under Public Trust Doctrine.*

The Central Street bridge and Pond are located within flowed and filled tidelands subject to Chapter 91, the Massachusetts Public Waterfront Act, and the Public Trust Doctrine. The proposed bridge replacement, culvert removal, and pond restoration project is anticipated to result in improved public access through replacement of failing public infrastructure and improvements to the roadway that will occur during the bridge replacement that will enhance bicycle and pedestrian use of the roadway.

Public Access Policy #2 & #3: *Improve public access to existing coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation and trail links (land- or water-based) to other nearby facilities. Increase capacity of existing recreation areas by facilitating multiple use and by improving management, maintenance, and public support facilities. Ensure that adverse impacts of developments proposed near existing public access and recreation sites are minimized.*

Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities, giving highest priority to regions of high need or limited site availability. Provide technical assistance to developers of both public and private recreation facilities and sites that increase public access to shoreline to ensure that both transportation access and recreation facilities are compatible with social and environmental characteristics of surrounding communities.

Not applicable.

Water Quality Policy #1: *Ensure that point-source discharges and withdrawals in or affecting coastal zone do not compromise water quality standards and protect designated uses and other interests.*

The proposed amount of roadway widening associated with the bridge reconstruction is considered redevelopment under the MassDEP Stormwater Management Standards, and the design will comply with the MassDEP Stormwater Management Standards to the extent practicable. The overall proposed bridge reconstruction and pond improvements project will not include creation of additional impervious area, addition of any new point source discharges, or expansion of a drainage system for increased collection.

Construction-period stormwater impacts will be addressed through implementation of appropriate erosion and sediment controls. Stormwater Management Standards will be addressed in the Wetlands Protection Act Notice of Intent that will be filed with the Town of Manchester-by-the-Sea Conservation Commission.

Water Quality Policy #2 & #3: *Ensure implementation of nonpoint source pollution controls to promote attainment of water quality standards and protect designated uses and other interests.*

Ensure that subsurface waste discharges conform to applicable standards, including siting, construction, and maintenance requirements for on-site wastewater disposal systems, water quality standards, established Total Maximum Daily Load limits, and prohibitions on facilities in high-hazard areas.

Erosion and sedimentation controls will be incorporated into the construction practices to minimize impacts to resource areas during the construction process and in compliance with the Massachusetts Stormwater Management Policy and Wetlands Protection Act Regulations.

5.3.2 Army Corps of Engineers Pre-Construction Notification

The proposed project is subject to jurisdiction under the United States Army Corps of Engineers (Corps) authorization under Section 404 of the Clean Water Act, due to work within Waters of the United States. Corps Authorization is also required under Section 10 of the Rivers and Harbors Act due to work within waters subject to the ebb and flow of the tide.

The Corps General Permit (GP) for Massachusetts cover specific activities within the limits of Corps jurisdiction. Specific area limits apply when 1) there is a discharge of dredged or fill material into waters of the U.S., and 2) as stated in each of the activity General Permits. The total temporary and permanent impact area is used to determine if a project is eligible for Self-Verification, Pre-Construction Notification, or Individual Permit coverage.

The project appears to qualify for authorization under multiple GP categories, including:

- GP 5. Dredging, Disposal of Dredged Material, Rock Removal and Rock Relocation
- GP 7. Bank and Shoreline Stabilization
- GP 10. Linear Transportation Projects
- GP 23. Aquatic Habitat Restoration, Enhancement, and Establishment Activities

The project is anticipated to be reviewed as a Pre-Construction Notification. A permit application will be prepared and submitted to the Corps, and will be concurrently reviewed by other federal agencies, including the U.S. Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA)/ National Marine Fisheries Service (NMFS) and the U.S. Fish & Wildlife Service (USFWS). This application will be submitted following submittal of the ENF.

In addition to environmental factors, the MA General Permit requires notification of the State Historic Preservation Office (SHPO), Tribal Historic Preservation Officers (THPOs) and Board of Underwater Archeological Resources (MA BUAR) (for underwater projects) per Section 106. The applicant will continue to coordinate with these parties in accordance with the Section 106 review process as the project progresses.

5.3.3 US EPA NPDES Construction General Permit NOI and SWPPP

Under the EPA National Pollutant Discharge Elimination System (NPDES) program, a Notice of Intent (NOI) for coverage under the Construction General Permit (CGP) and Stormwater Pollution Prevention Plan (SWPPP) for discharge of stormwater are required for construction site disturbances larger than one acre. As construction activities are anticipated to result in the cumulative disturbance of one or more acres of land, an NOI will be submitted to the EPA for coverage under the NPDES CGP and a SWPPP will be developed for the project.

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APPENDIX A

Legend

Limit of Work

Tighe&Bond
Engineers | Environmental Specialists

Based on USGS Topographic Map for Marblehead North, MA Revised 1985. Contour Interval Equals 3-Meters. Circles indicate 500-foot and half-mile radii

1:24,000

0 1,000 2,000

Feet

N

FIGURE 1
SITE LOCATION

Central Street Bridge Replacement/
Sawmill Brook Restoration Project
Manchester-by-the-Sea, Massachusetts

September 2019

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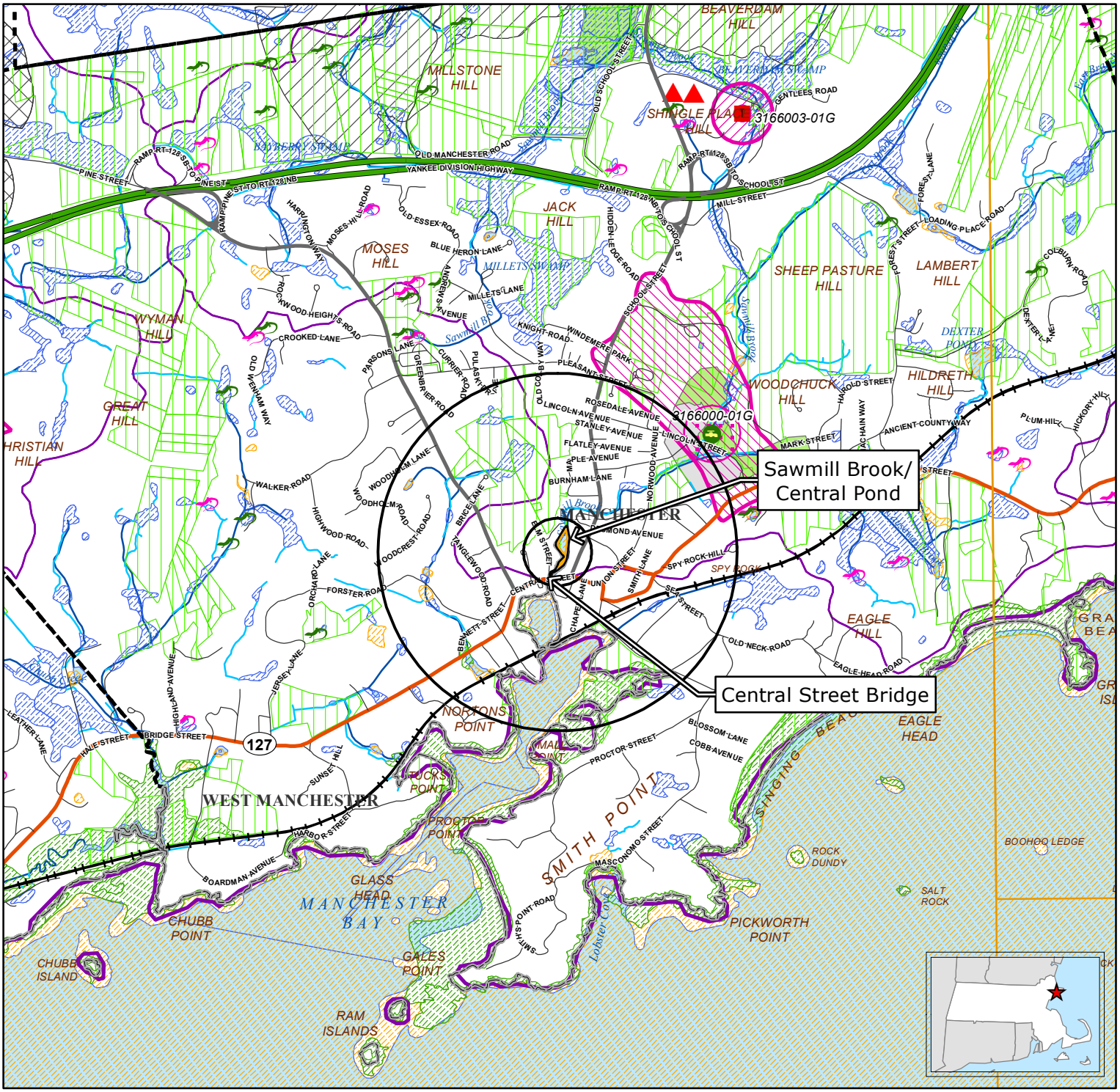

Legend

- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- Non-Landfill Solid Waste Sites
- Proposed Well
- Emergency Surface Water
- Community Public Water Supply - Surface Water
- Community Public Water Supply - Groundwater
- Non-Community Non-Transient Public Water Supply
- Non-Community Transient Public Water Supply
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Aquaducts
- Hydrologic Connections
- Stream/Intermittent Stream
- Powerline
- Pipeline
- Track or Trail
- Trains
- Public Surface Water Supply Protection Area (Zone A)
- DEP Approved Wellhead Protection Area (Zone I)
- DEP Approved Wellhead Protection Area (Zone II)
- DEP Interim Wellhead Protection Area (IWPA)
- Protected and Recreational Open Space
- Solid Waste Landfill
- Area of Critical Environmental Concern (ACEC)
- NHESP Priority Habitats for Rare Species
- NHESP Estimated Habitats for Rare Wildlife
- EPA Designated Sole Source Aquifer
- Major Drainage Basin
- Sub Drainage Basin
- MassDEP Open Water
- MassDEP Inland Wetlands
- MassDEP Coastal Wetlands
- MassDEP Not Interpreted Wetlands
- Public Surface Water Supply (PSWS)
- Water Bodies
- Non-Potential Drinking Water Source Area - High Yield
- Non-Potential Drinking Water Source Area - Medium Yield
- Potentially Productive Medium Yield Aquifer
- Potentially Productive High Yield Aquifer
- County Boundary
- Town Boundary
- USGS Quadrangle Sheet Boundary
- Limit of Work

1:24,000

0 1,000 2,000

Feet

N

FIGURE 2
PRIORITY RESOURCES

Central Street Bridge Replacement/
Sawmill Brook Restoration Project
Manchester-by-the-Sea, Massachusetts

Data source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology
Circles indicate 500-foot and half-mile radii.
Data valid as of September 2019.

September 2019

Tighe&Bond
Engineers | Environmental Specialists

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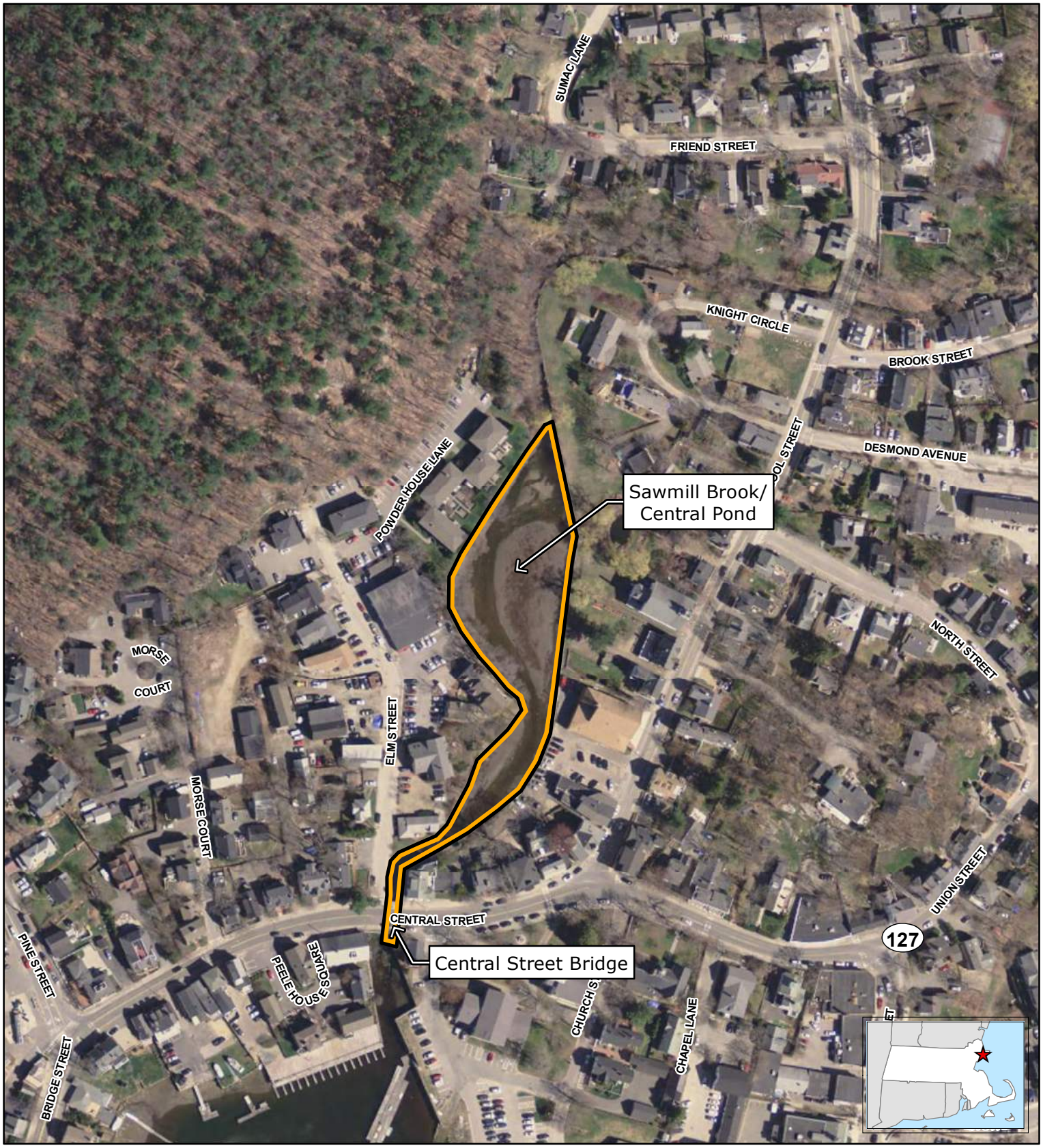

Legend

Limit of Work

Tighe&Bond
Engineers | Environmental Specialists

Based on MassGIS Color Orthophotography (2013)

1:2,400
0 100 200
Feet

N

FIGURE 3
ORTHOPHOTOGRAPH

Central Street Bridge Replacement/
Sawmill Brook Restoration Project
Manchester-by-the-Sea, Massachusetts

September 2019

V:\Projects\M\m1476\CentralSt_Bridge_MA\Maps\CentralSt_Bridge_MA_Aerial.mxd [Exported By: kjw, 9/19/2019, 1:15:21 PM]

M-1476

Tighe&Bond

APPENDIX B

Photo 1: View of Central Street Bridge and tide gate from the north / downstream.

Photo 2: Seepage at the seawall from downstream.

Photo 3: Central Street Bridge and tide gate from downstream.

Photo 4: View of the existing tide gate from southwest.

Photo 5: View of tide gate outlet from interior of tide gate chamber.

Photo 6: View of Central Street Bridge and approach channel walls from the south / upstream.

Photo 7: Sawmill Brook approaching Central Street looking upstream.

Photo 8: Segment of precast wall along Sawmill Brook between Central Street Bridge and Central Pond.

Photo 9: Transition from wall to riprap slope along Central Pond. Note collapsed wall on opposite bank.

Photo 10: West slope of Central Pond, looking toward Powder House Lane apartments.

Photo 11: Deteriorated section of wall on the eastern side of Sawmill Brook / Central Pond, looking toward the Manchester Fire Department building.

Photo 12: View of Central Street bridge, looking east (upstream is on the left side of the photo).

Photo 13: View of Central Street bridge, looking north / upstream toward Elm Street.

Photo 14: View looking upstream from the downstream side of the culvert toward the tide gate structure.

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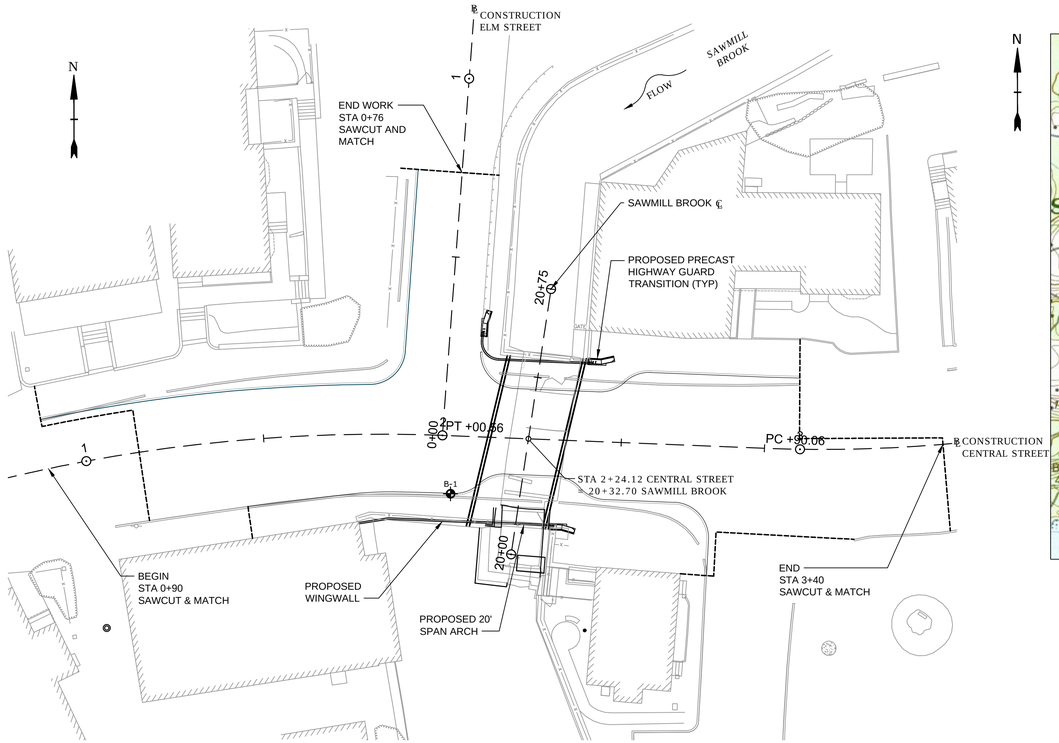
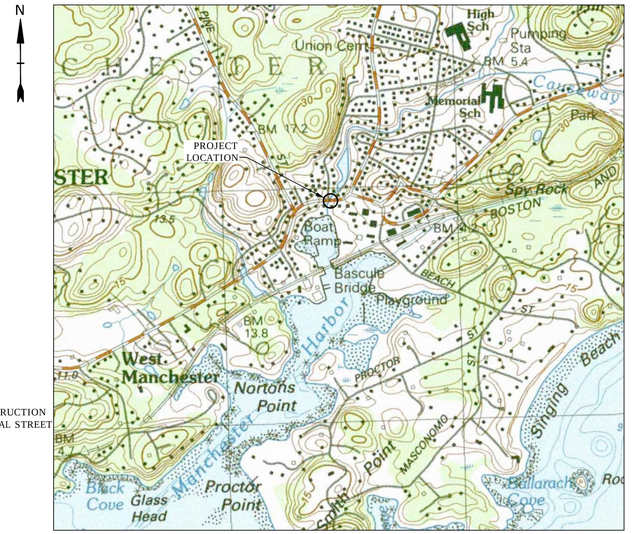
APPENDIX C



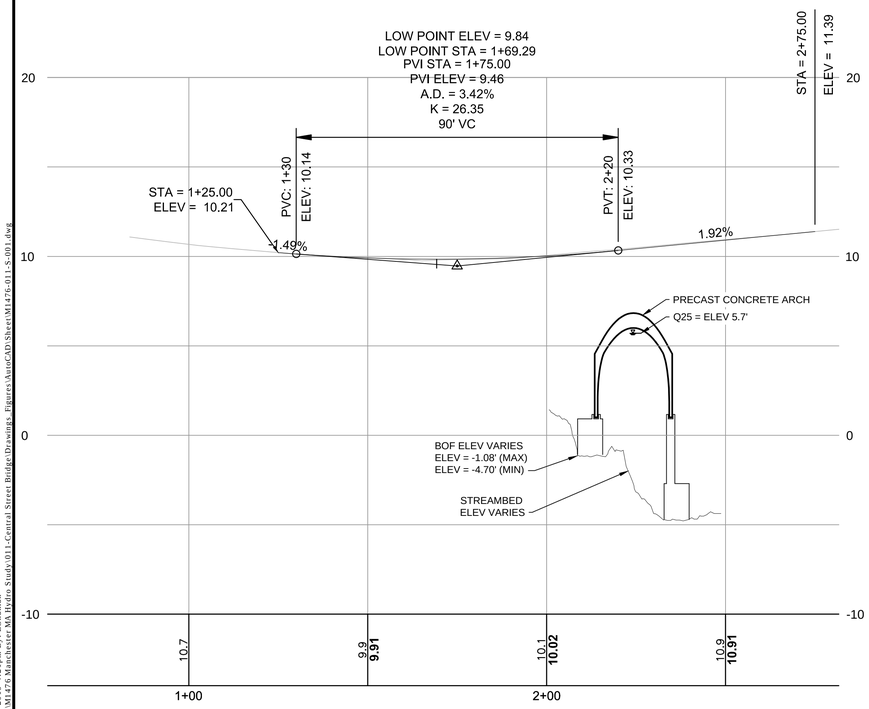
KEY PLAN
1" = 20'



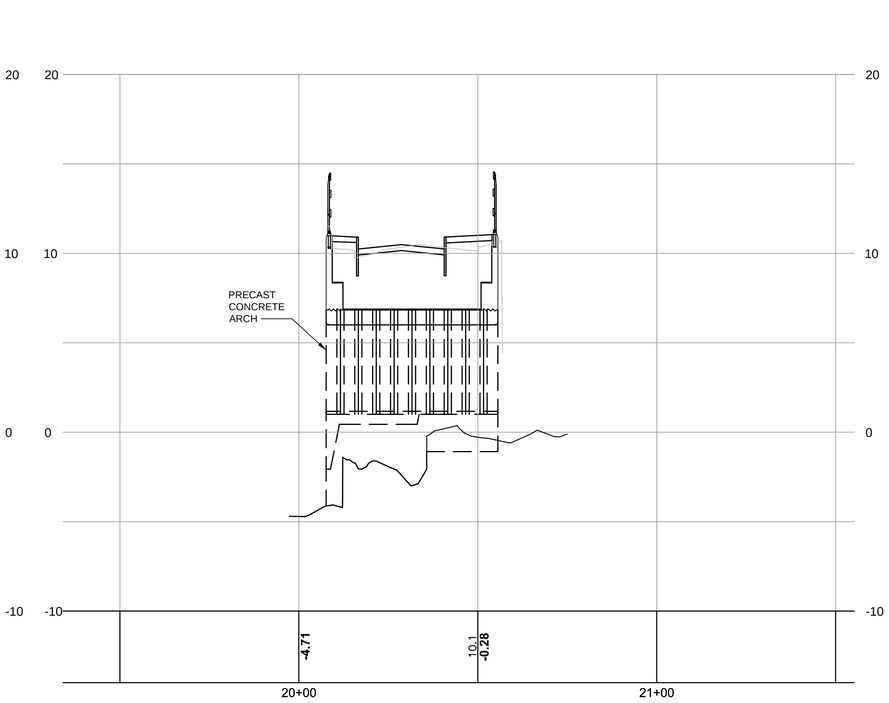
LOCUS PLAN
SCALE: 1"=1000'

BRIDGE DRAWING INDEX

HYDRAULIC DATA	
DRAINAGE AREA	5.0 SQ. MILES
WATER CONTROL FLOOD DISCHARGE (2 YR)	254 CFS
DESIGN FLOOD DISCHARGE (25 YR)	1,363 CFS
DESIGN FLOOD ANNUAL CHANCE (RETURN FREQUENCY)	4% (25-YEARS)
DESIGN FLOOD VELOCITY (25 YR)	7.5 FPS
DESIGN FLOOD ELEVATION (25 YR)	5.7 FEET
BASE (100-YR) FLOOD DATA	
BASE FLOOD DISCHARGE (100 YR)	2,267 CFS
BASE FLOOD ELEVATION (100 YR)	7.7 FEET
DESIGN AND CHECK SCOUR DATA	
SCOUR DESIGN FLOOD ANNUAL CHANCE (RETURN FREQUENCY)	2% (50-YEARS)
DESIGN FLOOD ABUTMENT SCOUR DEPTH	LEFT: 2 FT RIGHT: 2 FT
SCOUR CHECK FLOOD ANNUAL CHANCE (RETURN FREQUENCY)	1% (100-YEARS)
CHECK FLOOD ABUTMENT SCOUR DEPTH	LEFT: 2 FT RIGHT: 2 FT
FLOOD OF RECORD	
DISCHARGE	UNKNOWN
FREQUENCY (IF KNOWN)	N/A
MAXIMUM ELEVATION	N/A
DATE	N/A
HISTORY OF ICE FLOES	UNKNOWN
EVIDENCE OF SCOUR AND EROSION	UNKNOWN



PROFILE - CENTRAL STREET
SCALE: 1" = 20'H, 1"=4'V



PROFILE - SAWMILL BROOK
SCALE: 1" = 20'H, 1"=4'V

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25%
Plans
Not For
Construction

Central Street
Bridge
Replacement

Department of
Public Works

MassDOT Bridge No.
M-02-001, BIN 8AM

Town of
Manchester-By-
The-Sea,
Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-001.dwg
DRAWN BY:	D.BISHOP
CHECKED:	X
APPROVED:	X

BRIDGE KEY PLAN, PROFILES, LOCUS AND INDEX

SCALE: AS NOTED

S-001
SHEET 1 OF 6

Last Saved: 9/23/2019
Plotted On: Aug 22, 2019-4:21pm By: EOhanian
Tighe & Bond: J:\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-001.dwg

DESIGN LOADS AND SPECIFICATIONS:

1. DESIGN LOADING: HL-93
2. DESIGN: LOAD AND RESISTANCE FACTOR DESIGN (LRFD) IN ACCORDANCE WITH:
   AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH ED., 2017 AS AMENDED
   MASSDOT 2013 LRFD BRIDGE DESIGN MANUAL, AS AMENDED
3. SPECIFICATIONS: MASSDOT 1988 STANDARD SPECIFICATIONS AS AMENDED
4. FOUNDATION DATA: ABUTMENTS AND U-WINGWALL:
   SPREAD FOOTINGS SUPPORTED ON SOUND BEDROCK WITH A NOMINAL BEARING CAPACITY OF 100.0 TSF IN COMBINATION WITH A RESISTANCE FACTOR OF 0.45.
   PRECAST GUARD TRANSITION:
   TRANSITION BASE ON CONTROLLED DENSITY FILL (NON EXCAVATABLE) ON COMPACTED GRAVEL BORROW OR UNDISTURBED SOIL.
5. REINFORCING STEEL: AASHTO M31 (ASTM A 615) GRADE 60
   ALL BARS SHALL BE HOT-DIPPED GALVANIZED (ASTM A767 & ASTM A1094)
6. CONCRETE: PRECAST ACRH, PEDESTAL FOOTINGS, CURBS/HEADWALLS, GUARD TRANSITIONS, U-WINGWALL, AND U-WINGWALL FOOTINGS:
   5000 PSI, ¾", 685 HP CEMENT CONCRETE
7. SEISMIC: PEAK GROUND ACCELERATION (PGA) = 0.125g
   SITE CLASS = C
   SEISMIC DESIGN CATEGORY = A

GENERAL NOTES:

1. PLANS OF THE EXISTING BRIDGE ARE NOT AVAILABLE.
2. BORINGS WERE MADE BY NEW ENGLAND BORING CONTRACTORS ON 9/8/2018.
3. ALL EXISTING BRONZE DISCS REPRESENTING STATE BENCHMARKS OR SURVEY TRIANGULATION POINTS MUST NOT BE DISTURBED. WHEN THE WORK CALLED FOR INVOLVES DISTURBING A BRONZE DISC THE CONTRACTOR SHALL NOTIFY THE ENGINEER SUFFICIENTLY IN ADVANCE OF THE WORK TO PERMIT THE STATE TO TEMPORARILY RELOCATE THE AFFECTED MARKER.
4. ALL WORK SHALL COMPLY WITH OSHA'S LATEST STANDARDS. ALL REQUIREMENTS OF OSHA'S EXCAVATION STANDARDS SHALL BE PROVIDED BY THE CONTRACTOR INCLUDING, BUT NOT LIMITED TO, THE PROVISION FOR A COMPETENT PERSON ON SITE AND ANY REQUIRED DOCUMENTATION THAT MAY REQUIRE CERTIFICATION BY A PROFESSIONAL ENGINEER.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ALL UTILITIES FUNCTIONING PROPERLY IN THE AREAS UNDER CONSTRUCTION PRIOR TO COMPLETION OF THE PROJECT. ALL PIPES AND STRUCTURES WITHIN THE LIMITS OF THIS CONTRACT SHALL BE LEFT IN A CLEAN AND OPERABLE CONDITION AT THE COMPLETION OF THE WORK. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT SAND AND SILT FROM DISTURBED AREAS FROM ENTERING THE SYSTEM. CONTRACTOR IS RESPONSIBLE FOR DAMAGE SUSTAINED TO ANY EXISTING UTILITIES AND IT IS HIS RESPONSIBILITY TO MAKE REPAIRS TO THE REQUIREMENTS OF THE TOWN OR RESPECTIVE UTILITY COMPANY.
6. ANY AND ALL DEMOLISHED BUILDING MATERIALS, STRUCTURES, PIPES, PAVEMENT, CURBING, SURPLUS MATERIAL, AND SITE RUBBLE SHALL BE DISPOSED OF BY THE CONTRACTOR OFF-SITE AT HIS EXPENSE AND IN ACCORDANCE WITH ALL APPLICABLE STATE AND FEDERAL ENVIRONMENTAL REGULATIONS.
7. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES TO ENSURE THAT DEBRIS DOES NOT FALL ON ANY ROADWAY, RAILROAD, OR WATERWAY BELOW THE EXISTING STRUCTURE. ALL COSTS INCLUDING ERECTION, MAINTENANCE AND REMOVAL OF TEMPORARY STRUCTURES OR OTHER SUCH APPROVED METHODS, SHALL BE SUBSIDIARY TO THE APPROPRIATE ITEMS OF WORK BEING PERFORMED.
8. ALL MATERIALS AND METHODS ARE TO COMPLY WITH THE MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, DATED 1988, AND ITS LATEST REVISIONS.
9. ALL DISTURBED AREAS SHALL BE LOAMED & SEEDED UNLESS OTHERWISE SPECIFIED. OVER EXCAVATE LOAM & SEED AREAS AS REQUIRED TO MEET GRADE.
10. IF THERE ARE REVISIONS TO APPROVED PLANS, THE CONTRACTOR SHALL SUBMIT THESE CHANGES TO THE DESIGNER OF RECORD FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION. ONCE THESE REVISIONS ARE APPROVED BY THE MUNICIPALITY'S DESIGNER OF RECORD, THEY SHALL THEN BE SUBMITTED TO MASSDOT FOR FILING.
11. ALL DIMENSIONS ARE HORIZONTAL AND VERTICAL, AND ARE GIVEN AT 68 DEGREES FAHRENHEIT.
12. ALL WORK PERFORMED BY THE CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS AND REQUIREMENTS.
13. THE CONTRACTOR SHALL REVIEW AND UNDERSTAND ALL APPLICABLE ENVIRONMENTAL PERMITS AND ENSURE THAT ALL CONSTRUCTION CONDITIONS ARE MET.
14. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION SAFETY, AND MEANS AND METHODS TO PERFORM AND COMPLETE THE WORK.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO PRIVATE OR PUBLIC PROPERTY OUTSIDE THE LIMITS OF CONSTRUCTION SHOWN ON THE PLANS CAUSED BY THE CONTRACTOR, AT THE SOLE COST TO THE CONTRACTOR.
16. THE CONTRACTOR MUST COORDINATE ALL WORK WITH THE TOWN OF MANCHESTER-BY-THE-SEA, ALL UTILITY COMPANIES, THE ENGINEER, AND ANY AFFECTED ABUTTERS. WORK SHALL NOT PROCEED WITHOUT WRITTEN APPROVAL FROM THE TOWN OF MANCHESTER-BY-THE-SEA.
17. THE CONTRACTOR SHALL SUBMIT LITERATURE (MANUFACTURER'S LITERATURE, CUT SHEETS, APPLICATION PROCEDURES, ETC.) FOR ALL PRODUCTS PROPOSED FOR USE ON THE PROJECT, FOR APPROVAL BY THE ENGINEER. APPROVAL OF MATERIALS SHALL BE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, LATEST EDITION AS AMENDED, SUBSECTION 5.03 AND SECTION 6.00, CONTROL OF MATERIALS.
18. DETAIL OR SHOP DRAWINGS SHALL BE SUBMITTED AND APPROVED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, LATEST EDITION AS AMENDED, SUBSECTION 5.02, PLANS AND DETAIL DRAWINGS.
19. TAKE ALL NECESSARY MEASURES AND PROVIDE ALL NECESSARY CONTINUOUS BARRIERS OF SUFFICIENT TYPE, SIZE AND STRENGTH TO PREVENT ACCESS TO ALL OPEN EXCAVATIONS AT THE COMPLETION OF EACH DAY'S WORK.
20. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS OTHERWISE NOTED.
21. SHEAR KEYS SHALL BE 3" HIGH BY ONE-THIRD THE WIDTH OF THE CONCRETE ELEMENT, CENTERED, WITH 3" MIN. CLEAR EACH SIDE.
22. PEEL AND STICK BARRIER MEMBRANE SHALL BE 2' WIDE WITH PROTECTION BOARD (SUBSIDIARY) AND PLACED CENTERED OVER ALL HORIZONTAL AND VERTICAL EXPANSION AND CONSTRUCTION JOINTS.
23. APPLY PAVEMENT JOINT ADHESIVE ALONG ALL LONGITUDINAL JOINTS BETWEEN PAVEMENT PASSES AND ALONG BRIDGE CURB LINES AND EXPANSION JOINT ARMORING PRIOR TO PLACING ALL PAVEMENT COURSES.
24. FOR SURVEY CONTROLS SEE SHEETS C-001 TO C-004 (CIVIL SHEETS).
25. FOR BORING NOTES SEE SHEET S-003.
26. FOR HYDRAULIC DATA SEE SHEET S-001.
27. FOR ROAD CLOSURE TRAFFIC MANAGEMENT PLAN SEE SHEET C-702 (CIVIL SHEETS).

BRIDGE REMOVAL NOTES:

1. THE CONTRACTOR'S METHOD FOR REMOVAL OF THE EXISTING BRIDGE SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND ACCEPTANCE PRIOR TO THE COMMENCEMENT OF ANY REMOVAL OPERATIONS.
2. REMOVAL OF EXISTING BRIDGE STRUCTURE SHALL INCLUDE THE COMPLETE REMOVAL OF THE ARCH, FOOTINGS, HEADWALLS, AND WINGWALL. REFER TO SHEET C-005 (CIVIL SHEETS) FOR DEMOLITION PLAN.
3. REFER TO SHEET [FILL-IN FOR FINAL DESIGN] (CIVIL SHEETS) FOR WATER CONTROL SEQUENCING.

FOUNDATION NOTES:

1. FOUNDATION MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.
2. CONCRETE SHALL NOT BE PLACED IN WATER OR ON FROZEN GROUND.
3. BOTTOM OF FOUNDATION ELEVATIONS PROVIDED ON DRAWINGS SHALL BE CONSIDERED MINIMUM DEPTHS. CONTRACTOR SHALL REMOVE UNSUITABLE MATERIAL AS REQUIRED.
4. ALL FINISHED EXCAVATIONS SHALL BE VERIFIED AND APPROVED BY THE ENGINEER PRIOR TO PLACEMENT OF FORMWORK FOR CONCRETE FOUNDATION.
5. ALL EXCAVATIONS FOR FOOTINGS SHALL BE FINISHED BY HAND FOR THE LAST 6". ALL FINISHED EXCAVATIONS SHALL BE INSPECTED BY THE ENGINEER PRIOR TO ANY CONCRETE PLACEMENT.
6. ALL BACKFILL UNDER OR ADJACENT TO ANY PORTION OF THE STRUCTURE SHALL BE PLACED IN ACCORDANCE WITH MASSDOT STANDARD SPECIFICATIONS.
7. PRIOR TO PLACEMENT OF FOOTINGS, REVIEW IN-SITU CONDITIONS WITH THE OWNER'S DESIGNATED ENGINEER.

GEOTECHNICAL DESIGN PARAMETERS

1. MINIMUM EMBEDMENT FOR FROST PROTECTION = 4 FEET BELOW ADJACENT GROUND SURFACE.
2. FACTORED STRENGTH LIMIT STATE BEARING RESISTANCE = 45.0 TONS PER SQUARE FOOT
   a. THE BRIDGE DESIGNER SHALL VERIFY THE BEARING RESISTANCE BASED ON THE FINAL BRIDGE AND WINGWALL FOUNDATION DIMENSIONS AND EMBEDMENT
3. MAXIMUM ALLOWABLE SETTLEMENT = 1 INCH TOTAL, ½ INCH DIFFERENTIAL
4. MINIMUM LATERAL EARTH PRESSURES FOR RESTRAINED ARCH WALLS:
   a. STATIC = 61 POUNDS PER SQUARE FOOT PER FOOT (PSF/FT) AS AN EQUIVALENT FLUID PRESSURE, 200 PSF/FT MINIMUM
   b. SURCHARGE = 0.5 TIMES THE VERTICAL SURCHARGE LOAD UNIFORMLY DISTRIBUTED OVER THE HEIGHT OF THE WALL. THE MINIMUM VERTICAL SURCHARGE SHALL BE AN AASHTO HL-93 VEHICULAR LOAD.
   c. SEISMIC = $3.9H^2$ DISTRIBUTED AS AN INVERSE TRIANGLE OVER THE HEIGHT OF THE WALL
5. MINIMUM LATERAL EARTH PRESSURES FOR UNRESTRAINED WING WALLS:
   a. STATIC = 35 PSF/FT AS AN EQUIVALENT FLUID PRESSURE, 200 PSF/FT MINIMUM
   b. SURCHARGE = 0.28 TIMES THE VERTICAL SURCHARGE LOAD UNIFORMLY DISTRIBUTED OVER THE HEIGHT OF THE WALL. THE MINIMUM VERTICAL SURCHARGE SHALL BE AN AASHTO HL-93 VEHICULAR LOAD. THE DESIGN SHALL ACCOUNT FOR SLOPING GROUND SURFACE ABOVE THE WALLS.
   c. SEISMIC = $3.9H^2$ DISTRIBUTED AS AN INVERSE TRIANGLE OVER THE HEIGHT OF THE WALL
6. MINIMUM BACKFILL UNIT WEIGHT = 130 POUNDS PER CUBIC FOOT (PCF)
7. MAXIMUM BACKFILL ANGLE OF INTERNAL FRICTION = 32 DEGREES
8. MAXIMUM COEFFICIENT OF FRICTION FOR CONCRETE ON CLEAN, SOUND BEDROCK = 0.70 (DELTA= 35 DEGREES)
9. SITE CLASS = C
10. DESIGN PEAK SEISMIC GROUND ACCELERATION MODIFIED BY THE SHORT-PERIOD SITE FACTOR (A_S) = 0.103
11. DESIGN SPECTRAL RESPONSE ACCELERATION AT 0.2-SECOND PERIODS (S_{DS}) = 0.202
12. DESIGN SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIODS (S_{D1}) = 0.068

PRECAST CONCRETE BRIDGE STRUCTURE NOTES:

1. ITEM 995.01, BRIDGE STRUCTURE - STRUCTURE NO. 1, SHALL INCLUDE THE PRECAST CONCRETE ARCH, CURBS/HEADWALLS, PEDESTAL FOOTINGS USED TO SUPPORT THE RIGID FRAME, U-WINGWALL, AND WINGWALL FOOTING. JOINT MATERIALS, MEMBRANE, AND ANY OTHER MATERIALS REQUIRED FOR INSTALLATION OF THE PRECAST CONCRETE BRIDGE OR WINGWALL STRUCTURE SHALL BE SUBSIDIARY.
2. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS, SEALED AND SIGNED BY A CURRENTLY REGISTERED MASSACHUSETTS PROFESSIONAL ENGINEER TO THE MUNICIPALITY'S DESIGNER OF RECORD FOR REVIEW AND ACCEPTANCE FOR REVIEW TO ENSURE CONFORMANCE WITH THE CONTRACT DOCUMENTS. SHOP DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED PRIOR TO FABRICATION FOR ALL PRECAST CONCRETE ELEMENTS. SHOP DRAWINGS SHALL SHOW JOINT DETAILS AND REINFORCEMENT SIZE AND LOCATION.
3. CHANGES OR MODIFICATIONS DURING THE FABRICATION PROCESS MUST BE SUBMITTED TO THE MUNICIPALITY'S DESIGNER OF RECORD FOR ACCEPTANCE AND INCORPORATED INTO THE FINAL AS-BUILT DRAWINGS.
4. DIMENSIONS SHOWN FOR THE PRECAST CONCRETE ELEMENTS ARE ASSUMED AND ARE BELIEVED TO BE PRACTICABLE. NO ADJUSTMENTS TO QUANTITIES OR PAYMENTS WILL BE MADE AS A RESULT OF PROVIDING PRECAST UNITS SIZED DIFFERENTLY THAN SHOWN ON THE PLANS.
5. THE QUALITY OF MATERIALS, THE PROCESS OF MANUFACTURE, AND THE FINISHED PRECAST UNITS SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY THE ENGINEER.
6. JOINTS BETWEEN ABUTTING PRECAST UNITS SHALL BE MECHANICALLY CONNECTED, WATERTIGHT, GROUTED, AND MEMBRANED.
7. JOINTS BETWEEN ABUTTING PRECAST ARCH, WINGWALL, AND CURB/HEADWALL ELEMENTS SHALL BE MECHANICALLY CONNECTED, WATER TIGHT, AND MEMBRANED.
8. WATERPROOF MEMBRANE SHALL BE PROVIDED OVER THE STRUCTURE ACROSS THE ENTIRE ROADWAY WIDTH.
9. MEMBRANED SURFACES TO BE BACKFILLED AGAINST SHALL BE PROTECTED BY A PROTECTION BOARD.
10. EXPOSED CONCRETE SURFACES SHALL BE TREATED WITH WATER REPELLENT (SILANE/SILOXANE).
11. PRECAST CONCRETE CURB/HEADWALL ANCHORAGES, CURB, U-WINGWALL, AND ARCH SECTIONS SHALL BE DESIGNED TO ACCOUNT FOR ALL EARTH PRESSURE, LIVE LOAD SURCHARGES, AND BRIDGE RAILING LIVE LOAD AS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR NCHRP 350 TL-2 TEST LEVEL.
12. WEEP HOLES SHALL BE PLACED 1'-0" (TYP.) ABOVE THE TOP OF THE PEDESTAL FOOTING AND ONE (1) WEEP PROVIDED ON BOTH SIDES OF EACH ARCH OR WINGWALL UNIT OR 10'-0" (MAX.) SPACING ALONG FOOTING.
13. FOOTINGS SHALL HAVE A KEYWAY WITH THE SPECIFIED DIMENSIONS. GROUT SHALL BE PLACED AROUND THE BOTTOM OF THE ARCH OR WINGWALL AND TO THE TOP OF THE KEYWAY.
14. TOP SURFACES OF FOOTING UNITS SHALL BE SET UNIFORMLY TRUE & LEVEL TO A TOLERANCE OF +/- 1/8". PRECAST UNITS SHALL UNIFORMLY BEAR ON SUPPORTING MATERIAL.
15. ANY UNSUITABLE MATERIALS SUCH AS BOULDERS, ROOTS, ORGANIC SOILS, SILT/CLAY, OR FRACTURED BEDROCK ENCOUNTERED AT THE PROPOSED BOTTOM OF EXCAVATION ELEVATION SHALL BE REMOVED AND REPLACED WITH CONCRETE, AS DIRECTED BY THE ENGINEER.
16. DEWATERING SHALL BE REQUIRED AT EACH FOUNDATION LOCATION TO CONTROL THE WATER INFLOW AND ADEQUATELY DEWATER THE FOOTING EXCAVATION. SUMP PUMPING AREAS AROUND THE ENTIRE PERIMETER SHALL BE REQUIRED TO ADEQUATELY CONTROL THE GROUNDWATER WITHIN THE EXCAVATION AREAS. DEWATERING SHALL BE CONTINUOUS UNTIL THE PRECAST CONCRETE ARCH AND WINGWALLS ARE BACKFILLED EVENLY ON BOTH SIDES TO THE ELEVATIONS OF THE SURROUNDING WATER TABLE, UNLESS OTHERWISE DIRECTED.
17. ANY PROPOSED DEWATERING AND SHORING PROCEDURES SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW AND ACCEPTANCE.
18. WATER PUMPED FROM DEWATERING LOCATIONS SHALL BE FILTERED ADEQUATELY TO REMOVE FINE MATERIALS PRIOR TO RETURNING THE WATER TO THE RIVER/BROOK. ACTUAL LOCATION OF SEDIMENTATION BASIN TO BE DETERMINED BY CONTRACTOR AND APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
19. ANY FOUNDATION MATERIALS WEAKENED AS A RESULT OF INSUFFICIENT CARE WHILE MAINTAINING A DEWATERED CONDITION SHALL BE REMOVED AND REPLACED WITH CONCRETE AT NO EXPENSE TO THE OWNER.
20. REINFORCEMENT SHALL HAVE A 2" MINIMUM CLEAR COVER.
21. A CORROSION INHIBITOR CONCRETE ADDITIVE SHALL BE USED FOR ALL CONCRETE.
22. DATE TO BE PLACED ON THE INSIDE NORTHEAST FACE AND INSIDE SOUTHWEST FACE HIGHWAY GUARDRAIL TRANSITIONS. A SHEET SHOWING SIZE AND CHARACTER OF NUMERALS WILL BE FURNISHED. THE DATE USED SHALL BE THE LATEST YEAR OF CONTRACT COMPLETION AS OF THE DATE THE FIRST HIGHWAY GUARDRAIL TRANSITION IS CONSTRUCTED. ALL HIGHWAY GUARDRAIL TRANSITIONS SHALL FEATURE THE SAME DATE.

CHAPTER 85 SECTION 35 REVIEW AND APPROVAL NOTES:

1. IN ACCORDANCE AND COMPLIANCE WITH THE REQUIREMENTS OF CHAPTER 85 SECTION 35 OF THE MASSACHUSETTS GENERAL LAWS, THE CONTRACTOR SHALL SUBMIT TO THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION ALL CONSTRUCTION DRAWINGS AND DESIGN CALCULATIONS THAT SHALL BE USED TO FABRICATE AND CONSTRUCT THE STRUCTURE DENOTED ON THESE PLANS FOR REVIEW AND APPROVAL. THIS APPROVAL SHALL CONSTITUTE THE FINAL APPROVAL AS STIPULATED BY CHAPTER 85 SECTION 35 OF THE MASSACHUSETTS GENERAL LAWS.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25%
Plans
Not For
Construction

Central Street
Bridge
Replacement

Department of
Public Works

MassDOT Bridge No.
M-02-001, BIN 8AM

Town of
Manchester-By-
The-Sea,
Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-002.dwg
DRAWN BY:	D.BISHOP
CHECKED:	EAO
APPROVED:	DLL

BRIDGE NOTES

SCALE: AS NOTED

S-002
SHEET 2 OF 6

Last Saved: 6/22/2019
Plotted On: Aug 22, 2019-3:57pm By: EOhanian
Tighe & Bond: J:\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-002.dwg

Tighe&Bond
Engineers | Environmental Specialists

Project: Central Street Bridge
Location: Central Street, Manchester-by-the-Sea, MA
Client: Town of Manchester-by-the-Sea

Boring No. **B-1**
Page 1 of 1
File No. M-1476011
Checked by: C. Haker

Drilling Co.: New England Boring Contractors
Foreman: Mike Porter
T&B Rep.: M. Trovato
Date Start: 08/09/18 End: 08/09/18
Location See Exploration Location Plan
GS. Elev. 9.45' Datum: NAVD88

	Casing	Sampler
Type	HW	Split Spoon
I.D./O.D.	4"/4.5"	1-3/8"/2"
Hammer Wt.		140#
Hammer Fall		30"
Other		Auto hammer

Groundwater Readings				
Date	Time	Depth	Casing	Sta. Time
8/9/2018	13:45	6.3'		End of Boring

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/-	0-2	---	14-inches of Asphalt, over brown, fine to coarse SAND, some Gravel, trace Silt	ASPHALT 1.2'	1	No Well Installed
				---				
		S-2/-	2-4	---	Brown, fine to coarse SAND and GRAVEL, little Silt			

5								
		S-3/8	5-7	9 - 12	Medium dense, brown, GRAVEL, some fine to coarse Sand, trace Silt	FILL		
				2 - 13			2	
		S-4/4	8-10	50/6"	Very dense, brown, GRAVEL, little fine to coarse Sand, little Silt	9.9'	3	
10				---				
		C-1/58	10.5-15.5	2:04	Very hard to hard, moderate to slightly weathered, slightly fractured to sound, very coarse to coarse-grained GRANITE, with close to moderately close, horizontal to moderately dipping fractures; RQD = 95%			
				1:37				
				1:53				
				2:09				
				2:12				
15						BEDROCK		
		C-2/60	15.5-20.5	2:17	Very hard to hard, slight to very slightly weathered, slightly fractured to sound, very coarse to coarse-grained GRANITE, with close to moderately close, horizontal to shallow fractures; RQD = 98%			
				2:09				
				1:44				
				2:12				
				3:09				
20								
					Bottom of exploration at 20.5'			
25								
30								

Notes:
1) Vacuum excavated to approximately 5 feet below grade. Samples S-1 and S-2 were collected by hand.
2) Boulder encountered from approximately 7 to 8 feet below grade.
2) Refusal encountered at approximately 9.9 feet below grade, telescoped 3-inch casing in an attempt to advance the boring.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

BORING LOG B-1

BORING LOCATIONS		
BORING	STATION	OFFSET
B-1	0+52.3	RT. 16.2'

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON SHEET S-001 THUS: B-1
2. BORINGS WERE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1⅜" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT TIGHE & BOND'S OFFICE, 53 SOUTHAMPTON ROAD, WESTFIELD, MA 01085. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE DESIGN ENGINEER.
6. ALL BORINGS WERE MADE IN SEPTEMBER 2018.
7. BORINGS WERE MADE BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.
9. THE SURFACE ELEVATION ON EACH BORING LOG IS THE ELEVATION OF THE EXISTING GROUND AT THE TIME THE BORING WAS TAKEN.
10. SEE SHEET S-002 FOR GEOTECHNICAL DESIGN PARAMETERS.
11. ENGINEERING JUDGEMENT WAS EXERCISED IN PREPARING THE SUBSURFACE INFORMATION PRESENTED HEREIN. ANALYSIS AND INTERPRETATION OF SUBSURFACE DATA WAS PERFORMED FOR DESIGN AND ESTIMATING PURPOSES. PRESENTATION OF THE INFORMATION IN THE CONTRACT IS INTENDED TO PROVIDE THE CONTRACTOR ACCESS TO THE SAME DATA AVAILABLE TO THE OWNER. THE SUBSURFACE INFORMATION IS PRESENTED IN GOOD FAITH AND IS NOT INTENDED AS A SUBSTITUTE FOR PERSONAL INVESTIGATION, INDEPENDENT INTERPRETATION, INDEPENDENT ANALYSIS OR JUDGEMENT BY THE CONTRACTOR.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25% Plans Not For Construction

Central Street Bridge Replacement

Department of Public Works

MassDOT Bridge No. M-02-001, BIN 8AM

Town of Manchester-By-The-Sea, Massachusetts

MARK	DATE	DESCRIPTION

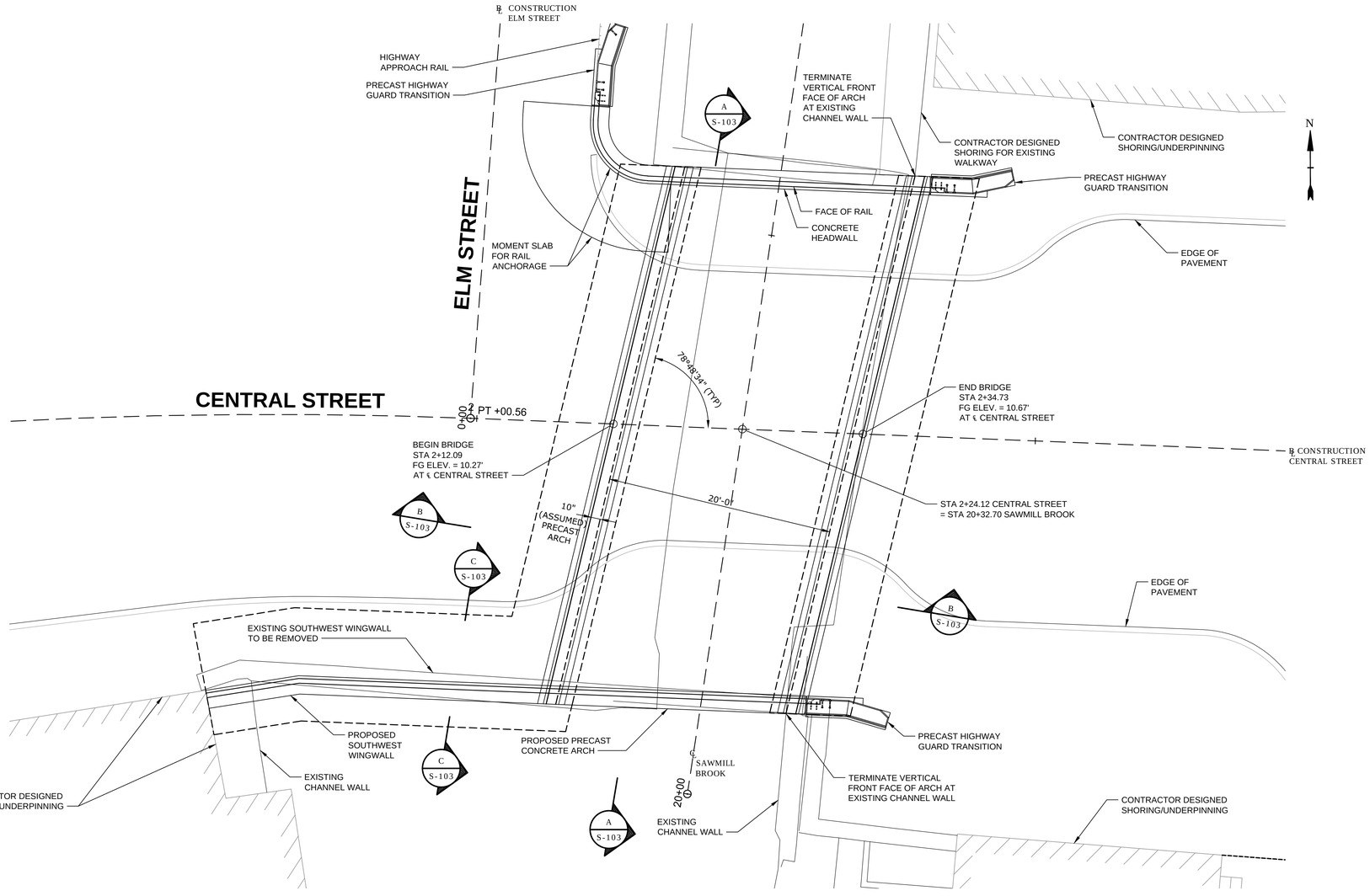
PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-003.dwg
DRAWN BY:	D.BISHOP
CHECKED:	EAO
APPROVED:	DLL

BORING LOGS AND BORING NOTES

SCALE: AS NOTED

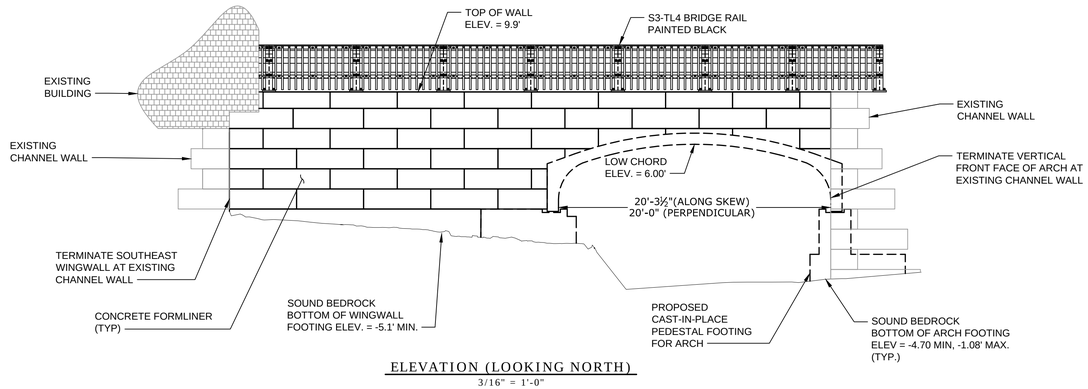
S-003
SHEET 3 OF 6

Last Saved: 8/22/2019
Plotted On: Aug 22, 2019 - 2:05pm By: EOhanian
Tighe & Bond - J:\M\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-003.dwg



GENERAL BRIDGE PLAN

3/16" = 1'-0"



ELEVATION (LOOKING NORTH)

3/16" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25%
Plans
Not For
Construction

Central Street Bridge Replacement

Department of Public Works

MassDOT Bridge No. M-02-001, BIN 8AM

Town of Manchester-By-The-Sea, Massachusetts

MARK	DATE	DESCRIPTION

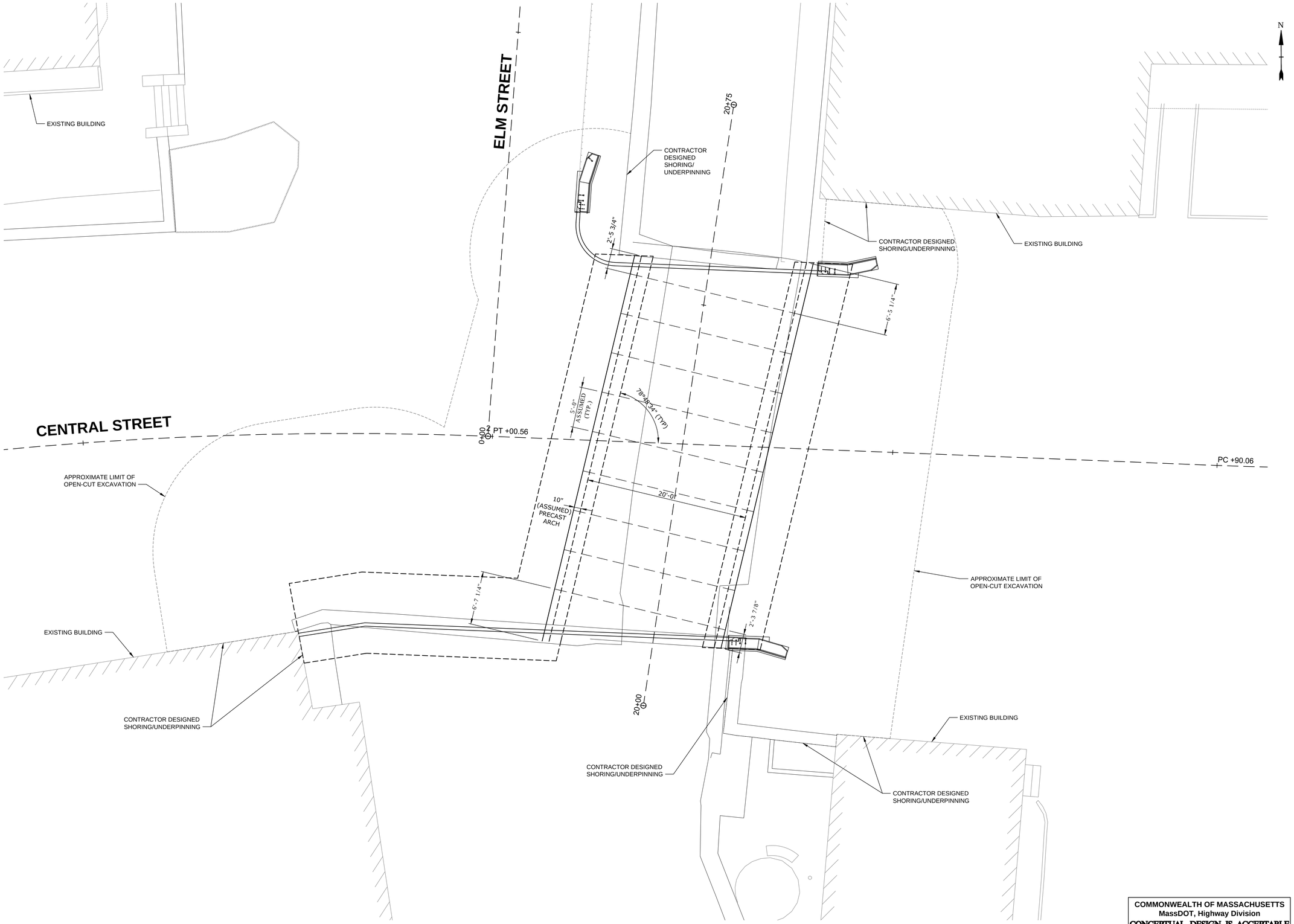
PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-101_102.dwg
DRAWN BY:	D.BISHOP
CHECKED:	EAO
APPROVED:	DLL

GENERAL BRIDGE PLAN AND ELEVATION

SCALE: AS NOTED

S-101
SHEET 4 OF 6

Last Saved: 8/23/2019
Plotted On: Aug 22, 2019-4:14pm By: EOhanian
Tighe & Bond: J:\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-101_102.dwg



BRIDGE FRAMING AND LAYOUT PLAN
3/16" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25%
Plans
Not For
Construction

Central Street Bridge Replacement

Department of Public Works

MassDOT Bridge No. M-02-001, BIN 8AM

Town of Manchester-By-The-Sea, Massachusetts

MARK	DATE	DESCRIPTION

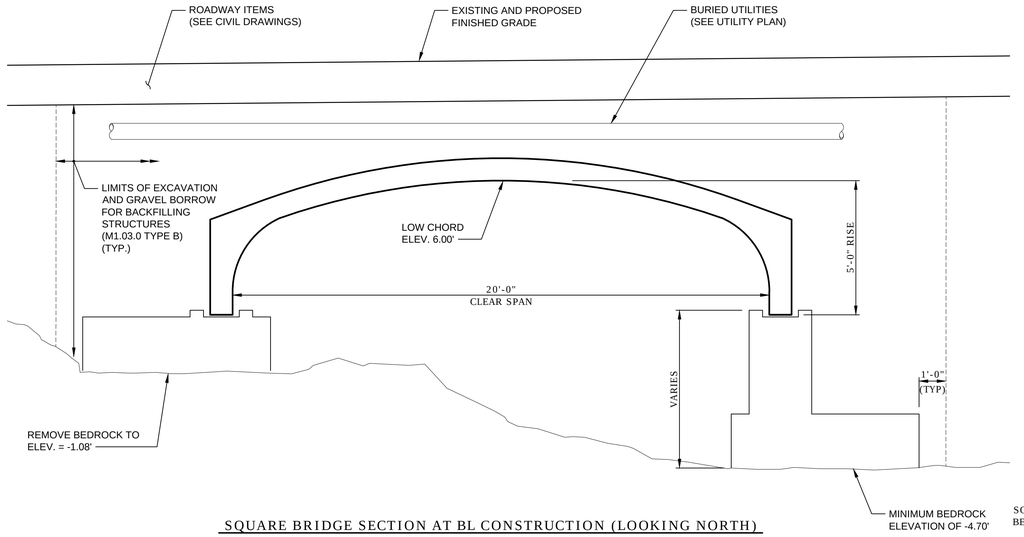
PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-101_102.dwg
DRAWN BY:	D.BISHOP
CHECKED:	EAO
APPROVED:	DLL

BRIDGE FRAMING AND LAYOUT PLAN

SCALE: AS NOTED

S-102
SHEET 5 OF 6

Last Saved: 8/23/2019
Plotted On: Aug 23, 2019 - 10:40am By: EOhanian
Tighe & Bond: J:\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-101_102.dwg

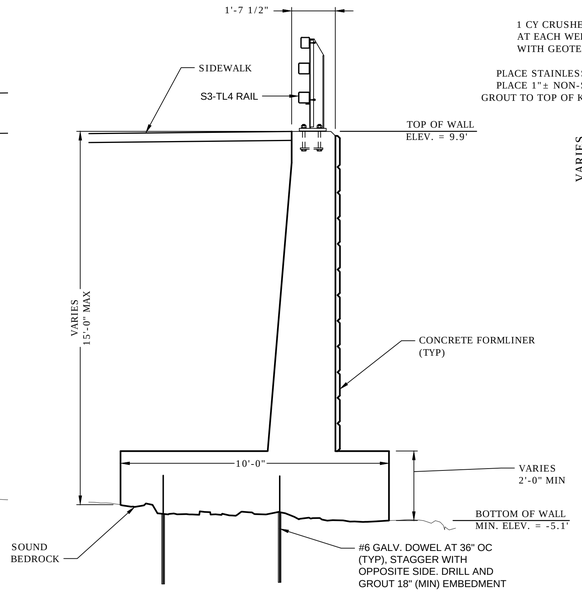


SQUARE BRIDGE SECTION AT BL CONSTRUCTION (LOOKING NORTH)

SECTION 3/8" = 1'-0" — B / S-101

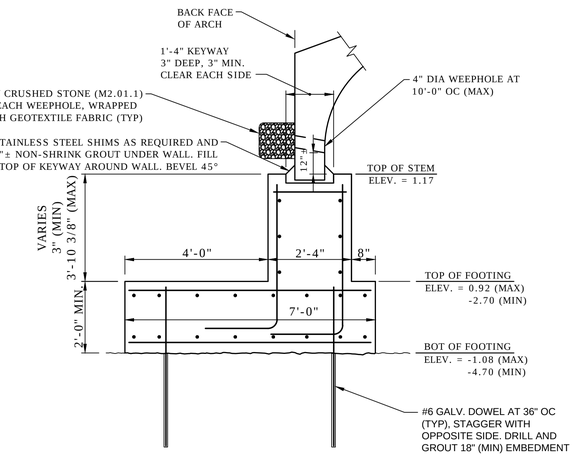
NOTE:

1. SECTION REFLECTS MAXIMUM AND MINIMUM ANTICIPATED BEDROCK ELEVATIONS. CONTRACTOR TO EVALUATE FIELD CONDITIONS AFTER DEMOLITION OF EXISTING BRIDGE AND REPORT TO ENGINEER PRIOR TO CASTING OF ARCH FOOTINGS.

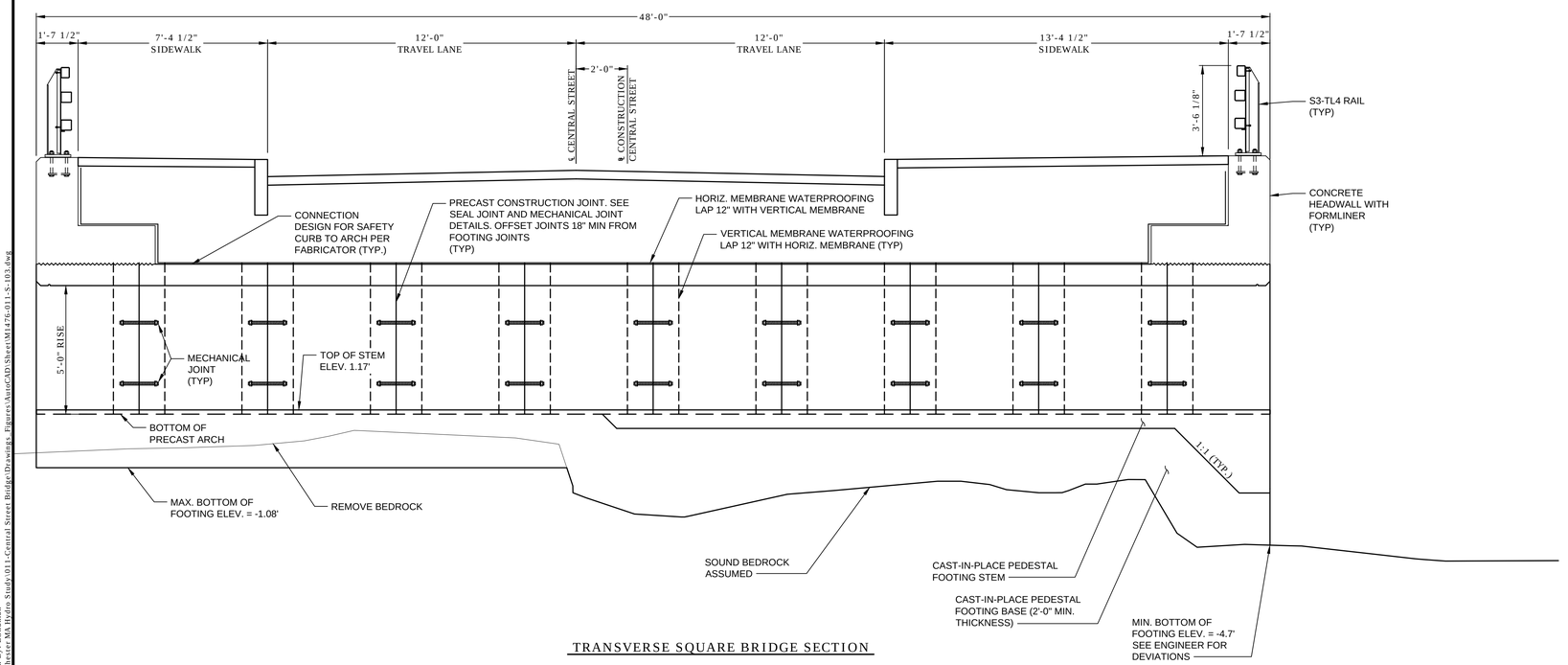


SOUTHWEST WINGWALL

SECTION 3/8" = 1'-0" — C / S-101

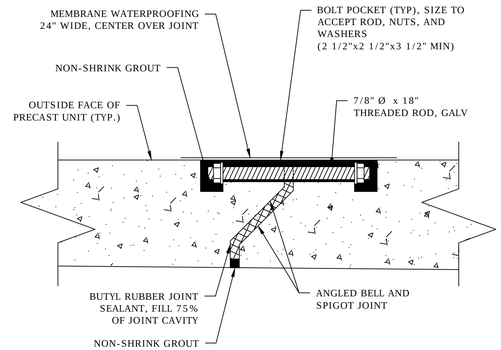


TYPICAL PRECAST ABUTMENT SECTION
1/2" = 1'-0"

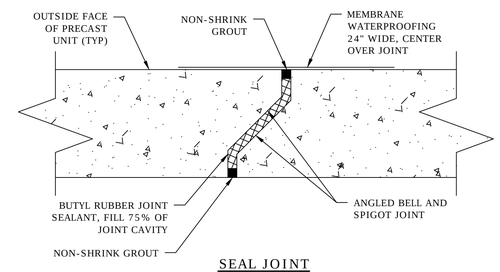


TRANSVERSE SQUARE BRIDGE SECTION

SECTION 3/8" = 1'-0" — A / S-101



MECHANICAL JOINT
NO SCALE



SEAL JOINT
NO SCALE

JOINT SEALANT NOTES:

1. PROVIDE BUTYL RUBBER JOINT SEALANT (ASTM C-990 & AASHTO M-198) BETWEEN PRECAST CONCRETE UNITS.
2. PROVIDE A MINIMUM OF 7 MECHANICAL CONNECTORS BETWEEN EACH ARCH UNIT (3 ON TOP AND 2 ON EACH SIDE).
3. ALL BOLT POCKETS SHALL BE FILLED WITH NON-SHRINK GROUT.
4. PEEL AND STICK BARRIER MEMBRANE SHALL BE PLACED IN 2-FOOT WIDE STRIPS, CENTERED OVER THE TOP AND/OR SIDES OF EACH JOINT.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
CONCEPTUAL DESIGN IS ACCEPTABLE TO MASSDOT FOR CONTRACTING

DISTRICT BRIDGE ENGINEER _____ DATE _____

Tighe&Bond
Engineers | Environmental Specialists

Draft 25% Plans Not For Construction

Central Street Bridge Replacement

Department of Public Works

MassDOT Bridge No. M-02-001, BIN 8AM

Town of Manchester-By-The-Sea, Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	M1476 - 011
DATE:	JUNE 2019
FILE:	M1476-011-S-103.dwg
DRAWN BY:	D.BISHOP
CHECKED:	EAO
APPROVED:	DLL

BRIDGE SECTION AND DETAILS

SCALE: AS NOTED

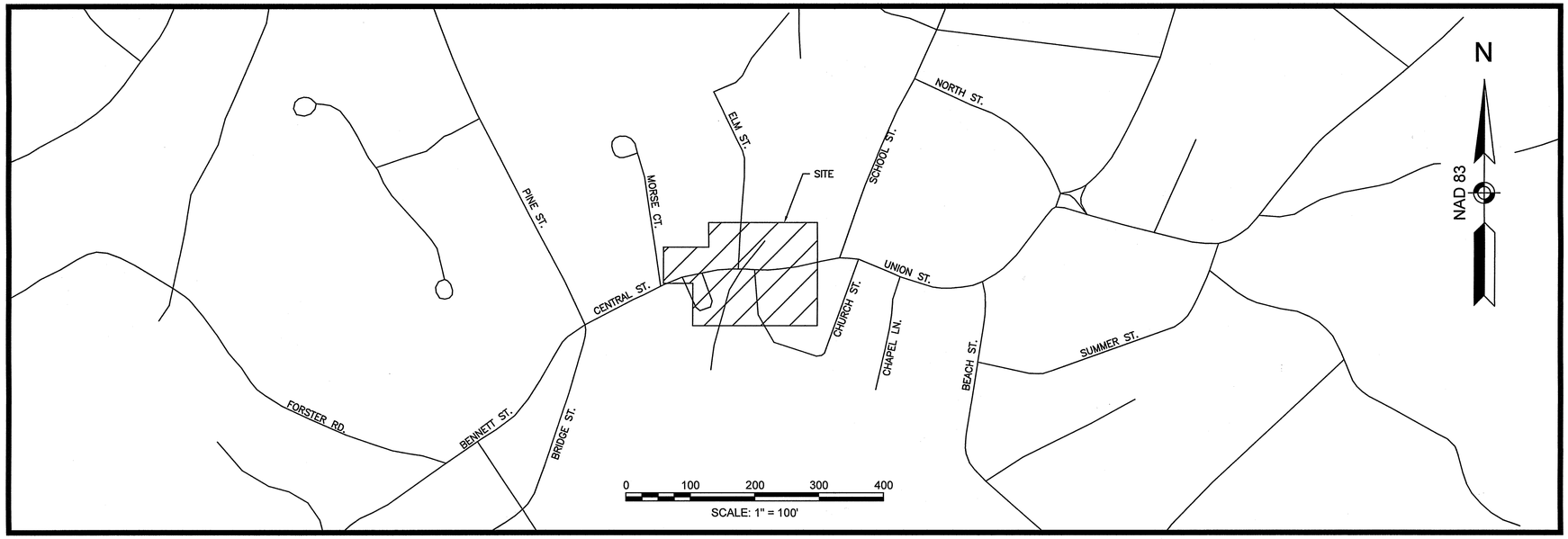
S-103
SHEET 6 OF 6

Last Saved: 8/23/2019
Plotted On: Aug 22, 2019-3:25pm By: EOhanian
Tighe & Bond: J:\M1476 Manchester MA Hydro Study\011-Central Street Bridge\Drawings - Figures\AutoCAD\Sheet\M1476-011-S-103.dwg

CITY/TOWN
STREET/ROUTE # OR NAME

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	X
PROJECT FILE NO.	XXXXXX		

TITLE SHEET, LEGEND & ABBREVIATIONS



LEGEND

—&—&—	APPROX. ABUTTERS LOT LINE (SEE NOTE 9)
— — — —	GAS LINE
— — — —	SEWER LINE
— — — —	TELEPHONE LINE
— — — —	WATER LINE
— — — —	UNDERGROUND ELECTRIC LINE
~~	SHRUB LINE
— — — —	OVERHEAD WIRE
——x——	CHAIN-LINK FENCE
——x——	HAND RAIL
——x——	OTHER FENCE
——10'——	MAJOR CONTOUR LINE
— —8'— —	MINOR CONTOUR LINE
——10'——	RIVER BED MAJOR CONTOUR LINE (SEE NOTE 10)
——8'——	RIVER BED MINOR CONTOUR LINE (SEE NOTE 10)
	BRICK
	CONCRETE
	CRUSHED STONE
	LANDSCAPED AREA
⊞ CB	CATCH BASIN - SQUARE
⊗	CLEANOUT
● DSK	DISK (CA/T, USC&GS, LAND COURT, ETC.)
Ⓓ	DRAIN MANHOLE
□ EHH	ELECTRIC HANDHOLE
Ⓔ	ELECTRIC MANHOLE
⊠ EM	ELECTRIC METER
⊗ FP	FLAG POLE
○ GG	GAS GATE
⊠ GM	GAS METER
	GAS SHUTOFF VALVE
	FIRE HYDRANT
	LIGHT POLE
Ⓜ	OTHER MANHOLE
□ POST	SQUARE POST
Ⓢ	SEWER MANHOLE
Ⓣ	TELEPONE MANHOLE
● 22"M	TREE
—O—	SIGN
—O— UPL#	UTILITY POLE
○ WG	WATER GATE
○ WSO	WATER SHUTOFF
BB	BITUMINOUS BERM
CIP	CAST IRON PIPE
CONC	CONCRETE
CS	COBBLESTONE
DBYL	DOUBLE YELLOW LINE
DMH	DRAIN MANHOLE
DS	DOWN SPOUT
DSK	DISK
EL	ELEVATION
EP	EDGE OF PAVEMENT
ETW	EDGE OF TRAVELED WAY
FF	FINISHED FLOOR
GRAN	GRANITE
HDW	HEADWALL
PLUG	LEAD PLUG WITH ESCUTCHEON PIN
RET	RETAINING
SWL	SOLID WHITE LINE
TYP	TYPICAL
VGC	VERTICAL GRANITE CURB

NOTES:

1. REFERENCE: TOWN OF MANCHESTER-BY-THE-SEA. CENTRAL STREET BRIDGE OVER SAWMILL BROOK.
2. FIELD SURVEY PERFORMED BY B.T. & T.M.M. DURING AUGUST 2018 USING A TRIMBLE S6 TOTAL STATION WITH A TRIMBLE TSC3 DATA COLLECTOR AND A SOKKIA B21 AUTO LEVEL. TRAVERSE ADJUSTMENT BASED ON LEAST SQUARE ANALYSIS. ADDITIONAL FIELD SURVEY PERFORMED BY M.J.C. IN AUGUST 2018 USING A LEICA P40 HDS SCANNER. REGISTRATION ADJUSTMENT BASED ON LEAST SQUARE ANALYSIS.
3. THIS MAP WAS PREPARED FROM RECORD RESEARCH, OTHER MAPS, LIMITED FIELD MEASUREMENTS AND OTHER SOURCES. IT IS NOT TO BE CONSTRUED AS A PROPERTY / BOUNDARY SURVEY AND IS SUBJECT TO SUCH FACTS AS SAID SURVEYS MAY DISCLOSE.
4. HORIZONTAL DATUM BASED ON MASSACHUSETTS MAINLAND ZONE NAD83(2011) DERIVED FROM REDUNDANT GPS OBSERVATIONS UTILIZING THE KEYNET GPS VRS NETWORK.
5. VERTICAL DATUM IS BASED ON NAVD88 DERIVED FROM REDUNDANT GPS OBSERVATIONS UTILIZING THE KEYNET GPS VRS NETWORK AND CALIBRATED TO THREE MASSDOT GEODETIC CONTROL STATIONS (REF. DSI PROJECT 4536).
6. PROPER FIELD PROCEDURES WERE FOLLOWED IN ORDER TO GENERATE CONTOURS AT (1') INTERVALS. ANY MODIFICATION OF THIS INTERVAL WILL DIMINISH THE INTEGRITY OF THE DATA, AND DOUCET SURVEY, INC. WILL NOT BE RESPONSIBLE FOR ANY SUCH ALTERATION PERFORMED BY THE USER.
7. THE ACCURACY OF MEASURED UTILITY INVERTS AND PIPE SIZES/TYPES IS SUBJECT TO NUMEROUS FIELD CONDITIONS, INCLUDING; THE ABILITY TO MAKE VISUAL OBSERVATIONS, DIRECT ACCESS TO THE VARIOUS ELEMENTS, MANHOLE CONFIGURATION, ETC.
8. ALL ELECTRIC, GAS, TEL. WATER, SEWER AND DRAIN SERVICES ARE SHOWN IN SCHEMATIC FASHION, THEIR LOCATIONS ARE NOT PRECISE OR NECESSARILY ACCURATE. NO WORK WHATSOEVER SHALL BE UNDERTAKEN ON THIS SITE USING THIS PLAN TO LOCATE THE ABOVE SERVICES. CONSULT WITH THE PROPER AUTHORITIES CONCERNED WITH THE SUBJECT SERVICE LOCATIONS FOR INFORMATION REGARDING SUCH. CALL DIG-SAFE AT 1-888-DIG-SAFE.
9. ABUTTER AND RIGHT OF WAY LINES SHOWN HEREON ARE FROM MASS.GOV OFFICE OF GEOGRAPHIC INFORMATION (MASSGIS) ONLY.THE REFERENCE PLANS LISTED HEREON ARE PROVIDED AS A COURTESY ONLY; THE SCOPE OF THIS TOPOGRAPHIC SURVEY DID NOT INCLUDE BOUNDARY ANALYSIS OR FIELD SURVEY EFFORTS TO UNCOVER RECORD MONUMENTS.
10. ELEVATIONS AND LOCATIONS SHOWN DEPICTING SPRING LINE ARE BASED ON DATA FROM LASER SCAN POINT CLOUD OF STONE ARCH CULVERT.
11. VISIBLE UTILITIY STRUCTURES (MANHOLES, CATCH BASINS, GAS & WATER VALVES, ETC.) WERE LOCATED BY INSTRUMENT SURVEY BY THIS OFFICE. THE CORRESPONDING STORMWATER DRAIN & SANITARY SEWER INVERT SIZE & ELEVATION IS PER SURVEY DONE BY THIS OFFICE. THE LOCATIONS OF THE REMAINING UNDERGROUND UTILITIES ARE BASED ON THE LOCATIONS OF S.U.E. PAINT MARKS (BY OTHERS - UNKNOWN) OBSERVED ON SITE AT THE TIME OF OUR SURVEY.

massDOT Massachusetts Department of Transportation Highway Division

PREPARED BY:
DOUCET SURVEY INC
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REVISIONS		
REV.	COMMENTS	DATE
01	SMH INVERTS, ADD MISC. FEATURES	10/18/18
02	ADD REF. PLAN 19, MISC. UPDATES	11/09/18

SCALE: 10 FEET TO THE INCH

FILE NAME: 5521A_SV
FIELD BOOK. NO: XXXX
DRAWN BY: W.D.C. CHECKED BY: W.J.D.
FIELD CHIEF: XXX PARS. NO: XXXXXXX

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

CENTRAL STREET

(BRIDGE NO. X-XX-XXX)

IN THE (T/C) OF

MANCHESTER BY THE SEA

AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION

DATE:

SHEET 1 OF 4

5521A_SV.DWG Plotted on 14-Dec-2018 9:06 AM

CITY/TOWN
STREET/ROUTE # OR NAME

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	X
PROJECT FILE NO. XXXXXX			

TITLE SHEET, LEGEND & ABBREVIATIONS

5521A_SV.DWG Plotted on 14-Dec-2018 9:08 AM

REFERENCE PLANS:

1. **"PLAN OF A PORTION OF THE MAIN ROAD IN MANCHESTER SHOWING THE PROPOSED WIDENINGS" DONE BY CHARLES A. PUTNAM, DATED NOVEMBER 23, 1871. COUNTY OF ESSEX RECORD #1230.**
2. **"PLAN OF A PORTION OF CENTRAL STREET AT THE JUNCTION OF SCHOOL STREET AND UNION STREET IN THE TOWN OF MANCEHSTER AS ALTERED" DONE BY CLINTON C. BARKER COUNTY ENGINEER DATED SEPTEMBER 1947. S.E.D.R.D. PLAN #76-35.**
3. **"PLAN OF A PORTION OF CENTRAL STREET FROM ELM STREET TO SCHOOL STREET IN THE TOWN OF MANCEHSTER AS ALTERED" BY JOHN O. MARMAALA COUNTY ENGINEER DATED SEPTEMBER 1953. S.E.D.R.D. PLAN #84-8.**
4. **"PLAN OF LAND IN MANCHESER, MASS FOR JEAN E. GRELET" DATED MARCH 20, 1959 BY DANA F. PERKINS & SONS, INC. S.E.D.R.D. PLAN #92-74.**
5. **"PLAN OF A PORTION OF ELM STREET FROM CENTRAL STREET 700 FEET NORTHERLY IN THE TOWN OF MANCHESTER AS LAID OUT" BY EARL H. PAGE DATED OCTOBER 25, 1966. S.E.D.R.D. PLAN #107-91.**
6. **"PLAN OF LAND IN MANCHESTER, MASSACHUSETTS COUNTY OF ESSEX FOR ANN N. KILEY & DOROTHY B. KILEY" DATED FEBRUARY 14, 1985. DONE BY W. C. CAMMETT ENGINEERING, INC. S.E.D.R.D. PLAN #233-32.**
7. **"SITE PLAN 27 CENTRAL ST. CONDOMINIUMS" DONE BY W. C. CAMMETT ENGINEERING, INC. DATED FEBRUARY 1985. S.E.D.R.D. PLAN #233-33.**
8. **"PLAN OF LAND BELONGING TO SAMUEL KNIGHT SONS CO." DATED SEPTEMBER 27, 1946 BY RICHARD A. WIRLING. S.E.D.R.D. PLAN #1946-824.**
9. **"PLAN OF LAND IN MANCHESTER OT BE CONVEYED FROM F. J. MERRILL TO THE CRICKET PRESS, INC." FEBRUARY 15, 1923. BY RAYMOND C. ALLEN. S.E.D.R.D. PLAN #2549-181.**
10. **"LAND OF JOHN W. MARSHALL HEIRS" DATED OCTOBER 28, 1944 BY WARREN A. CROMBIE. S.E.D.R.D. PLAN #3465-1.**
11. **"PLAN OF LAND BELONGING TO SAMUEL KNIGHT SONS, CO." DATED DECEMBER 10, 1946 BYRICHARD A. WIRLING. S.E.D.R.D. PLAN #3521-600.**
12. **"PROPERTY OF JEAN E. GRELET, CENTRAL ST, MANCHESTER MASS" DATED NOVEMBER 8, 1952 S.E.D.R.D. PLAN #3925-1.**
13. **"PLAN OF LAND IN MANCHESTER PROPERTY OF SEA ROCK ESTATE, INC." DATED DECEMBER 18, 1970. BY ESSEX SURVEY SERVICE, INC. S.E.D.R.D. PLAN #5765-800.**
14. **"PLAN OF LAND IN MANCHESTER PROPERTY OF SEA ROCK ESTATE, INC." DATED MAY 3, 1971 BY ESSEX SURVEY SERVICE, INC. S.E.D.R.D. PLAN #5835-1.**
15. **"PLAN OF LAND IN MANCHESTER PEELE HOUSE SQUARE" FOR SEA ROCK ESTATE, INC. DATED JULY 11, 1972 BY ESSEX SURVEY SERVICE, INC. S.E.D.R.D. PLAN #5961-297.**
16. **"PLAN OF LAND IN MANCHESTER PEELE HOUSE SQUARE" FOR SEA ROCK ESTATE, INC. DATED MAY 8, 1973. BY ESSEX SURVEY SERVICE, INC. S.E.D.R.D. PLAN #6025-1.**
17. **"PLAN OF LAND IN MANCHESTER PROPERTY OF ARTHUR A. & MARJOIRE SECHER" DATED JUNE 11, 1984. BY ESSEX SURVEY SERVICE, INC. S.E.D.R.D. PLAN #7688-133.**
18. **"PLAN TO ACCOMPANY PETITION OF THE TOWN OF MANCHESTER. TO CONSTRUCT A RETAINING WALL AND FILL SOLID MANCHESTER HARBOR" DATED NOVEMBER 3, 1921. BY RAYMOND C. ALLEN. S.E.D.R.D. PLAN #36-31.**
19. **PLAN TITLED "MANCHESTER-BY-THE-SEA DOWNTOWN ATLAS, MANCHESTER-BY-THE-SEA, MASSACHUSETTS, ESSEX COUNTY" PREPARED BY DGT SURVEY GROUP DATED 6-10-2015.**

DRAINAGE STRUCTURES
CB 1104
RIM ELEV.=14.2'
(A) 4" CIP INV.=12.1' (4" METAL**)
(B) 10" CMP INV.=10.5' (8"**)
CB 1153
RIM ELEV.=10.1'
SUMP ELEV.=7.8'
CONC. CHANNEL TO OUTFALL
CB 1196
RIM ELEV.=9.2'
(OUTFALL) 12" CLAY INV.=5.3' (10" CONC**)
(A) 12" CLAY INV.=5.2' (12"**)
CB 1215
RIM ELEV.=9.2'
(1228) 15" CMP INV.=2.6'
(A) 8" METAL INV.=1.6'
(B) 8" METAL INV.=1.5'
DMH 1228
RIM ELEV.=10.1'
(1245) 10" CLAY INV.=6.4' (10" CLAY**)
(1215) 15" CMP INV.=5.5'
DMH 1245
RIM ELEV.=11.5'
(1215) 12" PVC INV.=9.3' (12" PVC**)
(A) VERY RECESSED (12" CLARY FROM CB 1246**)
WATER ELEV.=9.3'
SUMP ELEV.=8.3'
CB 1246
RIM ELEV.=11.2'
(A) 12" UNKN INV.=9.6'
(10" OR 12" CLAY TO DMH 1245**)

**INDICATES PIPE SIZE/DIA. INFO. IS PER REF. PLAN 19

SEWER STRUCTURES
SMH 1081
RIM ELEV.=12.4'
CC=-1.1'
(1155) UNKN BC=-1.2' (12" PIPE**)
(1109) UNKN BC=-1.3' (15" PIPE**)
SMH 1109
RIM ELEV.=14.6'
(1081) 15" UNKN INV.=-2.1' (15" PIPE**)
(A) 15" UNKN INV.=-2.6'
(B) 15" UNKN INV.=-2.7' (18" PIPE**)
SMH 1155
RIM ELEV.=10.2'
(A) 4" PVC INV.=4.7'
(B) 4" PVC INV.=0'
(C) UNKN INV.=-0.3' (6" PIPE**)
(1248) UNKN INV.=-0.6' (15" PIPE**)
(1081) UNKN INV.=-0.6' (12" PIPE**)
CC=-0.6'
SMH 1248
RIM ELEV.=13.7'
(A) 8" UNKN INV.=6.7'
(B) 8" UNKN INV.=0.1'
(1155) 12" UNKN INV.=-0.3' (15" PIPE**)
(C) 12" UNKN INV.=-0.4' (12" PIPE**)
(D) 12" UNKN INV.=-0.4'

**INDICATES PIPE SIZE/DIA. INFO. IS PER REF. PLAN 19

OTHER STRUCTURES
MH 1063
RIM ELEV.=11.5'
SUMP ELEV.=6.8'
DRY NO PIPES W/ WATER SHUT OFF
MH 1550
RIM ELEV.=13.8'
SUMP ELEV.=9.9'
DRY NO PIPES W/ ELECTRIC METER AND CHANNEL TO FOUNTAIN

massDOT Massachusetts Department of Transportation Highway Division

COMMONWEALTH OF MASSACHUSETTS WILLIAM J. DOUCET No. 45709 PROFESSIONAL LAND SURVEYOR

PREPARED BY:
DOUCET SURVEY INC
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http://www.doucetsurvey.com

REVISIONS

REV.	COMMENTS	DATE
01	SMH INVERTS, ADD MISC. FEATURES	10/18/18
02	ADD REF. PLAN 19, MISC. UPDATES	11/09/18

SCALE: 10 FEET TO THE INCH

FILE NAME: 5521A_SV
FIELD BOOK. NO: XXXX
DRAWN BY: W.D.C. CHECKED BY: W.J.D.
FIELD CHIEF: XXX PARS. NO: XXXXXXX

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

CENTRAL STREET

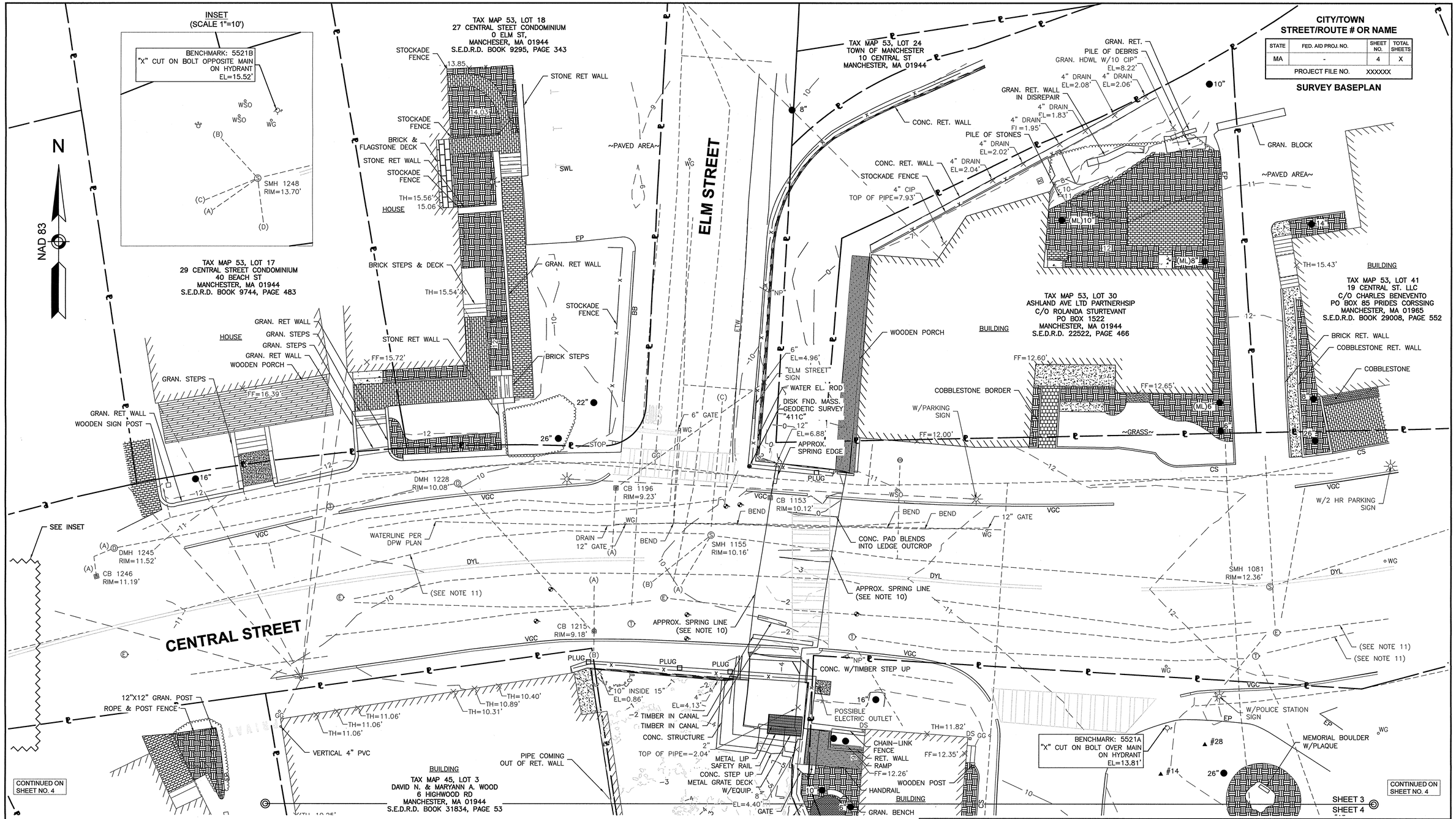
(BRIDGE NO. X-XX-XXX)

IN THE (T/C) OF

MANCHESTER BY THE SEA

AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF
TRANSPORTATION, HIGHWAY DIVISION

DATE:



CITY/TOWN
STREET/ROUTE # OR NAME

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	X
PROJECT FILE NO.	XXXXXX		

SURVEY BASEPLAN

5521A_SV.DWG Plotted on 14-Dec-2018 9:21 AM

REVISIONS		
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massDOT
Massachusetts Department of Transportation
Highway Division

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COMMONWEALTH OF MASSACHUSETTS
WILLIAM J. DOUCET
No. 45709
PROFESSIONAL LAND SURVEYOR

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

CENTRAL STREET

(BRIDGE NO. X-XX-XXX)

IN THE (T/C) OF

MANCHESTER BY THE SEA

AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF
TRANSPORTATION, HIGHWAY DIVISION

DATE: SEPTEMBER 10, 2018

SHEET 3 OF 4

CITY/TOWN
STREET/ROUTE # OR NAME

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	X
PROJECT FILE NO.	XXXXXX		

SURVEY BASEPLAN

N

NAD 83

CONTINUED ON SHEET NO. 3

CENTRAL STREET

CB 1215
RIM=9.18'

APPROX. SPRING LINE (SEE NOTE 10)

(SEE NOTE 10)

(SEE NOTE 11)

CONC. W/TIMBER STEP UP

POSSIBLE ELECTRIC OUTLET

BENCHMARK: 5521A
"X" CUT ON BOLT OVER MAIN ON HYDRANT
EL=13.81'

W/POLICE STATION SIGN

MEMORIAL BOULDER W/PLAQUE

12"X12" GRAN. POST

ROPE & POST FENCE

10"X10" GRAN. POST

VERTICAL 4" PVC

PIPE COMING OUT OF RET. WALL

BUILDING
TAX MAP 45, LOT 3
DAVID N. & MARYANN A. WOOD
6 HIGHWOOD RD
MANCHESTER, MA 01944
S.E.D.R.D. BOOK 31834, PAGE 53

HOUSE

TAX MAP 45, LOT 2
SEA ROCK ESTATE, INC
5C PEELE HOUSE SQUARE
MANCHESTER, MA 01944
S.E.D.R.D. BOOK 5696, PAGE 116

TAX MAP 45, LOT 37
SEA ROCK ESTATE, INC
5C PEELE HOUSE SQUARE
MANCHESTER, MA 01944
S.E.D.R.D. BOOK 9397, PAGE 574

10" INSIDE 15"
EL=0.86'

2 TIMBER IN CANAL
TIMBER IN CANAL
CONC. STRUCTURE
TOP OF PIPE=-2.04'

METAL LIP
SAFETY RAIL
CONC. STEP UP
METAL GRATE DECK W/EQUIP.

CHAIN-LINK FENCE
RET. WALL
RAMP
FF=12.26'
WOODEN POST
HANDRAIL

BUILDING
GRAN. BENCH

GATE
EL=4.40'

4" DRAIN
EL=7.26'

4" EL=4.53'

4" EL=3.63'

RIVER BED CONTOURS

4" DRAIN
EL=7.03'
4" DRAIN
EL=2.96'

4" DRAIN
EL=6.83'

4" CAPPED
TOP OF PIPE=4.56'

CONC. RET. WALL

4" DRAIN
EL=6.99'

CONC. RET. WALL

4" DRAIN
EL=6.94'
4" DRAIN
EL=4.31'

4" DRAIN
EL=1.10'
4" DRAIN
EL=6.89'

4" DRAIN
EL=6.96'

4" DRAIN
EL=-0.82'
4" DRAIN
EL=6.87'

PAD MOUNTED A/C
FF=12.15'

(2)GM

WOODEN POST
"SEASIDE 1 GARDEN" GRAN. MEMORIAL

MW

CHAIN-LINK FENCE

~PAVED AREA~

(3) 30 MIN. PARKING

MEMORIAL GRAN. BENCH

CHURCH STREET

TAX MAP 45, LOT 23
TOWN OF MANCHESTER
10 CENTRAL ST
MANCHESTER, MA 01944

BUILDING

SHEET 3
SHEET 4

OMH 1063

DISK FND. MASS DEPT. PUBLIC WORKS "AH52"
CONC. FLAG BASE

W/POLICE & HP ENTRANCE SIGN

GL SOLAR PANEL

BRICK STEPS

EHH W/SWITCH & COND. DOWN TO AC

FF=19.00'

#14 #15 #16 #18 #26 #28

TH=10.40' TH=10.89' TH=10.31' TH=11.06' TH=11.06' TH=11.06' TH=10.25' TH=11.82' FF=12.35' FF=10.11'

0 10 20 30 40
SCALE: 1" = 10'

COMMONWEALTH OF MASSACHUSETTS
WILLIAM J. DOUCET
No. 45709
PROFESSIONAL LAND SURVEYOR

massDOT
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SHEET 4 OF 4

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

CENTRAL STREET

(BRIDGE NO. X-XX-XXX)

IN THE (T/C) OF

MANCHESTER BY THE SEA

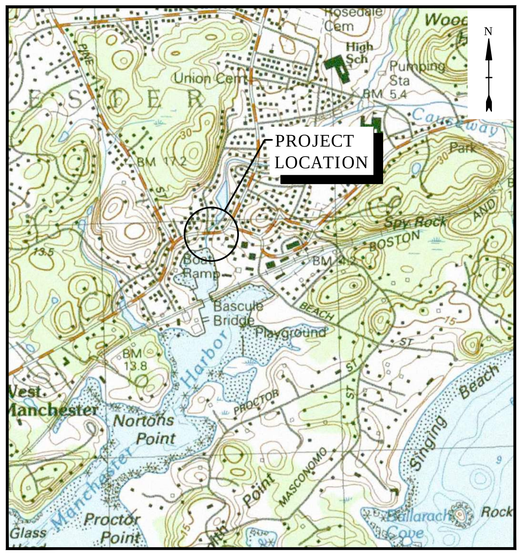
AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF
TRANSPORTATION, HIGHWAY DIVISION

5521A_SV.DWG Plotted on 14-Dec-2018 9:09 AM

TOWN OF MANCHESTER-BY-THE-SEA,
MASSACHUSETTS
CENTRAL POND RESTORATION

JUNE 2019

LIST OF DRAWINGS	
SHEET NO.	SHEET TITLE
	COVER
G-001	GENERAL NOTES, LEGEND AND ABBREVIATIONS
C-001	EXISTING CONDITIONS AND DEMOLITION PLAN
C-100	SITE PLAN
C-501 TO C-502	CONSTRUCTION DETAILS



LOCATION MAP
SCALE: 1" = 1000'

PREPARED FOR:

TOWN OF MANCHESTER-BY-THE-SEA
GREG FEDERSPIEL, TOWN ADMINISTRATOR
CHUCK DAM, PE, DEPARTMENT OF PUBLIC WORKS DIRECTOR
MARY REILLY, GRANTS ADMINISTRATOR

BOARD OF SELECTMEN
SUSAN BECKMANN, CHAIR
ARTHUR STEINER, VICE CHAIR
ELI BOLING
MARGARET DRISCOLL
BECKY JAQUES

PREPARED BY:

Tighe&Bond
Engineers | Environmental Specialists

PERMIT SET
NOT FOR CONSTRUCTION

COMPLETE SET 6 SHEETS

GENERAL NOTES:

1. BASE PLAN ENTITLED "TOPOGRAPHIC PLAN FOR TIGHE & BOND OF SAWMILL BROOK BRIDGE STREET TO NORWOOD AVE, MANCHESTER-BY-THE-SEA, MASSACHUSETTS" PREPARED BY DOUCET SURVEY INC. IN DECEMBER 2017.
2. THE HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE VERTICAL DATUM IS BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. BOLD TEXT AND LINES INDICATES PROPOSED WORK. LIGHT TEXT AND LINES INDICATES APPROXIMATE EXISTING CONDITIONS.
4. WETLAND RESOURCE AREAS WERE DELINEATED BY TIGHE & BOND ON 4/18/2018.
5. SOIL BORINGS WERE ADVANCED BY NEW ENGLAND BORING CONTRACTORS ON NOVEMBER 28, 2018.
6. NOTIFY "DIGSAFE" AT 1-888-344-7233 TO ARRANGE FOR MARKING OUT EXISTING UNDERGROUND UTILITIES AT LEAST 72 HOURS (EXCLUDING SATURDAYS, SUNDAYS, AND HOLIDAYS) PRIOR TO BEGINNING EXCAVATION AT ANY GIVEN LOCATION. UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR BE ALLOWED TO START ANY KIND OF EXCAVATION WORK PRIOR TO OBTAINING ALL THE NECESSARY INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES AT THE SITE. ACCOMPLISH ALL EXCAVATION SO THAT UNDERGROUND UTILITIES OR STRUCTURES ARE NOT DAMAGED. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE INCURRED DURING EXCAVATION OPERATIONS. REPAIR ANY EXISTING PIPE OR UTILITY DAMAGED DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.
7. THE OWNER AND ENGINEER ASSUME NO RESPONSIBILITY FOR THE LOCATION OF EXISTING UTILITIES. THE ENGINEER AND OWNER MAKE NO GUARANTEE AS TO THE UNDERGROUND CONDITIONS THAT MAY BE ENCOUNTERED.
8. FIELD MEASURE TO VERIFY EXISTING AND CONTRACT INTERFACE DIMENSIONS, LOCATIONS, AND OTHER CONDITIONS.
9. TEST PITS TO LOCATE EXISTING UTILITIES ARE STRONGLY ENCOURAGED AND MAY BE ORDERED BY THE ENGINEER.
10. IF CHANGES TO THE DESIGN ARE PROPOSED, THE CHANGES SHALL BE SUBMITTED TO THE OWNER/ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.
11. MAKE NECESSARY ARRANGEMENTS TO PERFORM ANY WORK NEAR OVERHEAD UTILITIES PRIOR TO THE START OF CONSTRUCTION.
12. EXISTING UTILITY POLES IN CLOSE PROXIMITY TO CONSTRUCTION MAY REQUIRE TEMPORARY SUPPORT BY THE UTILITY COMPANY. INCLUDE COST UNDER THE PRICES BID FOR THE VARIOUS ITEMS OF WORK.
13. NO OPEN TRENCHES WILL BE ALLOWED OVERNIGHT. THE USE OF ROAD PLATES TO PROTECT THE EXCAVATION WILL BE CONSIDERED UPON REQUEST, BUT BACKFILLING IS PREFERRED.
14. STORE FUEL, OIL, PAINT, OR OTHER HAZARDOUS MATERIALS IN A SECONDARY CONTAINER AND REMOVE FROM THE SITE TO A LOCKED INDOOR AREA WITH AN IMPERVIOUS FLOOR DURING NON-WORK HOURS.
15. IMMEDIATELY REPORT SPILLS OF OIL AND/OR HAZARDOUS MATERIALS (OHM) TO THE MASSDEP.
16. PROVIDE A SUFFICIENT SUPPLY OF ABSORBENT SPILL RESPONSE MATERIALS, SUCH AS BOOMS OR BLANKETS, AT THE CONSTRUCTION SITE AT ALL TIMES TO CLEAN UP POTENTIAL SPILLS OF HAZARDOUS MATERIALS.
17. FURNISH AND INSTALL TRAFFIC CONTROL/SAFETY DEVICES TO ENSURE SAFE VEHICULAR TRAFFIC THROUGH THE WORK AREA OR FOR SAFELY IMPLEMENTING DETOURS AROUND THE WORK AREA.
18. SAWMILL BROOK IS RECOGNIZED AS A RAINBOW SMELT SPANNING AREA. NO INWATER WORK WILL BE PERMITTED DURING SPAWNING SEASON.

EROSION AND SEDIMENTATION CONTROL NOTES:

E1. TEMPORARY SEDIMENT AND EROSION CONTROL BY THE CONTRACTOR SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS LISTED BELOW.

E2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES NECESSARY TO EXECUTE AND COMPLETE THE WORK OF THE CONTRACT, IN COMPLIANCE WITH THE TERMS AND CONDITIONS CONTAINED IN THE CONTRACT AND PROJECT PERMITS. CONTROLS SHOWN ON THE CONTRACT DRAWINGS AND MENTIONED IN THE TECHNICAL SPECIFICATIONS SHALL BE CONSIDERED MINIMUM REQUIREMENTS. THE CONTRACTOR SHALL EMPLOY WHATEVER SUPPLEMENTARY MEASURES NECESSARY TO PROTECT WETLANDS, WATERS, AND ADJACENT AREAS FROM DISTURBANCE OR DISCHARGE OF SEDIMENTS.

E3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SEDIMENT AND EROSION CONTROLS TO MEET THE CONDITIONS OF ALL APPLICABLE PERMITS AND REGULATIONS. SUCH CONTROLS SHALL BE INSTALLED WHEREVER THE POTENTIAL EXISTS FOR THE DISTURBANCE OF LAND OR THE TRANSPORT OF SEDIMENT.

E4. EROSION AND SEDIMENTATION CONTROLS SHALL CONSIST OF COMPOST FILTER TUBES INSTALLED PER DETAILS PROVIDED ON THESE DRAWINGS.

E5. COMPOST FILTER TUBES SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF CLEARING AND GRUBBING ACTIVITIES. LOCATION OF COMPOST FILTER TUBES TO BE ADJUSTED UPON COMPLETION OF CLEARING AND GRUBBING BUT PRIOR TO COMMENCEMENT OF GRADING ACTIVITIES.

E6. ALL EROSION AND SEDIMENTATION CONTROLS SHALL BE MAINTAINED IN GOOD CONDITION AND PROPER WORKING ORDER. NECESSARY REPAIRS SHALL BE MADE IMMEDIATELY.

E7. ALL EROSION AND SEDIMENTATION CONTROLS SHALL BE PROPERLY DISPOSED OFF-SITE UPON COMPLETION OF WORK, SITE STABILIZATION, AND/OR AUTHORIZATION FROM THE OWNER.

E8. MAINTAIN AN ADDITIONAL SUPPLY OF EROSION CONTROL MEASURES THROUGHOUT THE CONSTRUCTION PERIOD.

E9. SILT TRAPPED AT BARRIERS SHALL BE REMOVED AND DISPOSED OF IN UPLAND AREAS OUTSIDE BUFFER ZONES. MATERIALS DEPOSITED IN ANY TEMPORARY SETTLING BASIN SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT. ALL DISTURBED AREAS SHALL BE RESTORED.

E10. INSTALL EROSION CONTROLS AT THE EDGE OF PROPOSED WORK. EROSION CONTROLS SHALL ACT AS LIMIT OF WORK LINE TO HELP ENSURE THAT EQUIPMENT DOES NOT DISTURB ADJACENT PROPERTIES.

E11. ADDITIONAL EROSION CONTROLS MAY BE REQUIRED TO PREVENT SEDIMENTS FROM DISCHARGING TO ADJACENT PROPERTIES OR INTO EXISTING STORM DRAIN SYSTEMS.

E12. STABILIZE THE AREAS OF CONSTRUCTION ACTIVITIES AT THE CLOSE OF EACH CONSTRUCTION DAY. CHECK EROSION CONTROLS AT THIS TIME AND MAINTAIN OR REINFORCE IF NECESSARY.

E13. PROTECT NEW WORK FROM FLOODING. PROPERLY SLOPE GRADING IN THE AREAS SURROUNDING ALL EXCAVATIONS TO PREVENT WATER FROM RUNNING INTO THE EXCAVATED AREA OR TO ADJACENT PROPERTIES. UPON COMPLETION OF THE WORK, RESTORE ALL AREAS IN A SATISFACTORY MANNER.

E14. ALL SILT-LADEN WATER MUST BE SETTLED OR FILTERED TO REMOVE ALL SEDIMENTS IN A SEDIMENTATION BASIN OR FILTER BAG LOCATED DOWNSTREAM, PRIOR TO RELEASE TO A WATERWAY OR EXISTING DRAINAGE SYSTEM.

E15. DEWATER AS NECESSARY TO KEEP CONSTRUCTION AREAS FREE OF WATER, DISCHARGE WATER FROM DEWATERING TO THE APPROPRIATE LOCATION AND WITHOUT SEDIMENT.

E16. AT THE END OF EACH WORK DAY, ANY SEDIMENTS TRACKED ONTO PUBLIC RIGHT-OF-WAYS BEYOND THE PROJECT LIMITS SHALL BE SWEPT AWAY.

ABBREVIATIONS

BIT	BITUMINOUS
CONC	CONCRETE
CMP	CORRUGATED METAL PIPE
ELEV	ELEVATION
EOP	EDGE OF PAVEMENT
EOW	EDGE OF WATER
HMA	HOT MIXED ASPHALT
R&D	REMOVE AND DISPOSE
R&S	REMOVE AND STACK
RET	RETAIN
SPK	SPIKE
TBM	TEMPORARY BENCHMARK
TYP	TYPICAL
UP	UTILITY POLE

LEGEND

992	INTERMEDIATE CONTOURS
990	INDEX CONTOURS
578	PROPOSED CONTOURS
OE	OVERHEAD WIRES
	EXISTING GUARD RAIL
	PROPOSED GUARD RAIL
	100-FOOT BUFFER ZONE
	200-FOOT RIVERFRONT AREA
	LAND SUBJECT TO FLOODING (BLSF)
	VEGETATED WETLAND BOUNDARY (BVW)
	TOP OF BANK (OHW)
	MEAN ANNUAL HIGH WATER (MAHW)
	EDGE OF WATER
	EROSION CONTROL BARRIER
	PROPOSED COFFERDAM
	LIMIT OF WORK
	PROPERTY BOUNDARY
	REVETMENT/COBBLE BOTTOM
WF3B-4	WETLAND FLAG
UP	UTILITY POLE
	DECIDUOUS/CONIFER TREE
	BOLLARD
	BORING
	PIPING, STRUCTURES, etc. TO BE REMOVED

BEST MANAGEMENT PRACTICES

INSPECTION AND MAINTENANCE
- SEDIMENT, EROSION CONTROLS, AND BEST MANAGEMENT PRACTICES (BMPS) SHALL BE INSTALLED PRIOR TO COMMENCING CONSTRUCTION AT THE SITE. NO WORK WHICH SHALL DISTURB THE SITE OR CREATE THE POTENTIAL FOR SEDIMENT RELEASE SHALL COMMENCE UNTIL THE SEDIMENT AND EROSION CONTROLS HAVE BEEN INSPECTED AND APPROVED BY THE OWNER, ENGINEER, AND REGULATORY AGENCIES. ALL CONTROLS AND BMPS SHALL BE SUBJECT TO INSPECTION BY THE OWNER, HIS REPRESENTATIVE, AND REGULATORY AGENCIES AT ANYTIME THEREAFTER.
- PERIODIC INSPECTION, MAINTENANCE, AND CLEANING OF TEMPORARY EROSION OF SEDIMENT CONTROL MEASURES AND BMPS SHALL BE REQUIRED. ALL CONTROLS AND BMPS SHALL BE INSPECTED EVERY 7 DAYS AND WITHIN 24 HOURS OF RAINFALL EVENTS OF 0.5 INCHES OR GREATER. ROUTINE INSPECTION AND MAINTENANCE WILL REDUCE THE CHANCE OF POLLUTING STORMWATER BY FINDING AND CORRECTING PROBLEMS BEFORE THE NEXT RAIN EVENT. THE FOCUS OF THE INSPECTION WILL BE TO DETERMINE:
  1. WHETHER OR NOT THE MEASURE WAS INSTALLED / PERFORMED CORRECTLY;
  2. WHETHER OR NOT THERE HAS BEEN ANY DAMAGE TO THE MEASURE SINCE IT WAS INSTALLED OR PERFORMED; AND
  3. WHAT SHOULD BE DONE TO CORRECT ANY PROBLEMS WITH THE MEASURE. EACH MEASURE IS TO BE OBSERVED TO DETERMINE IF IT IS STILL EFFECTIVE.

  IN SOME CASES, SPECIFIC MEASUREMENTS MAY BE TAKEN TO DETERMINE IF MAINTENANCE OF THE MEASURES IS REQUIRED.

SITE MANAGER
- PRIOR TO CONSTRUCTION, A SITE MANAGER WILL BE DESIGNATED BY THE CONTRACTOR TO BE RESPONSIBLE FOR INSTALLATION, MONITORING, INSPECTION, AND CORRECTION OF EROSION AND SEDIMENT CONTROL MEASURES.

CONSTRUCTION SITE ENTRANCE
- TO REDUCE THE TRACKING OF SEDIMENT FROM THE CONSTRUCTION SITE ONTO OTHER AREAS OF THE PROPERTY AND/OR PUBLIC ROADS, AS WELL AS THE PRODUCTION OF AIRBORNE DUST, A STABILIZED CONSTRUCTION ENTRANCE IS TO BE ESTABLISHED AT ANY PERMANENT CONSTRUCTION STAGING AREA. THE ENTRANCE IS TO CONSIST OF A 6-INCH THICK PAD OF CRUSHED STONE UNDERLAIN WITH FILTER FABRIC OR A BITUMINOUS CONCRETE APRON. IT IS TO BE REMOVED AND THE AREA RESTORED FOLLOWING CONSTRUCTION.

SITE CLEARING
- DURING SITE CLEARING, EXISTING VEGETATION WITHIN THE OVERALL LIMITS OF CLEARING AND GRUBBING SHALL BE REMOVED, EXCEPT AS OTHERWISE DIRECTED. PRIOR TO ANY SITE CLEARING ACTIVITIES, SEDIMENT CONTROL BARRIERS SHALL BE PLACED ALONG THE OUTER LIMIT OF DISTURBANCE. CLEARING IS TO BE LIMITED TO THOSE AREAS OF PROPOSED WORK. DISTURBED AREAS ARE TO BE KEPT TO A MINIMUM. NO TREE WITH A BREAST HEIGHT DIAMETER OF GREATER THAN 6 INCHES SHALL BE CLEARED FROM AREAS OUTSIDE THE LIMITS OF CLEARING AND GRUBBING WITHOUT PRIOR APPROVAL FROM THE OWNER.

DUST CONTROL
- STANDARD DUST CONTROL MEASURES, INCLUDING SPRAYING AND MISTING SHALL BE USED AS NECESSARY. CALCIUM CHLORIDE SHALL NOT BE ALLOWED ON THIS PROJECT.

STAGING AREAS
- THE CONTRACTOR SHALL COORDINATE LAYDOWN STAGING AREAS FOR STORING EQUIPMENT AND MATERIALS WITH THE OWNER.
- STAGING AREAS SHALL BE SURROUNDED WITH COMPOST FILTER TUBE EROSION BARRIERS ON THE DOWNHILL SIDE.
- DURING AND AFTER CONSTRUCTION, ALL PAVED ROAD AND DRIVEWAY SURFACES ARE TO BE SCRAPED AND BROOMED FREE OF EXCAVATED MATERIALS ON A DAILY BASIS, UNLESS APPROVED BY THE OWNER.

STOCKPILED MATERIALS
- STOCKPILES OF SOIL CREATED DURING CONSTRUCTION ACTIVITIES ARE TO BE SURROUNDED WITH AN EROSION CONTROL BARRIER AROUND THE PERIMETER OF THE STOCKPILE. STOCKPILES OF ERODIBLE MATERIAL ARE TO BE COVERED PRIOR TO INCLEMENT WEATHER WITH A MINIMUM OF 20 MIL POLYETHYLENE SHEETING. STOCKPILES LEFT UNDISTURBED LONGER THAN 14 DAYS SHALL BE SEEDED OR COVERED.

EQUIPMENT FUELING
- EQUIPMENT FUELING AND OTHER ACTIVITIES INVOLVING PETROLEUM, OIL, OR OTHER POTENTIALLY HAZARDOUS SUBSTANCES ARE TO BE PERFORMED AT PRE-APPROVED, DESIGNATED AREAS WITH APPROPRIATE SPILL PREVENTION AND CONTROL MEASURES. PORTABLE SECONDARY CONTAINMENT IS TO BE USED, AND SORBENT MATERIALS ARE TO BE PLACED AROUND THE PERIMETER OF THE FUELING AREA.

CONSTRUCTION DEWATERING
- CONSTRUCTION DEWATERING SHALL BE REQUIRED DURING PORTIONS OF CONSTRUCTION WHICH REQUIRE EXCAVATION OR OTHER ACTIVITIES WHERE GROUNDWATER MAY INTERFERE WITH THE WORK.
- CONSTRUCTION DEWATERING DISCHARGES SHALL BE PRE-TREATED FOR SEDIMENT REMOVAL BY PASSING THROUGH AN APPROPRIATELY SIZED FILTER SOCK, SILT BAG, FRACTIONATION / SEDIMENTATION TANK, OR SEDIMENT TRAP PRIOR TO DISCHARGE, AS NECESSARY.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING DEWATERING TECHNIQUES AND MAINTAINING DEWATERING PROCEDURES THROUGHOUT THE DURATION OF THE PROJECT.

OUTLET PROTECTION
- APPROPRIATE OUTLET PROTECTION, CONSISTING OF RIPRAP CHANNEL LINING, A LEVEL SPREADER, OR OTHER SUCH MEASURE SHALL BE PROVIDED AT THE OUTLET OF ANY DEWATERING CONDUIT OR STORMWATER CULVERT OR CHANNEL OUTFALL TO REDUCE VELOCITIES AND ENHANCE SEDIMENTATION PRIOR TO DISCHARGE.

LIMITS OF WORK
- THE CONTRACTOR SHALL LINE THE UPGRADIENT BOUNDARY OF WORK AREAS WITH ORANGE SAFETY FENCING BEFORE THE START OF SITE CLEARING ACTIVITIES EXCEPT WHERE CHAIN-LINK FENCING IS NEEDED TO RESTRICT PUBLIC ACCESS.

SURFACE WATER CONTROL
- THE CONTRACTOR MUST MAINTAIN THE SITE FLOWAGE OF SURFACE WATER THROUGH THE WORK AREA IN ACCORDANCE WITH THE SPECIFICATIONS. ALL COFFERDAMS SHALL CONSIST OF NON-ERODIBLE MATERIAL. THE CONTRACTOR SHALL SUBMIT A WATER CONTROL PLAN THAT WILL ADDRESS EMERGENCY MEASURES TO IMPLEMENT IN THE EVENT A STORM OCCURS DURING CONSTRUCTION.

TURBIDITY MONITORING AND CONTROL
- TURBIDITY SHALL BE MONITORED AND CONTROLLED BY THE CONTRACTOR. A TURBIDITY CURTAIN SHALL BE INSTALLED SURROUNDING AREAS OF EXCAVATION AT AND BELOW THE IMPOUNDMENT WATER LINE.
- IF TURBIDITY LEVELS ARE UNACCEPTABLE AS JUDGED BY THE OWNER, ENGINEER, OR REGULATORY AGENCY, ADDITIONAL MEASURES SHALL BE IMPLEMENTED AT NO EXPENSE TO THE OWNER.

TEMPORARY STABILIZATION
- WHEN NECESSARY, TEMPORARY SLOPE PROTECTION SHALL BE PROVIDED BY INSTALLING SEDIMENT TRAP BARRIERS AT THE TOE OF FILLS OR CUT SLOPES. IF ADDITIONAL STABILIZATION IS NEEDED, THEN THE CONTRACTOR SHALL INSTALL MULCH LOGS, MATTING, SUCH AS STRAW, JUTE, WOOD FIBER, OR BIODEGRADABLE MESH. A TACKIFIER SHALL BE USED ON LOOSE MATERIALS USED FOR TEMPORARY EROSION CONTROL.
- IN THE EVENT THAT DISTURBED AREAS AT THE SITE ARE TO BE LEFT UN-WORKED FOR MORE THAN TWO WEEKS, THE AREAS SHALL BE MULCHED WITH STRAW AT A RATE OF 100 LBS. PER 1,000 S.F. TO HELP CONTROL EROSION. 100% BIODEGRADABLE EROSION CONTROL BLANKETS OR TWO INCHES OF WOOD CHIP MULCH MAY ALSO BE USED AS TEMPORARY COVER.
- IN THE EVENT THAT DISTURBED AREAS AT THE SITE ARE TO BE LEFT UN-WORKED FOR MORE THAN ONE MONTH, THE AREAS SHALL BE TOPSOILED AND SEEDED AS PER THE SPECIFICATIONS AND AT NO ADDITIONAL COST TO THE OWNER.
- LEAVE THE SURFACE OF ALL EXCAVATIONS AND FILLS IN A FIRM AND STABLE CONDITION AT THE END OF EACH DAY. ROLL OR OTHERWISE TREAT THE SURFACE AS NEEDED.

SITE RESTORATION
- STABILIZATION OF DISTURBED AREAS OR NEW SOIL FILLS SHALL BE IMPLEMENTED WITHIN 14 DAYS AFTER GRADING OR CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED. APPROPRIATE VEGETATIVE SOIL STABILIZATION IS TO BE USED TO MINIMIZE EROSION. TEMPORARY AND PERMANENT VEGETATIVE COVER IS TO BE ESTABLISHED IN ACCORDANCE WITH THE PROJECT PLANS AND SPECIFICATIONS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORATION OF PREVIOUSLY VEGETATED UPLAND AREAS DISTURBED BY CONSTRUCTION ACTIVITIES. RESTORATION OF UPLAND AREAS CONSIST OF REPLACEMENT OF TOPSOIL OR PLACEMENT OF IMPORTED LOAM AS NEEDED SUCH THAT A MINIMUM OF 4 INCHES OF SUITABLE MATERIAL IS PRESENT AND APPROPRIATELY LIMED, FERTILIZED, GRADED, AND SCARIFIED. FIELDS DISTURBED OR COMPACTED BY CONSTRUCTION ACTIVITIES SHALL BE PLOWED TO LOOSEN THE SOIL, HARROWED TO PROVIDE AN EVEN SURFACE, AND APPROPRIATELY PREPARED FOR PLANTING.
- DISTURBED UPLAND AREAS SHALL THEN BE HYDROSEEDED WITH AN APPROVED SEED MIX AT THE RATE RECOMMENDED BY THE MANUFACTURER. SEEDING RATE SHALL BE DOUBLED FOR DORMANT SEEDING. SEED MIX SHALL BE DRY SITE RESTORATION SEED MIX UNLESS OTHERWISE NOTED OR AS APPROVED BY THE ENGINEER.
- 100% BIODEGRADABLE EROSION CONTROL BLANKETS MUST BE USED FOR STABILIZATION OF SLOPES IN EXCESS OF 3H:1V AND MAY BE USED IN LIEU OF HYDROSEEDING AT THE CONTRACTOR'S DISCRETION TO PROVIDE ADDITIONAL EROSION PROTECTION.
- FINAL STABILIZATION SHALL BE CONSIDERED COMPLETE WHEN ALL SOIL-DISTURBING ACTIVITIES HAVE BEEN COMPLETED AND A UNIFORM, PERENNIAL VEGETATIVE COVER WITH A DENSITY OF EIGHTY PERCENT HAS BEEN ESTABLISHED OR EQUIVALENT STABILIZATION MEASURES (SUCH AS THE USE OF MULCHES OR EROSION CONTROL MATTING) HAVE BEEN EMPLOYED ON ALL UNPAVED AREAS AND AREAS NOT COVERED BY PERMANENT STRUCTURES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE OF ALL VEGETATED SURFACES, INCLUDING WATERING, FERTILIZING, REPAIRING EROSION, INVASIVE PLANT REMOVAL, AND RE-SEEDING UNTIL ESTABLISHMENT CONDITIONS ARE MET AND UNTIL THE END OF THE CONTRACTUAL MAINTENANCE PERIOD.

THE NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DRY SITES:

COMMON NAME	BOTANICAL NAME
CREEPING RED FESCUE	*Festuca rubra*
CANADA WILD RYE	*Elymus canadensis*
ANNUAL RYEGRASS	*Lolium multiflorum*
PERENNIAL RYEGRASS	*Lolium perenne*
BLUE GRAMA	*Boutelova gracilis*
LITTLE BLUESTEM	*Schizachyrium scoparium*
INDIAN GRASS	*Sorghastrum nutans*
ROUGH BENTGRASS/TICKLEGRASS	*Agrostis scabia*
UPLAND BENTGRASS	*Agrostis perennans*

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PERMIT SET

CENTRAL POND RESTORATION

Central Street to Knight Circle

Manchester -by-the-Sea, MA

VERIFY SCALE
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0 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

MARK	DATE	DESCRIPTION
2	FEB 2019	Issued For Bidding

PROJECT NO:	22-1467
DATE:	2018/01
FILE:	M1476-012-G-001_NotesLgnd.dwg
DRAWN BY:	DWB
CHECKED:	DRB
APPROVED:	DLL

GENERAL NOTES, LEGEND AND ABBREVIATIONS

SCALE: NO SCALE

G-001

N

ELM STREET

CONSTRUCTION ACCESS

APARTMENT BUILDING

END RETAINING WALL REMOVAL

PRIVATE OUTFALL

PRIVATE OUTFALL

SILL=12.7'

SILL=10.7'

COMMERCIAL BUILDING

CENTRAL POND

200 FOOT RIVERFRONT BUFFER (TYP)

100 YEAR FLOOD ZONE (TYP)

ZONE AE STILLWATER BASED ON ELEVATION DOWNSTREAM OF CENTRAL STREET BRIDGE (ELEV: 10')

DMH 1004

DMH 1005

18"x48" BOX CULVERT INV: 3.6'

MEAN HIGH WATER (ELEV: 4.5')

100 FOOT WETLAND BUFFER (TYP)

HISTORIC HIGH WATER (ELEV: 8.9')

ELM STREET

SILL=9.0'

CENTRAL POND

HIGH HIGH WATER (ELEV: 4.9')

BRIDGE STREET

CB 1002

CB 1001

SILL=9.3'

BEGIN RETAINING WALL REMOVAL

ROUTE 127

SILL=11.5'

SILL=8.0'

R&D GUARDRAIL

REMOVE LIGHT POLES & ABANDON UTILITIES

REMOVE POLE & ABANDON UTILITIES

HISTORIC HIGH WATER (ELEV: 8.9')

REMOVE TREE

RET

LOCATE AND PROTECT UNDERGROUND UTILITIES

CENTRAL STREET

ZONE AE STILLWATER BASED ON ELEVATION DOWNSTREAM OF CENTRAL STREET BRIDGE (ELEV: 10')

30 FOOT NO DISTURB ZONE (TYP)

50 FOOT NO BUILD ZONE (TYP)

SCALE IN FEET
0 20' 40'
GRAPHIC SCALE

Last Saved: 5/16/2019
Last Saved By: rdh
Tighe & Bond, Inc. J:\MM\1476 Manchester MA Hydro Study\012-Sawmill_Central Pond Restoration\Drawings_Figures\AutoCAD\Sheet\M1476-012-C-001_EC.dwg

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DATE:	2018/01
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CHECKED:	DRB
APPROVED:	DLL

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 20'

C-001

LEGEND			
HATCH	AREA (SF)	ZONE	PLANTS
	7,720	Sc	SPARTINA CYNOSUROIDES
	590	FW	CEPHALANTHUS OCCIDENTALIS
	825	BR	SCHOENOPLECTUS PUNGENS
			PANICUM VIRGATUM
			SOLIDAGO SEMPERVIRENS
			BACCHARIS HALIMIFOLIA
			IVA FRUTESCENS
			HIBISCUS MOSHEUTOS
	9,330	Sa1	SPARTINA ALTERNIFLORA SPACED 2' O.C.
	27,400	Sa2	SPARTINA ALTERNIFLORA SPACED 3' O.C.

ELM STREET

APARTMENT BUILDING

PROTECT PRIVATE OUTFALLS

END RETAIN WALL TIE INTO EXISTING WALL WITH A 5' CORNER AND GROUT TO SEAL

SAWMILL BROOK CHANNEL

COIR LOG (TYP)

ROOTWAD LOGS WITH BOULDERS USE IN TARGETED AREAS OF BANK SCOUR (TYP)

CENTRAL POND

12" PVC PIPE TO EXTEND BEYOND RETAINING WALL

18" X 18" BOX CULVERT

EROSION CONTROL BARRIER

200 FOOT RIVERFRONT BUFFER (TYP)

100 YEAR FLOOD ZONE (TYP)

ZONE AE STILLWATER (ELEV: 10')

MEAN HIGH WATER (ELEV: 4.5')

100 FOOT WETLAND BUFFER (TYP)

30 FOOT NO DISTURB ZONE (TYP)

50 FOOT NO BUILD ZONE (TYP)

SPLIT RAIL FENCE

SUPPLEMENT EXISTING WALL TOE PROTECTION WITH EMBEDDED BOULDERS 2'-3' DIA

HIGH HIGH WATER (ELEV: 4.9')

EMBED TYPE II RIPRAP AT TOE OF PROPOSED WALL. INFILL WITH SEDIMENT AND PLANT WITH Sc ZONE PLANTINGS

HISTORIC HIGH WATER (ELEV: 8.9')

TIMBER RAILING FENCE AT STAIRS

BRIDGE STREET

INSTALL STAIR ACCESS WITH FREESTANDING BOND BEAM AT TOP OF WALL ALONG STAIR SECTION

PROP BOLLARD (TYP)

ROUTE 127

PROP GUARDRAIL (TYP)

12" PVC PIPE TO EXTEND BEYOND RETAINING WALL

HISTORIC HIGH WATER (ELEV: 8.9')

BEGIN RETAIN WALL TIE INTO EXISTING WALL WITH A 5' CORNER AND GROUT TO SEAL

COFFERDAM OR TURBIDITY CURTAIN (TYP)

CENTRAL STREET

EMBED TYPE I RIPRAP AT TOE OF PROPOSED WALL. INFILL WITH SEDIMENT AND PLANT WITH Sc ZONE PLANTINGS

ZONE AE STILLWATER (ELEV: 10')

NOTES:
1. SAWMILL BROOK IS RECOGNIZED AS A RAINBOW SMELT SPANNING AREA. NO INWATER WORK WILL BE PERMITTED DURING SPAWNING SEASON.

SCALE IN FEET
0 30' 60'
GRAPHIC SCALE

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CENTRAL POND RESTORATION

Central Street to Knight Circle

Manchester -by-the-Sea, MA

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APPROVED:	DLL

SITE PLAN

SCALE: 1" = 30'

C-100

Last Saved: 6/27/2019
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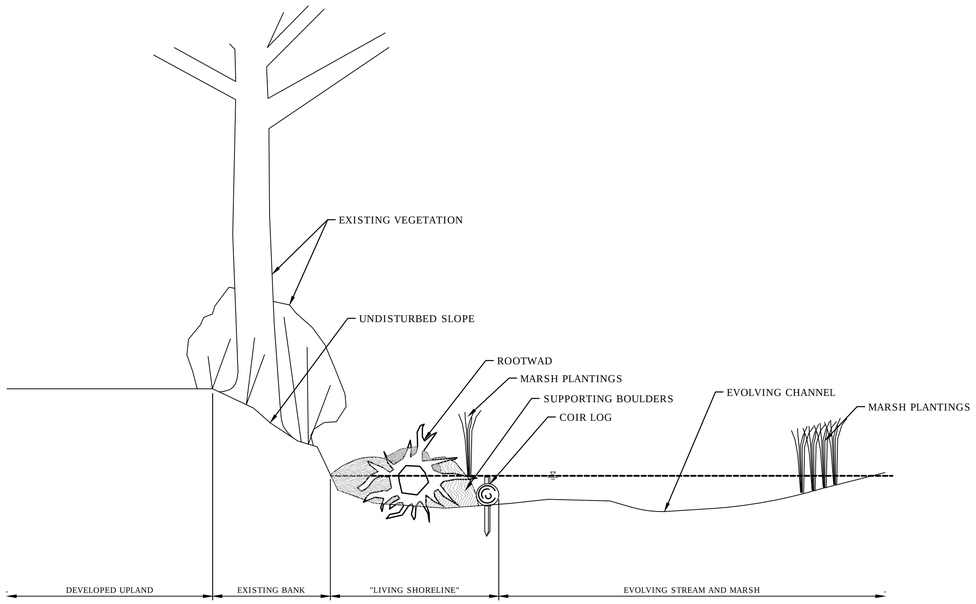
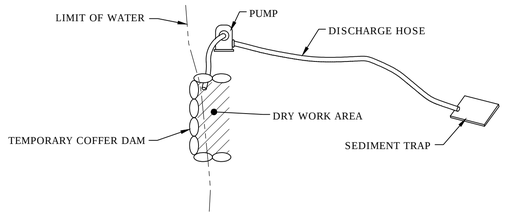
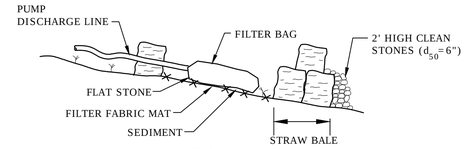


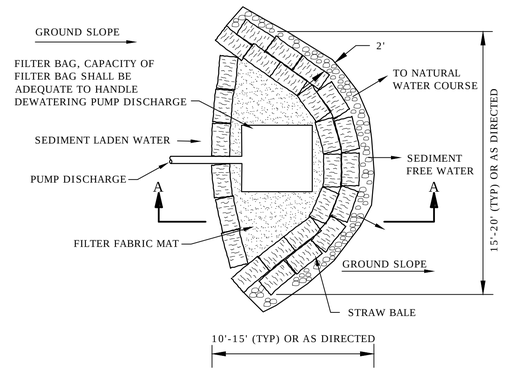
LIVING SHORLINE DETAIL
NO SCALE



NOTES:
1. DEWATERING EQUIPMENT SHALL REMAIN WITHIN THE PERMANENTLY IMPACTED AREAS AND SHALL DISCHARGE OUTSIDE OF THE WETLAND BOUNDARY AS SHOWN ON SHEET C-001.
2. DISCHARGE HOSE SHALL NOT CROSS THE STREAM AT ANY LOCATION.



SECTION A-A



COFFERDAM AND DEWATERING
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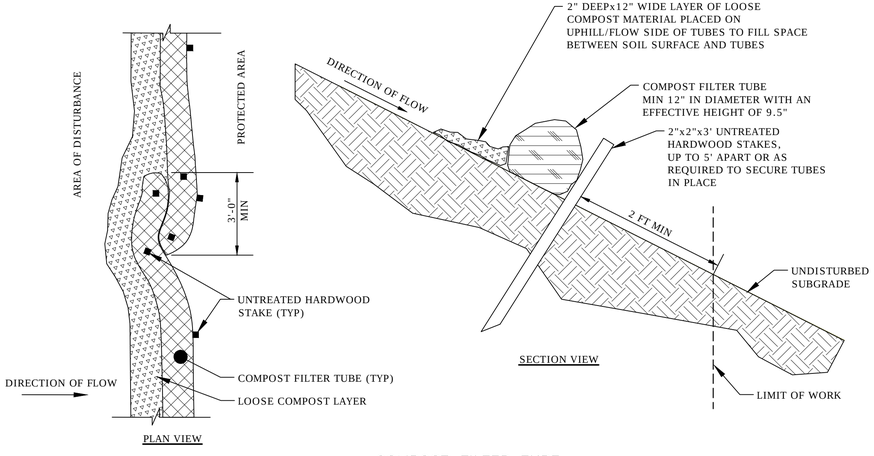

COMPOST FILTER TUBE
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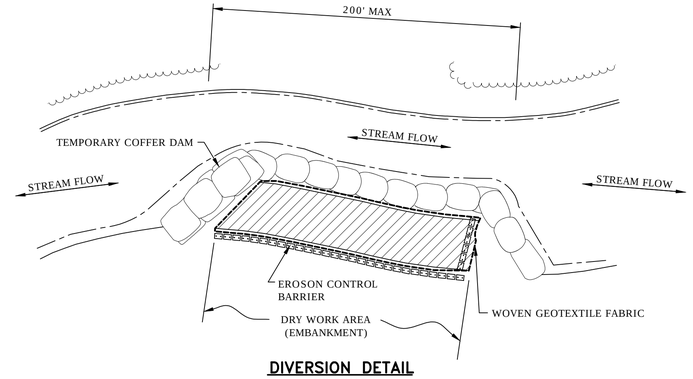

DIVERSION DETAIL
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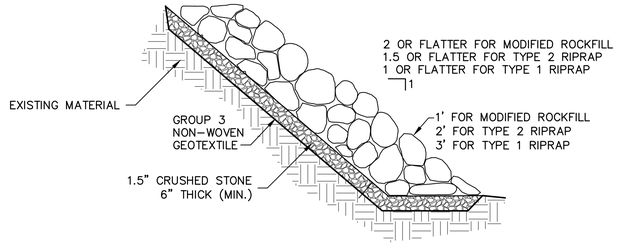

RIP-RAP INSTALLATION/SLOPE PROTECTION
NO SCALE

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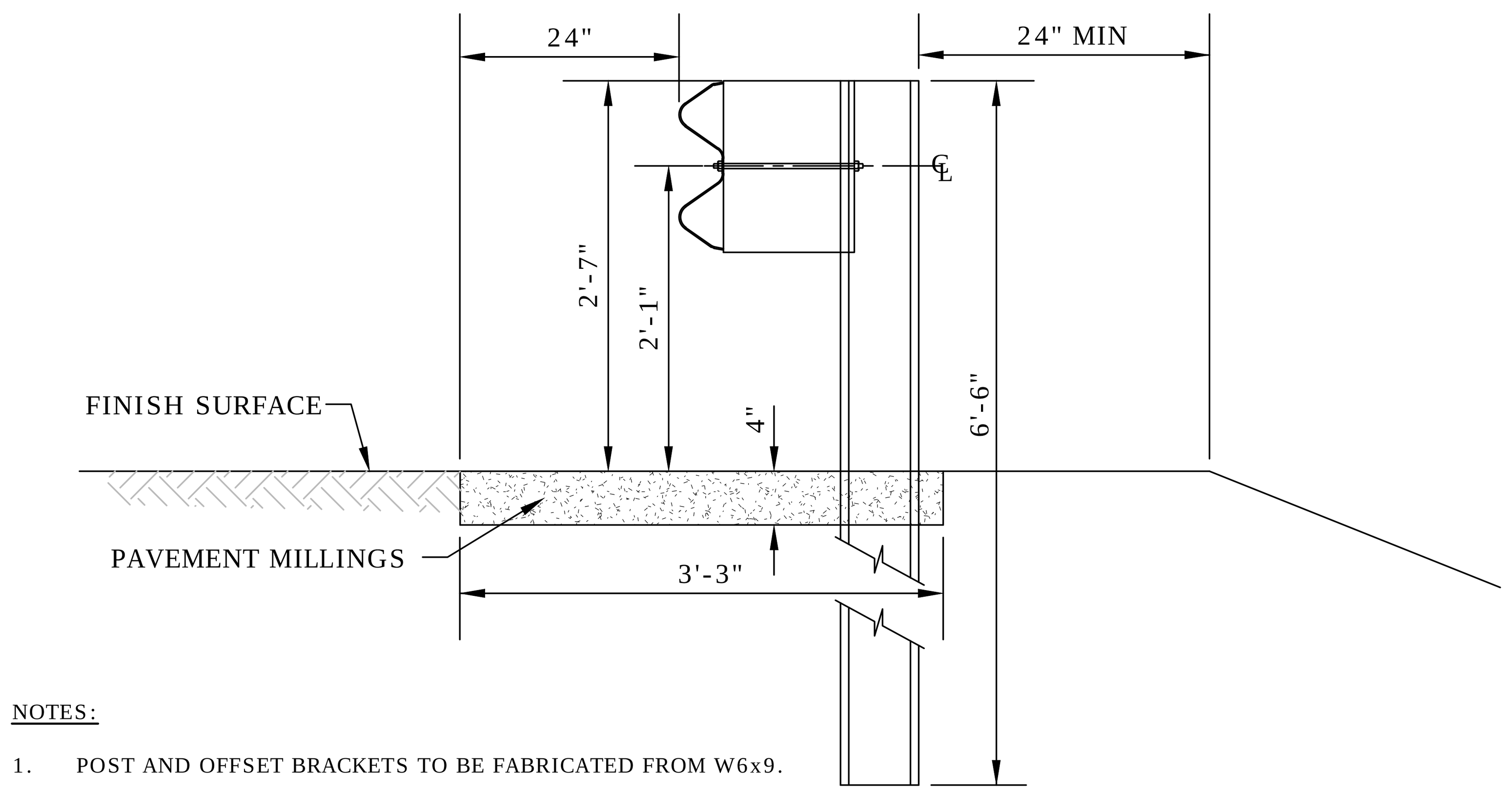
APPROVED:	DLL

CONSTRUCTION DETAILS

SCALE: AS NOTED

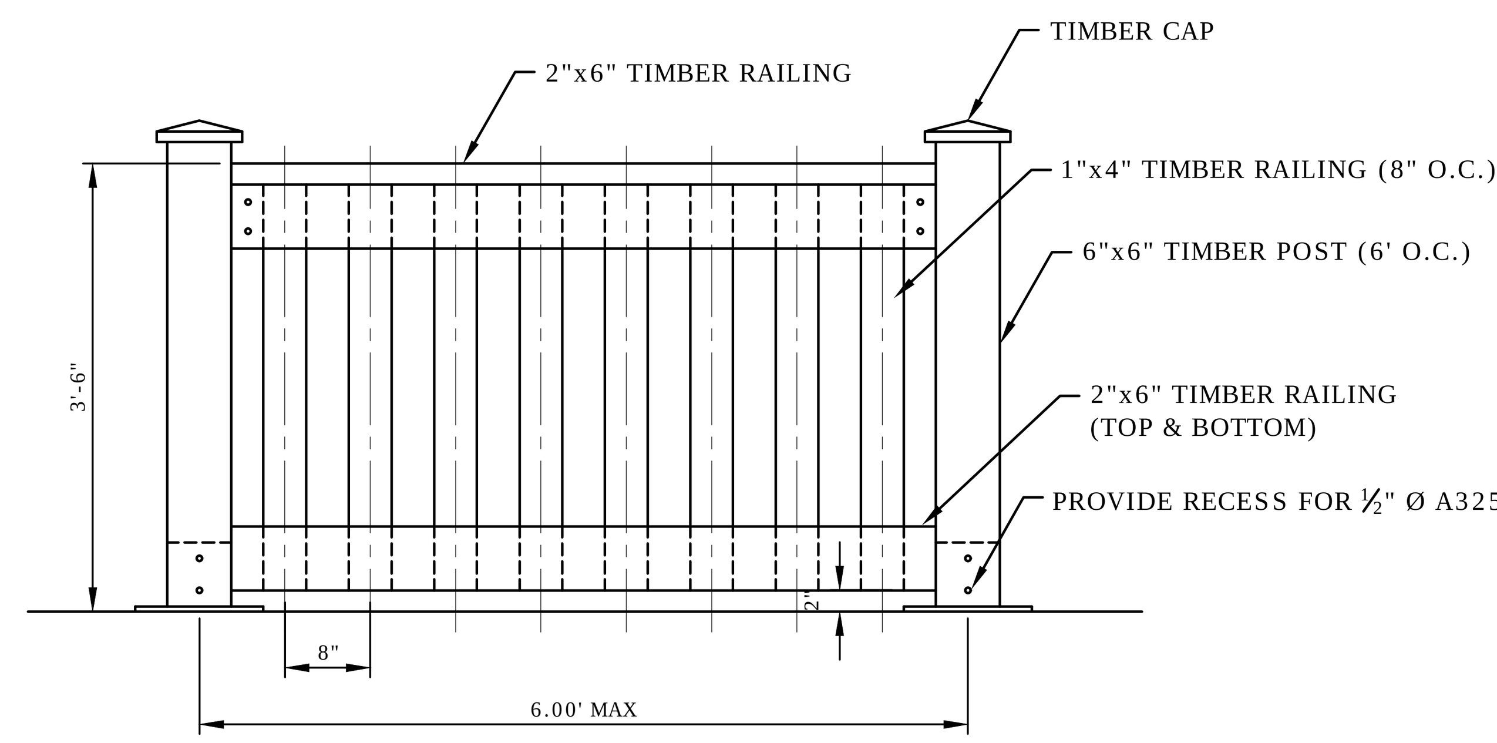
C-501



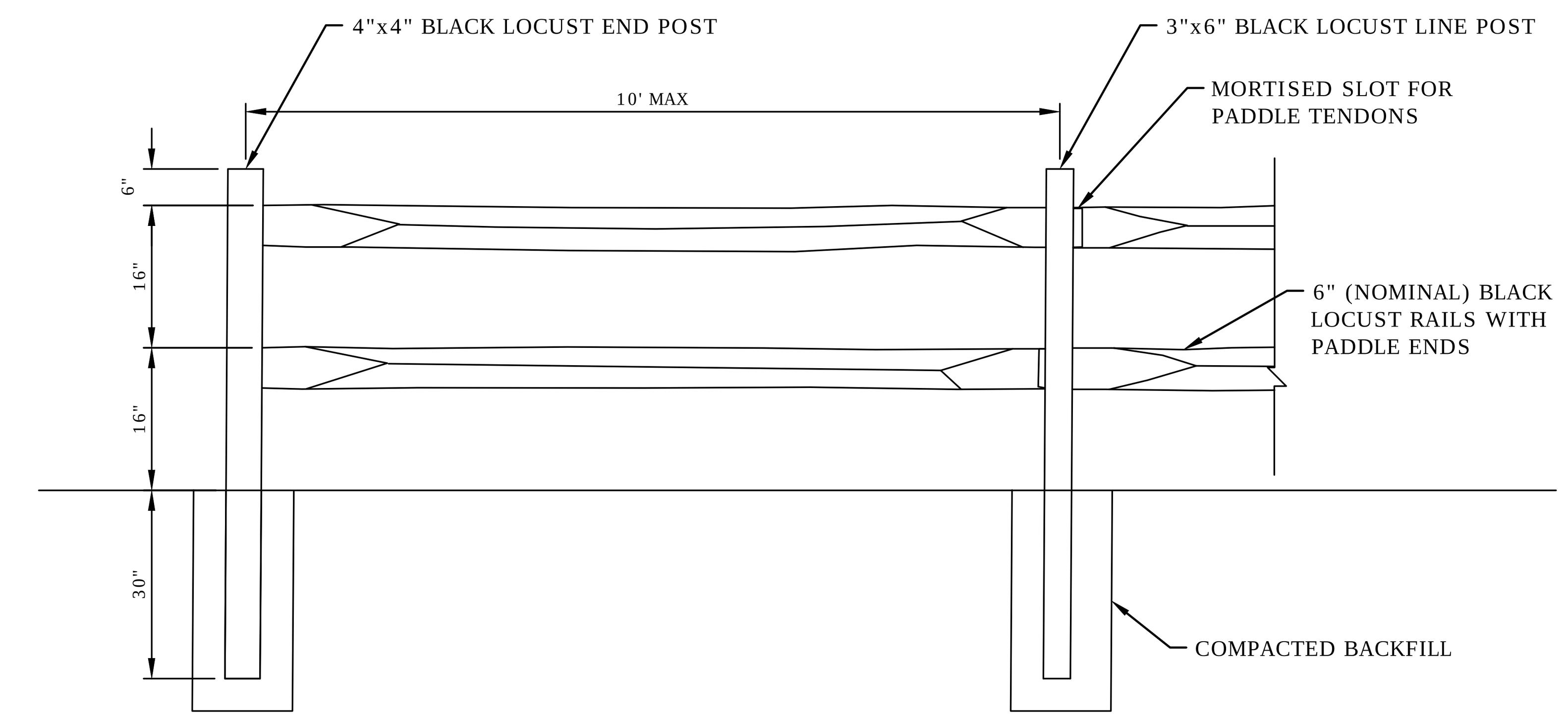
NOTES:

1. POST AND OFFSET BRACKETS TO BE FABRICATED FROM W6x9.
2. POST AND BRACKET HOLES TO BE 3/4" DIAMETER.
3. BACK-UP PLATE TO BE USED ON POSTS WHERE NO SPLICE OCCURS.
4. FABRICATION DIMENSIONS ALSO APPLY TO "C" POSTS AND BRACKETS.
5. MAXIMUM POST SPACING IS 6'-3" CENTER TO CENTER.
6. WHEN THE MAXIMUM POST SPACING IS EXCEEDED, NEST UP GUARDRAIL WITH 25' RAIL SEGMENT. MAXIMUM SPIN IS 12'-6" CENTER TO CENTER.
7. PROVIDE A TL2 RATED TERMINAL END SECTION AT EACH W RAIL TERMINUS.

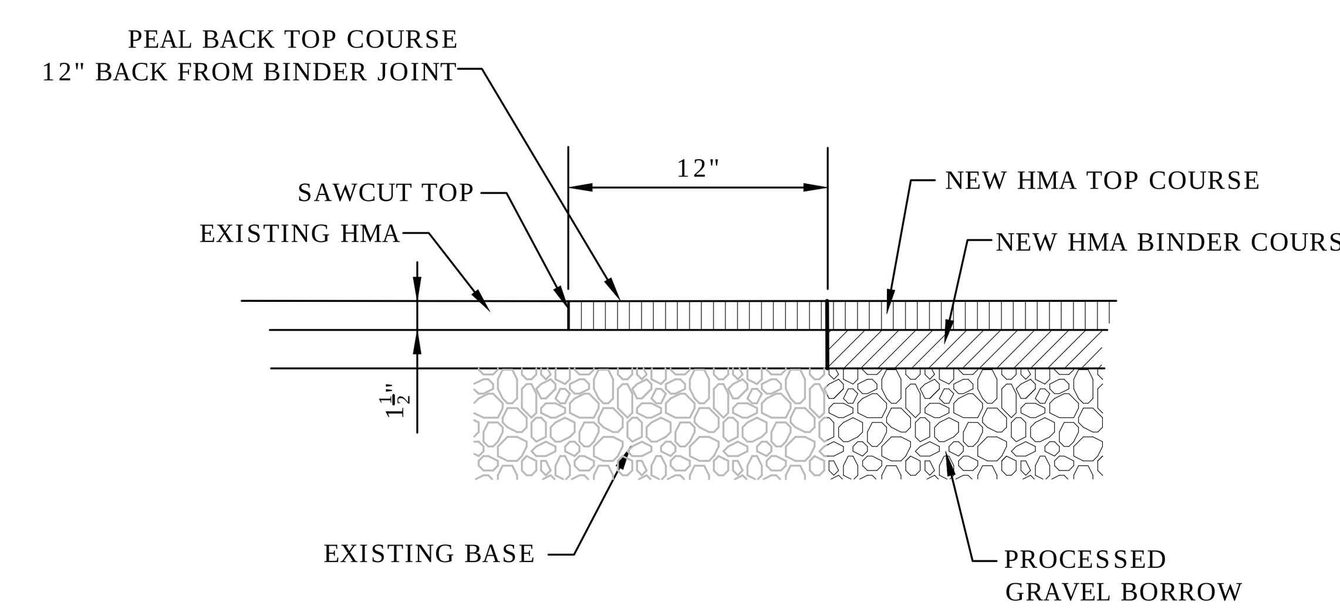
STEEL BEAM HIGHWAY GUARD W RAIL
NO SCALE



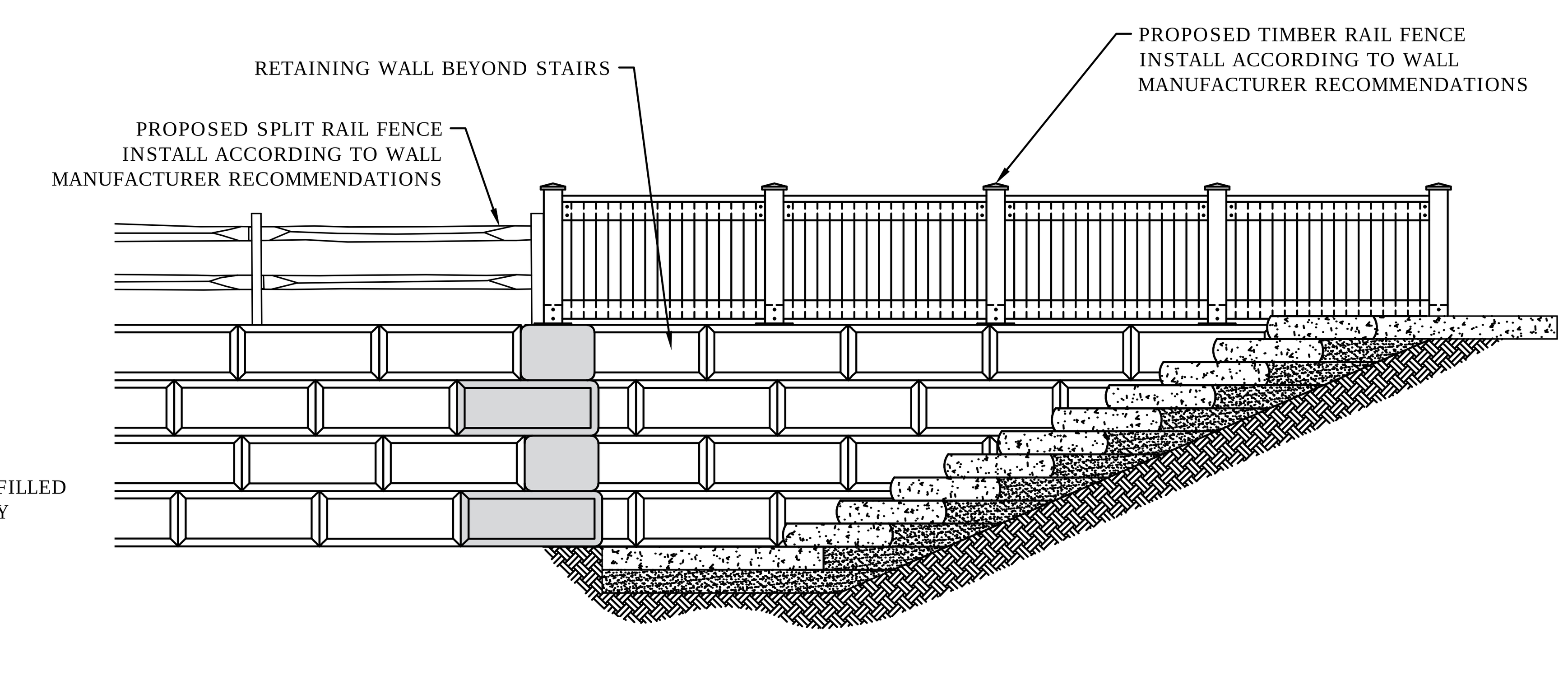
TIMBER RAILING
NO SCALE



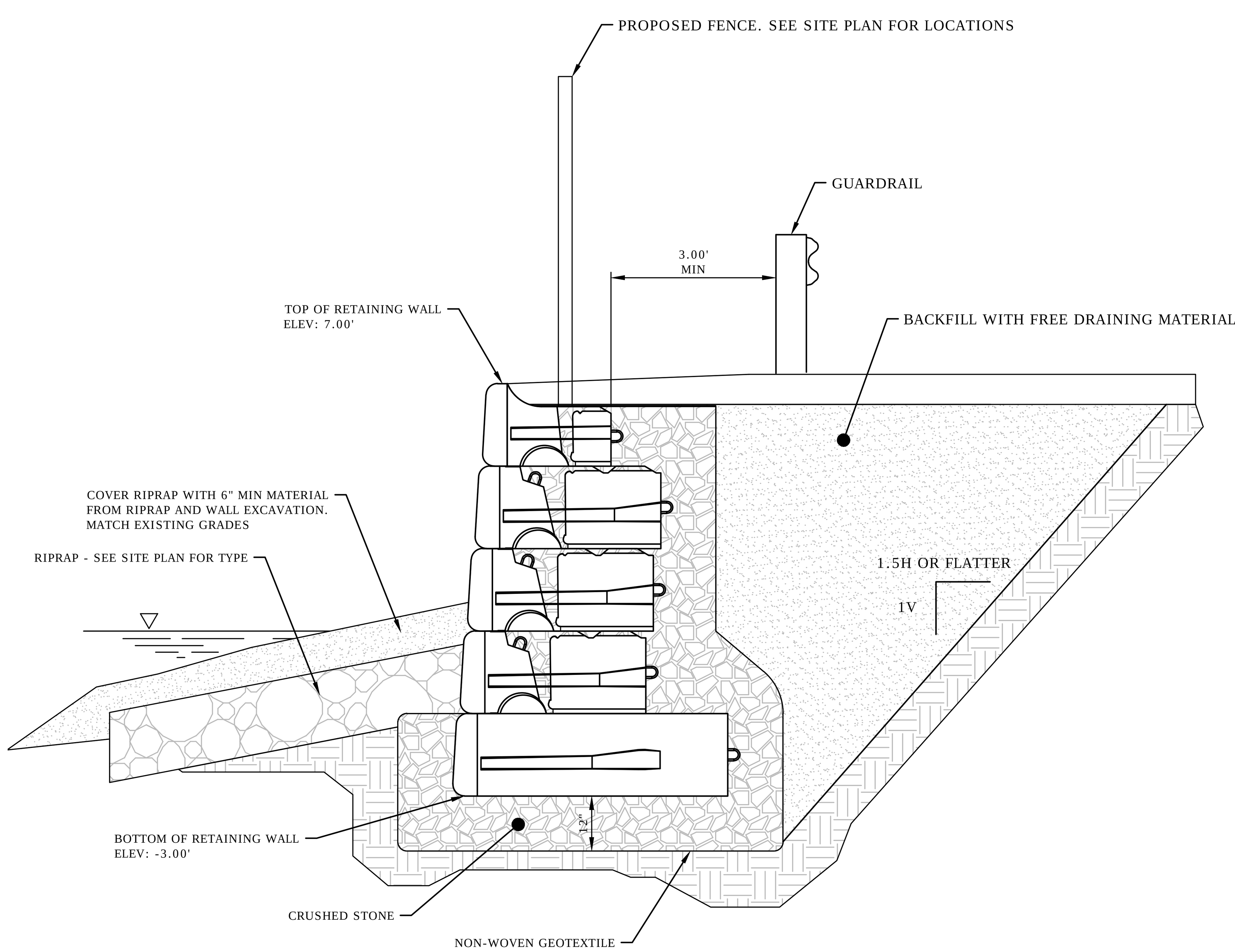
SPLIT RAIL FENCE
NO SCALE



PARKING LOT PAVEMENT REPAIR DETAIL
NO SCALE



SECTION A-A



GRAVITY BLOCK WALL
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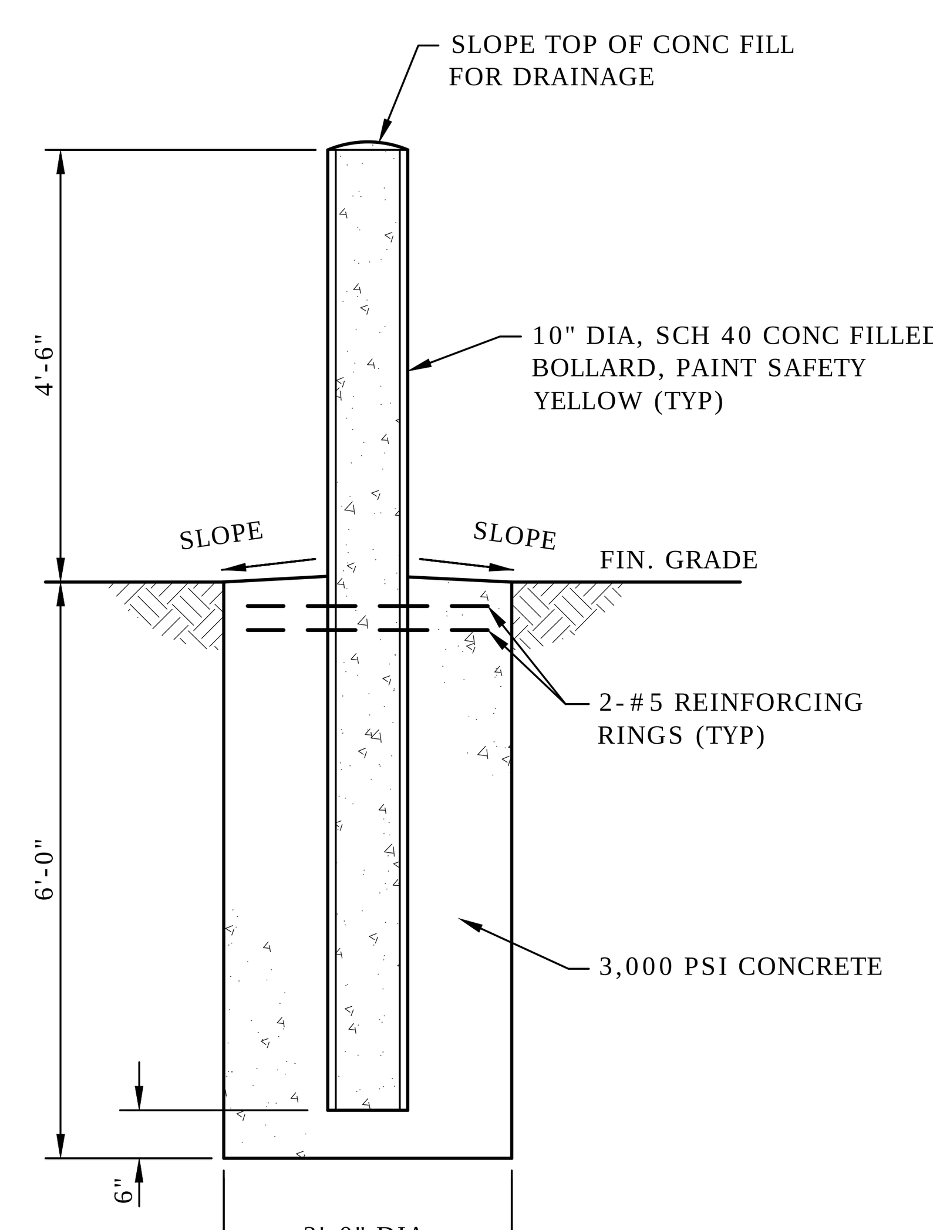
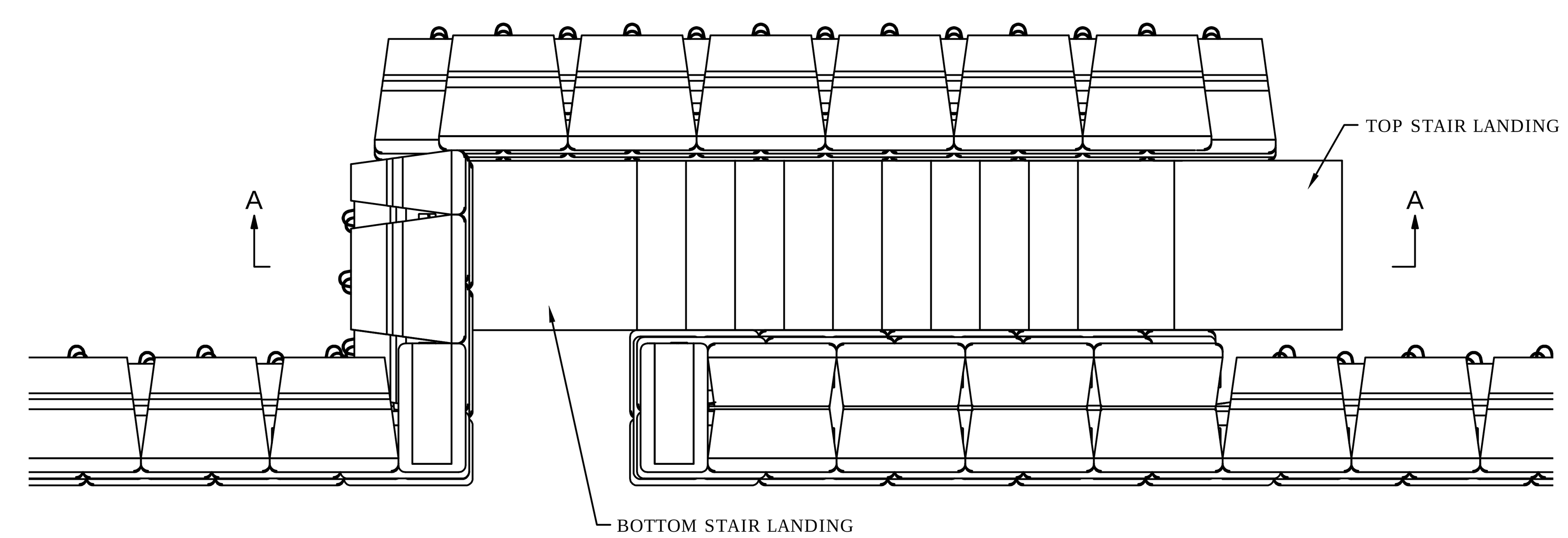


10" DIAMETER
STEEL BOLLARD
NO SCALE



PLAN

STAIR ACCESS
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POND
RESTORATION

Central Street
to Knight Circle

Manchester
-by-the-Sea, MA

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CONSTRUCTION DETAILS

SCALE: AS NOTED

C-502

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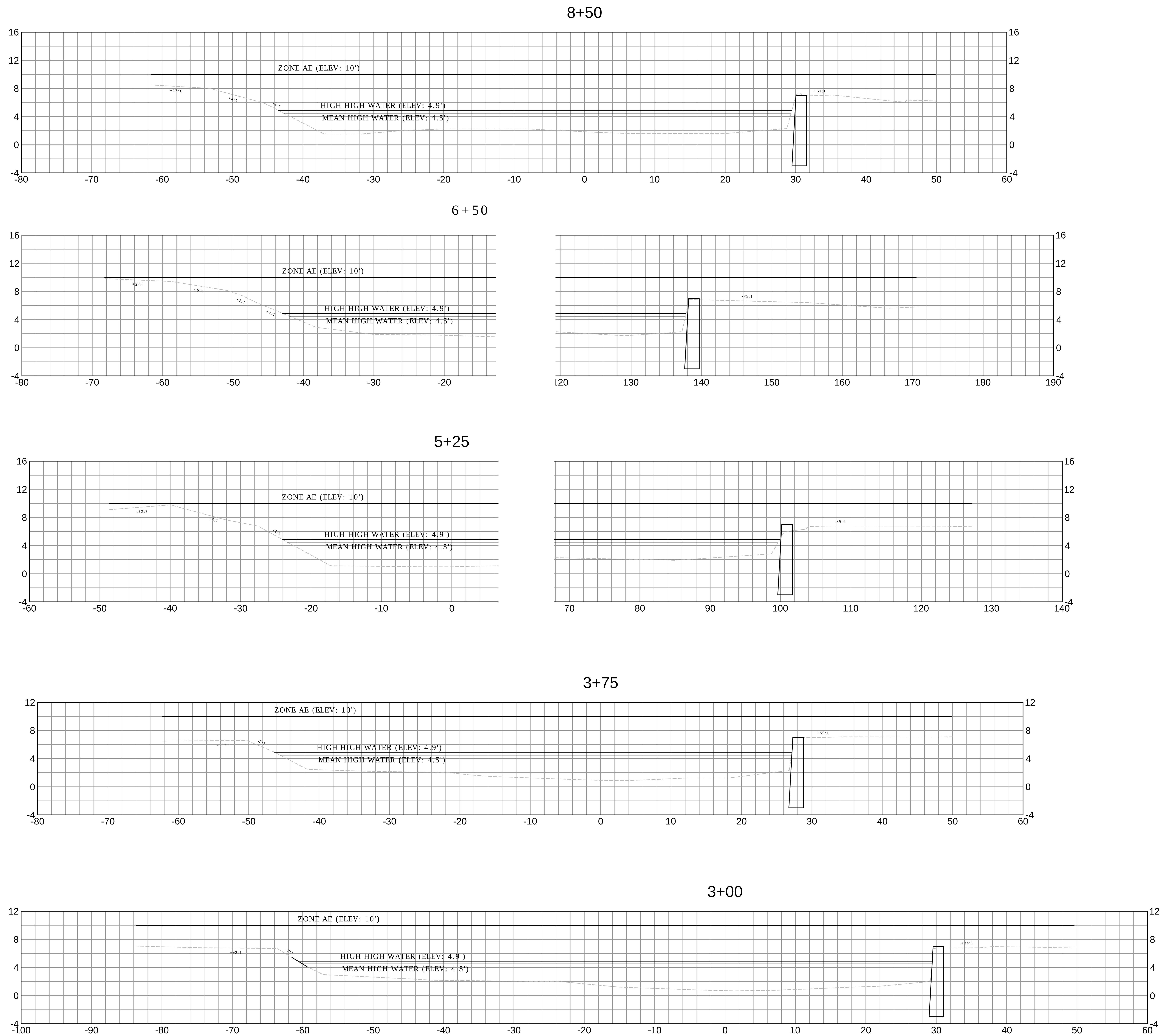
APPROVED:	GCB

SITE PLAN

SCALE: 1" = 30'

C-01



SCALE IN FEET
0 30' 60'
GRAPHIC SCALE

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DATE:	2018/01
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SITE PLAN

SCALE: 1" = 30'

C-01

Last Saved: 5/14/2019
Plotted On:May 14, 2019-1:10pm By: DWBradshaw
Tighe & Bond, Inc. C:\Users\DWBradshaw\appdata\local\temp\AcPublish_3324\M1476-012_Design.dwg

APPENDIX D

Task 3: Sediment Characterization and Flushing Studies - Sawmill Brook Flood Mitigation and Restoration Project

TO: Mary Reilly, Manchester-by-the-Sea Grants Administrator

FROM: Gabrielle Belfit, CFM; Gary Hedman, LSP; David Azinheira, CFM, P.E.

COPY: David A. Murphy, P.E.

DATE: June 18, 2018

1 Introduction

This memorandum describes the field methods, data analysis, and recommendations for sediment management under Task 3 "Sediment Characterization and Sediment Transport for the Sawmill Brook Tide Gate Removal and Restoration Feasibility Study". The memo includes a discussion of the sediment depth profiling, sediment physical and chemical characteristics, sediment sources, sediment transport modeling to evaluate the consequences of the Central Street Bridge tide gate removal, and recommendations for sediment management during the restoration of Central Pond and Lower Sawmill Brook.

Georgeann Keer, Division of Ecological Restoration (DER) and Eric Hutchins, NOAA Restoration Center (NOAA) served as technical advisors for this project. The technical advisors reviewed the field methodology providing helpful suggestions to refine the approach, were onsite during the initial sediment depth profile assessment and reviewed draft and final deliverables.

2 Sediment Characterization

2.1 Sediment Depth Profiling

Sediment profiling was conducted in the Central Pond portion of the project area to develop a baseline assessment of sediment depth. A total of nine sediment depth profiles were completed on November 28, 2017 and January 23, 2018, in the same location as the existing conditions plan surveyed cross sections shown in **Figure 1**. Sediment depths were collected by manually advancing a six-foot-long, half inch diameter steel probe to refusal, and recording the measurement. Sediment depths were profiled every 10 feet across each cross section and are summarized in Appendix A, along with sediment profile cross sections, depicted with the existing conditions survey cross section profile.

The sediment depth profiling of Central Pond indicated that accumulations of fine grained sediment and organic muck range from less than one foot to greater than six feet in depth, with the thickest areas of sediment located at Transect 6 and Transect 10. Sediment thickness along these transects was significantly variable, transitioning from approximately two feet to greater than six feet over the course of one profile interval (10 feet). **Inset 1** shows the sediment profiles for Transect 10, stretching out across the widest point of Central Pond. Deposition of sediment in Central Pond is the result of several contributing factors, most notably the dissipation of flow velocity when the Central Street tide gate is closed, impounding water across the Central Pond area. Sources of sediment include streambank erosion within and upstream of Central Pond, and untreated stormwater runoff from the surrounding areas.

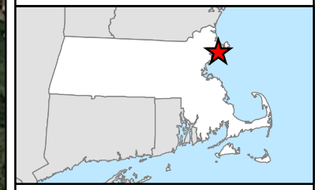
ORTHOPHOTOGRAPH SITE PLAN

LEGEND

Figure 1

Sediment Profiles Transect Locations

LOCUS MAP



N
W E
S

0 50 100
Feet

1 inch equals 75 feet

NOTES

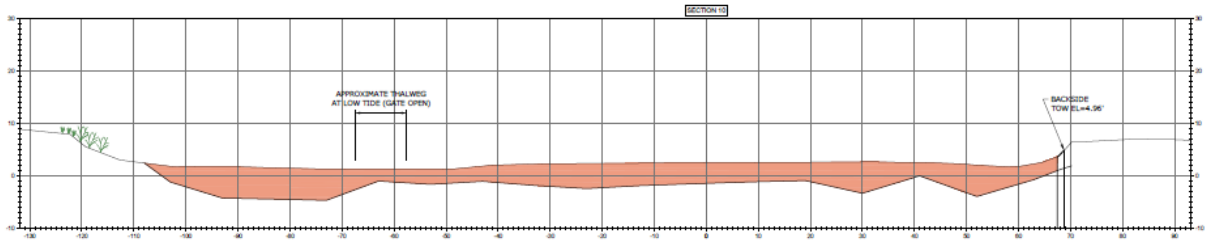
Transect locations are approximate on this figure.

Sawmill Brook Area
Manchester By the Sea, Massachusetts

January 2018

Tighe&Bond
Engineers | Environmental Specialists

G:\GIS\MA\ManchesterMA\avproj\Ortho_SawmillBrook_11x17.mxd Date Saved: 9/29/2017 User: JSM



Inset 1: Sediment Profile at Transect 10

Areas upstream and downstream of Central Pond are subject to higher stream flow velocities, and were observed to have limited areas of finer grained sediment (i.e. coarse sand) deposits. Sediment depth profiling was not conducted in these areas as the stream channel bottoms are comprised primarily of rock, gravel, and cobble that could not be penetrated by the manual probe.

The volume of sediment present in Central Pond was calculated using CAD area geometry provided by the survey elevation of the pond bathymetry and depth profiling, similar to the method used for determining cut and fill volumes. Based on data collected to date, approximately 5,350 cubic yards of sediment are present within the Central Pond portion of the project area, between Transect 4 (downstream) and Transect 13.

Photo 1: Conducting the sediment depth survey at Transect 11 (January 23, 2018).

2.2 Sediment Quality Analysis

Based on the data collected during the sediment depth profiling, visual observations of areas upstream and downstream of Central Pond, and potential restoration alternatives identified by project stakeholders, Tighe & Bond conducted a limited assessment of sediment quality in the Central Pond portion of the project area. Sediment sampling locations were designated based on the premise that the preferred restoration alternative would minimize mechanical dredging of sediment deposits within Central Pond and instead allow for natural transport of sediment through restoration of unimpeded flow conditions.

On January 23, 2018, Tighe & Bond collected three sediment samples from shallow sediment in Central Pond (Upstream, Downstream, and Pond). Samples were collected at low tide with the Central Street tide gate open to allow for access. These conditions also allowed for the identification of the current course of water flow through the Central Pond area at low tide. Two of the sediment samples (Upstream and Downstream) were collected from the center thalweg of the observed course of water flow. The third sediment sample ("Pond") was collected from the area of sediment that has accumulated in the eastern portion of Central Pond that is exposed during low tide when the Central Street tide gate remains open. The stream channel and sediment sampling locations are shown on **Figure 2.**

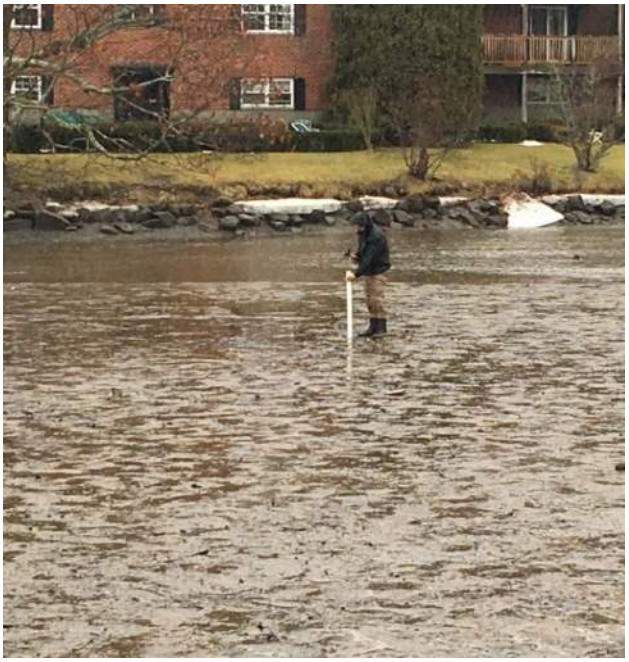


Photo 2: Sediment sample collection at Transect 12 (January 23, 2018).

In each of the sample locations, a dedicated, disposable six-foot length of two-inch diameter PVC tubing was manually advanced approximately three feet into the sediment with a rubber mallet. The top of the core tube was then capped with a rubber expansion plug and extracted, and recovered sediment was collected for compositing / sampling[1]. In order to collect sufficient sample volume, two to three cores were collected at each of the locations.

Sediment samples were placed in appropriate sample containers and submitted to ESS Laboratory, Cranston, Rhode Island for laboratory analysis of chemical constituents required under Massachusetts Department of Environmental Protection (MassDEP) 401 Water Quality Certification (310 CMR 9.07), and MassDEP Policy COMM 94-007, which regulates the reuse of sediment at Massachusetts landfills. The sediment sampling activities conducted during this feasibility evaluation were limited in scope. Additional sediment sampling would be necessary to support a 410 WQC permit application in support of the selected project design / alternative.

[1] US EPA. (2014). *Sediment Sampling Operating Procedures- SESDPROC-200-R3.* USEPA.

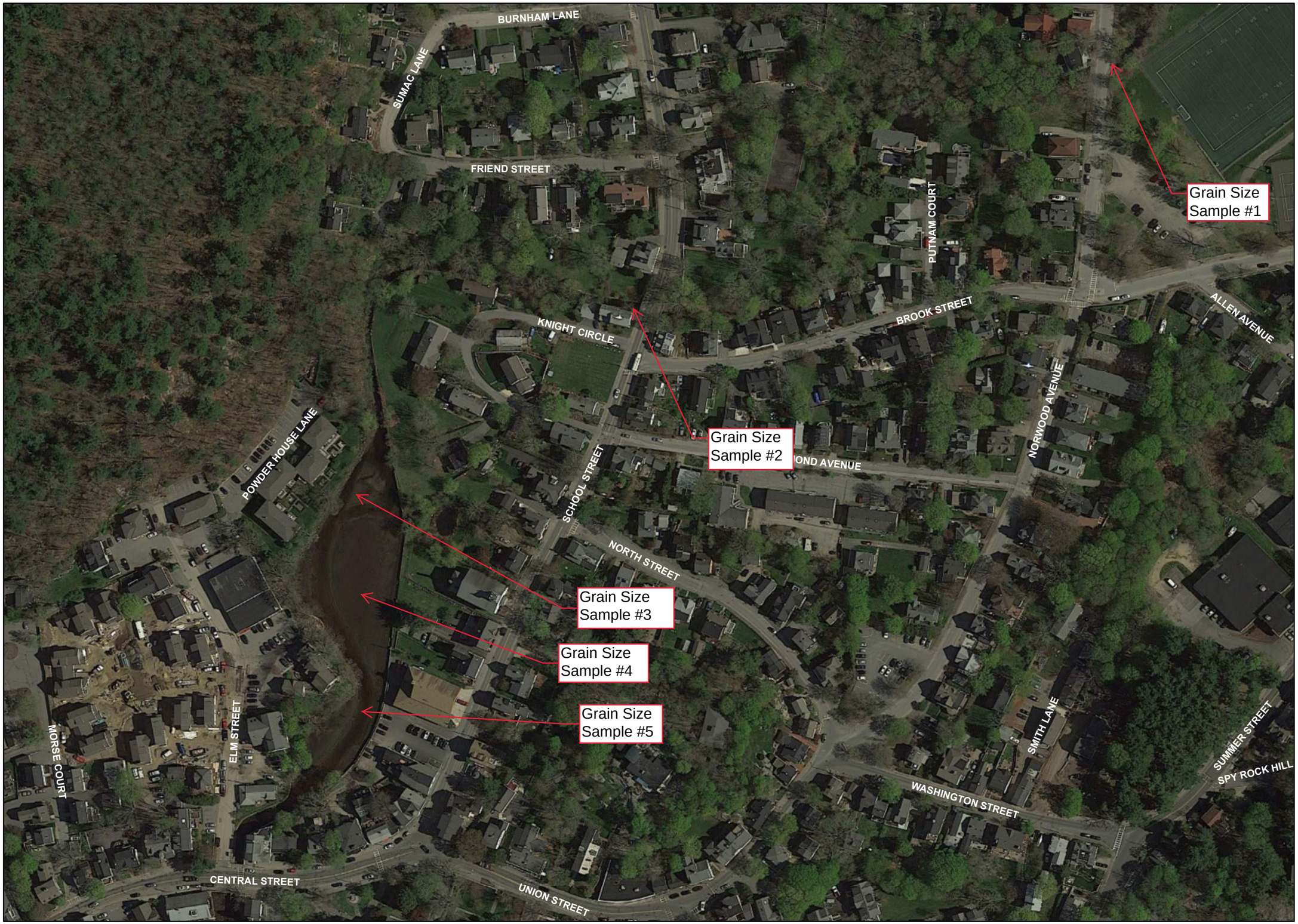
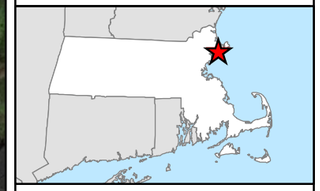


Figure 2

Sediment Sample Locations

LOCUS MAP



N
W E
S

0 50 100
Feet

1 inch equals 150 feet

NOTES

Sawmill Brook Area
Manchester By the Sea,
Massachusetts

January 2018

Tighe&Bond
Engineers | Environmental Specialists

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Sediment samples were analyzed for:

- Extractable petroleum hydrocarbons (EPH) with polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs) – National Oceanic and Atmospheric Administration (NOAA) 18 Congeners;
- Volatile organic compounds (VOCs) by Environmental Protection Agency (EPA) method 8270 SIM;
- Total organic carbon (TOC) by EPA Method 9060;
- Total petroleum hydrocarbons (TPH) by Method 8100 M;
- Resource Conservation and Recovery Act (RCRA) 8 metals
- Percent Moisture / Percent Solids by EPA Method 2540G;
- Grain size distribution by American Society for Testing and Materials (ASTM) D422.

As summarized Table 1, laboratory analysis of the sediment samples indicated the presence of low levels of metals, PAHs, and PCBs.

Table 1 - Sediment Results Summary
Central Pond
Manchester-by-the-Sea, MA

Analytes	No. Samples Detected	MA RCS-1	TECs	Sawmill Brook Maximum Concentration	NAE -2012-322
Metals (mg/kg)					
Arsenic	3 of 3	20	33	13.1	10
Cadmium	3 of 3	70	5	0.67	1.4
Chromium	3 of 3	100	110	15.3	**250**
Copper	3 of 3	1,000	150	23.9	87
Lead	3 of 3	200	130	**167**	110
Mercury	3 of 3	20	0.18	**0.441**	**0.68**
Nickel	3 of 3	600	49	8.5	19
Zinc	3 of 3	1,000	460	129.0	140
Total PCB Congeners (mg/kg)					
PCBs	3 of 3	1	0.06	0.00756	**0.15**
PAHs (mg/kg)					
Benzo(a)anthracene	3 of 3	7	0.110	**2.52**	0.88
Benzo(a)pyrene	3 of 3	2	0.150	**2.10**	0.69
Benzo(b)fluoranthene	3 of 3	7	NE	2.67	0.59
Benzo(g,h,i)perylene	3 of 3	1,000	NE	1.19	0.54
Chrysene	3 of 3	70	0.170	**2.27**	0.62
Fluoranthene	3 of 3	1,000	0.420	**6.23**	1.70
Indeno(1,2,3-cd)pyrene	3 of 3	7	NE	1.44	0.52
Phenanthrene	3 of 3	10	0.200	**1.26**	0.66
Pyrene	3 of 3	1,000	0.200	**4.50**	1.50

Notes:
Mg/kg – milligrams per kilogram
NAE-2012-322 – Bulk Chemical Analysis – Town of Manchester, Manchester Harbor – Tier III Sediment Evaluation
Total PCB congeners equals sum of congener numbers 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138, 153, 170, 180, 187, 195, 206, and 206.
Bold font denotes the listed concentration exceeds the MA RCS-1 or TEC criteria.
TEC – Threshold effects concentrations – Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan (1996).

Sediment sampling results are compared to two criteria in Table 1:

- MassDEP Reportable Concentrations for Soil (RCS-1), as established in 310 CMR 40.000, the Massachusetts Contingency Plan (MCP).
- Threshold Effects Concentrations (TECs), as established in *Revised Sediment Screening Values*, update to Section 9.0 of *Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan (1996).*

Sediment sampling results are compared to the RCS-1 values to determine if upland reuse of sediment is an alternative, as dredged material, including sediment, placed on or in the land at an upland location is subject to the release notification requirements and thresholds of 310 CMR 40.0300 and 40.1600 for soil, unless such placement is in accordance with the provisions of 310 CMR 40.0317(10) and 314 CMR 9.07 (4), (6), (9), (10), or (11).

With the exception of benzo(a)pyrene (2.10 mg/kg), lead (167 mg/kg) in the Downstream sediment sample, the detected concentrations of metals, PCBS, and PAH concentrations in the sediment samples collected in support of this feasibility evaluation were below the MassDEP Reportable Concentration (RCS-1) values in 310 CMR 40.000.

TECs are sediment screening values used to evaluate the potential risk of harm to the environment from sediment contamination during a Stage I Ecological Risk assessment conducted in accordance with the MCP. If each detected sediment contaminant concentration is equal to or less than the sediment screening criterion for the contaminant, no further evaluation of the risk of harm from the sediment is required. The current screening criteria for metals are based on the TECs that have been developed as consensus-based sediment quality guidelines by MacDonald et al. (2000).

The maximum concentration of total PCBs is below the RCS-1 values and TECs. In sediment samples collected from the Downstream and Pond sediment samples, lead, mercury, and several PAHs were detected at concentrations above the established TEC.

The grain size distribution results indicated that the Central Pond sediment consists of dark brown, silty sand (Sed-1, 2 and 3). Additional samples were taken at School Street and the Norwood Avenue Culvert. Sediment deposits here were limited to areas behind boulders and woody debris. Sediment was defined as poorly graded sand at Norwood Avenue and poorly graded gravel with sand at School Street. The grain size analysis is provided in Appendix C.

The results of the sediment sampling were confirmatory of visual observations. Central Pond is a shallow impounded system, with variable depth fine silt deposits overlaying bedrock (Cape Ann Granite). Sediment analysis identified several metals and PAHs that were above MassDEP the respective RCS-1 and TEC Screening Values.

2.3 Sediment Management Considerations

In accordance with 314 CMR 9.07(9) of the 401 Water Quality Certification regulations, upland placement of dredged material as fill or for other reuse activities is allowable, provided the concentrations of oil and hazardous material in the dredged material are less than the Method 1 S-1 soil standards as specified in 310 CMR 40.0975: *Identification of Applicable Soil Standards in Method 1*. The Method 1 S-1 standards consider the potential risk of harm to humans resulting from direct exposure to contaminants present in soil, and are applicable as the areas where upland reuse of sediment is feasible would be potentially accessible.

314 CMR 9.07(9) places additional criteria for the upland reuse of sediment, requiring that that the subject material is not otherwise a hazardous waste and will not adversely affect an existing public or private potable water supply, provided that:

The material is not reused at a location(s) where:

- The nature of the contaminants (evaluated as chemical families such as metals, PAHs, petroleum hydrocarbons, halogenated volatile organic compounds, halogenated pesticides, PCBs, and dioxin-like compounds) in the dredged material is different than that at the receiving location; and
- the concentration(s) of oil and hazardous materials in the soil at the receiving location are significantly lower than the levels of those oil and hazardous materials present in the material;

In accordance with 314 CMR 9.07(9), it is necessary to demonstrate that the receiving locations do not contain contaminant concentrations that are "significantly lower" than the levels present in the dredge sediment. In the case of Central Pond, since there were detections of benzo(a)pyrene above the MCP Method 1 soil standard in sediment samples collected from the Downstream location, upland reuse of sediment from this area would not be permitted in accordance with 314 CMR 9.07(9). We anticipate that the reuse of sediment from other areas in the project site for salt-marsh restoration would be acceptable, since contaminant levels would potentially be below the Method 1 S1 soil standards, and consistent with the concentrations identified in the "Pond" sample, collected from the area of accumulated sediment in the eastern portion of Central Pond that is exposed during low tide when the Central Street tide gate remains open. Any reuse of sediment in upland areas is subject to review and approval by MassDEP through the 401 Water Quality Certification permitting process.

While dredging and upland reuse of sediment within the project area could be evaluated as a feasible component to the overall project restoration plan. Tighe & Bonds assessment of sediment in the project area was conducted based on the premise that the preferred restoration alternative would minimize mechanical dredging of sediment deposits within Central Pond, and instead allow for natural transport of sediment through restoration of unimpeded flow conditions.

Historically, the flow of water through Central Pond has been restricted by the closed tide gate for significant portions of the year. It is important to note that the tide gate has been routinely opened during the spring to allow for fish passage, and also during the winter and spring seasons to alleviate upstream flooding during periods of peak runoff. During these periods of unrestricted flow conditions, sediment transport is occurring, with the ultimate discharge location in Central Harbor.

In addition to our evaluation of the potential for upland reuse of sediment, Tighe & Bond reviewed analytical data collected by CLE Engineering, of Marion, Massachusetts, in 2012 in support of a harbor dredging project (NAE-2012-322 – Bulk Chemical Analysis – Town of Manchester, Manchester Harbor – Tier III Sediment Evaluation), the results of which are summarized in Table 1. A complete copy of the Tier II Sediment Evaluation laboratory analytical report is included in Appendix B. Our review indicates that, overall, the nature of sediment quality upstream of the Central Street tide gate is not significantly different with regard to the presence of heavy metals, notably lead and mercury. Levels of total PCBs were slightly higher in the Central Harbor sediment samples collected by CLE, while levels of PAHs were slightly higher in samples collected by Tighe & Bond upstream of the Central Street tide gate.

Our visual observations, supported by the sediment analysis, confirm the feasibility of upland reuse of sediment from portions of the project area to create salt marsh areas along the banks

of Sawmill Brook. Our review of data collected to date also indicate that the restoration of natural flow conditions and sediment transport from Sawmill Brook into Central Harbor is unlikely to result in a deterioration of conditions with regard to concentrations of contaminants present in the sediment.

2.4 Bathymetry Development

The survey data was used to develop a bathymetric map of the Central Pond surface (Photo 3). The Pond is relatively flat, with a shallow gradient from ranging from 3 feet NAVD88 where Sawmill Brook enters Central Pond to 0.2 feet at the Central Street culvert inlet. Two main "islands" are present at low tide, one triangular feature at the entrance to the pond, and one kidney shaped feature centrally located. The surveyed bathymetry correlates well with orthophotos, considering the contour resolution is only one foot. At low tide, Sawmill Brook

Photo 3- Survey Bathymetry of Central Pond

flows into the widened section of the Pond, and then meanders over the first triangular rise, slowing the flow and causing sediment to drop out. The flow splits about 90% flows to the west and the rest flows along the western wall.

The three areas of elevated sediment have been consistent over the past 18 years. Looking at historic images of the Pond in Google Earth from 2001 to 2017 (Photo 4) there has been

some increase in the areas of visible deposition, but it has remained relatively consistent over the past 10 years.

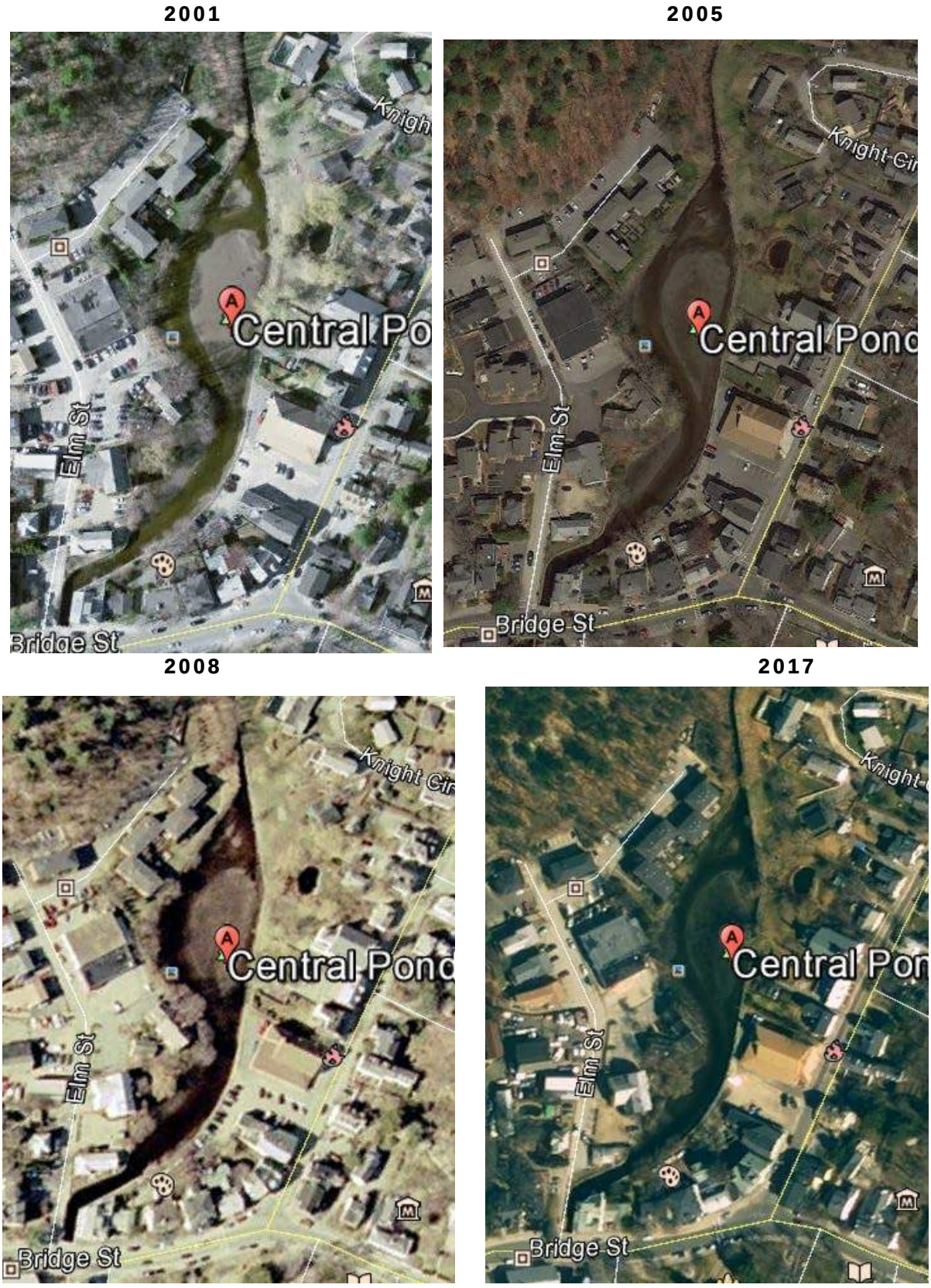


Photo 4: Views of Central Pond 2001-2017

To get better visual approximation of the distribution of sediment, the sediment depth profile data from the transects were linked with the bathymetry to develop a map showing the relative sediment depth throughout the pond (**Figure 3**). Three main areas of sediment deposition are noted in the figure. At the lower extent of the pond, there is an area of deposition just off the shallow shelf, where the stream widens up. In the center, there is a notable area on the eastern shore where there is a shallow bank, and stormwater outfall. A third area to the north is less well defined, there are significant gravel deposits in this location, and it is an area where the stream first hits the pond, and sediment can drop out as the velocity slows.

2.5 Stream Bank Survey

On April 18, staff completed a visual stream bank survey from Central Street to Norwood avenue to identify eroded bank reaches along Sawmill Brook. A photo log of the visual survey is provided in Appendix D. A variety of stream bank erosion control matrials are used along the Brook.

Central Pond Structures (Central Street to Knight's Circle)

This area includes the main area known as Central Pond extending from the Central Street Bridge up to Knights Circle. When the tide gate is closed the pond fluctuates an average of 4.25 to 4.90 feet from low to high tide. When the tide gate is open the depth ranges from 1.01 to 5.04 feet from low to high tide. The survey for Central Pond was conducted at low tide, to gain visual access to the toe of wall, and obtain photos from an in-stream perspective.

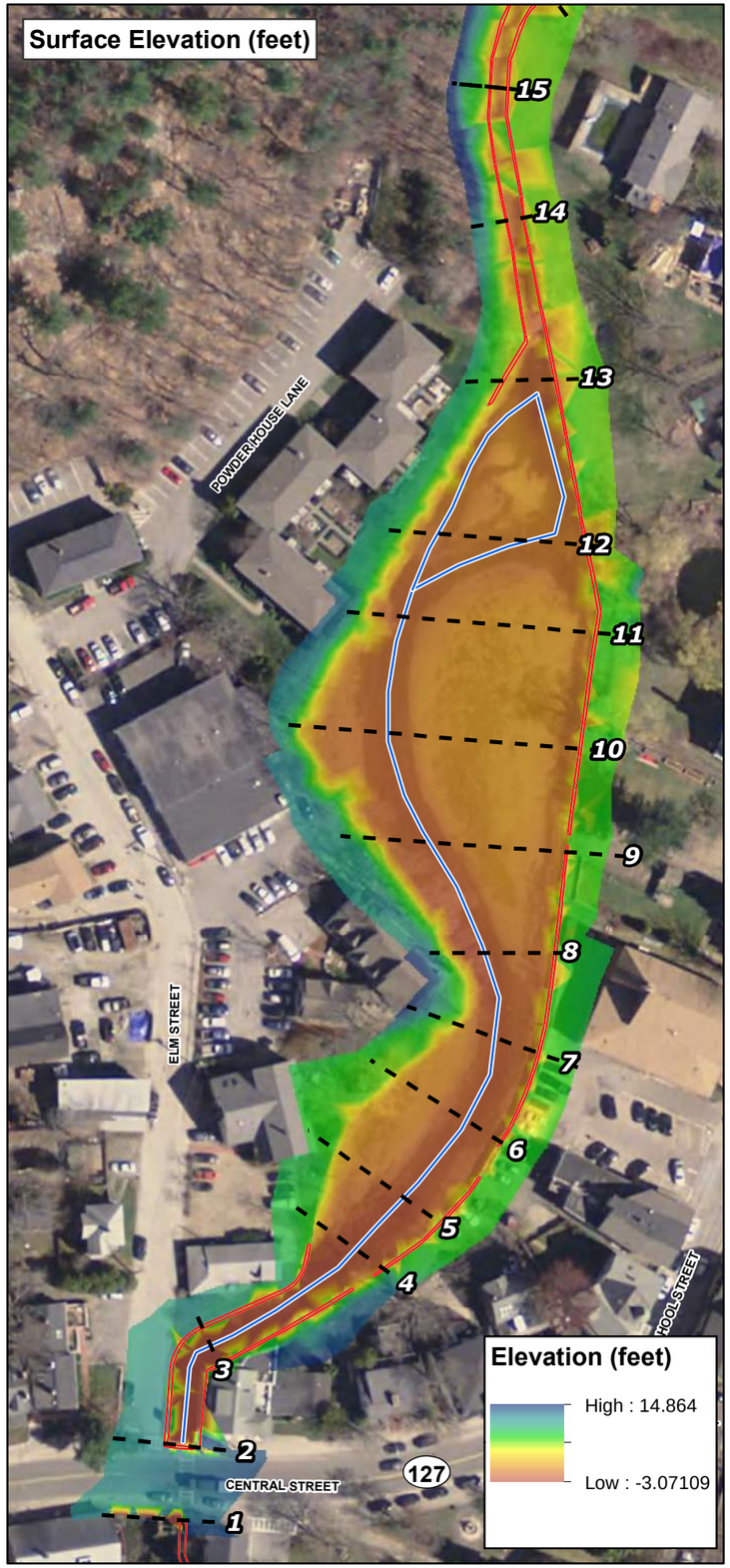
Granite block, poured concrete, brick, field stone and shale revetment and combinations of the above are the dominant structures found around Central Pond. The eastern shoreline is cut sharply into the Pond, with the wall defining the eastern bank boundary. The eastern shoreline was completely lined with wall structures ranging from 3-5 feet in height, with the tallest walls adjacent to Central Street along the channel that paralells Elm Street, and the lowest walls found on the south eastern shoreline, that are predominantly privately owned properties.

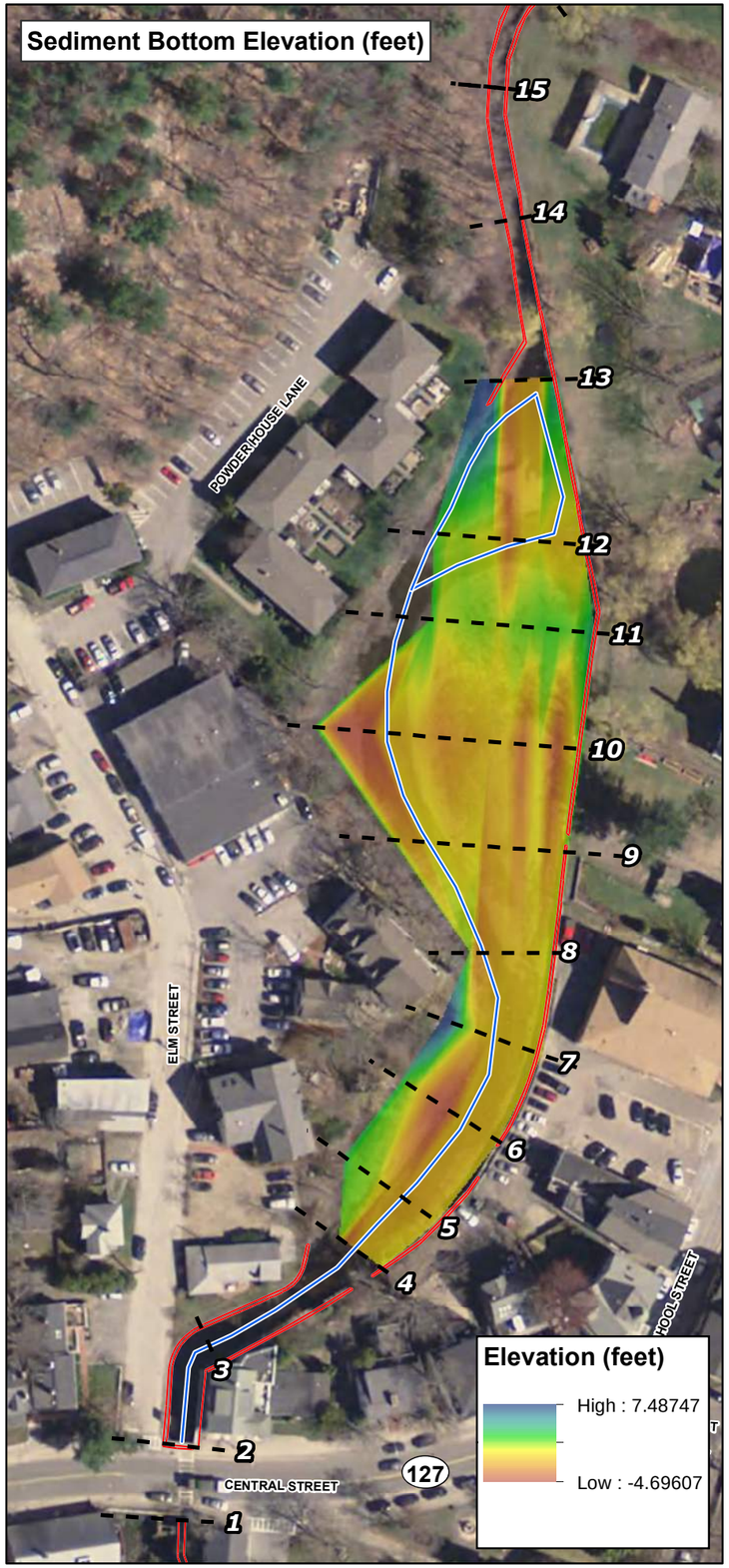
The western shoreline has a more gradual slope, and includes several shoals formed from finer sediments deposited as Sawmill Brook flows under low water flow, gathering in pockets along the shore. Several stormwater discharge outfalls were noted along the western shore that are also a source of sediment. Walls along the western shoreline varied from loose cobbles, revetment, to low fieldstone. The western shoreline is almost entirely under private ownership with the exception of a town-owned parcel on Elm Street .

Appendix D incudes the photos taken during the survey and include a Map Key to show the position and directional orientation of the photo. Photos 1 to 19 depict conditions along Central Pond.

The worst wall conditions were observed in the south-easten section of the Pond (extending from behind 19 Central Street to the Fire Station, where two wall sections have entirely collapsed, and approximately 400 feet is in need of extensive repair. The wall sections above the Fire Station to Knights Circle (approximately 400 feet) have areas that need moderate repairs including replacing cap stones and addressing land subsidence behind the wall.

Sections along the western shore could be improved to prevent continued soil erosion, and could benefit from soft erosion solutions including estabilshing vegetation, contolling public access and potential stormwater outfall improvments. The transition between the wall structure on town owned parcel on Elm Street to the rock rubble on the adjacent privately owned parcel could be improved. This is a high velocity location where the wider channel narrows to the channel above Central Street.





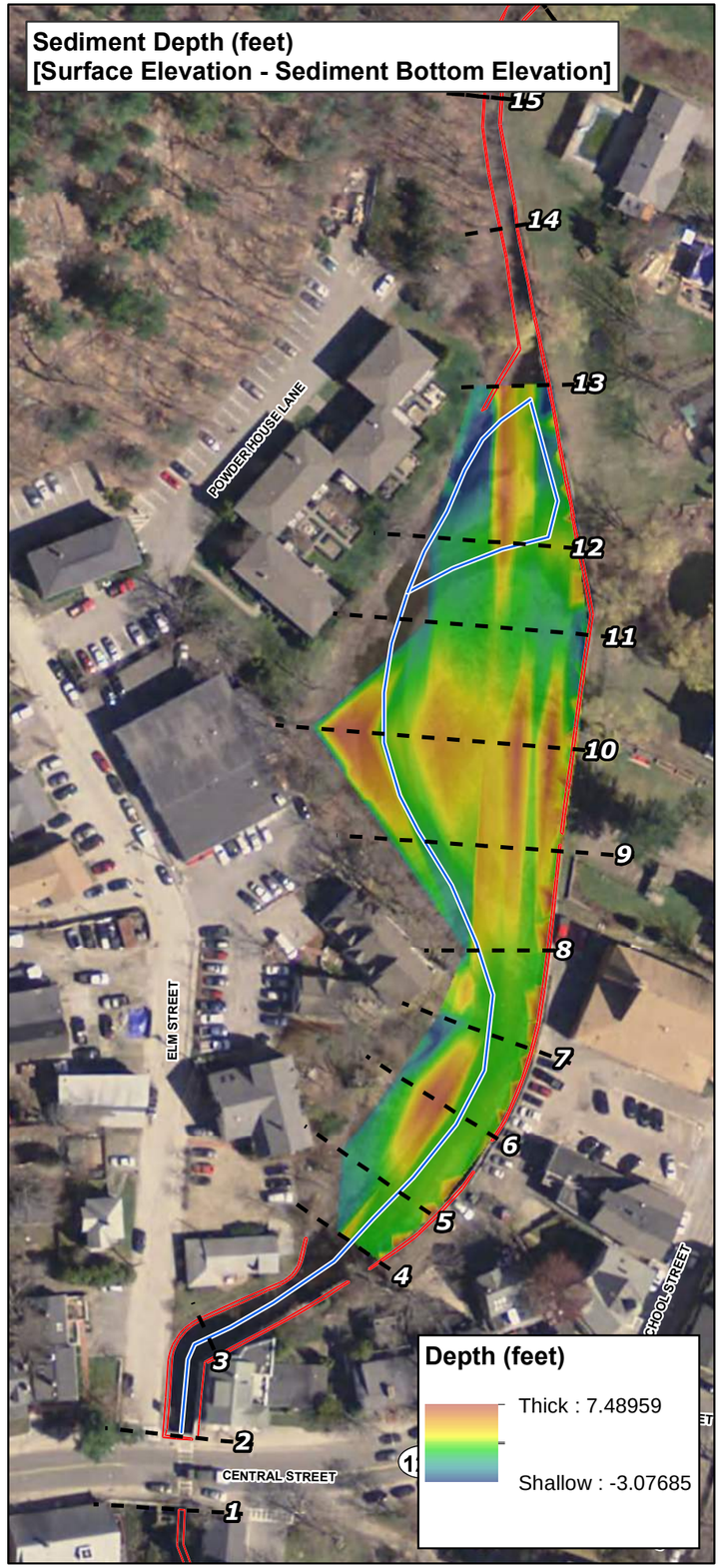


Figure 3

CENTRAL POND BATHYMETRY AND SEDIMENT DISTRIBUTION

LEGEND

- Transects
- Retaining Walls
- Thalwag

LOCUS MAP

N

0 50 100

Feet

1:1,200

NOTES

1. Based on MassGIS Color Orthophotography (2013)

Central Pond and Sawmill Brook
Manchester by the Sea
Massachusetts

April 2018

Tighe&Bond
Engineers | Environmental Specialists

V:\Projects\M\m1476\SawmillBrook_OverviewFigures\SedimentThickness_ManchesterByTheSeaMA_11x17_Final.mxd [Exported By: KJW, 4/17/2018, 5:10:49 PM]

M-1476

Sawmill Brook Structures (Knight's Circle to Norwood Ave)

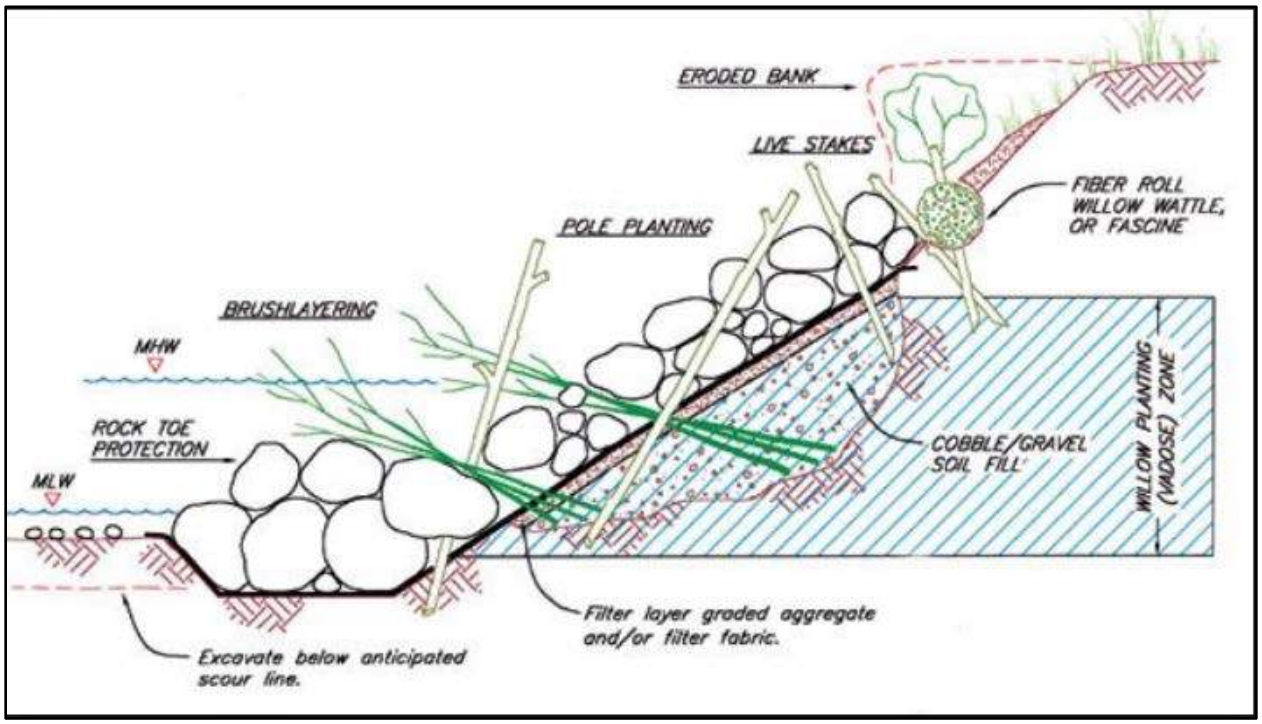
This area includes Sawmill Brook extending from the Knights Circle up to Norwood Avenue. Sawmill Brook is narrow, and predominantly channelized with a variety of stone structures, and occasional areas where wetlands border the stream. The walls vary in height from only a few feet to over 6 feet at Norwood Avenue. The Brook is cobble lined and water depth ranged from less than foot in the fall (typical low flow period) to 3 feet in the spring. The survey was completed under higher water conditions. Wall observations were limited to the upper section.

Granite block, field stone and combinations of the above are the dominant structures found along Sawmill Brook. Poured concrete was used in a few locations.

Appendix D incudes the photos taken during the survey and include a map key to show the position and directional orientation of the photo. Photos 20 to 47 depict conditions along Sawmill Brook.

A number of areas were observed to have deteriorating banks, wall structure collapse and direct outfalls that may contribute to sedimentation issues in Sawmill Brook. Beaver activity was noted at two locations below Norwood Avenue and one location above Norwood Avenue. The impoundment along narrow sections causes upstream water to backup and overtop the banks. In areas where low lying banks were left in a natural vegetated state, there were fewer signs of stream bank erosion. Where property owners had developed and landscaped up to the edge of the streambank, the worst erosion was noted.

Stream bank conditions could be improved with a combination of wall stabilzation repairs, modifying the bank in some locations to lessen the slope and naturalize it with appropriate plantings (Inset 2). Homeowners should be encouraged to plant buffers along the streambank with vegetation that will absorb strormwater runoff from adjacent lawns, and lessen foot traffic along the edge of the bank. Low growing species can be planted to maintain water views.



Inset 2: Bioengineering stream bank erosion control techniques

Source https://www.ernstseed.com/resources/planting-guides/erosion-control-revegetation-planting-guide/

3 Sediment Transport

Tighe & Bond performed a sediment transport analysis of lower Sawmill Brook to characterize sediment transport dynamics and to assess sediment stability within the stream for existing (tide gate open and closed) and proposed conditions.

3.1 Model Development

The analysis was developed using the HEC-RAS hydraulic model developed as part of Task 2: Hydrologic Monitoring and Flushing Studies and described in the Task 2 technical memorandum. The model included the following three geometry scenarios:

1. Existing Conditions with the Tide Gate Closed
2. Existing Conditions with the Tide Gate Open
3. A Proposed Condition with the Tide Gate Removed and Larger Central Street Culvert

The proposed condition improvements include removing the tide gate and replacing the existing Central Street Culvert with an 18-foot wide Conspan arch culvert. The proposed culvert would maintain the existing upstream and downstream invert elevations (-0.2 feet NAVD88, and -4 feet NAVD88, respectively), and provide a constant low chord elevation of 6 feet NAVD88. If the Town decides to replace the Central Street Bridge it is anticipated that the exact geometry of the proposed culvert would vary from the proposed model following a detailed underground utility survey.

The sediment transport analysis was performed using an approximation for the channel-forming discharge, often referred to as the “bankfull flow”. The bankfull flow is on average the 1.5-year frequency storm flow, and was calculated by updating the HEC-HMS model developed as part of the detailed hydrologic analysis performed as part of the February 2016 “Sawmill Brook Culvert and Green Infrastructure Analysis Task 4 Final Report: Evaluation of Locations for Flood Mitigation” prepared by Tighe & Bond. The 24-hour rainfall depth associated with the 1.5-year frequency storm was estimated as 2.99-inch using the Cornell University Northeast Regional Climate Center precipitation data used for the 2016 study. The peak flow computed at Norwood Avenue was 180 cubic feet per second, and the peak flow computed at Central Pond was 200 cubic feet per second.

The HEC-RAS sediment transport analysis tool requires grain size distributions to characterize existing sediment within a stream channel. The sediment sample testing, described in Section 2, included the development of grain size distributions (provided in Appendix C) that were used for HEC-RAS sediment transport modeling. These grain size distributions provide the percent of particles (by weight) that pass various size sampling sieves. The smallest sieve used for this type of analysis is the No. 200 sieve, with 0.075 millimeter openings. The sediment passing the No. 200 sieve are silt and clay sized particles, that are often referred to as “fine-grained sediment” for engineering purposes. The proportion of fine-grained sediment in streams has a substantial impact on degradation (removal of sediment) and aggregation (addition of sediment) because fine-grained sediment mobilizes at lower velocities than larger sediment. The amount of fine-grained soils observed from the sediment samples along Sawmill Brook from Norwood Avenue to Central Avenue are describe below:

- Sediment samples at School Street and Norwood Ave were composed of less than 1% fine-grained sediment.
- Samples in the stream channel upstream of Central Pond were composed of approximately 40% fine-grained sediment.

- Samples within Central Pond were composed of over 50% fine-grained sediment.
- Samples in the stream channel downstream of Central Pond were composed of approximately 25% fine-grained sediment.

The sediment transport analysis was performed using a quasi-unsteady flow, the Ackers-White Transport Function, the Thomas (Ex5) Sorting Method, and the Ruby Fall Velocity Method. Detailed descriptions of these methods are available in the HEC-RAS User's Manual[2]. The analysis was performed for existing conditions with the tide gate closed, existing conditions with the tide gate open, and for proposed conditions. To provide a reasonable range of tailwater conditions the models were run with both Mean Lower Low Water (MLLW) and Mean Higher High Water (MHHW) downstream boundary conditions. The modeled MHHW elevation was 4.77 feet NAVD88 and the MLLW elevation was -5.51 feet NAVD88 based on the NOAA Long Term Tide Water Level Monitoring Station ID: 8443970. Realistically, some variation in tides would be anticipated during a storm event; however, by looking at MHHW and MLLW a range of reasonable outcomes can be considered.

3.2 Evaluation of Sediment Transport Dynamics

The results of the sediment transport analysis for Sawmill Brook are shown in **Figures 4, 5 and 6**. Aggradation (soil deposition) of fine sediments is anticipated within Central Pond if a bankfull event occurred during MHHW for existing conditions (tide gate closed and open) and proposed conditions. This aggradation is caused by a decrease in velocity as water flows from Sawmill Brook upstream of Central Pond to the tidal backwater area at Central Pond during MHHW. For existing conditions when the tide gate is closed, aggradation would also be anticipated if a bankfull event occurred during MLLW, because the tide gate crest elevation would control the minimum water surface elevation within Central Pond. For existing conditions with the tide gate open and for proposed conditions, it is anticipated that degradation (soil loss) would occur if a bankfull event occurred during MLLW toward the downstream limit of Central Pond and the downstream channel. This degradation would remove previously settled fine-grained sediment due to higher velocities associated with flow freely leaving the pond during low tide without tidal backwater.

The process of aggradation of fine particles for a bankfull event during high tide when velocities are backwater limited and degradation of fine particles for a bankfull event during low tides when higher exit velocities are obtained more closely resemble natural sediment dynamics in tidal systems. It is anticipated that actual bankfull flood events would likely either occur during:

1. A range of tides limiting the extent of aggradation and degradation, or,
2. Occur during a storm surge, resulting in a higher probability for aggregation.

The existing tide gate when closed has created a condition where fine sediment settle during large flow events during both low and high tides, instead of allowing sediment to travel downstream during low tides as would have occurred if the tide gate was not in place. The existing system is in disequilibrium while the prevalence of fine-grained sediment within Central Pond is also indicative of a supply of fine sediment within the watershed. The proposed culvert replacement and tide gate removal at Central Street would restore a tidal ebb-and-flow similar to existing conditions observed during periods when the tide gate is left

[2] US Army Corps of Engineers. (2016). *HEC-RAS River Analysis System User's Manual Version 5.0*. Hydrologic Engineering Center.

Figure 4

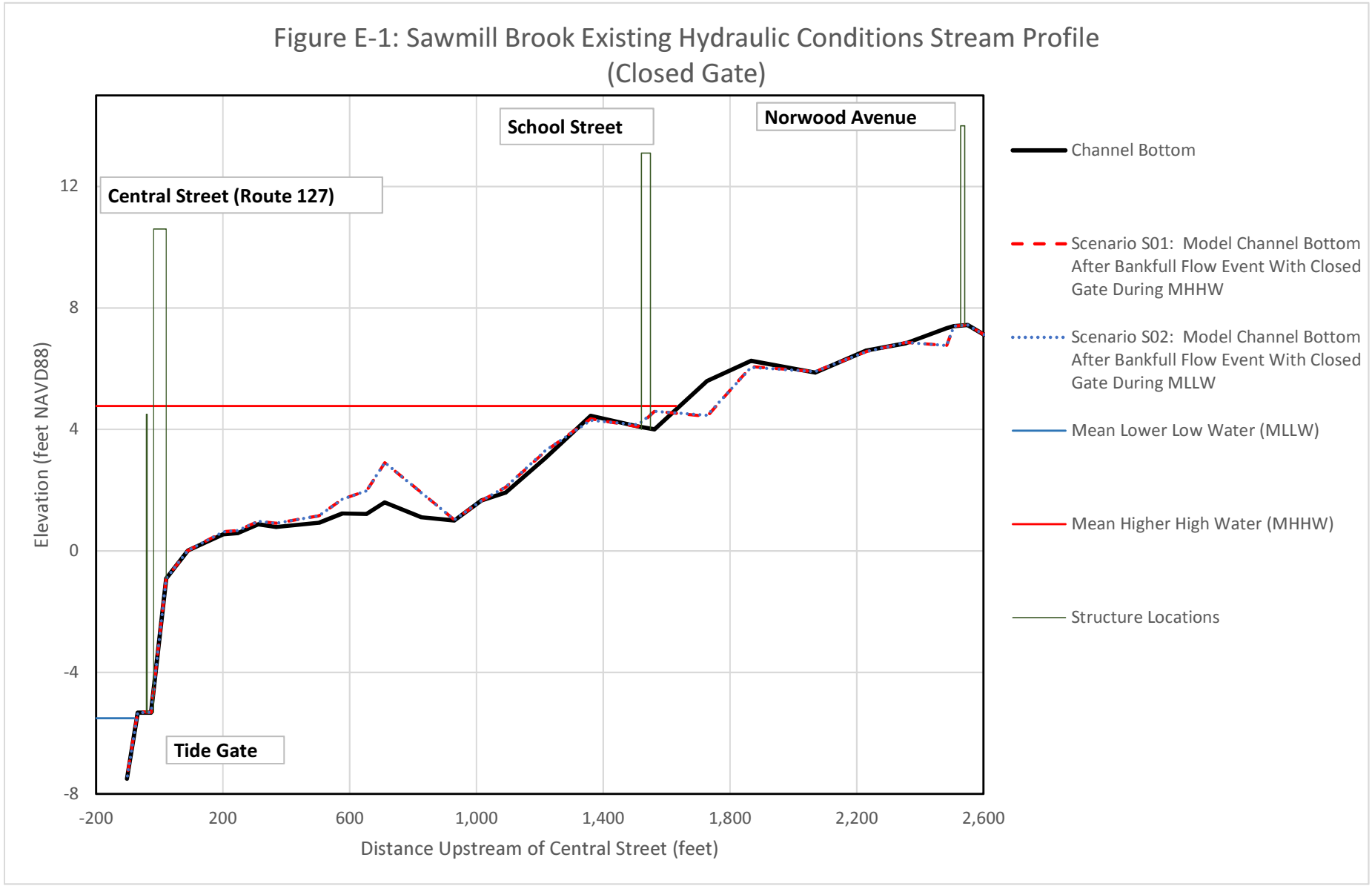


Figure E-1: Sawmill Brook Existing Hydraulic Conditions Stream Profile
(Closed Gate)
School Street
Norwood Avenue
Central Street (Route 127)
Tide Gate
12
8
4
0
-4
-8
Elevation (feet NAVD88)
-200
200
600
1,000
1,400
1,800
2,200
2,600
Distance Upstream of Central Street (feet)
Channel Bottom
Scenario S01: Model Channel Bottom After Bankfull Flow Event With Closed Gate During MHHW
Scenario S02: Model Channel Bottom After Bankfull Flow Event With Closed Gate During MLLW
Mean Lower Low Water (MLLW)
Mean Higher High Water (MHHW)
Structure Locations

Figure 5

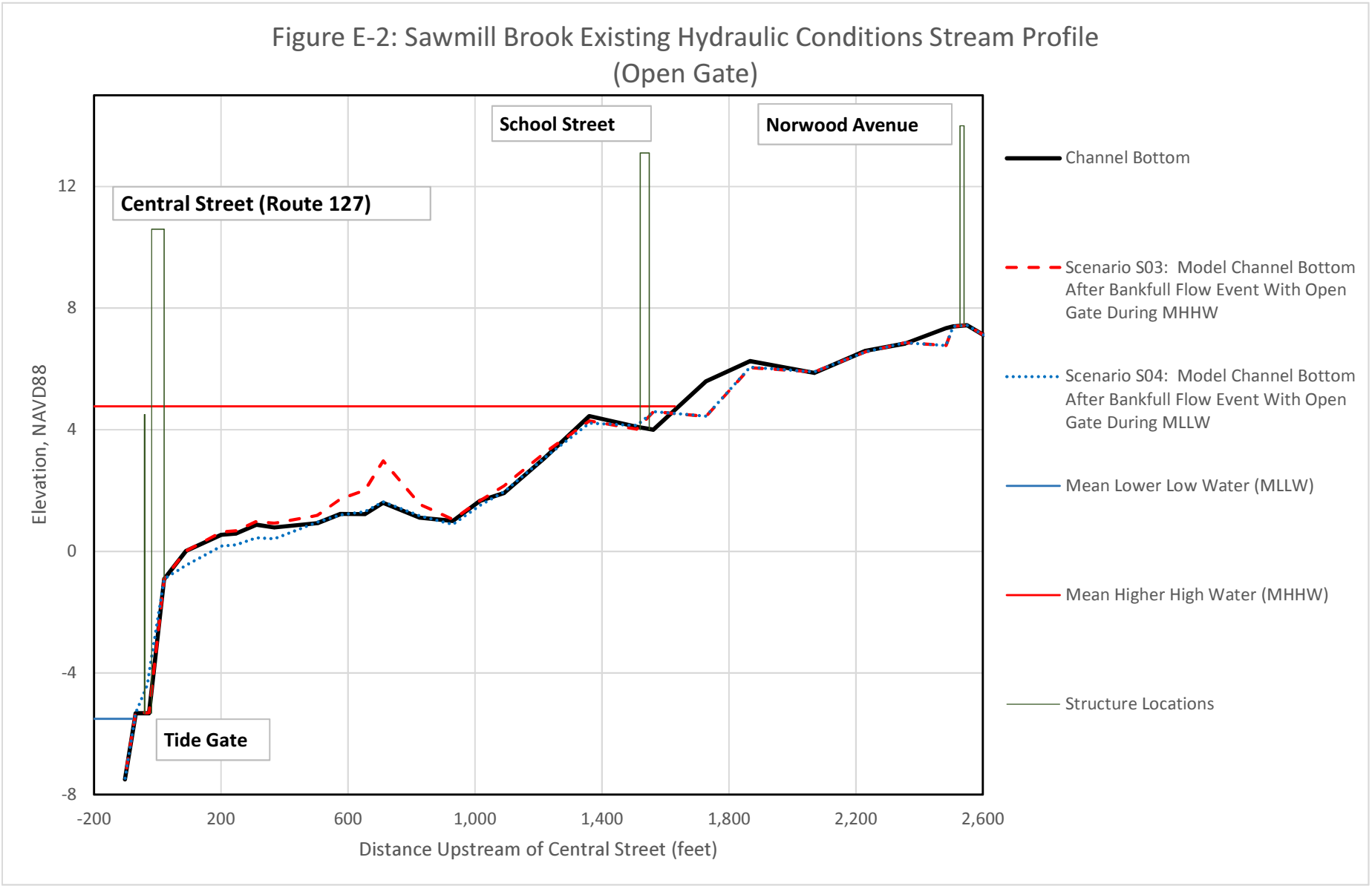


Figure E-2: Sawmill Brook Existing Hydraulic Conditions Stream Profile
(Open Gate)
School Street
Norwood Avenue
Central Street (Route 127)
Tide Gate
12
8
4
0
-4
-8
Elevation, NAVD88
-200
200
600
1,000
1,400
1,800
2,200
2,600
Distance Upstream of Central Street (feet)
Channel Bottom
Scenario S03: Model Channel Bottom After Bankfull Flow Event With Open Gate During MHHW
Scenario S04: Model Channel Bottom After Bankfull Flow Event With Open Gate During MLLW
Mean Lower Low Water (MLLW)
Mean Higher High Water (MHHW)
Structure Locations

Figure 6

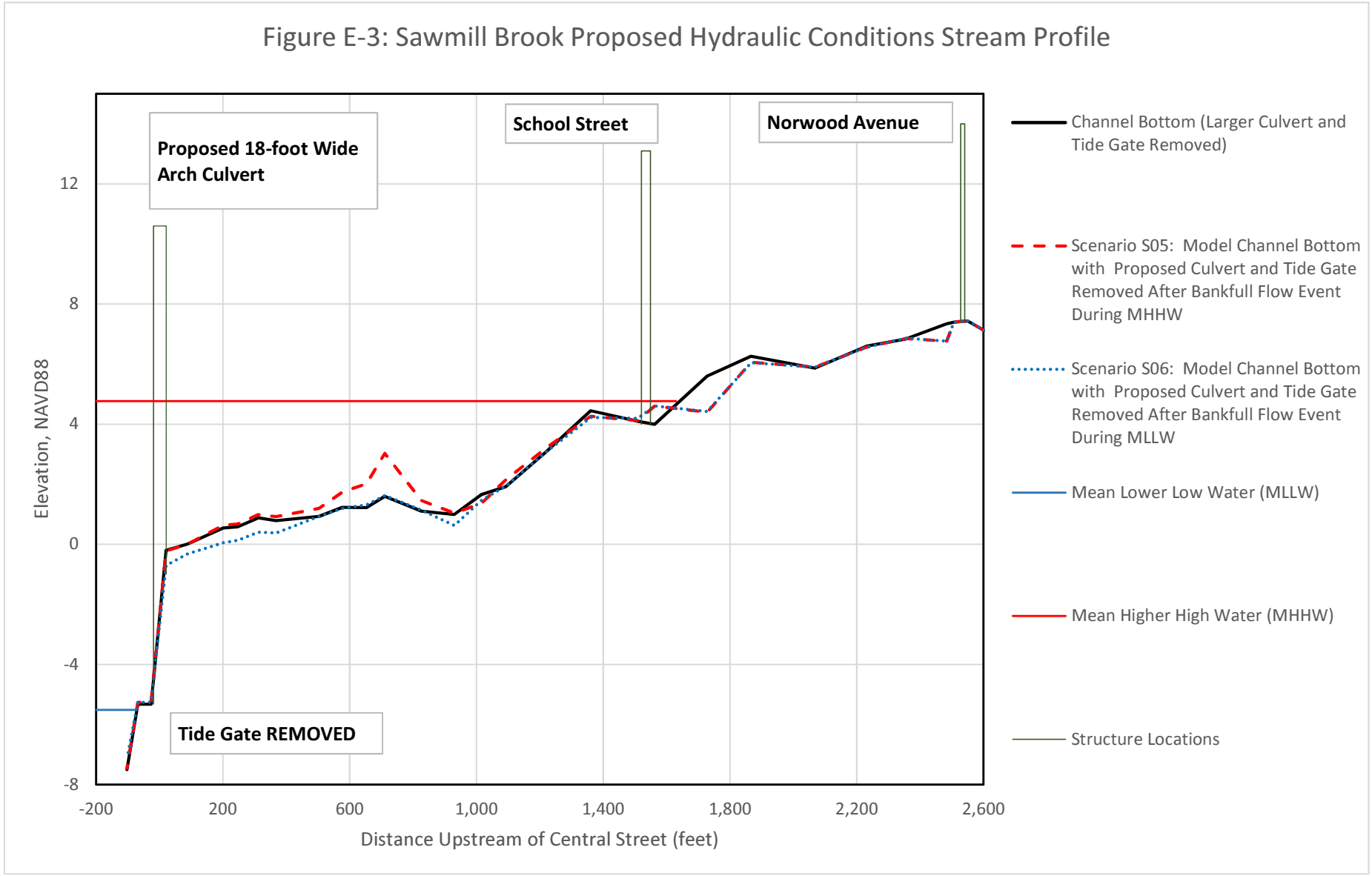


Figure E-3: Sawmill Brook Proposed Hydraulic Conditions Stream Profile
Proposed 18-foot Wide Arch Culvert
School Street
Norwood Avenue
Tide Gate REMOVED
Elevation, NAVD88
12
8
4
0
-4
-8
-200
200
600
1,000
1,400
1,800
2,200
2,600
Distance Upstream of Central Street (feet)
Channel Bottom (Larger Culvert and Tide Gate Removed)
Scenario S05: Model Channel Bottom with Proposed Culvert and Tide Gate Removed After Bankfull Flow Event During MHHW
Scenario S06: Model Channel Bottom with Proposed Culvert and Tide Gate Removed After Bankfull Flow Event During MLLW
Mean Lower Low Water (MLLW)
Mean Higher High Water (MHHW)
Structure Locations

open. While the natural tidal ebb-and flow may help reduce sedimentation within Central Pond, stormwater best management practices (BMPs) should be considered in the watershed to reduce the sediment supply (discussed in Section 4). Reestablishing a tidal ebb-and-flow may increase the probability for degradation of previously settled fine-grained sediment. The potential for degradation when high flows occur during low tides can be reduced by installing channel in-stream controls (e.g., stone features) and/or by removing fine-grained sediment from the channel bottom. Methods to reduce degradation are discussed in in Section 4.

4 Sediment Management for Restoration

Bottom substrate conditions in Sawmill Brook were observed from Central Street to Norwood Avenue, concentrating on characterizing the soft sediments within the Central Pond area. The location of soft sediment in center of the Pond flanked by areas of cobble and gravel above and below the Pond are consistent with the history of dredging and impoundment of Central Pond in the late 19th and early 20th century. Historic accounts have described the area as once being salt marsh. More recently the Pond has been periodically opened to release high flows during storm and seasonal openings to promote fish passage for Rainbow smelt. The following section discusses the sediment management issues at Central Pond and how this frames the selection of restoration alternatives.

4.1 Results of Sediment Characterization

The results of sediment characterization study found that approximately 5,350 cubic yards of sediment are present within the Central Pond area, between Transect 4 and Transect 13. The sediment depth ranged from 1 to over 6 feet in depth (beyond the limit of the probe). Based on the sieve analysis the material was predominantly dark brown silty sand in the pond area. The substrate in Sawmill Brook, from Norwood Avenue to the entrance of the Central Pond, was predominantly cobble, with gravel and sand in lesser amounts. The channel below the Pond, for 100 -200 feet upstream of the Central Street Bridge has a stony bottom, with cobbles, boulders and areas of gravel. The sediment sample taken at the Norwood Avenue culvert was classified as brown poorly graded sand. At the School Street culvert, the sediment sample was classified as brown poorly graded gravel with sand.

Sediment accumulation was noted along the shoreline on the western bank of the Pond and to the north of the Pond. Eroded banks were noted predominantly along the eastern bank of the pond, due to collapse of retaining walls. Sources of erosion on the western shore and further up the pond area likely due to runoff, and direct outfalls entering the Brook and Pond area. Further up Sawmill Brook, deposits of sediment were primarily found upstream of Beaver impoundments or large boulders due to the disruption in stream velocity allowing sediment carried by water to settle out as the velocity slowed down upstream of the isolated impoundment.

The sediment transport evaluation was consistent with observed conditions that fine sediment has settled out in Central Pond during large flow events during both low and high tides, instead of allowing sediment to travel downstream during low tides as would have occurred if the tide gate was not in place.

4.2 Recommendations for Restoration

Currently the restoration of Central Pond is focused on two main goals. The first goal is maintaining the flood storage capacity of the area by repairing and preventing further stream bank erosion. The second goal is to improve the habitat value of the area and promote fish passage, especially for rainbow smelt.

The best restoration element for reducing erosion would be to repair and replace sections of the granite retaining wall along the eastern bank of Central Pond. Areas along the western shore also contribute to sedimentation, particularly the large stormwater outfall. Solutions for reducing erosion range from soft stabilization including bio-engineered planting techniques, controlling public access and a stormwater outfall retrofit to eliminate the direct discharge.

Options for habitat improvements include instream channel modifications and potential instream planting on the raised areas that would further stabilize soft sediments and create habitat. Instream modifications may include dredging, rock veins and other forms of flow augmentation. **Figure 7** presents some of the physical conceptual elements for restoration.

An important component of the mitigation plan is to restore wetland and riparian ecosystems to the stream banks. After hydrologic restoration, freshwater is expected to override a weak saltwater wedge, meaning that freshwater and some minimally brackish-tolerant plants will be incorporated into the wetland restoration. One approach to consider would be to restore the wetland in two phases, the first phase would be populating experimental plots at areas representing variations in sediment size, organic matter content, and salinity. Observations from the plots would be used to populate the entire site in the second phase to improve wetland restoration success.

To establish marsh in this area planting areas may require moderate elevated so plant roots area closer to average high tide elevation. **Photo 5 and 6** provides a plan and cross section view of areas between Transect 6 and 12 and what the elevations would look like with potential salt marsh restoration. The cross sections indicate average high and low water elevations along with potential elevation of substrate to support suitable species.

Planting techniques using nursery grown plants in bio-mats would be ideal for this location, however additional evaluation is needed to support this alternative including obtaining additional salinity measurements, evaluation of suitable species, planting techniques, and maintenance requirements. Most of the planting work would likely be done manually. Substrate augmentation would require a light track vehicle within the pond area and could be mobilized from the shallow slope on the western bank. If desired, limited channel dredging could be accomplished using mechanical dredge to remove soft sediments, allowing the dredge material to settle, dewater and mixing in organic substrate before replacing as augmented soil to raise plating areas. Suitable fill would be covered by biodegradable geotextile material, and nursery plants would be staked on top of the geotextile. **Photo 7 and 8** provides a before and after photo rendering of the potential marsh restoration.

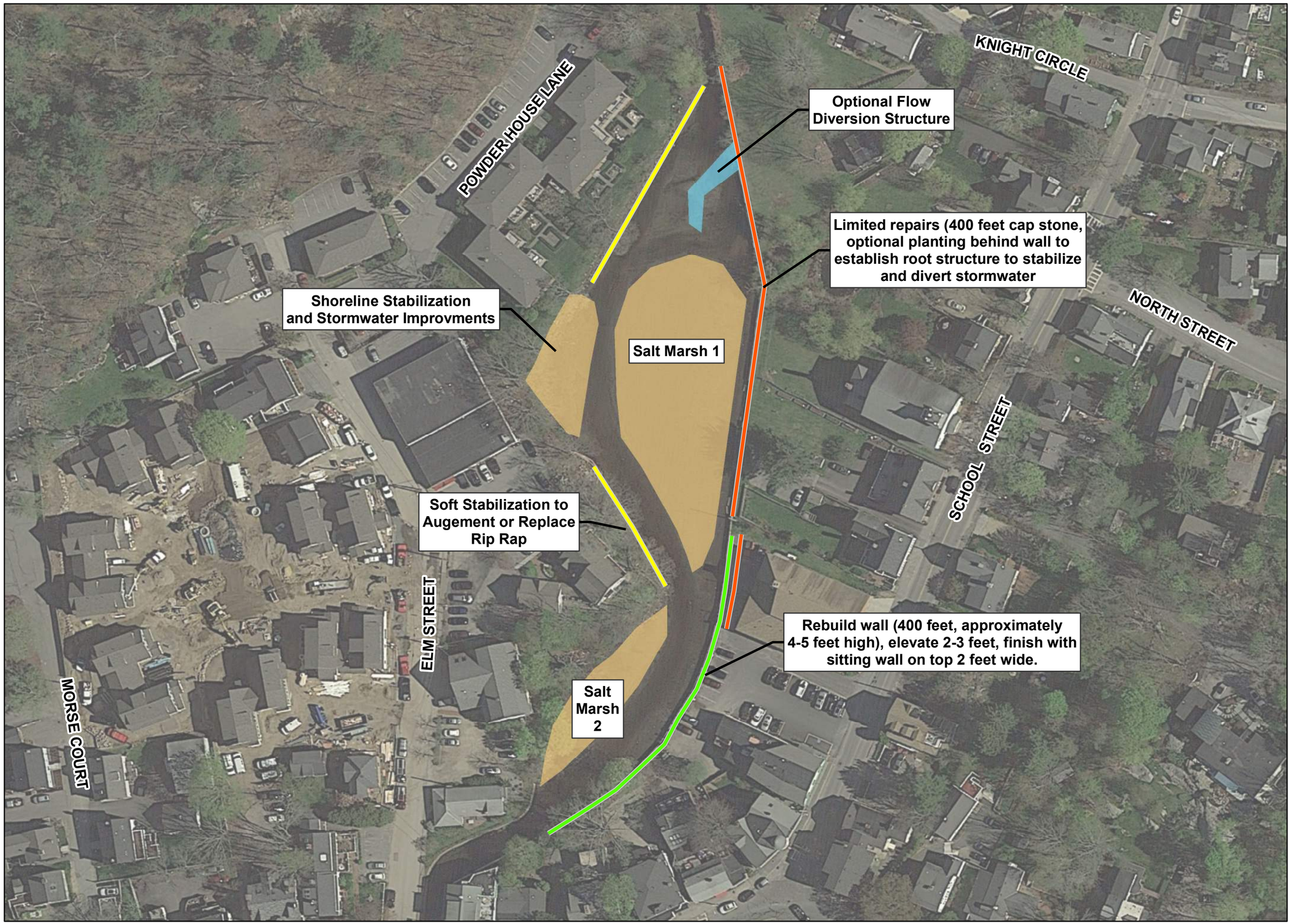
Options to maintain the area as a fresh water system would require a low rock structure downstream of the center of the pond to maintain elevations up to 3 feet upstream. The drawback to this would be continued maintenance to remove sediment that will be trapped behind the structure and limitations placed on fish passage, not unlike the existing tide gate. Rock riffles could be used no matter what option is done, creating additional water movement, aeration and scour pools will improve habitat value. Additional habitat improvements for smelt and Sea Run Brook Trout spawning could be provided further upstream.

The Town should first address the erosion along the stream banks while allowing the stream channel to flush naturally for a period before finalizing the renovation design. Removing sediment deposits and granite blocks from collapsed retaining walls would offset loss of storage resulting from the additional substrate required for salt marsh restoration. The opening of the Central Street Culvert will improve flushing and sediment volumes in the Pond would be expected to diminish over time. Sediment sources from Manchester Harbor on the high tide are expected to be insignificant compared to upstream sources. The Town should continue to investigate and reduce upstream sediment sources as identified in the Stream Bank Survey in Section 2.4 including eliminating direct outfalls, addressing issues caused by beaver dams, and repairing collapsed retaining walls. Providing public education for stream bank stabilization methods will be recommended in the next phase of the Sawmill Brook restoration project.

The alternatives for restoration will be ultimately be decided based on whether dredging is advisable to augment the islands, what type of habitat can be supported in a freshwater predominant estuarine system with up to 7 feet of tidal range and what alternatives can be

Figure 7

CENTRAL POND POTENTIAL RESTORATION ELEMENTS



LEGEND

- High Priority
- Soft Solutions for Bank Stabilization
- Town Owned
- Areas to Restore March in Central Pond
- Optional Flow Diversion Structure

LOCUS MAP

N

0 37.5 75

Feet

1:900

NOTES

Imagery © Google (2016)

Sawmill Brook Area
Manchester By the Sea, Massachusetts

May 2018

Tighe&Bond
Engineers | Environmental Specialists

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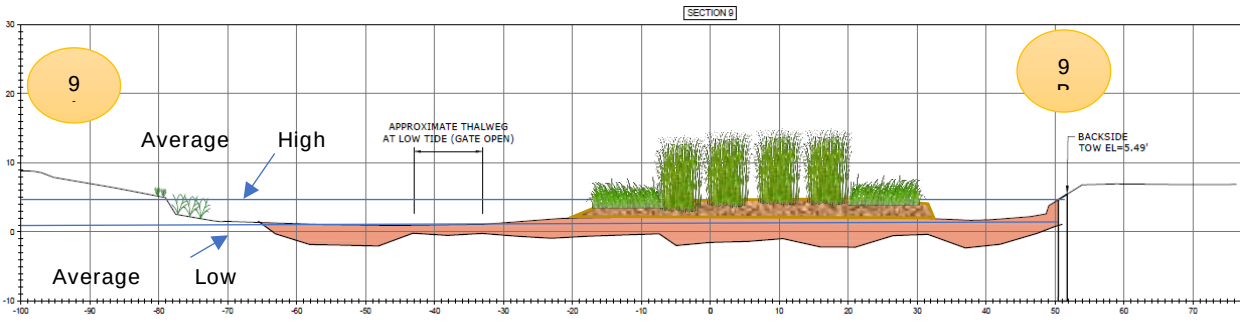
M-1476

permitted and what the restoration costs are. The goals should be aimed at maximizing flood storage and habitat value within the context of what improvements are most acceptable to the abutters. The next steps that are needed to advance the restoration project include addressing the private land ownership issues along eroding stream banks by establishing easements or developing memorandums of agreement for wall improvements, geotechnical studies needed for the wall design, a publicly vetted alternatives analysis and full permitting design of the recommendation alternative.



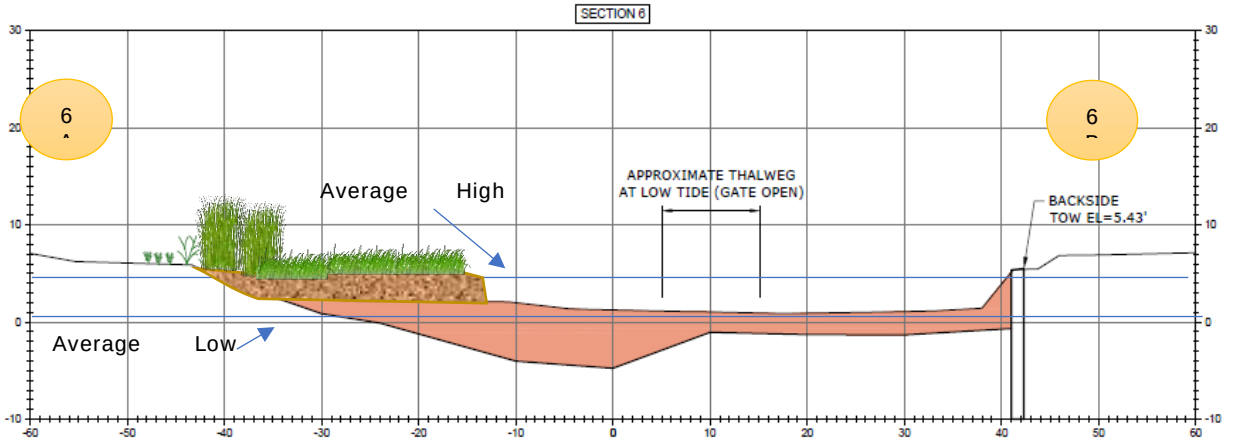


Photo 5
Conceptual Profile for Marsh Restoration- Transect 6 and 9

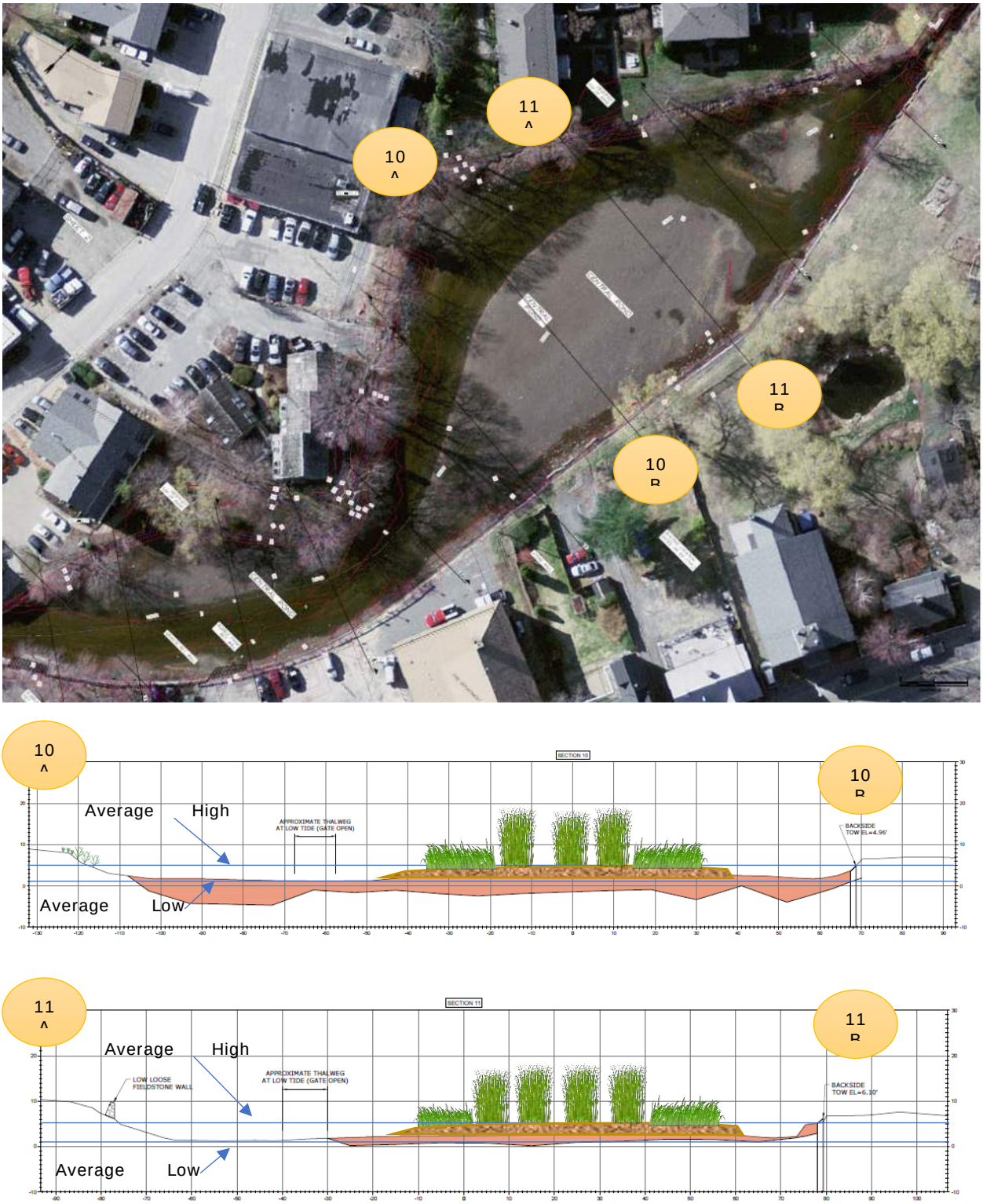


Photo 6
Conceptual Profile for Marsh Restoration- Transect 10 and 11

Photo 7
Before and After Restoration- South View

Photo 8
Before and After Restoration-North View

5 Conclusions

The sediment characterization and sediment transport modeling show and predict that sediment aggregates in Central Pond when the tide gate is closed. The existing tide gate when closed has created a condition where fine sediment settle during large flow events during both low and high tides, instead of allowing sediment to travel downstream during low tides as would have occurred if the tide gate was not in place. This disequilibrium has increased the prevalence of fine-grained sediment within Central Pond and is also indicative of a supply of fine sediment within the watershed.

The proposed culvert replacement and tide gate removal at Central Street would restore a tidal ebb-and-flow similar to existing conditions observed during periods when the tide gate is left open. Channel in-stream controls (e.g., stone features), eliminating sources of stream bank erosion and/or removing fine-grained sediment from the channel bottom can reduce the potential for degradation when high flows occur during low tides after restoration of a tidal ebb-and-flow.

Our visual observations, supported by the sediment analysis, confirm the feasibility of upland reuse of sediment from portions of the project area to create marsh areas along the banks of Sawmill Brook. Our review of data collected to date also indicate that the restoration of natural flow conditions and sediment transport from Sawmill Brook into Central Harbor is unlikely to result in a deterioration of conditions with regard to concentrations of contaminants present in the sediment.

Sediment Management Restoration Recommendations

- Develop permit level designs for retaining wall repairs, create additional instream storage by cleaning up wall debris. Remove sources of erosion due to failing retaining walls.
- Let the channel flush for a while before decision on dredging.
- If dredging is recommended, restrict it to instream reuse.

Next Steps

- Establish Memorandum of Understanding with private owner along the southwestern portion of Central Pond to complete Geotech and develop wall repair alternative designs.
- Conduct public outreach on bank stabilization techniques for other private abutters on the western shore of Central Pond and along Sawmill Brook.
- Fully involve the public in the alternatives analysis and selection of a preferred plan to maintain flood storage, address habitat improvements and fish passage.
- Depending on the restoration approach, an implementation plan and schedule will be developed including long-term monitoring efforts.
- Continue to monitor stream levels below and above the pond to documents any changes in elevations.

Appendices to the ***Sediment Characterization and Flushing Studies - Sawmill Brook Flood Mitigation and Restoration Project Technical Memorandum*** available upon request

Tighe&Bond

APPENDIX E

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

February 7, 2018

Janet Moonan
Tighe & Bond
1 University Avenue, Suite 104
Westwood, MA 02090

RE: Sawmill Brook Tide Gate and Stream Restoration, Sawmill Brook from Central Street to Norwood Avenue, Manchester, MA; MHC# RC.63761

Dear Ms. Moonan:

Staff of the Massachusetts Historical Commission (MHC) have reviewed the Project Notification Form (PNF), received at this office on January 17, 2018, submitted for the project referenced above.

The proposed project consists of evaluating the removal of the tide gate and dam under Central Street and the restoration of Central Pond and Sawmill Brook in Manchester. The work will also include either the replacement or widening of bridges and culverts as well as in-stream restoration between Central Avenue and Norwood Avenue. The information submitted indicates that the project will receive permitting and/or licensing from the Massachusetts Department of Transportation (MassDOT), the Massachusetts Department of Environmental Protection (MassDEP), and the Army Corps of Engineers (ACE).

The PNF is incomplete (950 CMR 71.07(2)). The MHC requests that the following information be submitted in order to evaluate the area of potential effect for the project:

- Scaled existing and proposed project plans for the work proposed, including rehabilitation of Central Street Bridge. All scaled existing and proposed conditions project plans should be sized no larger than 11" x 17."
- Approval and/or comments from the Manchester Historic District Commission.

These comments are provided to assist in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (36 CFR 800) and Massachusetts General Laws, Chapter 9, Sections 26-27C (950 CMR 71). If you have questions or require additional information, please contact Nadia Waski at this office.

Sincerely,

Linda Santoro
Preservation Planner
Massachusetts Historical Commission

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(617) 727-8470 • Fax: (617) 727-5128
www.sec.state.ma.us/mhc

MANCHESTER-BY-THE-SEA
HISTORIC DISTRICT COMMISSION
Town Hall, 10 Central Street
Manchester-by-the-Sea, Massachusetts 01944-1399

April 4, 2019

Board of Selectmen
10 Central Street
Manchester, MA 01944

Re: Central Street Bridge Replacement Project

Dear Board of Selectmen:

On behalf of the Historic District Commission ("HDC") of the Town of Manchester-by-the-Sea, I am writing to show support for the Central Street Bridge Replacement Project. Mr. Nate Desrosiers of the Town Department of Public Works staff, preliminarily reviewed certain aesthetic details, such as railing and wall treatments with the Commission at its meeting on March 28, 2019. We understand that the overall project includes removal of the tide gate, replacement of the Central Street Bridge, new abutment walls and other related structural improvements. We also understand that these improvements are partially funded by a grant from the MassDOT Small Bridge program, and that the design is subject to applicable MassDOT bridge design standards. We look forward to working with the DPW to ensure that the furnishings will be consistent with the setting of the historic district.

The Central Street Bridge is listed as non-contributing to the Manchester Village Historic District on the National Register of Historic Places inventory; and, as such, the proposed project as presented is not anticipated to affect known historical properties. In addition, the furnishings as presented to the Commission appear to be generally consistent with the setting of the historic district.

Sincerely,

John Round, Chairman
On Behalf of the Historic District Commission

JR:aa

cc: Mr. Gregory Federspiel, Town Administrator
Mr. Charles Dam, Director, Department of Public Works
Mr. Nate Desrosiers, Project and Facilities Manager, Department of Public Works

www.tighebond.com

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