Tighe&Bond
Engineers | Environmental Specialists

MANCHESTER-BY-THE-SEA MUNICIPAL VULNERABILITY ACTION GRANT

SAWMILL BROOK/ CENTRAL POND RESTORATION- SUMMARY REPORT
June 2019

SUBMITTED TO:

Manchester-by-the-Sea, MA

6/28/2019

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APPENDICES

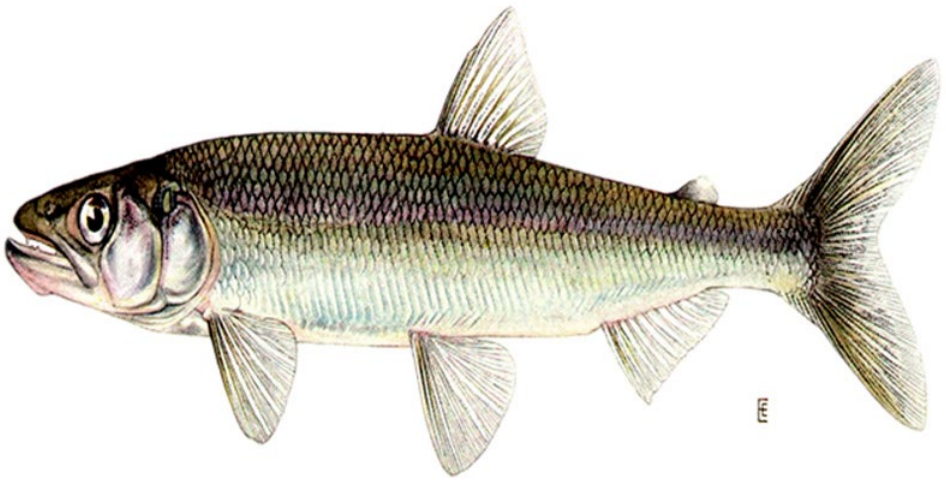
EXECUTIVE SUMMARY

Over five years of planning has gone into the Sawmill Brook Flood Mitigation/ Restoration project. The restoration project has multiple goals including fish passage improvement, wildlife habitat enhancement, public safety, and aesthetics that must be balanced with flood mitigation and climate change resiliency. The multiple goals of the project are necessary to secure regulatory permit approvals and correct historical environmental impacts. In 2018 Manchester-by-the-Sea (Town) completed a Massachusetts Environmental Trust (MET) grant demonstrating the technical feasibility of the restoration of the Central Pond area of Sawmill Brook. The Town was subsequently awarded a Municipal Vulnerability Preparedness (MVP) Action Grant to develop the permit level designs for the restoration of the pond and retaining walls.

The Central Pond restoration elements are critical components of the overall Sawmill Brook Flood Mitigation plan to stabilize sources of erosion and restore marsh, riparian habitat, and fish habitat; reduce flooding; and enhance coastal resiliency. In addition to providing overland drainage for a large area of Manchester-by-the-Sea, Sawmill Brook also provides critical habitat for state-listed species rainbow smelt and other species such as eel, herring and sea run brook trout. The Massachusetts Department of Environmental Restoration (DER) selected the 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 at this location.

Work completed under the grant included identification of town owned land along the eastern banks of Central Pond, reducing the required number of easements for the restoration project, geotechnical studies, and public outreach to discuss analysis of alternatives for the restoration design.

The MVP Action Grant final deliverable included permit level design for the preferred restoration option for Central Pond, including salt marsh planting and a flexible block retaining wall with public stairway access to the water. A conceptual graphic was prepared for public posting to describe the restoration elements.



SUMMARY OF THE PLANNING AND DESIGN PROCESS

The MVP Action grant involved the following steps in planning, studies outreach and design. Highlights of each major task are provided below:

PROPERTY OWNERSHIP RESEARCH FINDINGS

- Additional town owned property adjacent to Central Pond discovered on School Street and Central Street
- Town rights of way located on Central St and Elm Street
- Town boundary along west shore of Central Pond is unclear
- Assessors maps updates and west shore survey recommended

GEOTECHNICAL STUDIES

- Four 15-foot deep borings drilled on east shore of Central Pond
- Salinity profile of Central Pond sediment completed

ALTERNATIVES ANALYSIS AND OUTREACH

- Alternatives presented at October 2018 public meeting and preferred alternate selected February 2019 by Board of Selectmen

PERMITTING LEVEL DESIGN

- Final Deliverables: Conceptual Graphic, Permit Level Design, Opinion of Probable Construction Cost and Permitting Memo

Completing a salinity profile across the mud flats of Central Pond to identify the optimal species for restoration planting.

PUBLIC OUTREACH

Public outreach was accomplished by a combination of direct invitation, press releases, televised Board of Selectmen's meetings and postings on the Towns Website. The highlights of public outreach are listed below. Public Outreach deliverables are in Appendix A.

APPENDIX A:

PUBLIC MEETINGS-

- Public Meeting Agenda and Sign-in sheet October 18, 2018
- PowerPoint presentation
- Meeting Summary

BOARD OF SELECTMEN MEMOS AND MEETINGS

- Central Pond Alternatives Update Memo
- Tide Gate Removal Feasibility Memo
- Board of Selectmen Agenda and Minutes February 4, 2019

TOWN WEBSITE POSTINGS

Photo rendering of the potential salt marsh restoration at mid tide, view looking north from the eastern bank.

GEOTECHNICAL STUDIES

Four borings were installed along the eastern shoreline of Central Pond, behind the current retaining wall, on November 28, 2018.

In general, subsurface conditions consisted of 3.5 to 9.5 feet of fill, overlying 0.5 to 4.5 feet of sands, overlying silts and clays which were penetrated approximately 4.5 to 8.5 feet before the explorations were terminated. An approximate 2-foot thick layer of organic silt was encountered below the fill and above the sand at boring B-2.

Retaining wall alternatives evaluated include segmental retaining walls, both Mechanically Stabilized Earth (MSE) and gravity walls, and gabion retaining walls. Drainage features recommended for the different wall types are important to the performance and longevity of the new wall as poor drainage is likely contributing to the poor performance of the existing wall.

After the geotechnical memo, a geotechnical wall stability analysis was performed to support the permitting level design assumptions.

The geotechnical deliverables are provided in Appendix B.

APPENDIX B:

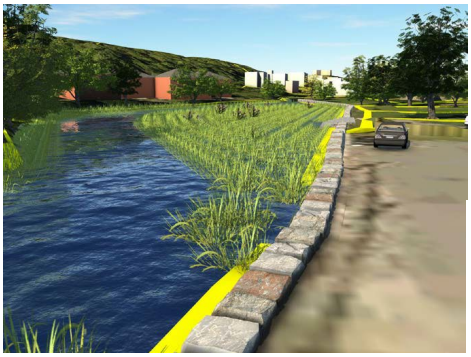
- Boring Locations and Logs
- Central Pond Geotechnical Report
- Geotechnical Wall Stability Analysis

View towards Manchester Harbor at the location of Boring B-3. Photos at the left show Boring Locations B-2, B-3 and the drilling equipment.

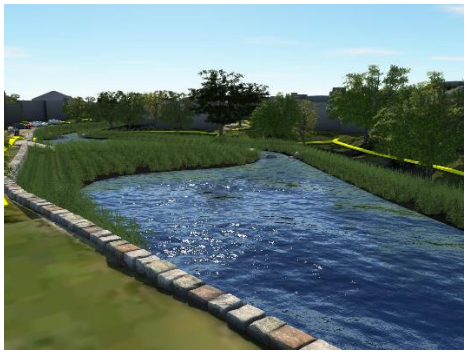
ALTERNATIVES ANALYSIS

Stream restoration alternative at low tide

Stream riffle alternative at mid tide



Pond alternative view north at high tide



Pond alternative view south at high tide

Three conceptual alternatives for the restoration of Central Pond were examined. These alternatives included a natural steam that maximizes ecological benefits, a series of pools at low elevations during low tide, and the restoration of the artificial condition (full pond) that is more consistent with the built-up human environment that residents and visitors currently experience.

The benefits and constraints for the three alternatives were analyzed. Feasibility, permitting issues, construction cost, public benefit, sustainability, ecological benefits, flood mitigation, complexity, maintenance and grant funding potential were all considered.

The pros and cons of the alternatives were presented to the abutters, Board of Selectmen and the public using variety of media including PowerPoint graphics, video renderings and printed material including narrative descriptions and landscape renderings.

Tighe & Bond recommended the stream alternative due to its low construction and negligible maintenance costs; relative ease of design and permitting; and overall ecological benefits. Alternatives for living shoreline and flexible wall options were further vetted in the design stage. Living shoreline options were recommended for the western shoreline, and segmental block wall for the eastern side, to replace the current retailing wall. The alternatives analysis deliverables are provided in Appendix C except for the video graphics due to size.

APPENDIX C:

- Alternatives PowerPoint
- BOS Alternatives Memo is provided in Appendix A

RESTORATION ALTERNATIVES EVALUATION

	STREAM	RIFFLES	POND
Feasibility	High	Moderate-high	Low
Permitting	Moderate	Complex	Complex
Construction Cost	<$50,000	$250,000	>$500,000
Public Benefits	Wildlife habitat diversified, fish passage maximized, improved water quality naturalized landscape, flood mitigation	Increased water feature, fish passage improved naturalized landscape, flood mitigation	Maximizes water feature
Sustainability	High	Moderate	Moderate
Ecological Benefits	High	High	Low
Flood Mitigation	25 Yr.	25 Yr.	25 Yr.
Complexity	Low	Moderate	High
Maintenance	Low	Moderate	High
Grant Potential	High	Moderate	Low

Matrix presenting the pros and cons of the three pond restoration options.

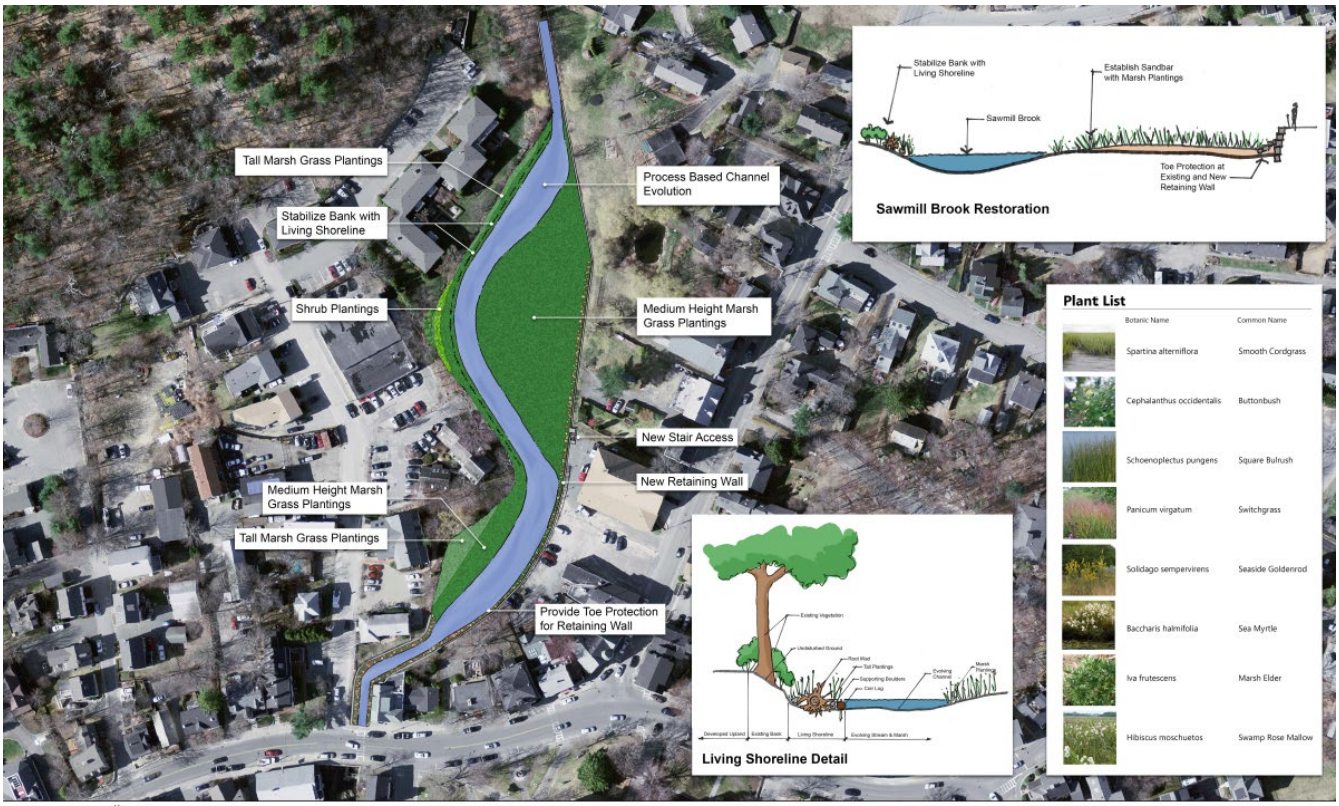
PERMIT LEVEL DESIGN PLANS

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. 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

Alternatives for embankment stabilization/restoration along the east and west sides of Central Pond presently include flexible block gravity walls. In situ subsurface silt and clay layers identified while performing the geotechnical boring program favor flexible wall options, since settlement that may occur due to the compressible soils would more negatively impact rigid wall structures. Improved drainage is included in the design with the goal of improved wall performance and longevity.

A public access stairway is proposed behind the Fire Station. The stairway will likely need to be protected with some type of safety rail due to public access within three feet of a fall of 30 inches or greater. The permit plans include a timber post and rail design to blend in with the surrounding area.



RESTORED SAWMILL BROOK MAY 2019
MANCHESTER-BY-THE-SEA, MASSACHUSETTS

A cross-sectional sampling of Sawmill Brook in 2018 revealed that at low tide the interstitial sediments of the mud flat are moderately saline (11%–17%), but that substrate salinity is even higher at depth (>26%). Only salt tolerant plants can be reasonably expected to thrive on the mudflat. However, the shoreline (particularly the west side) appears to receive quite a bit of fresh groundwater inflow and so it is anticipated that brackish and freshwater plants may be able to survive along that shoreline. Given the spatial variation in salinity regime, the restoration plan is to revegetate the mudflat and eastern shoreline with salt-tolerant plants and revegetate the western shoreline with brackish and/or freshwater plants. Select locations along the western shoreline areas were identified to establish living shorelines. The technique will include the use of root wads, coir logs and/or mesh to stabilize undercut or dissipate energy in high-energy sections of the stream channel. Plants appropriate for the planting zones will be inserted into these logs and/or mesh.

Appendix D includes the permitting level design deliverables.

APPENDIX D:

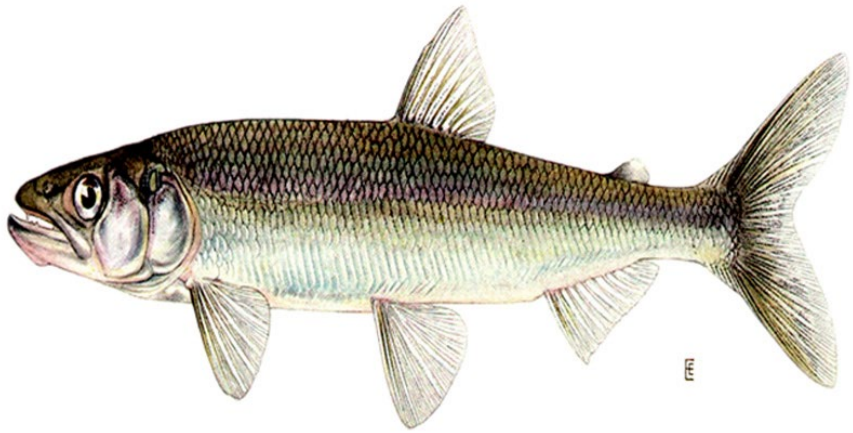
- Permit Level Design Plans
- Permit Level Opinion of Probable Construction Costs
- Identification and Assessment of Permits Needed for the Central Pond Restoration Project

TECHNICAL SUPPORT PROVIDED BY PROJECT PARTNERS

Numerous State and Federal agencies are supporting partners in this project and are providing grant funding, technical guidance, and public outreach support. Project partners include the Massachusetts Department of Transportation (MassDOT), the Massachusetts Office of Coastal Zone Management (CZM), the Massachusetts Division of Ecological Restoration (DER), the Massachusetts Environmental Trust (MET), the Massachusetts Division of Marine Fisheries (DMF), and the National Oceanic and Atmosphere Administration (NOAA) Restoration Center. The project is supported by dedicated Town Staff, the Board of Selectmen, the Manchester Coastal Resilience Advisory Group (CRAG) and volunteers through the Manchester Stream Team.

The project team is especially grateful to the guidance provided by Georgeann Keer, DER and Eric Hutchins, NOAA Restoration Center. Georgeann and Eric provided ongoing advice, attended the public hearings and provided critical input to improve the project deliverables.

As the project moves forward, the continued support of these partners will be vitally important.



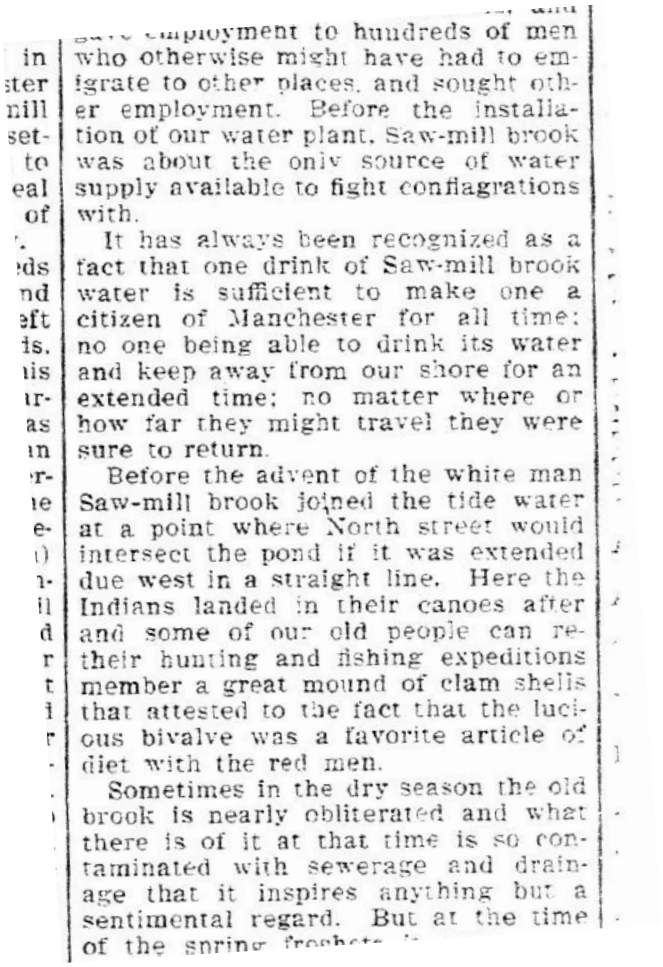
Some History of Central Pond and Sawmill Brook

Courtesy of the Manchester Historical Society

From the Manchester Town Warrant March 25, 1938

Central Pond was originally a salt marsh entending from the mouth of SawmillBrook to the inner harbor. Very early the waters of the Brook were dammed for a grist mill, later being used for power purposes by the early cabinet industry. Early in the last century, John Perry Allen, a manufacturer, bought from the Parish their marsh and dug the greater part of Central Pond, creating a large reservoir. At the same time he established the height to which water might be held. Through many years the title passed from one to another and was finally acquired by the Town, whose property it now is.

Excerpt from "The Story of Sawmill Brook" (12/3/1904)



employment to hundreds of men who otherwise might have had to emigrate to other places, and sought other employment. Before the installation of our water plant, Saw-mill brook was about the only source of water supply available to fight conflagrations with.

It has always been recognized as a fact that one drink of Saw-mill brook water is sufficient to make one a citizen of Manchester for all time: no one being able to drink its water and keep away from our shore for an extended time; no matter where or how far they might travel they were sure to return.

Before the advent of the white man Saw-mill brook joined the tide water at a point where North street would intersect the pond if it was extended due west in a straight line. Here the Indians landed in their canoes after and some of our old people can re- their hunting and fishing expeditions member a great mound of clam shells that attested to the fact that the luci- ous bivalve was a favorite article of diet with the red men.

Sometimes in the dry season the old brook is nearly obliterated and what there is of it at that time is so contaminated with sewerage and drainage that it inspires anything but a sentimental regard. But at the time of the spring freshets

Interesting note- over the years Central Pond was known as Mill Pond, Reservoir Pond or The Channel

APPENDIX A

Restoration Options for Central Pond

LOCATION: Manchester-by-the-Sea Town Hall
10 Central Street, Room 5

DATE: October 18, 2018

START TIME: 6:00 – 7:30 PM

1. Welcome – Greg Federspiel, Town Administrator
2. Stream Restorations – Eric Hutchins, NOAA Restoration Biologist
3. Flood Mitigation Planning – Gabrielle Belfit, Tighe & Bond
4. Sawmill Brook Restoration Goals – David Loring, P.E. Tighe & Bond
5. Sawmill Brook/ Central Pond Restoration Options – Dan Buttrick, P.E., Tighe & Bond
6. Central Street Bridge Project Update – David Loring, P.E. Tighe & Bond
7. Community Discussion

Post-Meeting Comments

If you would like to make additional comments after the meeting, please send them via e-mail or regular mail to:

Mary Reilly, Manchester Grants Administrator
10 Central Street - Manchester, MA 01944
reillym@manchester.ma.us
978-525-6427

Central Pond Restoration Public Meeting
October 18, 2018

Name	Address	E-Mail	Phone
Gabrielle Belfit	Tighe & Bond	gcbelfit@tighebond.com	508 367 5598
Milissa Oraibi	BLACK ARROW 26 central St.	crockerdile@comcast.net	978-332-4448
Barbara Warren	Salem Sound Coastwatch	barbara.warren@salemsound.org	978-741-7900
Hope Wolf-Bucci	2 Putnam Ct. MBTS	hopewb@comcast.net	
Fletcher Boyle	6 Putnam Ct	Fletcher, Boyle@Comcast.Net	508-776-0045
Olga Hayes	9 Tanglewood	olgahayes@comcast.net	978.526.1259
Patricia Gillis	8 Knight Circle	patriciadgillis@yahoo.com	9785264354
Deb Fraize	8B Morse	debfraize@yahoo	617 515-0305
Esther + Hannah Proctor	#2 16 School St	SSproctor@yahoo.com	(978)526-1419
Francie Caudill	16 Magnolia Ave.	fcaudill@comcast.net	978-526-7459
Carolyn Kelly	355 Summer St	carolyne covefarm.net	526-0050
Ken King	9 Tanglewood Rd.	KEN@meadowmountain.com (978 526-1259)	
[illegible]	33 Bridget	dnscollm@manchester.ma.us	
Alfred Rossi Sr	89 Bridge St.	ajbenrossi@gmail.com	508 328 2109
Chris Botsford	Conservation Administrator	botsfordc@manchester.ma.us	978 526 4397
Sue Brown	Town Planner		
Sue + Jeff Parker	41 Central	jpbradfordma@aol.com	978-704-9798

MET Central Pond Restoration Public Meeting
October 18, 2018

Name	*Address*	*E-Mail*	*Phone*
JEFF KARPANCH	18 SCHOOL ST	JAKARP@YAHOO.COM	978 526 2486
[illegible] RUSSELL	9 MAGNOLIA AVE		
Andy Gardner	13 School St.	AFGARDNER@GMAIL.com	
Eli Boling	99 Pleasant St.		
Dom Morozzi	26 School	dmorozzi32@comcast.net	6176538140
Lise Balch Kaufman	6 Knight C		
Eric Kaufman	6 Knight C		
Ron Rosselt	16 School St.	RLRJR@ESSEXPP.com	978-338-5300
Frances Colburn	185 Summer St		978-526-1627
Oliver Colburn	1 West Hill Place Boston 02114		978 526 1020
Eric Bourgault	40 Central St	ECBOURGAULT@GMAIL.com	617-388-2663
Patricia Mitchell	1 Flatley		
Ryan Allen	62 Pine		
Elisabeth Sears.	7 school st. #3	elisabethsears@msn.com.	978 810 5756
Jessica Lemothe	21 Walker Rd.	persbest@comcast.net	
Maryann Wood	6 Highwood/26 Central	Dmwoodie42@hotmail.com	
ADAM ZALLEN	21 ENDE	AMZ@cheat.com	

SAWMILL BROOK / CENTRAL POND RESTORATION

Manchester-by-the-Sea Town Hall – October 18, 2018

Eric Hutchins, Restoration Biologist, NOAA Fisheries
David Loring, P.E., ENV SP, LEED AP, Principal
Dan Buttrick, P.E., Senior Project Manager
Gabrielle Belfit, CFM, Senior Environmental Scientist

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PRESENTATION TOPICS

- Introduction
- Flood Mitigation Planning
- Restoration Goals
- Restoration Options
- Bridge Update

2018 MANCHESTER BY-THE-SEA HMP GREATEST FLOOD RISK:

SEVERE WINTER WEATHER

NOR' EASTERS

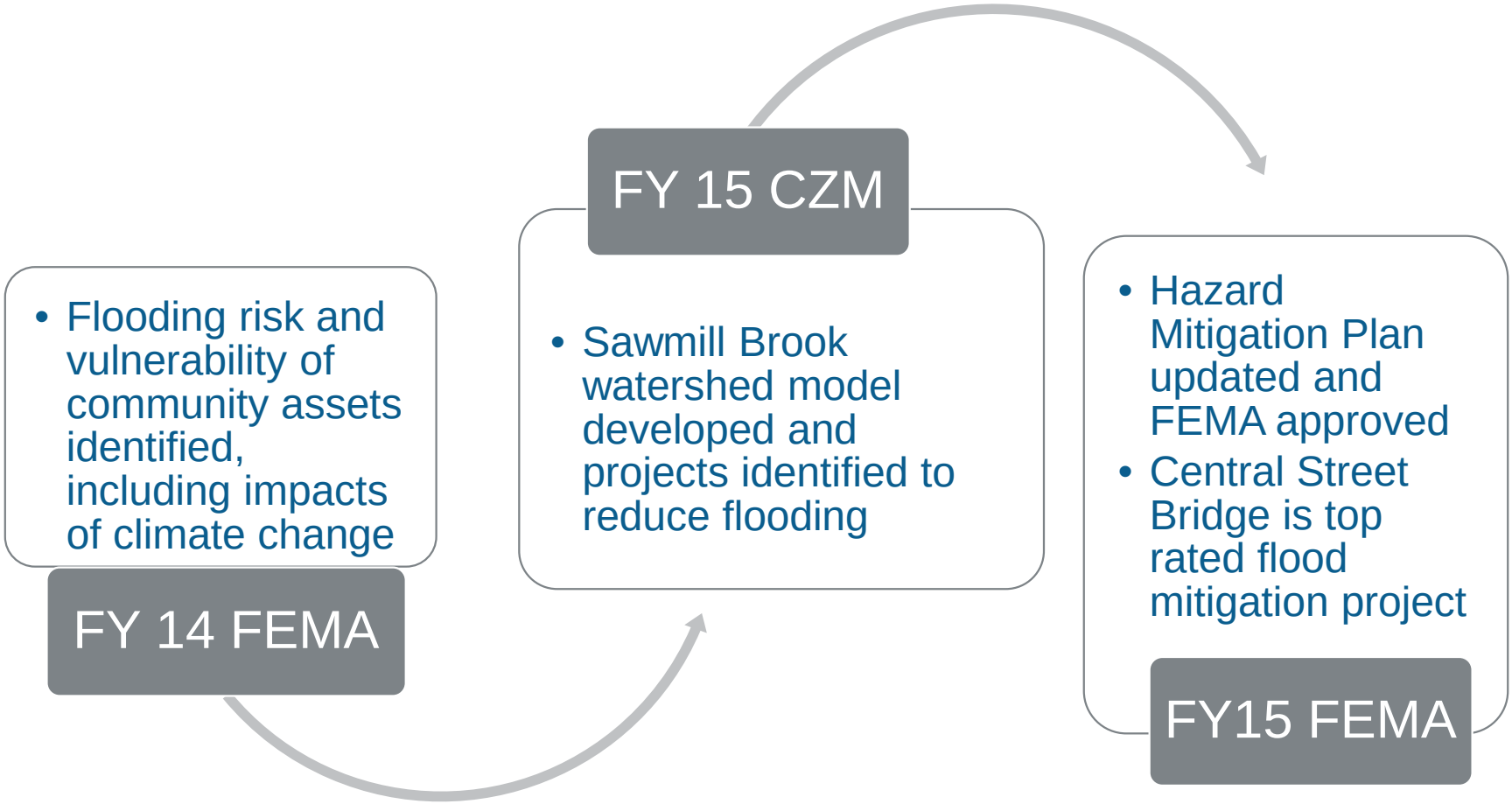
EXTREME PRECIPITATION

HURRICANES

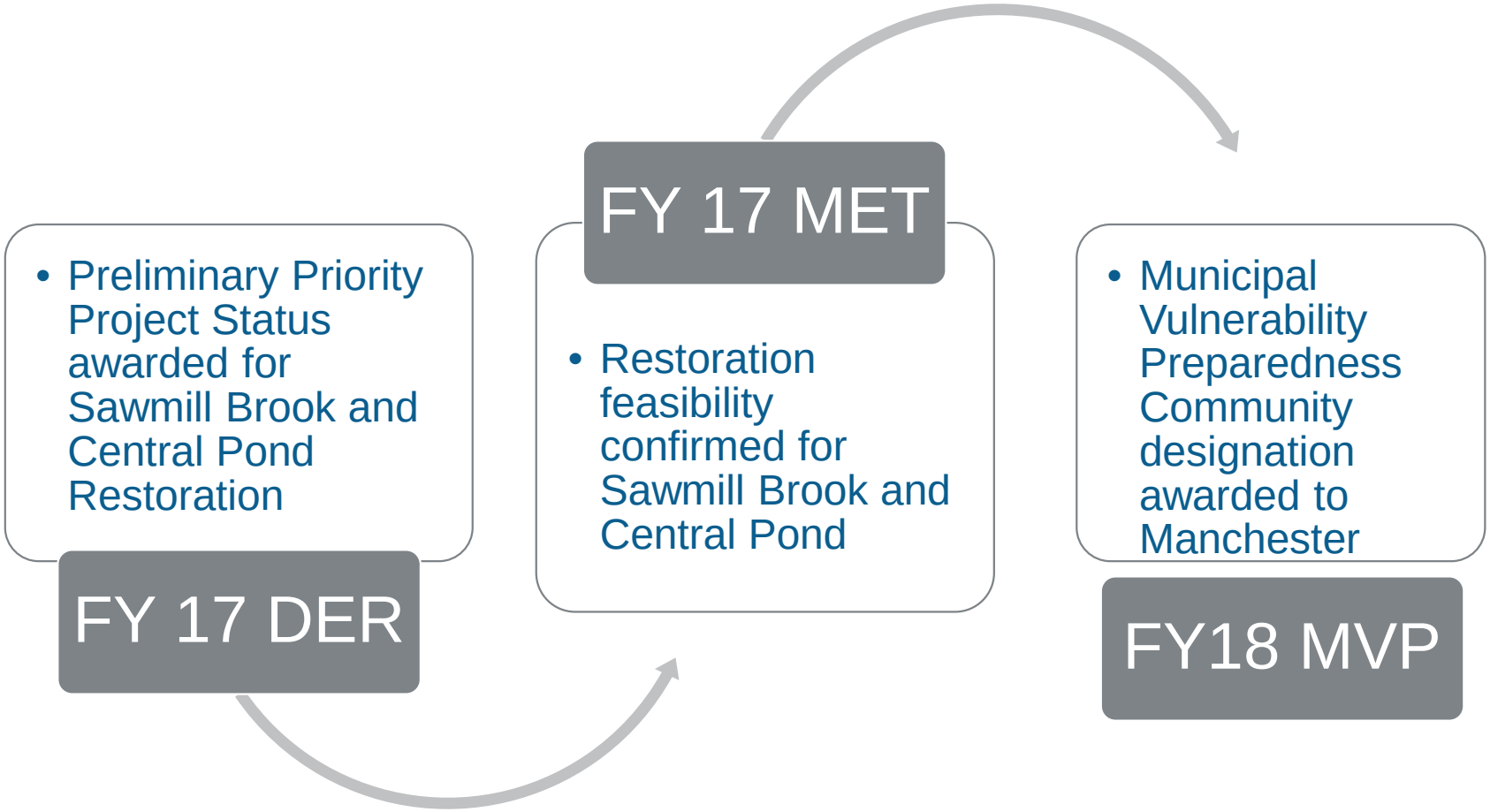
HISTORICAL FLOOD EVENTS

- **9/1938 "The Great New England Hurricane"**
  10-17 inches of rain and 20-foot storm surge
- **2/1978 "Blizzard of '78"**
  30 inch snowfall, 30-foot waves off shore 2 RL claims
- **10/1991 "Perfect Storm"**
  25 foot waves coincided with high tide 9 RL claims
- **5/2006 "Mothers Day Flood"**
  12 inches rain, 6 ft flood along the SMB, School St bridge destroyed, 150 homes damaged. 10 RL claims
- **1/2018 Nor'easter "Greyson"**
  Peak winds coinciding with high tide broke Boston Harbor 1978 high tide record.
- **3/2018- Nor'easters "Riley & Skylar"**
  Blizzard, high wind and storm surge. FEMA DR-4372/ 4379

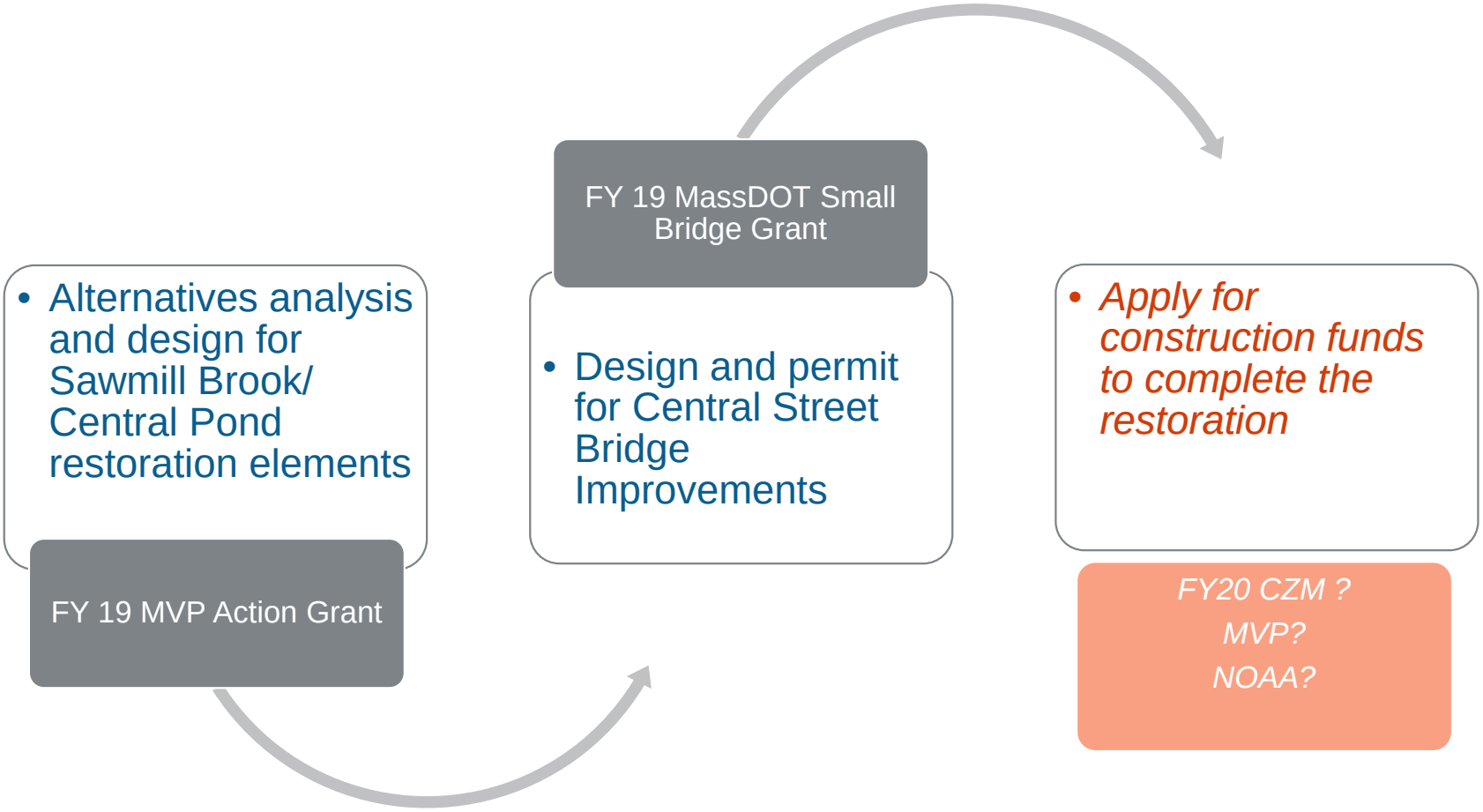
IDENTIFYING FLOOD MITIGATION SOLUTIONS



CONFIRMING FLOOD MITIGATION SOLUTIONS

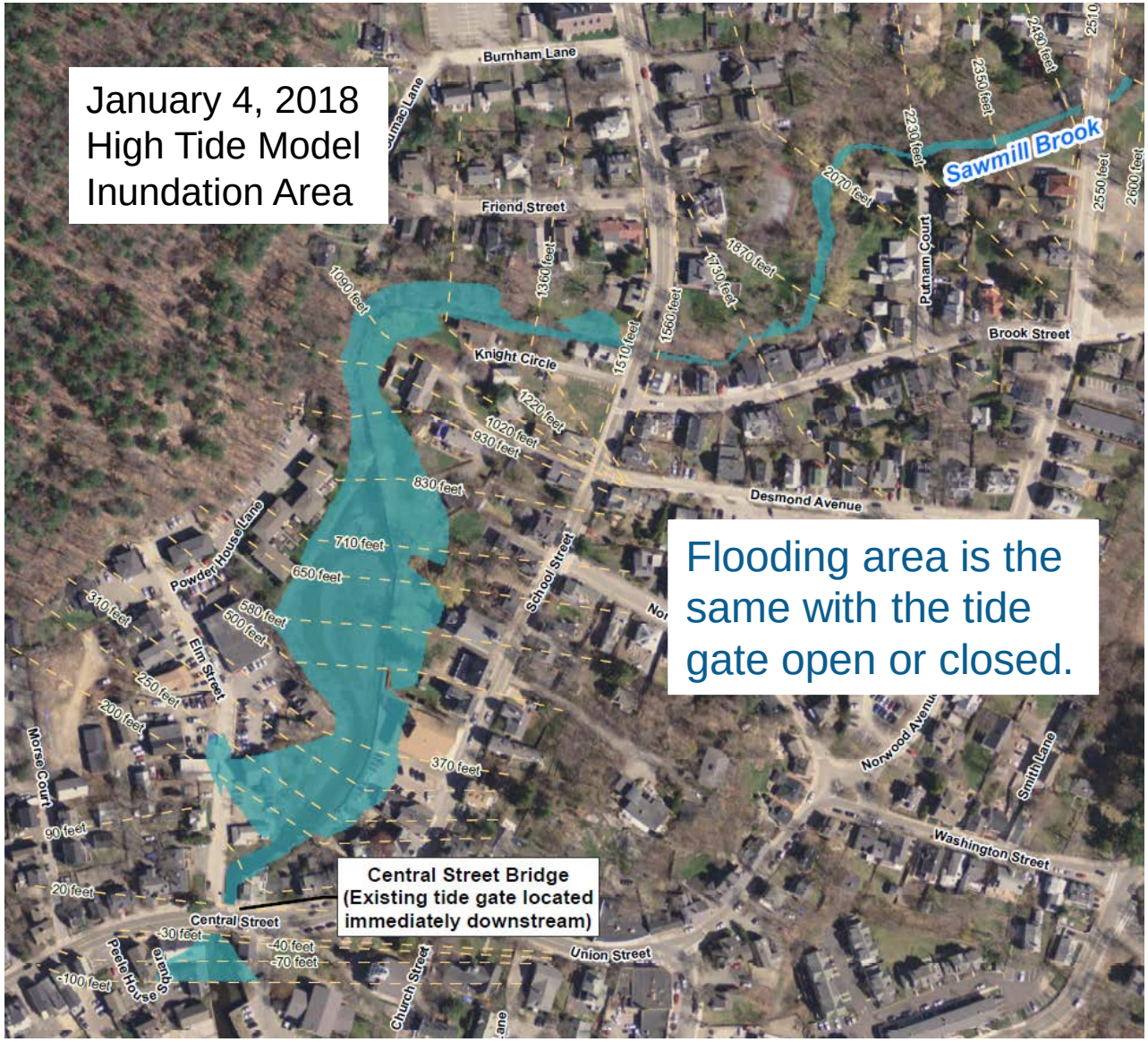


IMPLEMENTING FLOOD MITIGATION SOLUTIONS



FINDINGS FROM HYDROLOGIC MONITORING

FINDINGS FROM HYDRAULIC MODELING



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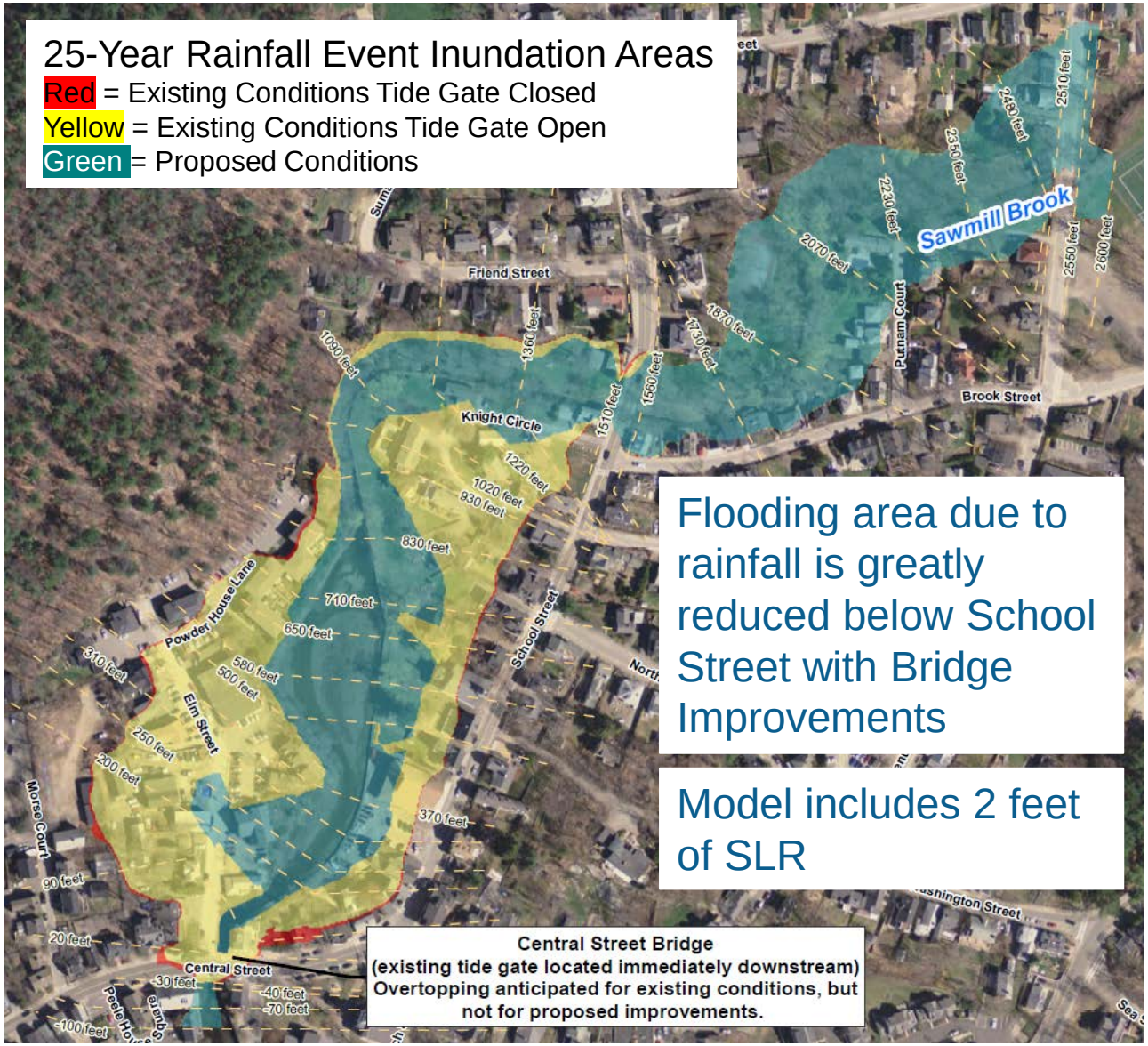
FINDINGS FROM HYDRAULIC MODELING



FINDINGS FROM SEDIMENT SURVEY

Central Pond

- 5,000 CY of soft sandy sediment
- Sources of sediment include bank erosion, stormwater runoff and natural debris
- Pond mudflats are highly saline
- Allowing sediment to naturally flush may be preferred approach over dredging- subject to permitting with state and ACOE

Upstream Channel

- Gravel and sand substrate ideal for fish spawning

FINDINGS FROM WALL SURVEY

- Granite block, poured concrete, brick, field stone and shale revetment and combinations of the above are the dominant structures found around Central Pond.
- Granite block, field stone and combinations of the above are the dominant structures found along Sawmill Brook.
- Almost 50% of the walls arounds Central Pond are in need of maintenance. A large portion of the shoreline of Central Pond is privately owned.
- Many locations can benefit from some type of bioengineering to stabilize banks using stone and plantings

SAWMILL BROOK / CENTRAL POND RESTORATION GOALS

- **Flood Mitigation**
- **Fish Passage**
- **Aesthetics**
  - Channel Improvements
  - Wildlife Habitat
  - Wall Improvements
  - Public Access

SAWMILL BROOK/ CENTRAL POND RESTORATION
CENTRAL STREET BRIDGE IMPROVMENTS

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IMPLEMENTING THE RESTORATION PROJECT

1. Identify access to wall structures for survey, repairs and maintenance
2. Geophysical survey
3. Ecological restoration alternatives analysis
4. Public review
5. Technical agency review
6. Final restoration design

RESTORATION ALTERNATIVES

1. Low level water impoundment
   - maintain permanent low level water impoundment with a cross-channel berm upstream of Central Street bridge where channel expands
2. Stream w/pools and riffles
   - stream restoration connecting low level pools impounded by low level riffle structures
3. Stream Restoration
   - unrestricted free flow water
   - Provides continuous low level stream

All alternatives provide full passage tidal exchange

STATE PERMITS

1. Massachusetts Wetlands Protection Act Notice of Intent and Stormwater Management Standards
2. Massachusetts Environmental Policy Act (MEPA) Environmental Notification Form (ENF) and/or Environmental Impact Report (EIR)
3. Massachusetts Department of Environmental Protection (MassDEP) Section 401 Water Quality Certification
4. MGL Chapter 91, The Massachusetts Public Waterfront Act - Waterways License
5. Massachusetts Historical Commission Project Notification and Review
6. Massachusetts Endangered Species Act (MESA) Project Review through the Natural Heritage and Endangered Species Program (NHESP)
7. Division of Marine Fisheries (DMF) Consultation
8. Massachusetts Office of Coastal Zone Management Federal Consistency Review

USACOE / EPA PERMITS

1. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit
2. EPA NPDES Dewatering General Permit
3. United States Army Corps of Engineers (USACE) Massachusetts General Permit Review/Permitting (Section 10/Section 404)

LOCAL (TOWN) PERMITS

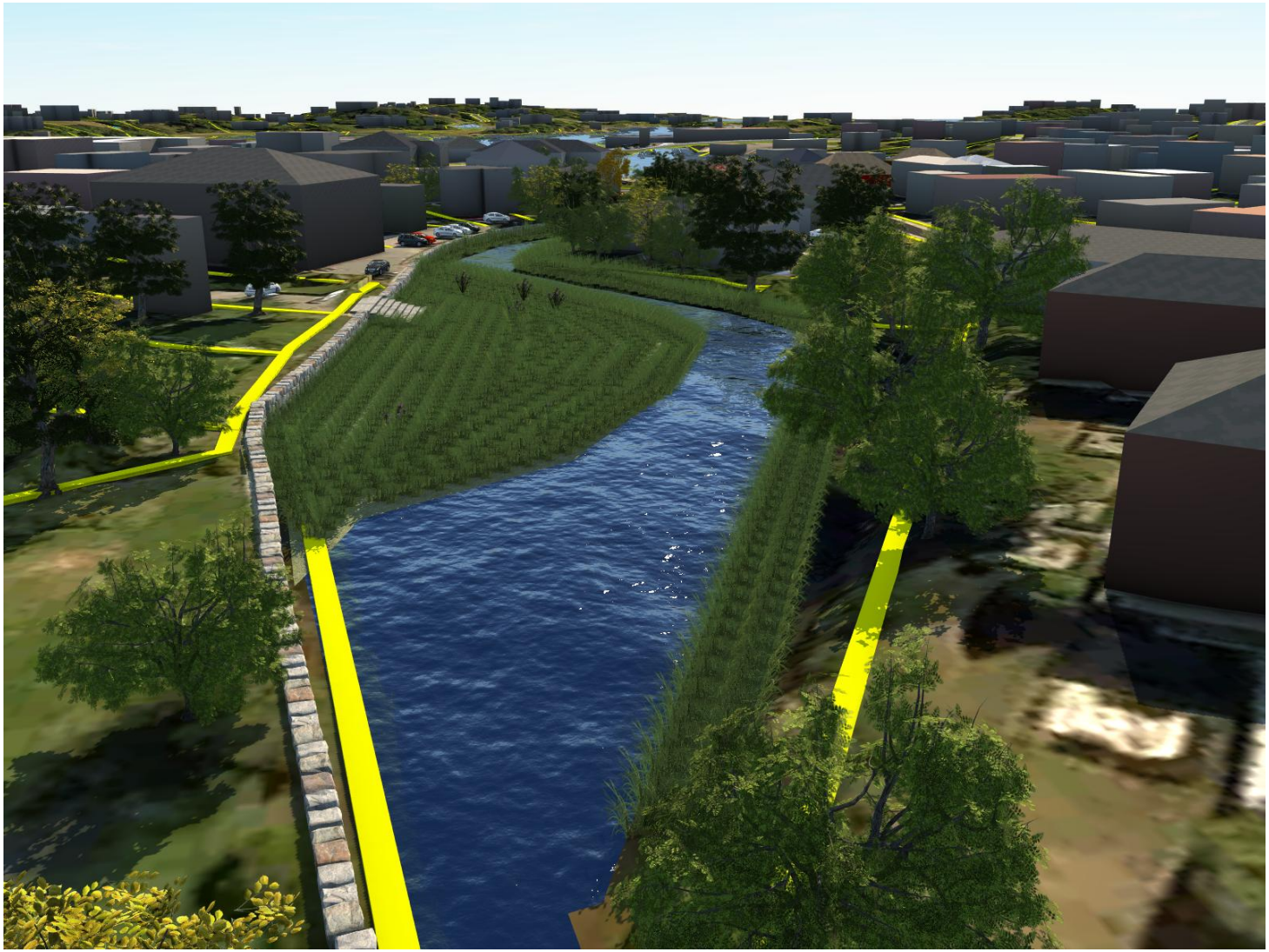
1. Wetlands Protection Act Notice of Intent and Stormwater Management Standards
2. Historical Commission Project Notification and Review
3. Planning Board
4. Street Opening
5. Trench Permit

RESTORATION ALTERNATIVES EVALUATION

	STREAM	RIFFLES	POND
Feasibility	High	Moderate-high	Low
Permitting	Moderate	Complex	Complex
Construction Cost	<$50,000	$250,000	>$500,000
Public Benefits	Wildlife habitat diversified, fish passage maximized, improved water quality naturalized landscape, flood mitigation	Increased water feature, fish passage improved naturalized landscape, flood mitigation	Maximizes water feature
Sustainability	High	Moderate	Moderate
Ecological Benefits	High	High	Low
Flood Mitigation	25 Yr.	25 Yr.	25 Yr.
Complexity	Low	Moderate	High
Maintenance	Low	Moderate	High
Grant Potential	High	Moderate	Low

STREAM RESTORATION

CENTRAL POND STREAM RESTORATION



STREAM RESTORATION

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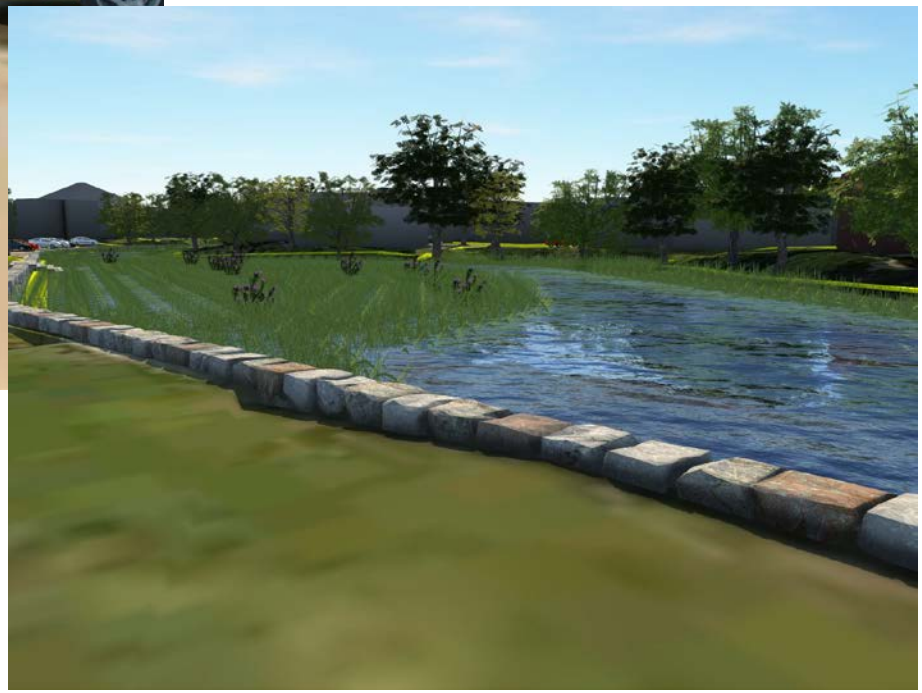

POOLS & RIFFLES

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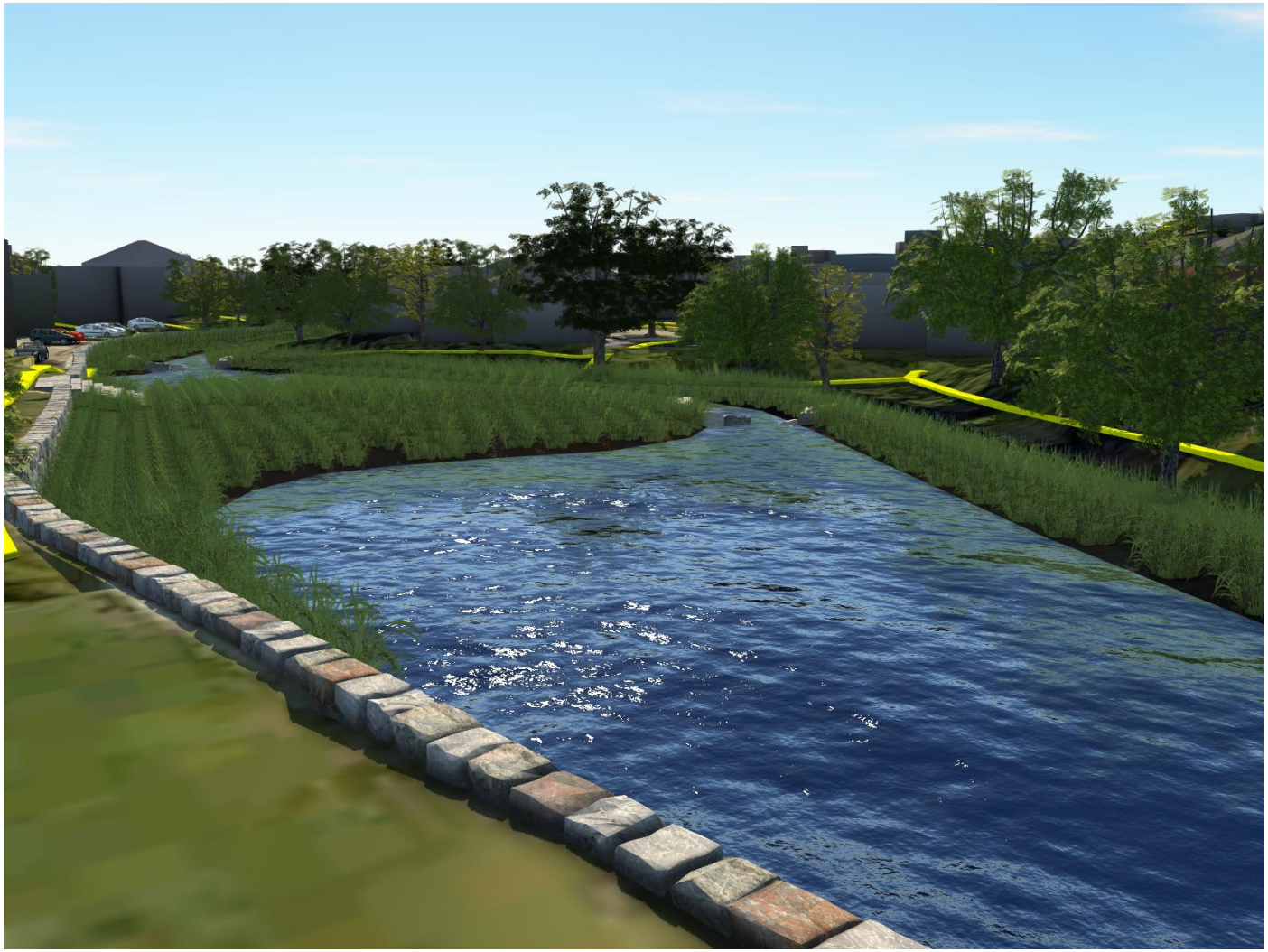
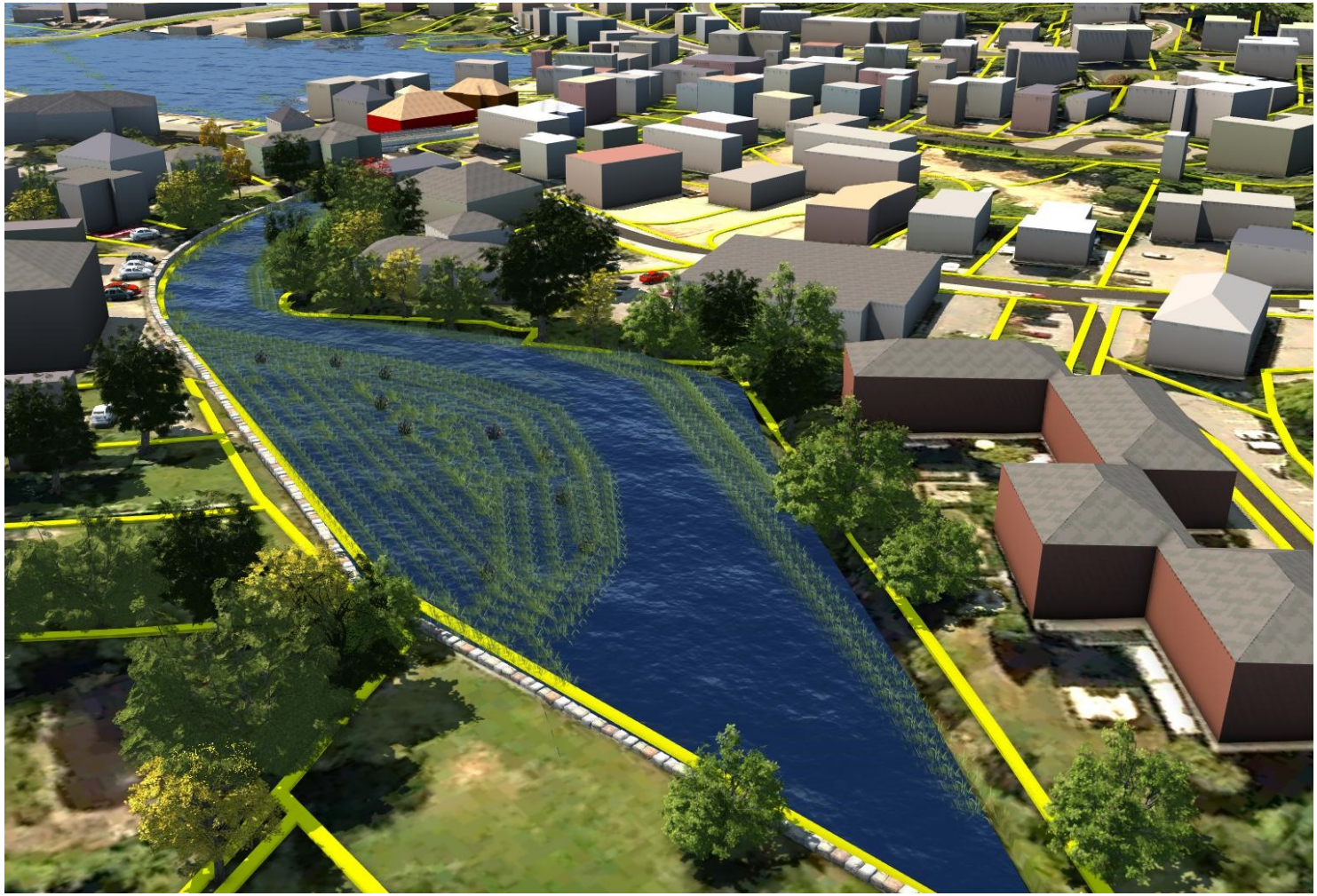


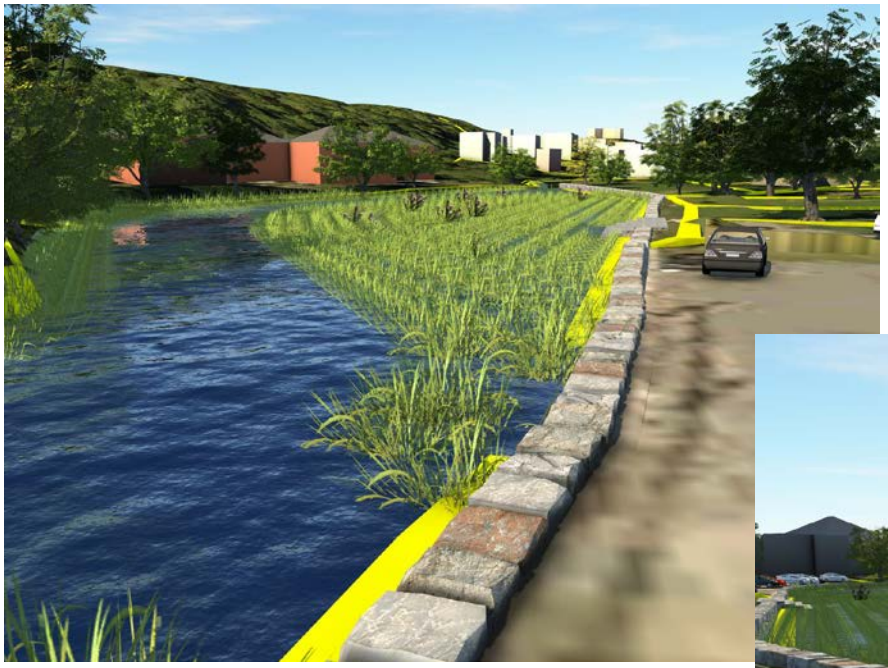
POOLS & RIFFLES

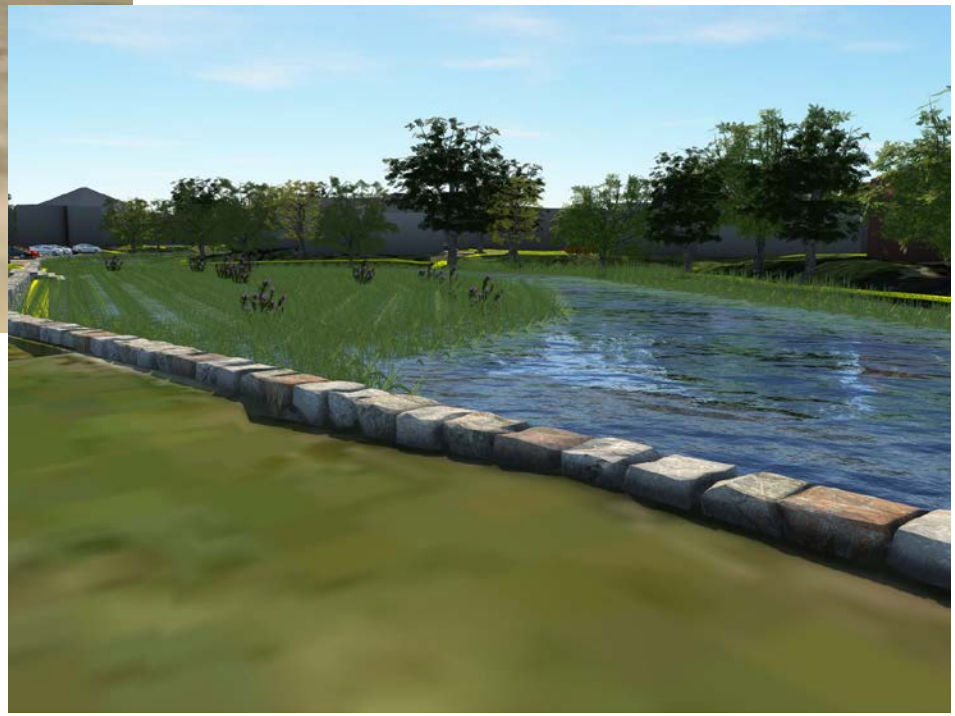
LOW LEVEL IMPOUNDMENT

LOW LEVEL IMPOUNDMENT



LOW LEVEL IMPOUNDMENT

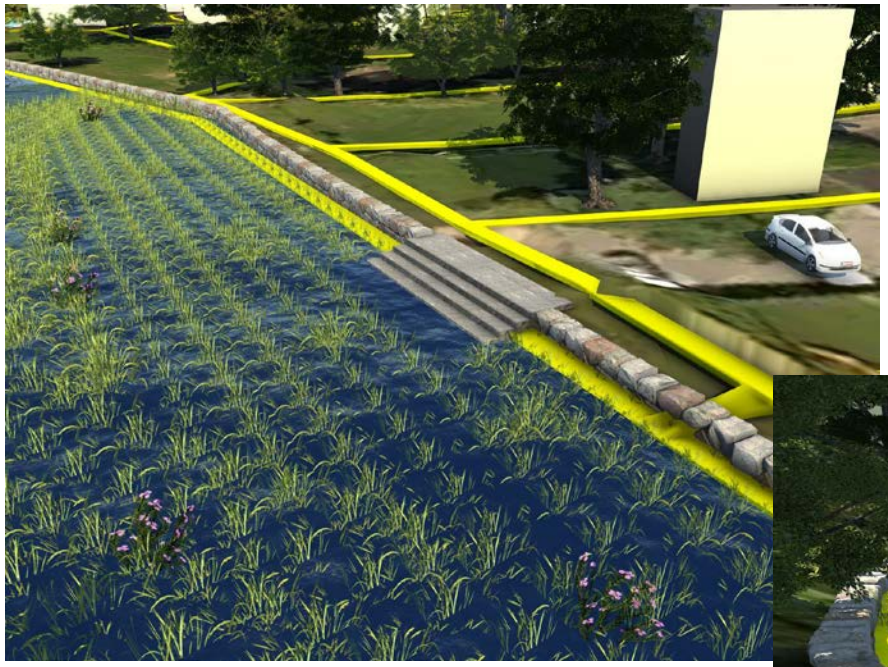




BANK TREATMENT EVALUATION

	LIVING SHORELINE	SEGMENTAL BLOCK WALL	GREEN GABIONS
Permitting	Agency Friendly	Higher Level Review	Moderate Review
Cost	$300 LF	$900/LF	$700/LF
Public Access	Open	Limited- access can be provided at key spots	Limited
Resiliency/ Sustainability	Small storm erosion	50-75 yr service life	50-75 service life
Maintenance	Debris/litter, plant maintenance, shoreline grading	Debris/litter	Debris/litter, growth maintenance

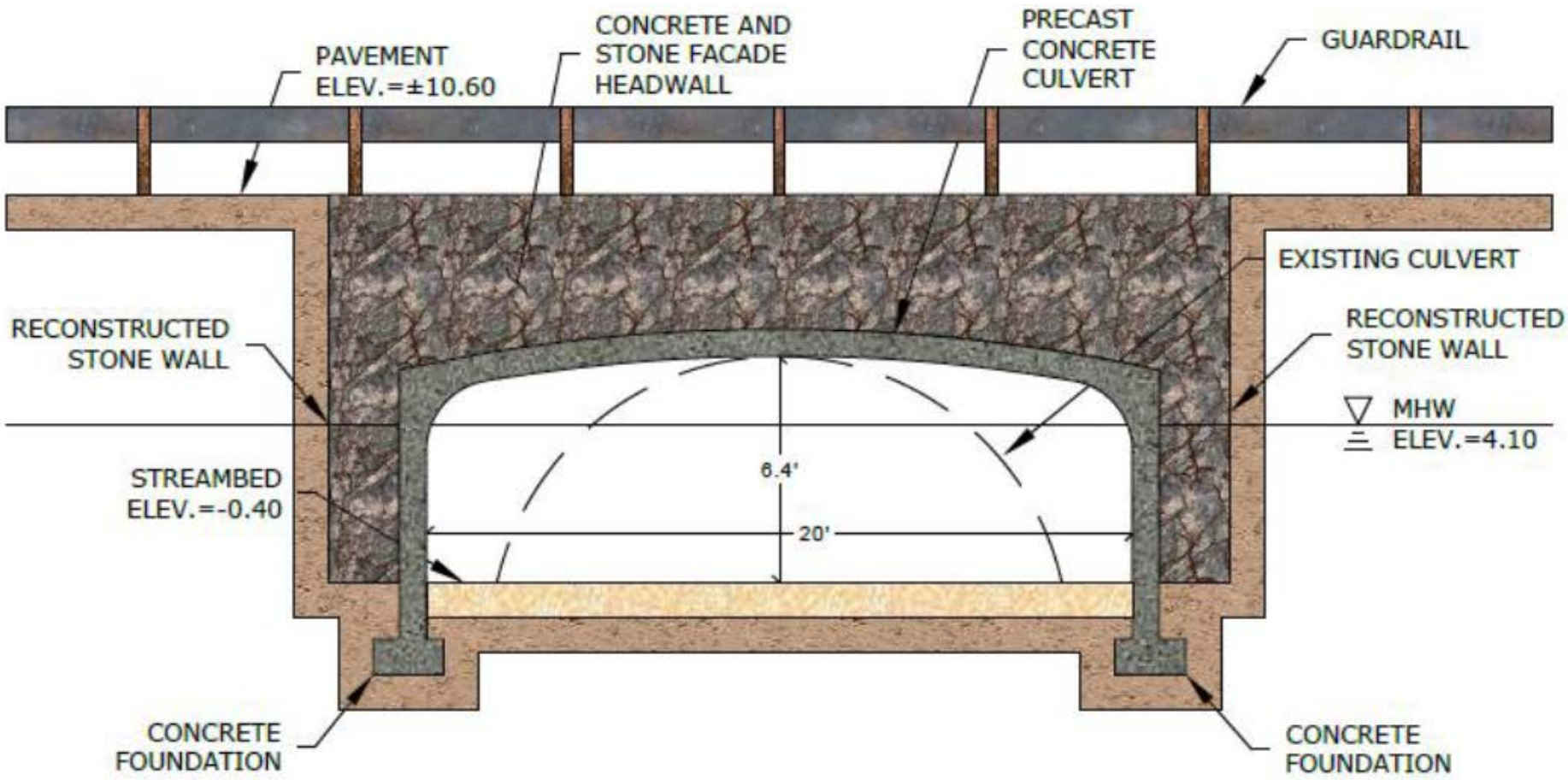
WALL REPAIRS AND BANK STABILIZED



BRIDGE RESTORATION PROJECT

Photo rendering of tide gate removed, new culvert, new granite wall and guard rail

BRIDGE RESTORATION PROJECT




DISCUSSION

Tighe&Bond¶

June·16,·2018¶

Datum·Conversion·Chart·¶

Datum¤	MLLW[1]¶ (NOAA· Datum)¤	NAVD88¶ (FEMA· Maps[2])¤	NGVD29¤	¤
FEMA·(AE·Zone)¤	¤	10¤	10.8¤	¤
Blizzard·of·2018·(1/4/18)¤	15.1[4]¤	8.9[6]¤	9.7¤	¤
100·YR·Flood·(NOAA)¤	¤	9.9[5]¤	¤	¤
HOTL¤	11.1¤	5.8¤	6.6¤	¤
MHHW¤	9.72¤	4.9¤	5.7¤	¤
MHW¤	9.26¤	4.5¤	5.3¤	¤
NAVD88¤	4.84¤	0¤	0.8¤	¤
MLW¤	0.34¤	-4.5¤	-3.7¤	¤
MLLW¤	0¤	-4.1¤	-3.3¤	¤

¶

FEMA:·Federal·Emergency·Management·Agency¶
NOAA:·National·Oceanic·and·Atmospheric·Administration¶
AE·Zone:·The·base·floodplain·where·base·flood·elevations·are·provided.¶
HOTL:·Highest·Observable·Tide·Line·(2018·predicted)¶
MHHW:·Mean·Higher·High·Water¶
MHW:·Mean·High·Water¶
NAVD88:·North·American·Vertical·Datum·of·1988·(NAVD88·is·0.81·ft·above·NGVD29)¶
MLW:·Mean·Low·Water¶
MLLW:·Mean·Lower·Low·Water¶
NGVD29:·National·Geodetic·Vertical·Datum·of·1929¶
¶

[1]This·data·is·based·on·the·1983-2001·tidal·epic·and·is·provided·by·NOAA.·For·Beverly·Harbor¶
[2]This·data·is·based·on·the·latest·FEMA·maps·for·Manchester-by-the-Sea·data·last·revised·in·July·of·2017.¶

VIEW OF CENTRAL POND AT LOW TIDE

POTENTIAL RESTORATION ALONG EAST BANK AT LOW TIDE

RESTORATION IN SUMMER MID-TIDE

RESTORATION IN SUMMER HIGH TIDE

KICKOFF MEETING SUMMARY

Sawmill Brook Restoration Project Kickoff Meeting Summary

LOCATION: Manchester-by-the-Sea Town Hall, 10 Central Street, Manchester

DATE: October 18, 2018

START TIME: 6:00 PM-7:30 PM

A welcome to the meeting was provided by Greg Federspiel, Manchester-by-the-Sea Town Administrator. Greg emphasized that nearly 5-years of planning has gone into the Sawmill Brook Flood Mitigation/ Restoration project. The project has multiple goals ranging from fish passage, wildlife habitat improvements, public safety and aesthetics which must be balanced with flood mitigation. Greg introduced the team from Tighe & Bond, and the new DPW Director, Chuck Dam and Facilities Manager, Nate Desrosiers and Eric Hutchins, NOAA Fisheries Biologist. Greg later introduced Mary Reilly, the Town's Grants Administrator.

Eric mentioned his 20-year experience in habitat restoration experience was entirely focused on dam and culvert removal and tide gates at similar locations throughout the Gulf of Maine. Eric is very familiar with the project, having been asked by the Town with other state technical agencies to participate in the restoration planning process for Sawmill Brook. Eric described the benefit of habitat restoration, restoration goals for NOAA and the unique feature of Sawmill Brook in supporting rainbow smelt populations just upstream of Central Pond. Eric described how dams or high velocity situations negatively impact rainbow smelt as they can't jump but must swim over the obstructions.

Tighe & Bond provided a slide presentation including the history of Sawmill Brook flood mitigation planning, an overview of the technical findings from the Sawmill Brook feasibility MET grant project, overview of the Sawmill Brook/ Central Pond restoration goals and the restoration alternative for the pond area and the walls. The slide presentation is attached.

The public participated with questions and comments throughout the slide presentation. A good deal of focus was spent on understanding the concept of what impact there was from removing the tide gate, and how storm surge and high tides currently passed over the gate regardless of its position being open or closed. Tighe & Bond engineers explained that the tide gate acts as a water control structure, impeding inland floods from draining to Manchester Harbor, but not controlling storm surge. As an example, flooding from the January 4th Nor'easter broke record high tide elevations and flooded several properties along the Pond despite the tide gate being closed.

Questions from the audience ranged from observations on historic flooding, past uses of the pond for skating and historic observations of fish species. Presentation of the restoration alternatives prompted very specific questions such as what the alternatives would look like, specific comments on the pros and cons elements, how long the restoration would take to finish, why the tide gate could not be enlarged to a higher elevation, benefits of public access, and potential walkways that could link to pathways on Town conservation land. The video rendering of the alternatives gave the audience a good idea of what the water surface elevations would look like at low tide. All options would look the same at high tide elevations.

The next steps for the restoration project were described including geotechnical borings and development of wall alternatives. A brief update on Central Street Bridge Project was provided, noting geotechnical and survey had been completed and design work was underway.

APPENDIX B

Tighe&Bond
Engineers | Environmental Specialists

221476012-02
January 14, 2019

Mr. Gregory Federspiel
Town Administrator
Manchester Town Hall
10 Central Street
Manchester-by-the-Sea, MA 01944

Re: **Geotechnical Evaluation for Retaining Wall Improvements**
Sawmill Brook – Central Pond Restoration

Dear Mr. Federspiel:

Tighe & Bond is pleased to present this geotechnical evaluation for proposed improvements to retaining walls which exist along the eastern bank of Central Pond in Manchester-by-the-Sea, MA. A Site Locus is presented as Figure 1 of Appendix A. This evaluation was completed in accordance with Purchase Order Number MAN-CON-201 dated July 26, 2018. The vertical datum referenced in this report is the North American Vertical Datum of 1988 (NAVD88).

Executive Summary

In general, subsurface conditions consisted of 3.5 to 9.5 feet of fill, overlying 0.5 to 4.5 feet of sands, overlying silts and clays which were penetrated approximately 4.5 to 8.5 feet before the explorations were terminated. An approximate 2-foot thick layer of organic silt was encountered below the fill and above the sand at boring B-2.

Retaining wall alternatives evaluated and discussed in this report include segmental retaining walls, both Mechanically Stabilized Earth (MSE) and gravity walls, and gabion retaining walls. The drainage features recommended for the different wall types are important to the performance and longevity of the new wall as poor drainage is likely contributing to the poor performance of the existing wall.

A net allowable bearing pressure of one ton per square foot (tsf) is recommended for a segmental retaining wall or gabion wall constructed on a compacted crushed stone leveling pad bearing on proof compacted existing fill or native sands, or on undisturbed native silts or clays. If organic silt is encountered at the bottom of the leveling pad it should be over-excavated from the leveling pad bearing zone, which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of pad, and replaced by compacted Crushed Stone wrapped in a non-woven geotextile separation fabric.

Additional test borings and laboratory testing should be performed during the design phase to refine the preliminary settlement estimates and evaluate the global stability of the new wall.

Site Conditions

Existing – A dry-stacked granite block retaining wall exists along the eastern bank of Central Pond. Much of the wall is in need of repair and portions of the wall have collapsed in two areas south of the Fire Station. Vehicles routinely park behind the wall in paved and unpaved areas south of the Baptist Church. North of the Church the areas behind the walls are landscaped with grass and some trees.

Existing topographic information is limited, however, in areas where it is currently available existing site grades along the bottom of the walls range from approximately elevation 0 feet at the southern end to elevation 2 to 3 feet elsewhere, and existing site grades along the top of the walls range from approximately elevation 8 to 9 feet in southern portions to elevation 6 to 7 feet elsewhere. Existing wall heights range from approximately 3 to 8 feet, tallest at the southern end.

The existing retaining wall is often overtopped during periods of flooding. The tide gate which currently exists downstream on the south side of the Central Street bridge was identified as a contributor to upstream flooding and is to be removed as part of the bridge replacement project. While removal of the tide gate will help reduce upstream flooding it is not anticipated to prevent it.

Proposed – Replacement of the existing retaining wall with either a segmental block wall or a gabion wall is currently being considered. It is anticipated that the new wall would be constructed within the same footprint as the existing wall, the site grading would remain relatively unchanged, and wall heights would be similar to the existing wall heights. The total length of wall replacement has not yet been determined.

Subsurface Conditions

The generalized subsurface conditions described in the text below summarize trends observed in the subsurface explorations. The boundaries between soil strata are approximate and based on interpretations of widely spaced explorations and samples. Actual conditions could be more variable.

Test Borings – Four geotechnical test borings (B-1 through B-4) were drilled by New England Boring Contractors of Derry, NH on November 28, 2018. Test borings were advanced with 4-inch inner diameter flush joint casing and drive and wash methods to depths of approximately 15 feet below the existing ground surface. Split-spoon sampling and Standard Penetration Tests (SPTs) were conducted at maximum 5-foot intervals. Test borings were terminated in native soils. Borings were backfilled upon completion with cuttings.

Approximate boring locations are shown on Figure 2, of Appendix A. Test boring logs are included in Appendix B.

Laboratory Testing – Laboratory tests were performed to aid in soil classifications, evaluate liquefaction potential, and evaluate soil re-use potential. One mechanical Particle Size Analysis tests (ASTM D6913), and four Atterberg limits test (ASTM D4318) were performed on samples taken during the explorations. Laboratory test results are included in Appendix C.

Summary of Subsurface Conditions – In general, subsurface conditions observed in the explorations consisted of approximately 5 to 6 inches of peastone, asphalt pavement or topsoil overlying 3.5 to 9.5 feet of fill, overlying 0.5 to 4.5 feet of sands, overlying silts and clays which were penetrated approximately 4.5 to 8.5 feet before the explorations were terminated. An approximate 2-foot thick layer of organic silt was encountered below the fill and above the sand at boring B-2. Table 1 below presents the general stratigraphy encountered during the subsurface exploration program in descending depth from below the surficial peastone, asphalt, or topsoil.

Table 1
Description of Subsurface Conditions Encountered

Strata (In Descending Depth)	General Description
FILL	Loose to very dense, brown, fine to coarse SAND with up to 50% Gravel and 50% Silt (containing up to 10% Brick at B-1, B-2 and B-4, and up to 10% Coal and Coal Ash at B-1)
ORGANIC SILT	Soft, dark brown ORGANIC SILT with up to 35% fine to coarse Sand and 20% Gravel (encountered at B-2 only)
SAND	Loose to very dense, brown to black, fine to coarse SAND with up to 35% Gravel, 35% Silt and 10% Shells (encountered at B-1, B-2 and B-3 only); varying to dense, gray, fine to coarse SAND with up to 50% Gravel and 20% Silt (encountered at B-4 only)
SILT	Medium dense, brown SILT with up to 35% fine to coarse Sand, 35% Fibrous Peat, 10% Gravel and 10% Wood (encountered at B-1 only); varying to loose to medium dense, gray SILT with up to 10% fine to coarse Sand (encountered at B-3 only)
CLAY & SILT	Stiff to very stiff, gray CLAY & SILT with up to 50% fine to coarse Sand and 10% Gravel (encountered at B-2 and B-4 only)

Groundwater was encountered near the existing ground surface at boring B-4 and at depths ranging from approximately 2 to 9 feet below the existing ground surface at the remaining borings. Water levels were taken during or immediately after drilling and may not reflect stabilized conditions. Water levels can fluctuate with the tide, season, precipitation, and nearby construction or other below grade activities, such as excavation, dewatering, wells, infiltration basins, etc.

Geotechnical Evaluation and Recommendations

The analyses and recommendations submitted in this evaluation are based upon the data obtained from the relatively widely spaced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If significant variations from these descriptions appear during construction, it will be necessary to re-evaluate these recommendations.

Retaining Wall Alternatives

Segmental Retaining Walls

A segmental retaining wall is a modular system consisting of pre-cast concrete block units dry-stacked on top of each other which resist overturning and sliding through their weight,

block to block friction, block to block interlocking using shear keys or dowels, and sometimes geogrid reinforcement. They can be constructed with a near vertical face or with a slight batter. There are many segmental wall systems to choose from, each offering different block sizes, surface textures and colors. These systems are typically separated into two categories; mechanically stabilized earth (MSE) retaining walls and gravity retaining walls, which are both discussed below.

Drainage is critical to the successful performance of any retaining wall and may be a cause of the poor performance of the existing wall. As Central Pond water levels may overtop the walls additional wall drainage features are recommended and discussed in the sections below.

Being somewhat flexible structures, segmental retaining walls typically do not require frost protection through embedment at the toe and therefore have relatively shallow embedment depths. The minimum embedment depth is 6 inches, but greater embedment may be required for wall stability or scour protection, which will be needed for this project due to fluctuating water levels in front of the wall. Segmental retaining walls are typically designed to bear on leveling pads consisting of compacted crushed stone or unreinforced concrete. A crushed stone leveling pad is recommended as it will more readily accommodate differential settlement along the wall, not require additional wall embedment for frost protection, and may aid with wall drainage.

MSE Walls

MSE retaining walls use horizontal layers of geogrid reinforcement placed between the blocks and extended a specified distance behind the wall to provide increased sliding and overturning resistance. The strength, spacing and length of the geogrid is designed for site specific conditions including, but not limited to the block type, retained soil properties, wall height, and seismic and surcharge loading. In general, the minimum geogrid length measured from the front face of the wall is at least 60% of the total wall height and not less than 4 feet. In addition, soils located within the geogrid reinforced zone behind the wall are typically select granular fills which are required to meet material specifications for grain size and shear strength.

A blanket and heel drain are recommended below and behind the geogrid reinforced soil zone, respectively, to promote wall drainage during times of high water and to help reduce the potential for hydrostatic forces acting within the wall system. Recommendations for drainage materials are provided in the geotechnical design recommendations section of this report.

Excavations for construction of MSE walls must extend far enough behind the wall to install the geogrid and the heel drain located behind the reinforced zone, and therefore are most often used in areas where the wall will retain fills to be placed behind the wall. In wall replacement scenarios such as this, the existing site soils would need to be removed to allow for placement of the geogrid and select soils within the reinforced soil zone and construction of the heel drain. Design of the geogrid reinforcement would also need to account for utilities or embedded structures which may be located behind the wall within the reinforced zone.

Gravity Walls

Gravity segmental retaining walls rely on their self-weight without the use of geogrid to achieve resistance to sliding and overturning forces. As such, gravity wall block units are typically much larger than MSE wall block units and range from approximately 16 to 18 inches tall and 46 to 48 inches wide at the face, 28 to 84 inches deep, and weigh about 1,000 pounds for smaller units to more than 4,000 pounds for larger units. One benefit of gravity walls is they do not rely on the strength of geogrid or the connection between the geogrid and block units to help resist destabilizing forces. Another benefit is that the extent of excavation behind the wall is typically less than that for an MSE wall since geogrid is not used. This lends itself

to situations where a retaining wall is required within a cut area, or where the limit of excavation needs to be reduced due to cost or physical constraints. A downside to gravity walls is that their relatively heavy weight can be a challenge from a bearing capacity, settlement, and installation perspective.

Drainage is equally as important for a gravity wall. Crushed Stone wrapped in a non-woven geotextile separation fabric should be used as free draining backfill behind the wall to promote wall drainage during times of high water and to help reduce the potential for hydrostatic forces acting on the back side of the wall. Recommendations for drainage materials are provided in the geotechnical design recommendations section of this report.

Gabion Walls

Gabions are wire mesh baskets filled with stone to form flexible, permeable structures that used for earth retention, among other uses. The wire can be twisted or welded together and can be made from stainless steel and/or PVC coated for increased corrosion protection. The type of stone fill can be chosen based on local availability and desired aesthetics. Gabions are available as assembled baskets, as unassembled panels, or in rollstock for use in fabricating custom sizes. They are typically assembled and filled with stone on-site, but may also be constructed off-site and trucked in. The face of a gabion wall may also be planted to provide a vegetated façade, if accounted for in the wall design.

Gabion walls are most often constructed as gravity walls with a 6-degree batter from vertical with either a stepped front face or stepped back face depending on the desired look. They may also be constructed as MSE walls using wire mesh reinforcement, rather than geogrid, fastened to the wire baskets and extended a specified distance into the backfill. A gravity rather than an MSE type gabion wall would be the preferred gabion alternative for this project due to its simpler construction and reliance on gravity to resist destabilizing forces rather than wire mesh reinforcement.

A benefit of gabion walls is that they are constructed with stone and are free draining. As such, additional drainage features would not be needed behind a gabion wall, however, a non-woven geotextile separation fabric should be placed along the backside of the gabions to help prevent migration of soil into the stone fill. Another benefit of a gabion wall is its flexibility which makes it less susceptible to differential settlements than a segmental retaining wall.

Potential Settlement

A preliminary evaluation of potential settlements due to consolidation of the underlying clay was performed for a gravity wall, which would likely be the heaviest of the three retaining wall alternatives discussed above. A preliminary evaluation of a gravity wall alternative using ReCon Analysis Software developed by ReCon Retaining Walls showed that a 5-foot deep (front to back) bottom block may be needed to achieve wall stability for an 8-foot tall wall, the tallest anticipated, with a 250 pound per square foot surcharge load applied behind it to account for parked vehicles, and would result in a bearing pressure of approximately 1,700 pound per square feet (psf). For the settlement analysis the base of the retaining wall was modeled as a 5-foot wide continuous strip footing having a bearing pressure of one ton per square foot (tsf). Although the clay was not fully penetrated by the test borings and its thickness is not known at this time, it was assumed that the clay extends deeper than the pressure bulb for the assumed footing width. Compressibility parameters for the clay were assumed based on experience with similar marine clays.

Based on the stiff consistency of the clays versus the relatively shallow depth at which they were encountered the clays are likely over-consolidated and most, if not all the settlement would be from recompression of the clay. Assuming over-consolidation ratios (OCR) of 5 and

2, potential settlements were estimated to be approximately ½ inch and 2 inches, respectively. These estimates should be refined during the design phase through additional test borings and laboratory testing to determine the thickness and compressibility of the clay if a segmental block wall is the selected alternative. If a gabion wall alternative is selected, then it is anticipated that the net load increase on the underlying clays and the resulting settlements would be relatively small and tolerable to the more flexible gabion wall system.

Global Stability

Global stability of the selected retaining wall alternative should be completed during final design. Additional test borings and laboratory testing should be performed during the design phase to determine the thickness and strength of the clay which will likely impact the global stability of the new wall.

Geotechnical Design Recommendations

Retaining Wall Design – Based on the subsurface conditions observed in the test borings and assuming bottom of wall elevations similar to the existing walls, a preliminary wall embedment depth of 1-foot, which is fairly typical for relatively low height walls, and a 12-inch thick leveling pad, soils at the leveling pad subgrade level are anticipated to consist of existing fill soils or native sands. Organic silt may be encountered at the bottom of the leveling pad near boring B-2, and if it is it should be over-excavated from the leveling pad bearing zone, which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of pad, and replaced by compacted Crushed Stone wrapped in a non-woven geotextile separation fabric. If the new wall is embedded deeper than anticipated, then medium dense silts or stiff clays could also be encountered at the bottom of the leveling pad.

Subgrades and required fill to achieve proposed grade should be prepared, placed, and compacted as recommended later in this letter.

A net allowable bearing pressure of one ton per square foot (tsf) is recommended for a segmental retaining wall or gabion wall constructed on a compacted crushed stone leveling pad bearing on proof compacted existing fill or native sands, or on undisturbed native silts or clays. It is recommended that segmental retaining walls or gabion retaining walls be designed for the following lateral loads:

- Static: 40 psf/ft as an equivalent fluid pressure
- Surcharge: 0.31 times the vertical surcharge load uniformly distributed over the height of the wall. The minimum vertical surcharge should be equivalent to an H-20 vehicular load, if vehicles (including construction equipment) will be allowed above the wall within a distance of the 1.5 times the wall height. The wall design should account for sloping ground surface in front of and behind the wall, as applicable.
- Seismic: $4.6H^2$ distributed as an inverse triangle over the height of the wall

These design values were calculated using Rankine Theory with a soil unit weight of 130 pounds per cubic foot (pcf) and a friction angle of 32 degrees, and do not include hydrostatic loads as it is assumed that drainage systems will be installed to prevent buildup of hydrostatic pressures. Drainage systems should include the use of Crushed Stone wrapped in non-woven geotextile separation fabric placed directly behind MSE walls and as blanket and heel drains for MSE walls, and as backfill for gravity walls. To further limit hydrostatic pressures, it is recommended to install a 6-inch diameter perforated PVC pipe at the base of an MSE or gravity wall as well as at the intersection of the blanket and heel drain of an MSE wall to help drain the wall backfill. The pipe should be surrounded by at least 6 inches of Crushed Stone

that is wrapped a non-woven geotextile separation fabric. The pipes should either be tied into a site drainage system or should daylight periodically through weep holes in the wall.

The entire reinforced zone of an MSE wall should consist of select granular materials to be specified by the wall designer. Additional fill needed behind the heel drain of an MSE wall should consist of Granular Fill. Fill needed behind a gabion wall should consist of Gravel Borrow separated from the gabion baskets by a non-woven geotextile separation fabric, or Crushed Stone wrapped in a non-woven geotextile separation fabric.

Where the calculated lateral earth pressure is less than 200 pounds per square foot (psf), it should be increased to 200 psf to account for compaction induced stresses.

The recommended minimum factors of safety against sliding and overturning are 1.5 and 2.0, respectively. A coefficient of friction equal to 0.50 ($\delta = 27$ degrees) should be used for masonry on crushed stone.

The retaining wall will be exposed to salt water from the harbor and possibly to road salt from parking areas behind the wall. Therefore, the retaining wall design must include protective measures to guard against potential corrosion and alkali silica reaction in concrete. This may require the use of stainless steel gabion baskets, if gabions are the selected alternative, or concrete made with aggregate which has passed tests for alkali silica reaction potential and a mix design that is appropriate for use in saltwater environments.

Seismic Design - Based on data from the borings, the site is assigned to Site Class D, according to the Massachusetts State Building Code (MSBC). The design spectral response accelerations at short periods (S_{DS}) and at 1-second periods (S_{D1}) are 0.266 and 0.118, respectively. These values were calculated based on mapped spectral response accelerations and the appropriate magnification factors for Site Class D. The Seismic Design Category should be determined by the retaining wall design engineer based upon the seismic use groups presented in the building code.

Based on standard penetration test N-values, groundwater levels measured at the site, gradation of the soils observed in the explorations, and the liquefaction susceptibility charts included in the MSBC, soils encountered in the borings are not considered susceptible to liquefaction.

Geotechnical Construction Recommendations

This section provides comments related to earthwork and other geotechnical aspects of the project that will aid those responsible for preparing construction specifications.

Excavation and Fill – Conventional heavy construction equipment should be suitable for excavation in existing soil materials. Excavation should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest edition. Subgrades should be excavated in such a way to minimize disturbance, such as using a smooth faced bucket.

Table 2 presents the required gradations for the imported materials to be used as retaining wall backfill as discussed in the retaining wall design section of this report.

Table 2
Gradation Requirements for Borrow Materials

Sieve Size	Percent Finer by Weight		
	Granular Fill	**Gravel Borrow**	**1-1/2" Crushed Stone**
2/3rd lift thickness	100		
2 inch	--	100	100
1½ inch	--	--	95-100
1 inch	--	--	35-70
¾ inch	--	--	0-25
½ inch	--	50-85	--
No. 4	--	40-75	--
No. 10	30-95	--	--
No. 40	10-70	--	--
No. 50	--	8-28	--
No. 200	0-15	0-10	--

All backfill should be placed in 12-inch maximum lifts and should be compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor laboratory test (ASTM D1557). Thinner lifts may be needed depending on the material placed and the type of compactor used. Crushed Stone should be placed in loose lift thicknesses of less than 12 inches and be compacted with heavy compaction equipment to achieve an unyielding subgrade.

Dewatering – Except for periods around low tide, water levels are anticipated to be above the bottom of the leveling pad. Temporary cofferdams with pumping from properly filtered sumps will likely be required to keep excavations dry and allow placement and compaction of fills to be completed in the dry. Water should be discharged according to federal, state, and local regulations. The water level should be temporarily lowered at least two feet below excavations to limit potential "boils", loss of fines, or softening of the ground. Surface water entering the construction area should be diverted away from excavations.

Bearing Surface Preparation – Excavated granular subgrades should be proof compacted with either 10 passes of a 10-ton vibratory drum roller for open excavations or 6 passes of a large, reversible, walk behind vibratory compactor capable of exerting a minimum force of 2,000 lbs in trench or pit excavations. Any subgrades that are soft or yielding under proof compaction efforts should be removed below the leveling pad bearing zone which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of pad and replaced with compacted Crushed Stone wrapped in a non-woven geotextile. If proof compaction will prove detrimental to the surface due to the presence of groundwater, static

rolling may be allowed at the discretion of the Engineer. Silt and clay subgrades should not be proof compacted.

Due to the high fines (silt) content in the existing fill soils and sands and the possible presence of silts or clays at the bottom of the bearing pad, some of the bearing surfaces may be easily disturbed during foundation construction activities should they become wet from precipitation or groundwater. If desired, the bearing surfaces may be over-excavated by 6 to 12 inches and replaced by a layer of compacted Crushed Stone wrapped in a non-woven geotextile separation fabric to provide a stable working surface.

Time between final excavation and placement of the leveling pad should be minimized to limit disturbance and groundwater induced softening of the subgrade. Soil bearing surfaces should be protected against freezing and the elements before placement of the leveling pad. If construction is performed during freezing weather, walls should be backfilled as soon as possible after they are constructed. Alternatively, insulating blankets or other means may be used for protection against freezing.

Reuse of Existing Soils - Existing subsurface materials, excluding topsoil and organic silt, may be re-used as Granular Fill, regardless of its gradation, provided it is environmentally appropriate, free of organics, debris, stones greater than two thirds the lift thickness in diameter, or other unsuitable material, and they are placed to the required degree of compaction. It should be noted that some of the existing site soils have a relatively high fine grained content, which could make them difficult to place and compact to the required degree of compaction when excessively wet. Native silts or clays excavated during construction will likely not be suitable for reuse on-site since tight control of the material's moisture content, or moisture conditioning through wetting or drying, would be required for material placement and compaction.

Existing site soils may not be re-used as select fill within the reinforced zone of an MSE wall or as Gravel Borrow or Crushed Stone unless it meets the material gradation requirements presented above or as specified by the wall designer, which is unlikely.

It was not within Tighe & Bond's scope of work to evaluate the potential for soil contamination with regard to suitability for reuse under the Massachusetts Contingency Plan (MCP) regulations or for off-site disposal purposes.

Closing

The preceding recommendations provided herein are for specific application to the proposed improvements to retaining walls which exist along the eastern bank of Central Pond in Manchester-by-the-Sea, MA, in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made. In the event that any changes in the design or location of the proposed structure are made, the conclusions and recommendations in this report should not be considered valid unless verified in writing. This report is for design purposes only and may not be sufficient to prepare accurate quantity take-offs. It is discouraged that this report in its entirety be included in the construction documents or be provided to a contractor. Rather, the construction recommendations should be incorporated appropriately into the construction specifications as well as exploration locations, exploration logs, and laboratory test results for the contractor's use under informational purposes only.

Thank you for the opportunity to provide these services. Please contact Gabrielle Belfit at (508) 304-6362 or Dave Brogan at (603) 433-8818 if you should have any questions, comments, or require additional information.

Very truly yours,

TIGHE & BOND, INC.

David R. Brogan, P.E.
Senior Engineer

David L. Loring, P.E., ENV SP, LEED AP
Vice President

Enclosures:

Appendix A – Figures
Appendix B – Exploration Logs
Appendix C – Laboratory Test Results

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Appendix A
Figures

FIGURE 1
SITE LOCATION MAP

Sawmill Brook - Central Pond Restoration
Manchester-by-the-Sea, MA

January 2019

Tighe&Bond
Engineers | Environmental Specialists

Based on USGS Topographic Map for Marlbehead North, MA Quadrangle. Revised 1985. Circles indicate 500-foot and half-mile radii.

1:24,000
0 1,000 2,000
Feet

N

G:\GIS\MA\SiteLocus\Manchester\topo_SawmillBrook-CentralPond.mxd

M-1476-012

LEGEND

B-1 APPROXIMATE LOCATION OF TEST BORING DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH ON NOVEMBER 28, 2018

N

SCALE IN FEET
0 60' 120'
GRAPHIC SCALE

CHURCH
GRANITE RET. WALL
FIRE DEPARTMENT
B-4
B-3
B-2
B-1
CENTRAL POND
9+00
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
RUBBLE FROM RET. WALL
RUBBLE FROM RET. WALL
GRANITE RET. WALL
CENTRAL STREET
COMMERCIAL BUILDING
APARTMENT BUILDING
COMMERCIAL BUILDING
COMMERCIAL BUILDING
COMMERCIAL BUILDING
COMMERCIAL BUILDING
COMMERCIAL BUILDING
MUSEUM
ELM STREET
ROUTE 127

SUBSURFACE EXPLORATION LOCATION PLAN

SAWMILL BROOK - CENTRAL POND RESTORATION
MANCHESTER-BY-THE-SEA, MA

DATE: 1/9/2019
SCALE: AS SHOWN
FIGURE: #2

Tighe&Bond
Engineers | Environmental Specialists

Jan 08, 2019-5:00pm Plotted By: BJL
Tighe & Bond, Inc. J:\M\M1476 Manchester MA Hydro Study\009_MET_Sawmill Feasibility\Drawings_Figures\Geotech\M1476_Subsurface-Site Plan.dwg

Appendix B
Exploration Logs

Tighe&Bond
Engineers | Environmental Specialists

Boring No. **B-1**
Page 1 of 1
File No. M-1476012-02
Checked by: D. Brogan

Project: Sawmill Brook - Central Pond Restoration
Location: Manchester-by-the-Sea, MA
Client: Town of Mancheste-by-the-Sea

Drilling Co.: New England Boring Contractors
Foreman: Pete McClenahan
T&B Rep.: M. Trovato
Date Start: 11/28/18 End: 11/28/18
Location See Exploration Location Plan
GS. Elev. ±8' 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
11/28/18	13:30	9'		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-1/10	0-2	8 - 7	6-inches of Peastone, over medium dense, brown, fine to coarse SAND, some Gravel, little Silt, trace Brick	0.5' PEASTONE		No Well Installed
				7 - 5				
		S-2/11	2-4	5 - 5	Medium dense, brown, fine to coarse SAND, some Gravel, little Silt			
				6 - 6				
		S-3/8	4-6	3 - 3	Loose, brown, fine to coarse SAND, some Silt, little Gravel, trace Brick	FILL		
5				2 - 2				
		S-4/6	6-8	2 - 5	Medium dense, brown, fine to coarse SAND, some Silt, little Gravel, trace Brick, Coal, Coal Ash			
				7 - 6				
		S-5/0	8-10	5 - 4	No Recovery			
				3 - 7				
10						10'		
		S-6A/6	10-12	11 - 13	S-6A: Medium dense, brown, fine to coarse SAND, some Gravel, some Silt; S-6B: Medium dense, brown, SILT, some fine to coarse Sand, some Fiberous Peat, trace Gravel, trace Wood	10.5 SAND		
		S-6B/7		6 - 7				
		S-7/8	12-14	3 - 4	Medium dense, brown, SILT, some fine to coarse Sand, some Fiberous Peat, trace Gravel, trace Wood	SILT		
				6 - 6				
15					Bottom of Exploration at 15'			
20								
25								
30								

Notes:

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

Tighe&Bond
Engineers | Environmental Specialists

Boring No. **B-2**
Page 1 of 1
File No. M-1476012-02
Checked by: D. Brogan

Project: Sawmill Brook - Central Pond Restoration
Location: Manchester-by-the-Sea, MA
Client: Town of Mancheste-by-the-Sea

Drilling Co.: New England Boring Contractors
Foreman: Pete McClenahan
T&B Rep.: M. Trovato
Date Start: 11/28/18 End: 11/28/18
Location See Exploration Location Plan
GS. Elev. ±7' 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
11/28/18	11:30	2.3'		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-1/5	0-2	9 - 10	6-Inches of Peastone, over medium dense, brown, fine to coarse SAND, some Gravel, little Silt	0.5' PEASTONE		No Well Installed
				18 - 26		FILL		
		S-2/8	2-4	8 - 6	Loose, brown, fine to coarse SAND, some Gravel, some Silt, trace Brick			
				2 - 2		4'		
5		S-3A/12	4-6	4 - 1	S-3A: Soft, dark brown, ORGANIC SILT, little fine to coarse Sand, trace Gravel; S-3B: Soft, dark brown, ORGANIC SILT, some fine to coarse Sand, little Gravel	ORGANIC SILT		
		S-3B/4.5		1 - 1		6'		
		S-4A/7	6-8	2 - 3	S-4A: Loose, brown, fine to coarse SAND, some Silt, little Gravel, trace Brick; S-4B: Stiff, gray, CLAY & SILT, little fine to coarse Sand, trace Gravel	6.5' SAND		
		S-4B/3		5 - 5				
		S-5/2	8-10	9 - 2	No Recovery			
				2 - 2				
10		S-6/6.5	10-12	3 - 5	Stiff, gray, CLAY & SILT and fine to coarse SAND, little Gravel	CLAY & SILT		
				6 - 6				
		S-7/23	12-14	7 - 10	Very stiff, gray, CLAY & SILT, trace fine to coarse Sand, trace Gravel			
				8 - 7				
15					Bottom of Exploration at 15'			
20								
25								
30								

Notes:

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

Tighe&Bond
Engineers | Environmental Specialists

Boring No. **B-3**
Page 1 of 1
File No. M-1476012-02
Checked by: D. Brogan

Project: Sawmill Brook - Central Pond Restoration
Location: Manchester-by-the-Sea, MA
Client: Town of Mancheste-by-the-Sea

Drilling Co.: New England Boring Contractors
Foreman: Pete McClenahan
T&B Rep.: M. Trovato
Date Start: 11/28/18 End: 11/28/18
Location See Exploration Location Plan
GS. Elev. ±8' 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
11/28/18	9:30	3.3'		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-1/8	0-2	6 - 6	5-inches of Asphalt, over medium dense, brown, fine to coarse SAND and GRAVEL, little Silt	0.4' ASPHALT		No Well Installed
				7 - 5		FILL		
		S-2A/3	2-4	5 - 4	S-2A: Loose, brown, fine to coarse SAND, little Gravel, little Silt; S-2B: Loose, brown, fine to coarse SAND and SILT, little Gravel	4'		
		S-2B/6		2 - 2				
		S-3A/9	4-6	2 - 1	S-3A: Loose, dark brown, fine to coarse SAND, some Gravel, little Silt, trace Shells; S-3B: Loose, dark brown to black, fine to coarse SAND, some Silt, trace Gravel, trace Shells			
5		S-3B/4.5		4 - 8		SAND		
		S-4/6	6-8	8 - 25	Very dense, dark brown to black, fine to coarse SAND, some Silt, trace Gravel, trace Shells			
				35 - 18				
		S-5A/3	8-10	9 - 4	S-5A: Loose, gray, fine to coarse SAND, some Gravel, little Silt; S-5B: Loose, gray, SILT, trace fine to coarse Sand	8.5'		
		S-5B/7		3 - 6				
10		S-6/10.5	10-12	5 - 7	Medium dense, gray, SILT, trace fine to coarse Sand			
				11 - 10		SILT		
		S-7/16	12-14	8 - 7				
				7 - 7	Medium dense, gray, SILT,			
15					Bottom of Exploration at 15'			
20								
25								
30								

Notes:

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

Tighe&Bond
Engineers | Environmental Specialists

Project: Sawmill Brook - Central Pond Restoration
Location: Manchester-by-the-Sea, MA
Client: Town of Mancheste-by-the-Sea

Boring No. **B-4**
Page 1 of 1
File No. M-1476012-02
Checked by: D. Brogan

Drilling Co.: New England Boring Contractors
Foreman: Pete McClenahan
T&B Rep.: M. Trovato
Date Start: 11/28/18 End: 11/28/18
Location See Exploration Location Plan
GS. Elev. ±7' 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
11/28/18	16:00	0.3'		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
						0.5' TOPSOIL		
						FILL		No Well Installed
5		S-1/10	4-6	89 - 26	Very dense, brown, fine to coarse SAND, some Gravel, little Silt, trace Brick			
				25 - 22		6'		
		S-2/9	6-8	19 - 21	Dense, gray, fine to coarse SAND and GRAVEL, little Silt	SAND and GRAVEL		
				15 - 11		8'		
		S-3/12	8-10	7 - 7	Stiff, gray, CLAY & SILT			
10				4 - 4				
		S-4/18	10-12	4 - 5	Stiff, gray, CLAY & SILT	CLAY & SILT		
				3 - 3				
		S-5/13	12-14	6 - 7	Stiff, gray, CLAY & SILT, trace Gravel			
				7 - 4				
15					Bottom of Exploration at 15'			
20								
25								
30								

Notes:

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

Appendix C
Laboratory Test Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
Tighe & Bond
Worcester, MA
PM: Dave Brogan
Assigned By: Dave Brogan
Collected By: M. Trovato

Project Information:
Sawmill Brook - Central Pond Restoration
Manchester-by-the-Sea, MA
T&B Project Number: 221476012-02
Summary Page: 1 of 1
Report Date: 12.27.18

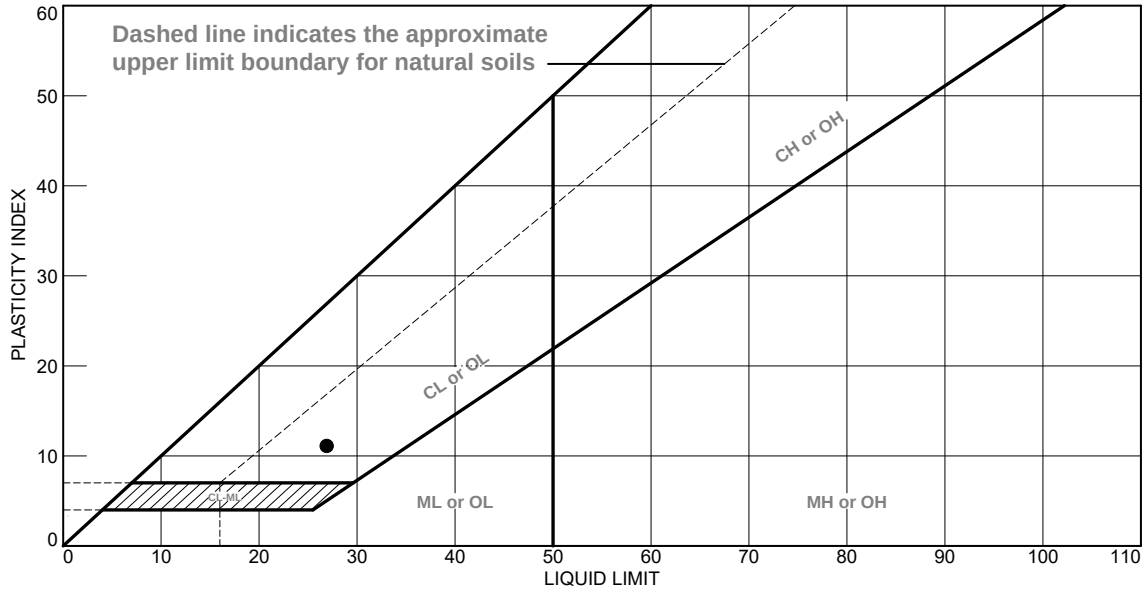
LABORATORY TESTING DATA SHEET

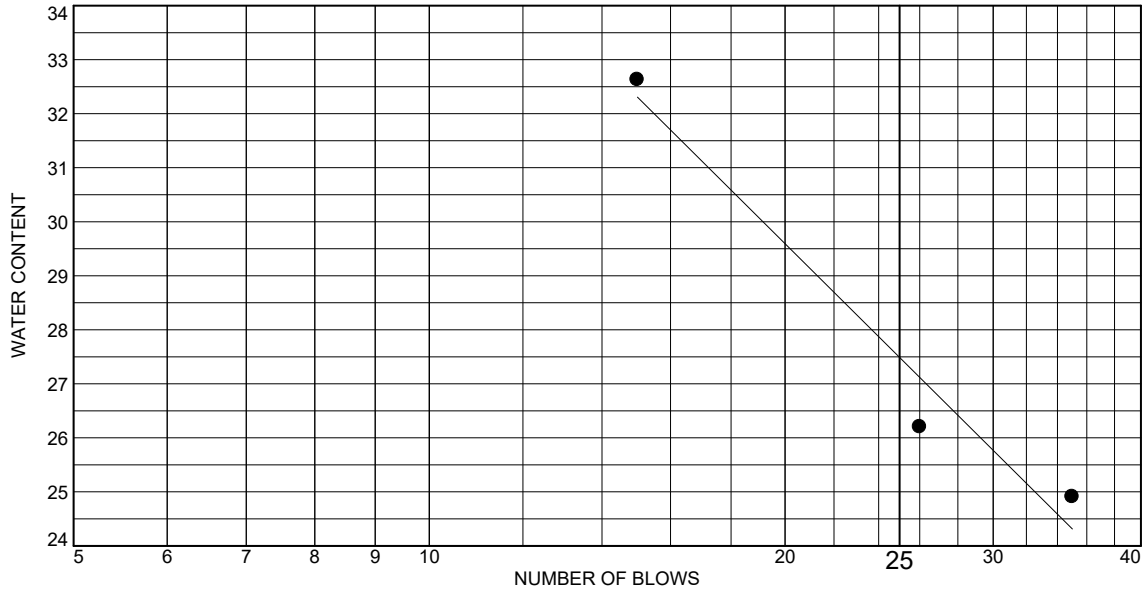
Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
B-2	S-7	12-14	18-S-1957	23.7	27	16														Grey silty clay
B-3	S-6	10-12	18-S-1958	19.8	NV	NP														Grey silt
B-4	S-3	8-10	18-S-1959	23.6	35	18														Grey silty clay
B-4	S-4	10-12	18-S-1960	29.3	31	17														Grey silty clay
B-1	S-2	2-4	18-S-1961				25.1	58.7	16.2											Brown and Grey silty sand with gravel

Reviewed By _____

12.28.2018

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey silty clay	27	16	11			

Project No. 221476012- **Client:** Tighe & Bond

Project: Sawmill Brook - Central Pond Restoration

Manchester-by-the-Sea, MA

Source of Sample: Borings **Depth:** 12-14'

Sample Number: B-2 / S-7

Thielsch Engineering Inc.

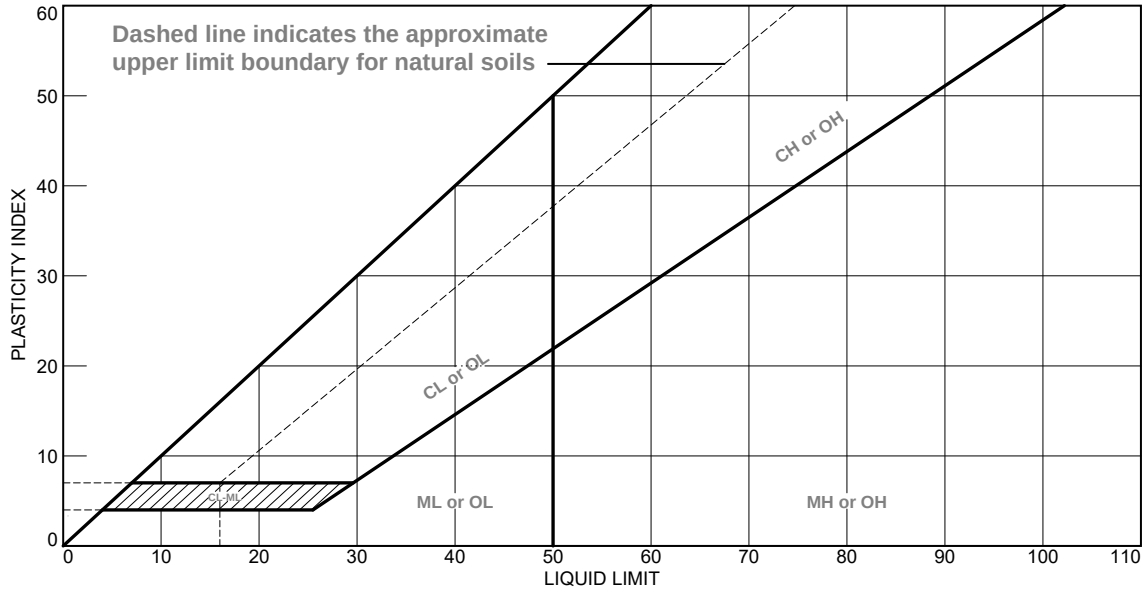
Cranston, RI

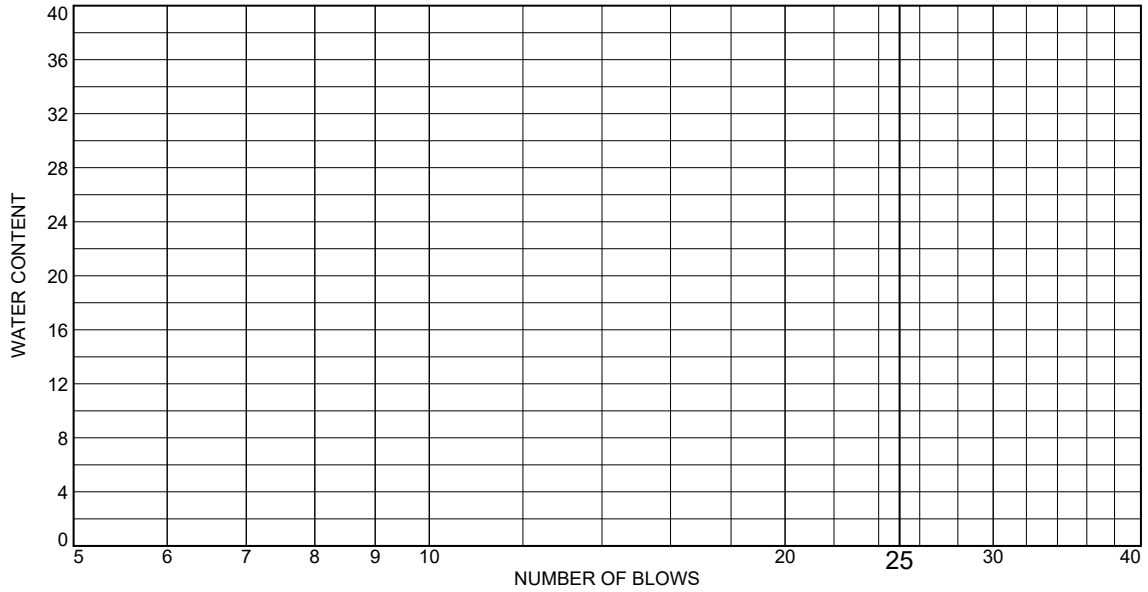
Remarks:

Figure 18-S-1957

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey silt	NV	NP	NP			

Project No. 221476012- **Client:** Tighe & Bond

Project: Sawmill Brook - Central Pond Restoration

Manchester-by-the-Sea, MA

Source of Sample: Borings **Depth:** 10-12'

Sample Number: B-3 / S-6

Thielsch Engineering Inc.

Cranston, RI

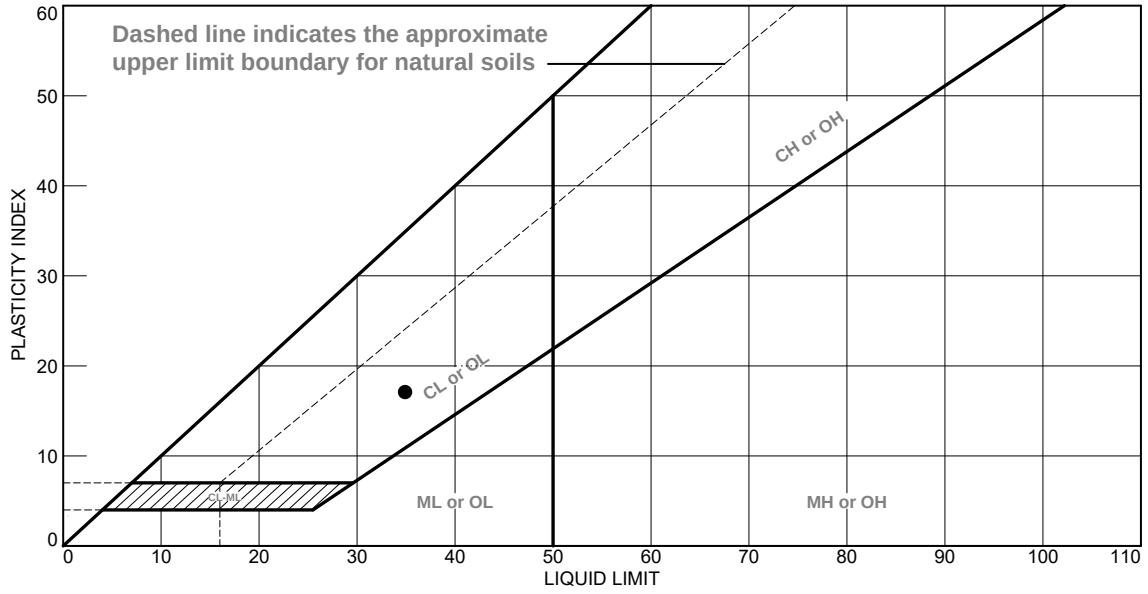
Remarks:

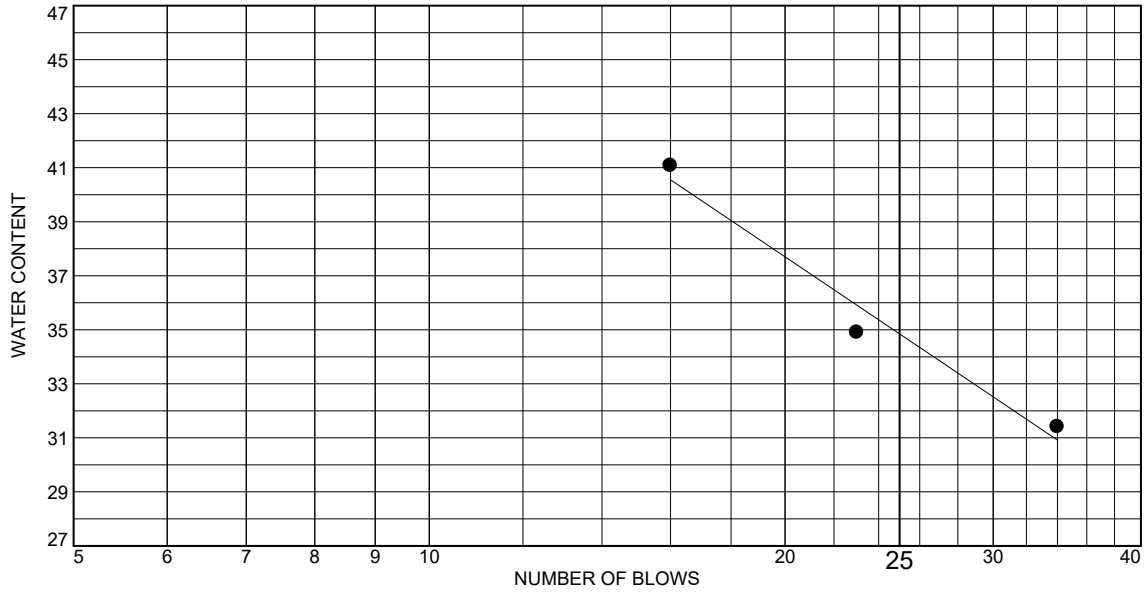
●Sample could not be rolled down to a 1/4 inch.

Figure 18-S-1958

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey silty clay	35	18	17			

Project No. 221476012- **Client:** Tighe & Bond

Project: Sawmill Brook - Central Pond Restoration

Manchester-by-the-Sea, MA

Source of Sample: Borings **Depth:** 8-10'

Sample Number: B-4 / S-3

Thielsch Engineering Inc.

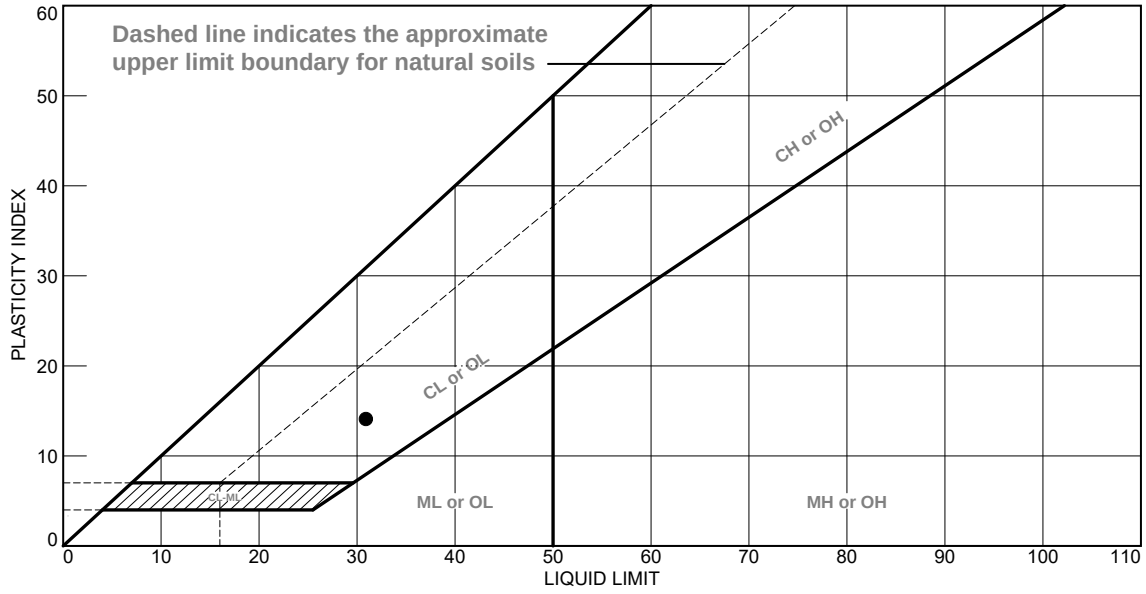
Cranston, RI

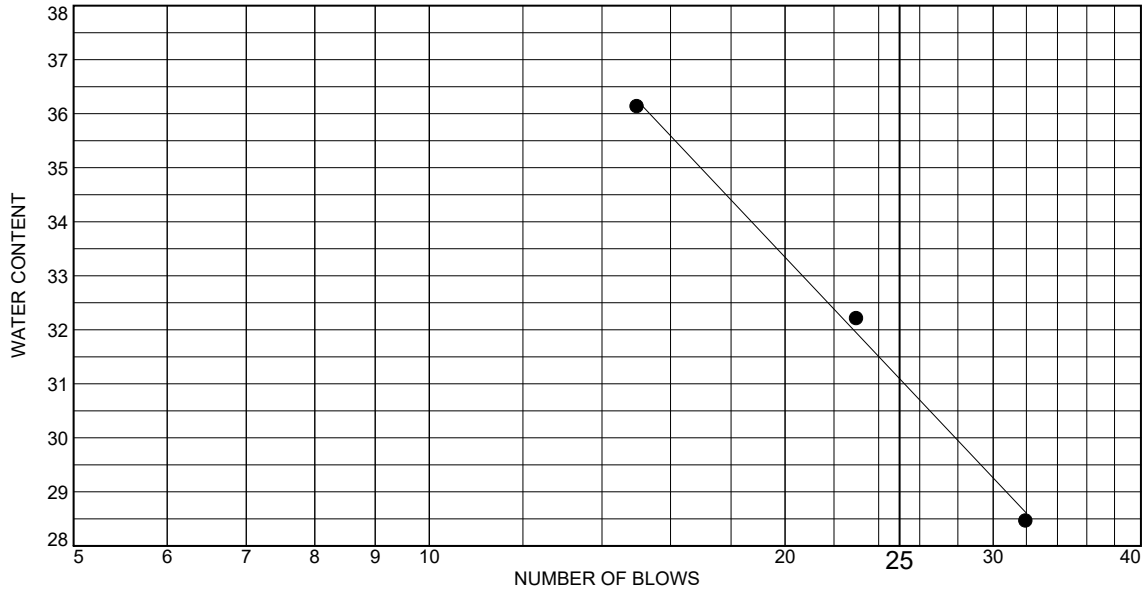
Remarks:

Figure 18-S-1959

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey silty clay	31	17	14			

Project No. 221476012- **Client:** Tighe & Bond

Project: Sawmill Brook - Central Pond Restoration

Manchester-by-the-Sea, MA

Source of Sample: Borings **Depth:** 10-12'

Sample Number: B-4 / S-4

Thielsch Engineering Inc.

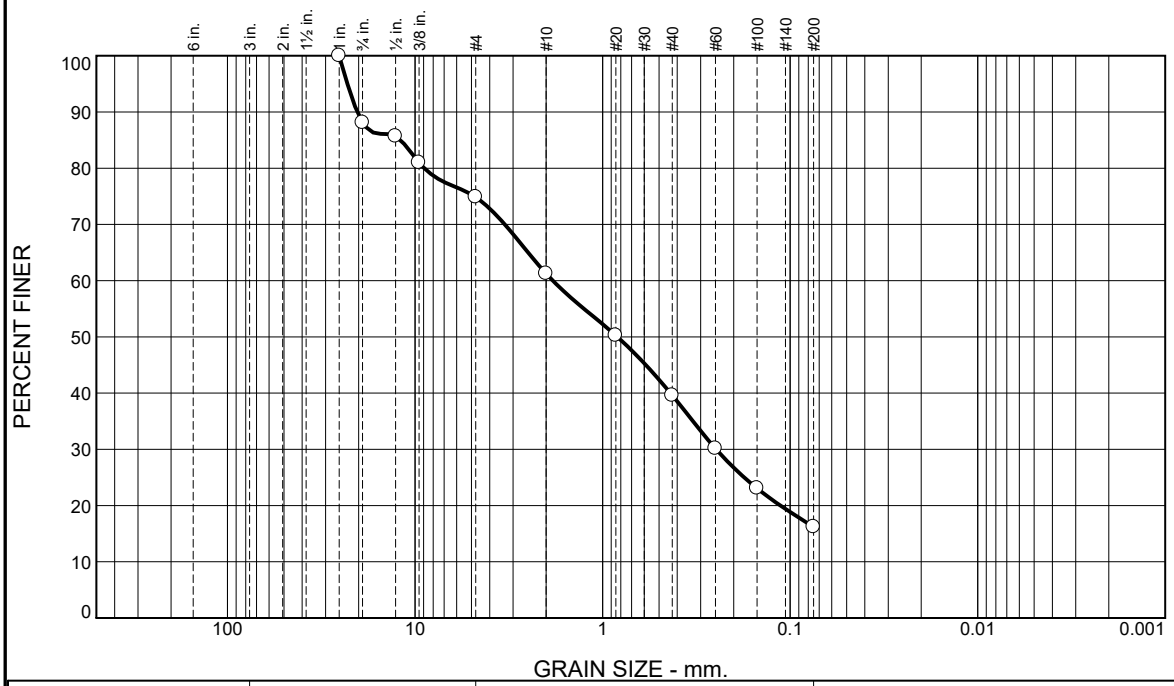
Cranston, RI

Remarks:

Figure 18-S-1960

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.9	13.2	13.6	21.7	23.4	16.2	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	88.1		
0.5"	85.7		
0.375"	81.0		
#4	74.9		
#10	61.3		
#20	50.2		
#40	39.6		
#60	30.1		
#100	23.1		
#200	16.2		

* (no specification provided)

Material Description

Brown and Grey silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 20.3194 D_{85}= 11.9525 D_{60}= 1.8410
D_{50}= 0.8345 D_{30}= 0.2478 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 12.17.18 **Date Tested:** 12.20.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 2-4' **Date Sampled:**
Sample Number: B-1 / S-2

Thielsch Engineering Inc.

Cranston, RI

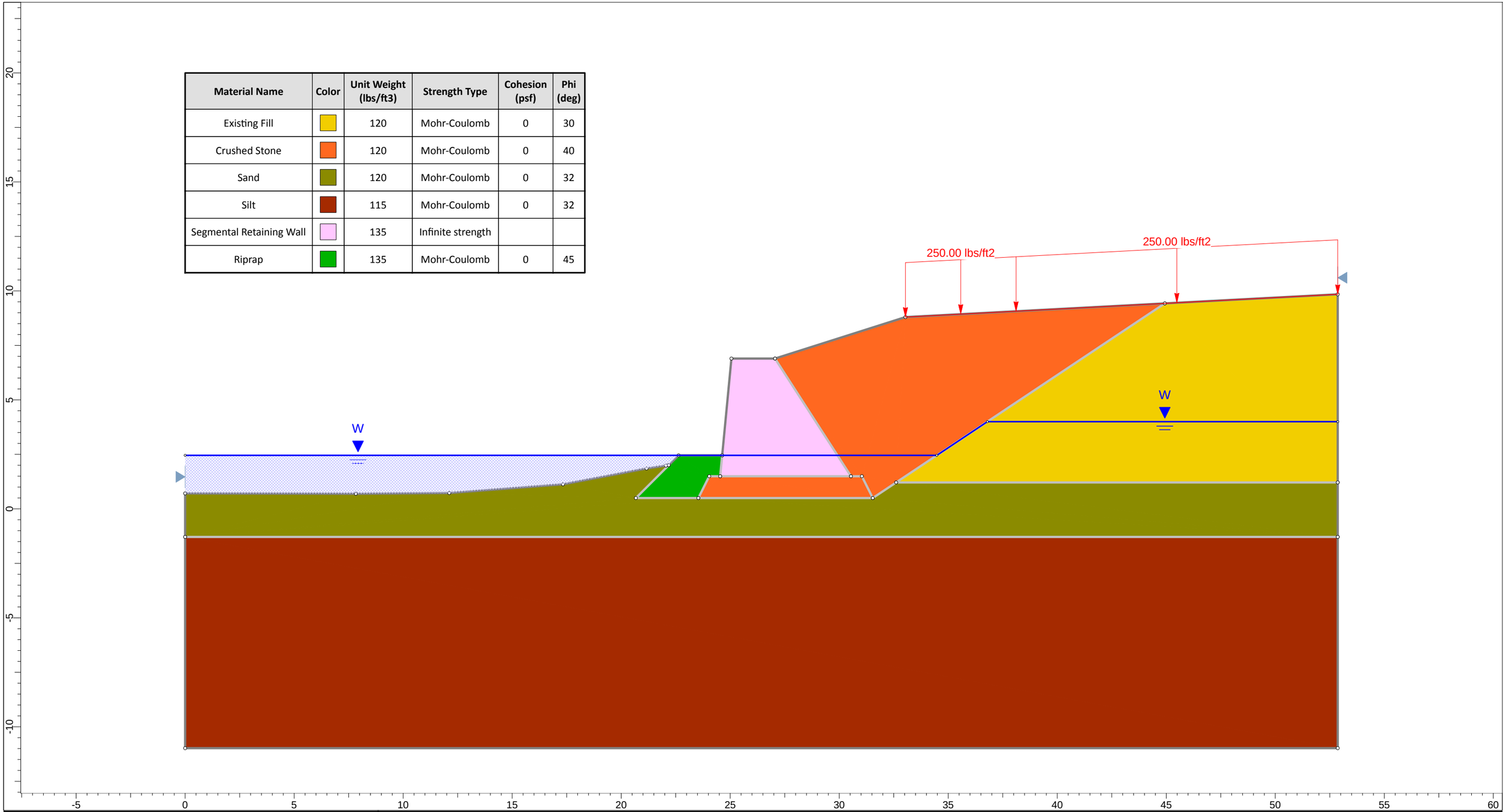
Client: Tighe & Bond

Project: Sawmill Brook - Central Pond Restoration
Manchester-by-the-Sea, MA

Project No: 221476012-02 **Figure** 18-S-1961

GEOTECHNICAL WALL STABILITY ANALYSIS

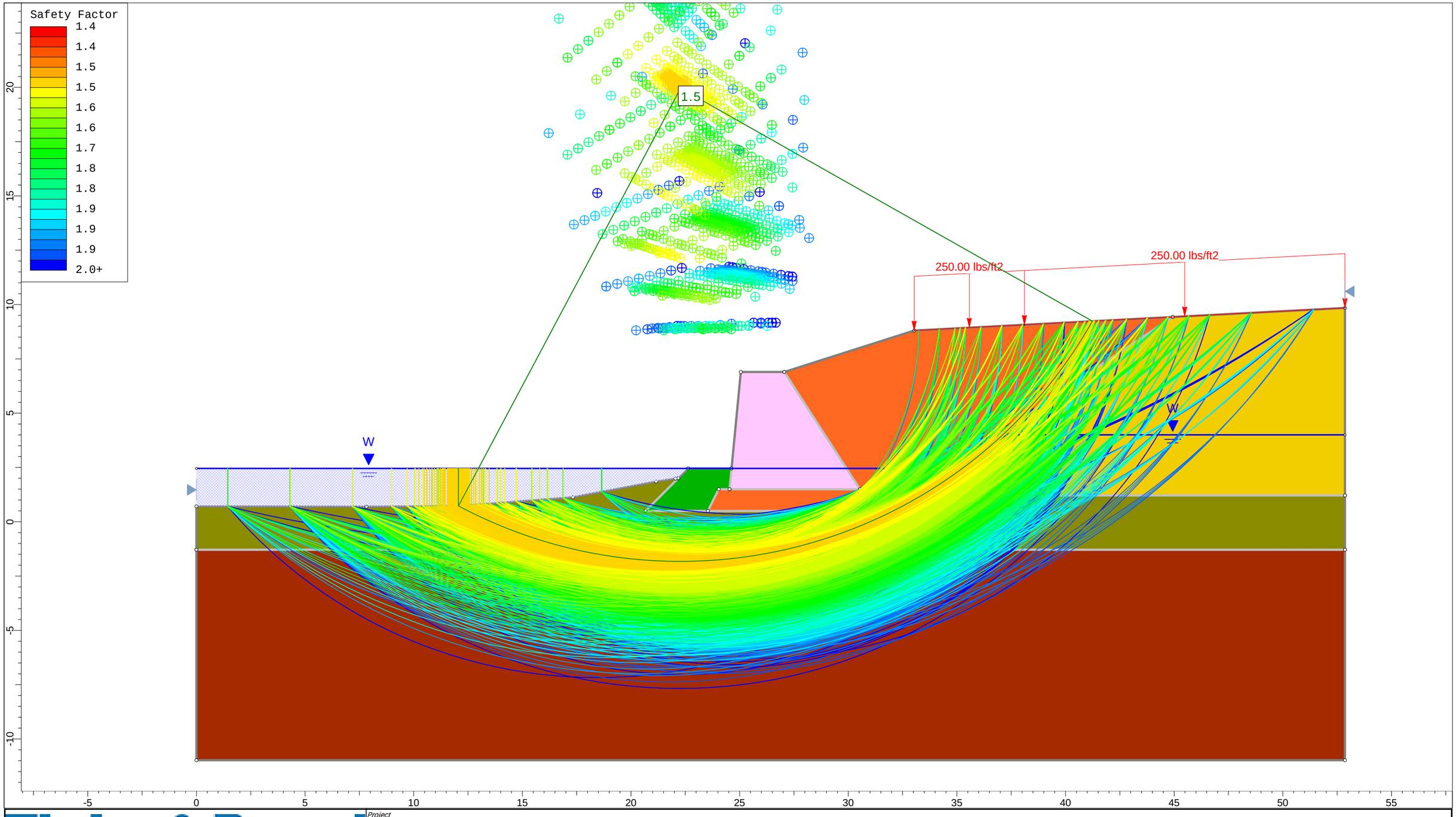
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Existing Fill		120	Mohr-Coulomb	0	30
Crushed Stone		120	Mohr-Coulomb	0	40
Sand		120	Mohr-Coulomb	0	32
Silt		115	Mohr-Coulomb	0	32
Segmental Retaining Wall		135	Infinite strength		
Riprap		135	Mohr-Coulomb	0	45



Tighe&Bond
Engineers | Environmental Specialists

Project	M-1476-012 Central Pond Restoration		
Analysis Description	Section 4		
Drawn By: D. Gnatek	Scale: 1:50	Company: Tighe & Bond, Inc.	
Date: 5/10/2019		File Name: M-1476-012 - Copy.slmd	

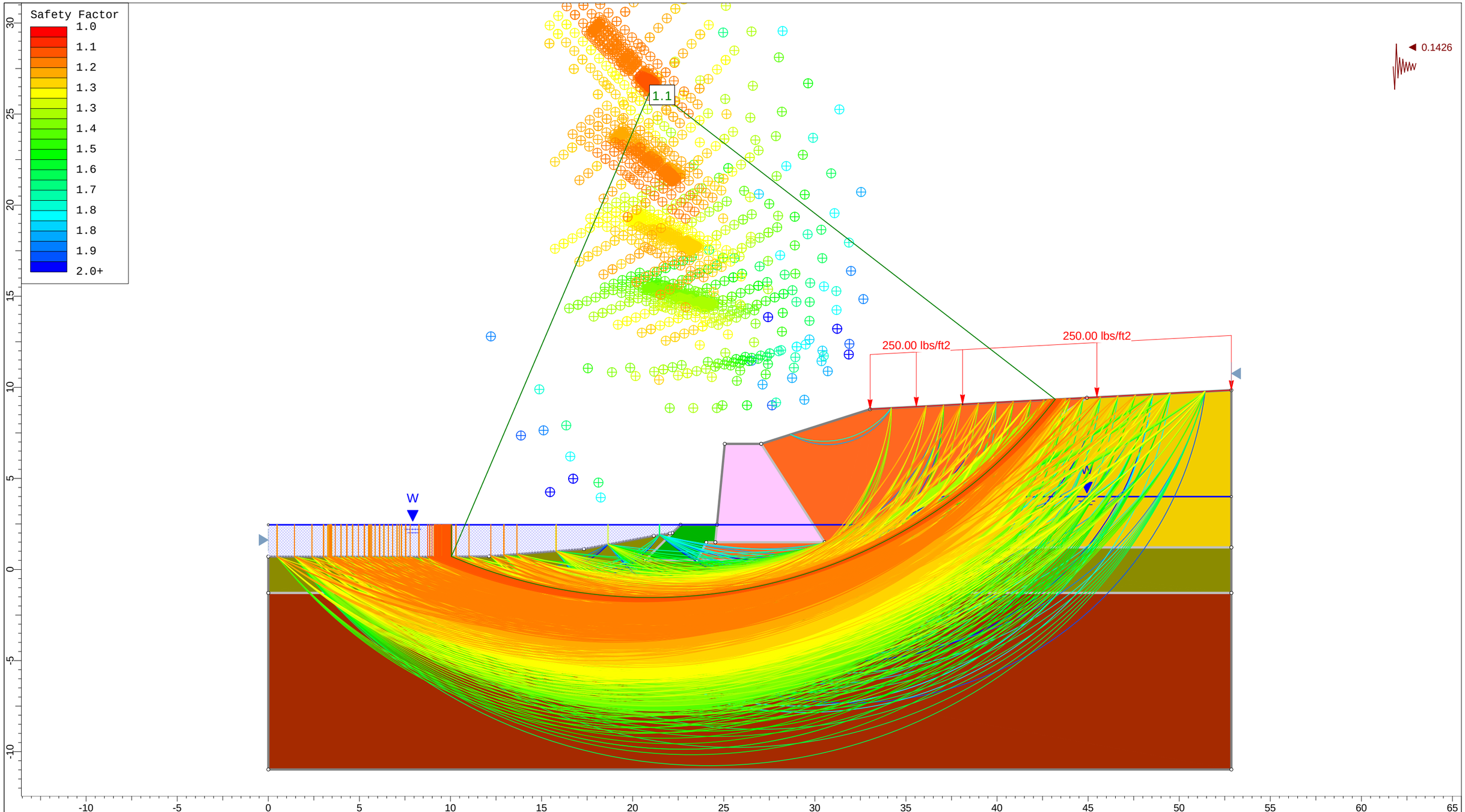
SLIDE 8.0



Tighe&Bond
Engineers | Environmental Specialists

SLIDEINTERPRET 8.018

Project	M-1476-012 Central Pond Restoration			
Analysis Description	Section 4			
Drawn By	D. Gnatek	*Scale*	1:50	*Company* Tighe & Bond, Inc.
Date	5/10/2019			*File Name* M-1476-012 - Copy.slmd



Tighe&Bond

Engineers | Environmental Specialists

SLIDEINTERPRET 8.018

Project	M-1476-012 Central Pond Restoration				
Analysis Description	Section 4 - Seismic				
Drawn By	D. Gnatek	*Scale*	1:60	*Company*	Tighe & Bond, Inc.
Date	5/10/2019			*File Name*	M-1476-012 - Copy.slmd

APPENDIX C

MANCHESTER-BY-THE-SEA

BOARD OF SELECTMEN • TOWN HALL
Manchester-by-the-Sea, Massachusetts 01944-1399
Telephone (978) 526-2000 FAX (978) 526-2001

MEETING: BOARD OF SELECTMEN
DATE: MONDAY, FEBRUARY 4, 2019
TIME 6:00 P.M. BOS MEETING
LOCATION: TOWN HALL ROOM # 5

WELCOME: CALL TO ORDER **6:00PM**
PUBLIC INPUT: ON ITEMS NOT ON THE AGENDA
ANNOUNCEMENTS /CHAIRMAN's REPORT

AGENDA

1. **FIRE FIGHTER AND POLICE OFFICER SWEARING IN CEREMONY** **6:00 P.M.**
2. **REVIEW AFTER ACTION REPORT 1/20/19 STRUCTURE FIRE** **6:15 P.M.**
3. **TOWN MEETING** **6:40 P.M.**
   a. **ELECTRONIC VOTING DEVICES DISCUSSION**
   b. **PETITION ARTICLES, OTHER SPECIAL ARTICLES**
4. **PRESENTATION/DISCUSSION ON CENTRAL ST DAM/CULVERT PROJECT & MILL POND** **7:00 P.M.**
5. **MASTER PLAN IMPLEMENTATION DISCUSSION WITH PLANNING BOARD** **7:30 P.M.**
6. **WHITE BEACH STUDY GRANT AWARD DISCUSSION** **8:00 P.M.**
7. **FY2020 BUDGET UPDATE/DISCUSSION**
8. **CONSENT AGENDA**
   - *BOS MINUTES - JANUARY 7, 2019*
   - *375TH COMMITTEE – APPROVE ADDITIONAL APPOINTMENTS & ESTABLISHMENT OF DONATIONS ACCOUNT*
9. **CORRESPONDENCE**
   - *INVITATION TO ESSEX BI-CENTENNIAL ICE CREAM SOCIAL*
   - *XFINITY LETTER REGARDING MUNICIPAL EMERGENCY REPORTING PROCEDURE REMINDER*
   - *CORRESPONDENCE FROM LORI MACCAUSLAND RE: PROPOSED LEGISLATION PROTECTING EELGRASS*
   - *COMCAST LETTER REGARDING FORM 500, COMPLAINT DATA*
   - *XFINITY LETTER REGARDING INTERNATIONAL PACKAGE UPDATE*
   - *CORRESPONDENCE FROM LORI MACCAUSLAND RE: DUMPSTER REGULATIONS*
10. **TOWN ADMINISTRATOR'S REPORT**

11. **OTHER MATTERS, AS MAY NOT HAVE BEEN REASONABLY ANTICIPATED BY THE CHAIR (DISCUSSION ONLY)**

UPCOMING MEETINGS
Tuesday, February19, 2019 – Selectmen's Meeting
Monday, March 4, 2019 – Selectmen's Meeting

Received by the Town Clerk

Date: Jan. 31st 2019 **at** 1610

Christy St Pierre
Signature

Sarah Neal
Clerk/Bd. Member

Tighe&Bond

Engineers | Environmental Specialists

CENTRAL POND RESTORATION

Manchester-by-the-Sea Town Hall – February 4, 2019

David Loring, P.E., ENV SP, LEED AP, Principal

Tighe&Bond

SAWMILL BROOK/ CENTRAL POND RESTORATION /CENTRAL STREET BRIDGE IMPROVMENTS

Tighe&Bond

SAWMILL BROOK / CENTRAL POND RESTORATION GOALS

- ❖ **Flood Mitigation**
- ❖ **Fish Passage**
- ❖ **Aesthetics**
  - Channel Improvements
  - Wildlife Habitat
  - Wall Improvements
  - Public Access

PRESENTATION TOPICS

- Central Pond Restoration
- Tide Gate Function
- Central Pond Banks

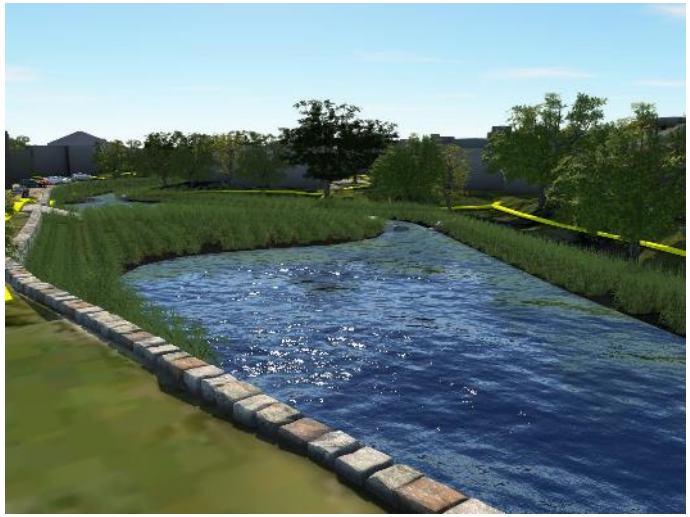
CENTRAL POND RESTORATION ALTERNATIVES

1. Low level water impoundment
   - maintain permanent low level water impoundment with a cross-channel berm upstream of Central Street bridge where channel expands
2. Stream w/pools and riffles
   - stream restoration connecting low level pools impounded by low level riffle structures
3. Stream Restoration
   - unrestricted free flow water
   - Provides continuous low level stream

All alternatives provide full passage tidal exchange

LOW LEVEL IMPOUNDMENT

POOLS & RIFFLES



STREAM RESTORATION

RESTORATION ALTERNATIVES EVALUATION

	STREAM	RIFFLES	POND
Feasibility	High	Moderate-high	Low
Permitting	Moderate	Complex	Complex
Construction Cost	<$50,000	$250,000	>$500,000
Public Benefits	Wildlife habitat diversified, fish passage maximized, improved water quality naturalized landscape, flood mitigation	Increased water feature, fish passage improved naturalized landscape, flood mitigation	Maximizes water feature
Sustainability	High	Moderate	Moderate
Ecological Benefits	High	High	Low
Flood Mitigation	25 Yr.	25 Yr.	25 Yr.
Complexity	Low	Moderate	High
Maintenance	Low	Moderate	High
Grant Potential	High	Moderate	Low

FINDINGS FROM WALL SURVEY

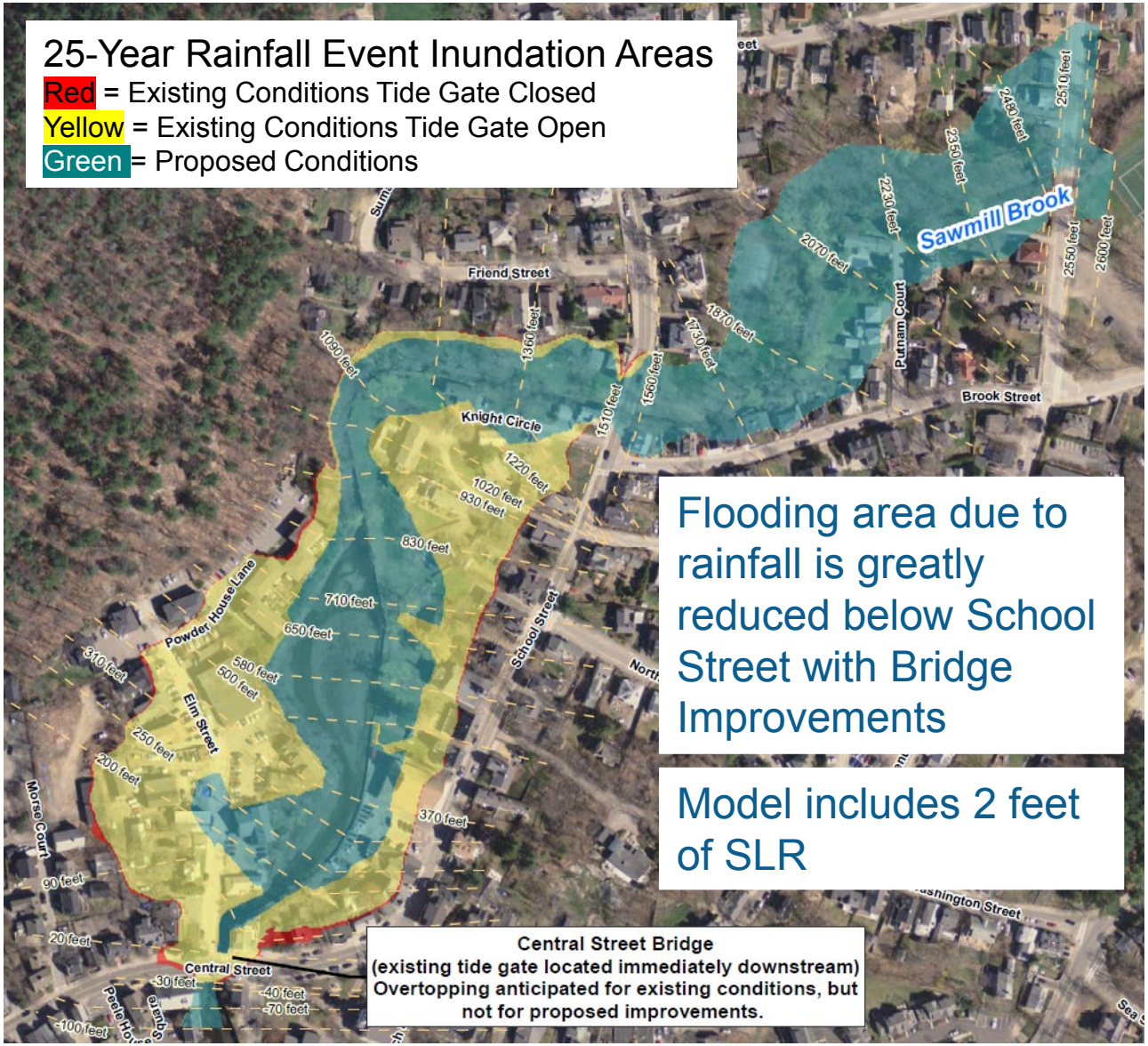
- Granite block, poured concrete, brick, field stone and shale revetment and combinations of the above are the dominant structures found around Central Pond.
- Granite block, field stone and combinations of the above are the dominant structures found along Sawmill Brook.
- Almost 50% of the walls arounds Central Pond are in need of maintenance. A large portion of the shoreline of Central Pond is privately owned.
- Many locations can benefit from some type of bioengineering to stabilize banks using stone and plantings

BANK TREATMENT EVALUATION

	LIVING SHORELINE	SEGMENTAL BLOCK WALL	GREEN GABIONS
Permitting	Agency Friendly	Higher Level Review	Moderate Review
Cost	$300 LF	$900/LF	$700/LF
Public Access	Open	Limited- access can be provided at key spots	Limited
Resiliency/ Sustainability	Small storm erosion	50-75 yr service life	50-75 service life
Maintenance	Debris/litter, plant maintenance, shoreline grading	Debris/litter	Debris/litter, growth maintenance

TIDE GATE

FINDINGS FROM HYDRAULIC MODELING

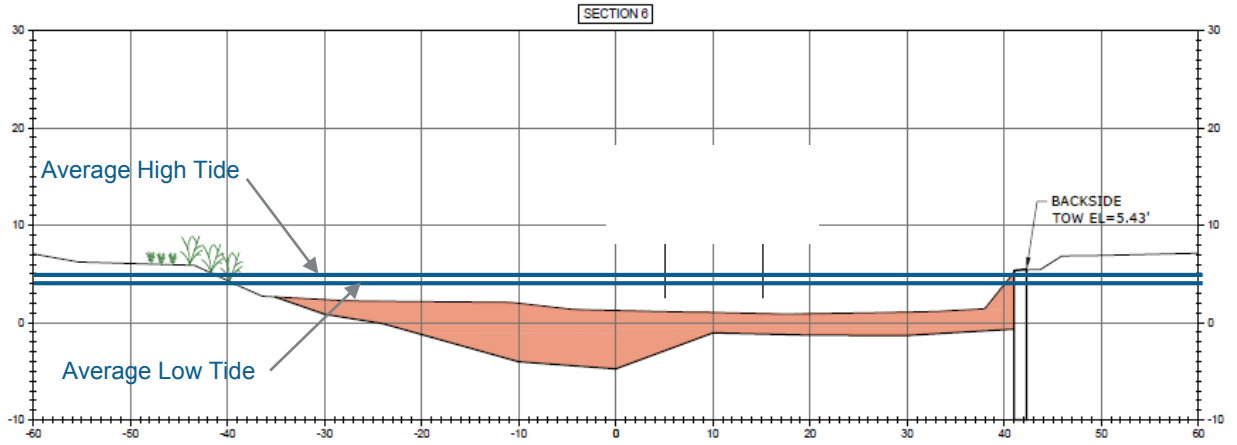


BRIDGE RESTORATION PROJECT

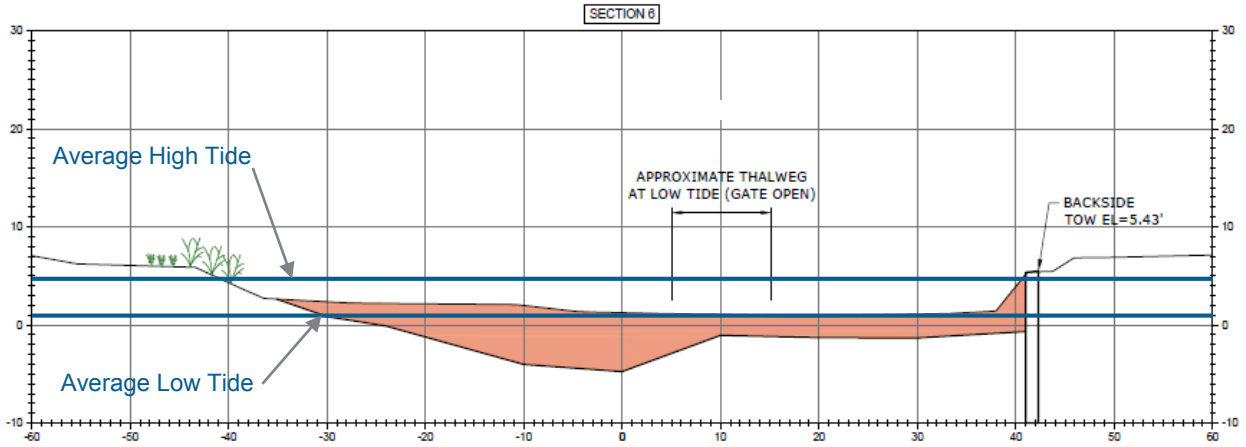
Photo rendering of tide gate removed, new culvert, new granite wall and guard rail

Tighe&Bond

BEFORE AND AFTER TIDE GATE REMOVAL



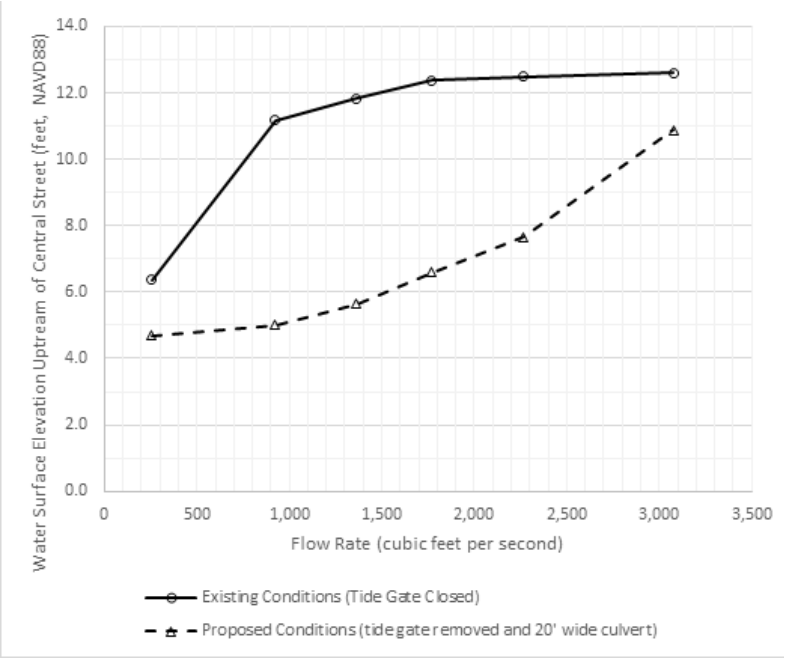
Pond with Gate Closed



Gate Removed

Tighe&Bond

STAGE DISCHARGE CURVE

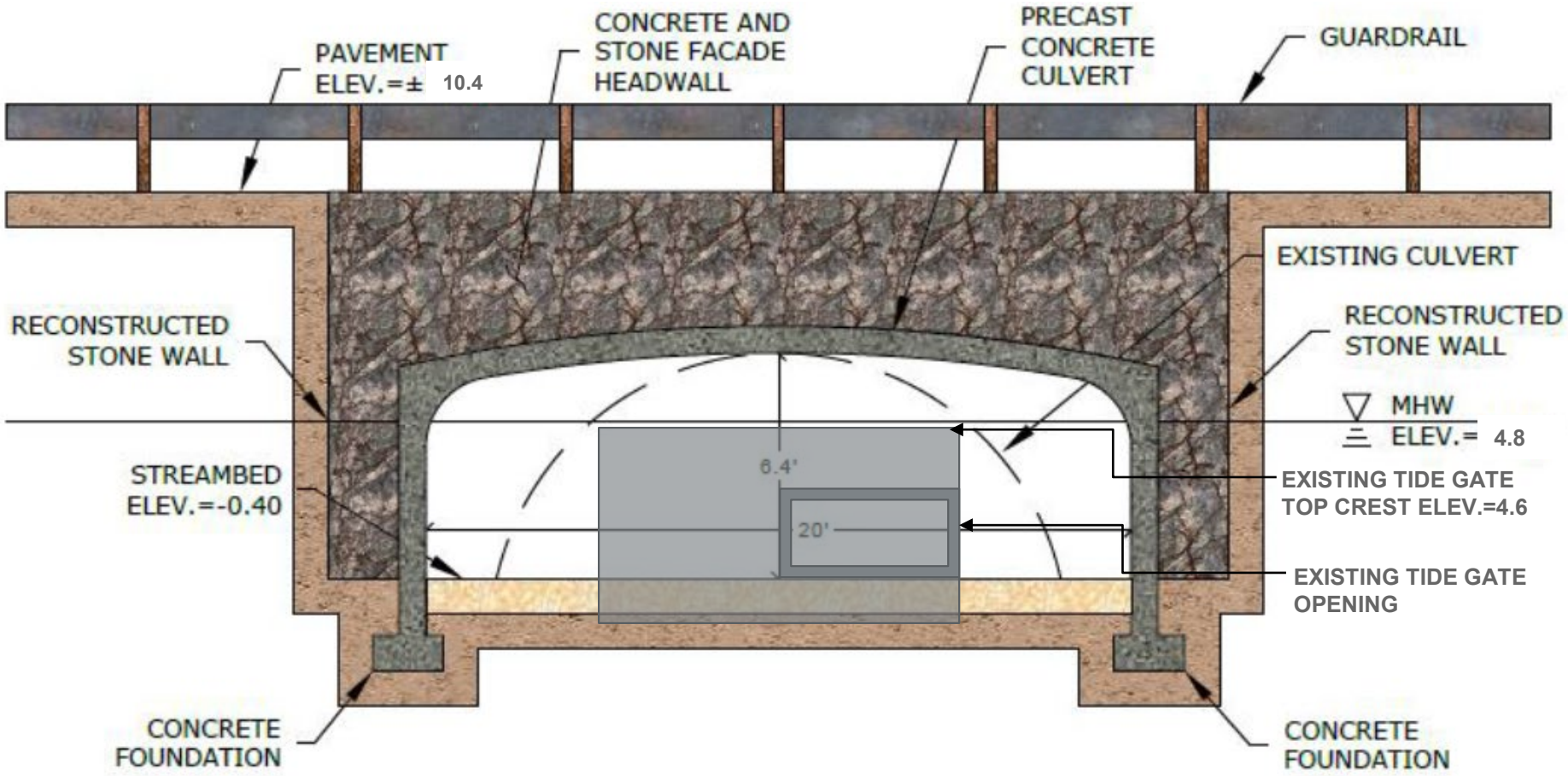


EXISTING – current bridge with tide gate closed

FUTURE – new bridge with tide gate removed

STORM EVENT	FLOW (CFS)	EXISTING WSEL (ft)	FUTURE WSEL (FT)
2	254	6.4	4.7
10	924	11.2	5
25	1,363	11.8	5.6
50	1,772	121.4	6.6
100	2,267	12.5	7.7
500	3,078	12.6	10.6

CENTRAL STREET
BEFORE AND AFTER TIDE GATE REMOVAL




DISCUSSION

Tall Marsh Grass Plantings

Stabilize Bank with Living Shoreline

Shrub Plantings

Medium Height Marsh Grass Plantings

Tall Marsh Grass Plantings

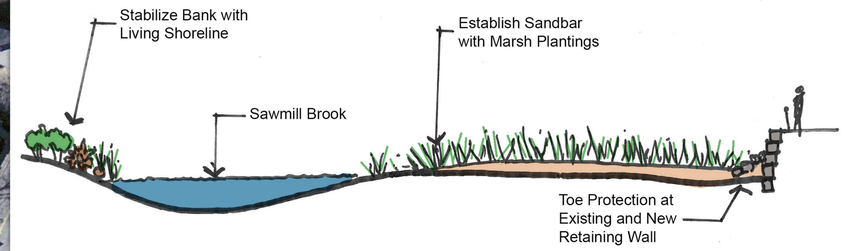
Process Based Channel Evolution

Medium Height Marsh Grass Plantings

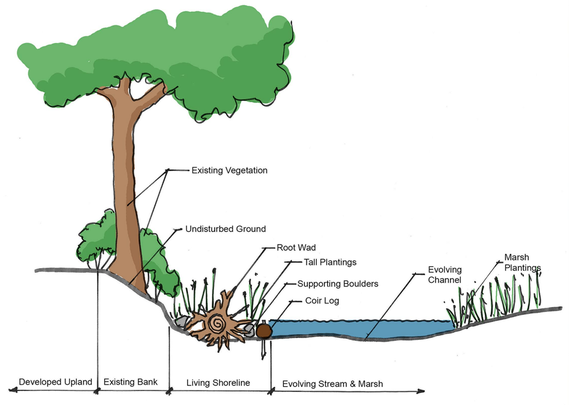
New Stair Access

New Retaining Wall

Provide Toe Protection for Retaining Wall



Sawmill Brook Restoration



Living Shoreline Detail

Plant List

	Botanic Name	Common Name
	Spartina alterniflora	Smooth Cordgrass
	Cephalanthus occidentalis	Buttonbush
	Schoenoplectus pungens	Square Bulrush
	Panicum virgatum	Switchgrass
	Solidago sempervirens	Seaside Goldenrod
	Baccharis halmifolia	Sea Myrtle
	Iva frutescens	Marsh Elder
	Hibiscus moschuetos	Swamp Rose Mallow

SCALE IN FEET
0 50' 100'
GRAPHIC SCALE

N

RESTORED SAWMILL BROOK MAY 2019
MANCHESTER-BY-THE-SEA, MASSACHUSETTS

Tighe&Bond
Engineers | Environmental Specialists
April 2019
M-1476_Aerial_Central Pond.dwg

BOARD OF SELECTMEN MEETING MINUTES

MANCHESTER-BY-THE-SEA

BOARD OF SELECTMEN • TOWN HALL
Manchester-by-the-Sea, Massachusetts 01944-1399
Telephone (978) 526-2000 FAX (978) 526-2001

MINUTES OF THE BOARD OF SELECTMEN

February 4, 2019 6:00 p.m. Town Hall, Room 5

MEMBERS PRESENT: Chairperson, Ms. Beckmann, Mr. Boling, Ms. Jaques, Ms. Driscoll and Mr. Steinert
MEMBERS ABSENT:
STAFF PRESENT: Town Administrator, Mr. Federspiel, BOS Clerk, Ms. Hunter, BOS/TA Executive Assistant, Sonja Nathan, Town Planner, Ms. Brown, Interim Fire Chief Beardsley, Police Chief Conley, Town Moderator, Mr. Wilson, Town Clerk, Ms. St. Pierre, DPW Director, Mr. Dam and Chairperson of School Committee, Ms. Erdmann
GUESTS: David Loring, PE, Env, SP, LEED AP, Members of Planning Board and Residents
PRESS: Mr. Cronin, *Gloucester Times* and Ms. Brown, *Cricket*

At 6:00 p.m. Ms. Beckmann called the BOS Business Meeting to order noting the meeting was being video/audio-taped by a volunteer from Cape Ann TV (1623 Studios) and audio-taped by Ms. Hunter and asked if anyone in the audience was taping the meeting, to please inform the Board of Selectmen. Additionally, Ms. Beckmann asked those present to please turn off or silence their cell phones.

Ms. Beckmann asked if there were any comments or statements for the Board not on the agenda. There were none.

1. **Fire Fighter and Police Officer Swearing in Ceremony:**

Ms. St. Pierre, swore in new Police Officers: Andrea Locke and Jennifer Gilson and new Reserve Officers: Jeffery Martin and Coulter Chute.

Ms. St. Pierre also swore in new Fire Fighters: William Keaton, Michael Porcaro and Erik Junker (Fire Fighter Junker is the department's new "Floater" Fire Fighter).

The Officers and Fire Fighters were thanked by the Board of Selectmen and recognized for their service to the residents of Manchester-by-the-Sea.

2. **Review After-Action Report 1/20/19 Structure Fire:**

Interim Fire Chief Beardsley and DPW Director, Mr. Dam presented the After-Action Report.

Ms. Jaques was interested in the warranty offered on the equipment. Ms. St. Pierre stated she has not read the fine print on the contract but believes there is a warranty.

Mr. Boling was interested in knowing more about the polling possibilities and would like to have a presentation from the company around that opportunity. Ms. St. Pierre indicated she could set up a conference call or a presentation around the time of Town Meeting when Turning Technologies is in Town.

Adding the cost of clickers and laptops for Power Point presentations will be included in the Capital Budget and added as a separate Article for approval at Town Meeting.

The Board of Selectmen agreed to the complimentary demonstration of Turning Technologies to go forward at the Annual Town Meeting on April 1, 2019.

b. Petition Articles, Other Articles:

Mr. Wilson would like the Board to place an article on the warrant updating the Town's by-law language about voting to include electronic voting. The moderator has the authority to determine the method of voting but for clarity Mr. Wilson is requesting the Town **amend the by-law to include electronic voting.**

Additionally, there are two citizen petition articles. One is a **non-binding vote on whether to continue to add fluoride to the Town's water supply**.

The second petition article seeks **to limit the use of polystyrene and other plastics** in food related businesses.

Ms. St. Pierre is reviewing the possibility of adding the following articles: all boards filing minutes in a timely manner with the Town Clerk, increasing late licensing for fees for dogs and special legislation to increase parking fees to $35.

Mr. Gilbert, 11 Magnolia Ave – many residents are in support of the petition to ban plastic straws, cutlery and to go containers. Mr. Gilbert stated the biggest issue to discuss is alternative products to use for businesses. This by-law would put MBTS in the forefront of communities in the State supporting this type of legislation. Ms. Beckmann is interested in further discussion on this issue at the Board's next meeting on Tuesday, February 19, 2019.

4. Presentation Discussion on Central St. Dam/Culvert Project & Mill Pond:

Mr. Federspiel introduced the presentation by stating the project has progressed through state supported grants totaling over $400K. The grants helped to define the scope of the project. A construction grant of $500K has also been received with additional funds for the construction costs approved at Town Meeting.

Following years of study, the Town is ready to make decisions on the reconstruction of the Central Street Culvert/Dam and the future of Central or Mill Pond. Mr. Loring from the Town's consulting firm Tighe and Bond presented designs for the reconstructed culvert and dam as well as three options for the future of the pond. Designs presented:

1) Low Level water impoundment – maintain permanent low-level water impoundment with a cross-channel berm upstream of Central Street bridge where channel expands
2) Stream with pools and riffles – stream restoration connecting low level pools impounded by low level riffle structures
3) Stream Restoration – unrestricted free flow water provides continuous low-level stream

All alternatives provide full passage tidal exchange.

In order to reduce flooding along Sawmill Brook as it winds its way through the village and empties into the inner harbor, the Town needs to widen the culverts and restore the free flow of water (remove the tide gate.) Construction will start with the last culvert which is also the culvert in the worst condition. The Town is on borrowed time before the old dam and stone arch culvert collapse.

The tide gate was installed in the 1930's to create the pond for aesthetic purposes and as a public skating place. Despite some opinions to the contrary, it does not serve as protection to storm surge from the ocean. High tides regularly come over the top of the tide gate. Its elevation is 4.6 feet while the higher high tide of the day average 4.8 feet with storm surges well above this elevation. The road itself is at an elevation of 10.6 feet.

There are a few property owners abutting the pond who want more protection against storm surge and who also want to keep a pond for aesthetic reasons. Greater storm surge protection from the harbor would require raising Central Street or otherwise installing a new sea wall along Central Street from roughly the library to Pine Street – not a very practical or cost-effective solution. Ultimately our solution may involve a storm barrier at the mouth of the harbor.

The current tide gate needs to be removed in order to complete the reconstruction of the culvert and to satisfy hydraulic capacity requirements the State has for the new culvert. To maintain the pond as it has been over the last 80+ years would require a new dam/tide gate upstream of Central Street. Getting permits for such a structure that really only has an aesthetic purpose and diminishes flood protection would be difficult at best. It also has costly long-term maintenance needs. The consulting engineers do not recommend this project.

<u>The preferred option is to reestablish Sawmill Brook as a free-flowing stream with sea grasses where the pond is today that will flood with the tide cycles</u>. Thus, around high tides it will look like a pond and at low tides will look like a salt marsh with a stream.

As explained by the engineers, there is a "middle" option that creates smaller pooled areas within the foot print of the existing pond area. Again, the entire area would be a pond around high tides. At low tide, there would be small impoundments within the stream. This option has added costs and maintenance issues but to a lesser extent than the full pond option.

Mr. Steinert asked if 6 foot 4 inches was a minimum requirement for the road surface as noted on the slide. Mr. Loring stated it was not a minimum requirement however given buried underground utilities and ADA compliance issues for the grade of sidewalks and road – plus bedrock underneath, 6 foot 4 inches was the recommended height of the new culvert.

Mr. Boling asked about guardrails and compliance with Mass DOT regulations around the bridge and existing railings not being crash worthy. Mr. Boling thought the Historic Commission was funded with a CPC grant to recommend wrap around railings for the area. Mr. Federspiel indicated that funding was put on hold.

Mr. Boling's second question related to maintenance options and if permitting agencies were involved with on-going maintenance options. Mr. Loring indicated the natural stream option would likely require the least amount of maintenance given the stream would be naturally restored. He went on to state the ripple and pond options would likely require additional interactions with state and permitting agencies and possibly long-term state oversight.

Ms. Jaques asked about periodic cleanup of the stream. Mr. Loring stated it would be a natural process and following an inland storm the stream would be flushed.

Mr. Steinert requested information on funding the project. Mr. Loring replied to date all the work done had been funded through grants, Mr. Federspiel stated additional funds had been approved at Town Meeting. Mr. Steinert was also concerned about residents and how flooding impacted their property. Mr. Loring stated unfortunately the do-nothing option will only exacerbate the flooding problem.

Mr. Boling asked if upstream flooding and the culvert under School Street was limited in size and if there was a capacity to increase the size of the culvert. The answer is yes, the crossings at School and Norwood Street would gain modest improvement if the culvert were enlarged. Mr. Federspiel indicated this was a different project and part of the water shed study.

Mr. Mastrogiacomo, 9 Masconomo Street asked about road closure and how the new concrete structures would be installed. The road will likely be closed to one lane and the precast structure comes in a series of segments and the pieces are assembled on site.

Ms. Coleman, 9 Friend Street would like to have seen more seasonal depictions of how pond restoration would look – all the images appear to be in the summer. She is also interested in returning the Pond to its historic use as a winter gathering place (skating) for Town residents.

Mr. Ben Colburn, Peele House Square asked how the opposite side of the culvert would be impacted by the proposed changes. He was concerned the larger opening would increase the velocity in the tidal flow. Mr. Loring indicated the flow will likely be unchanged or decreased likely helping the velocity of flow on both the Town owned side and privately-owned side.

Ms. Beckmann asked that additional questions be held for the Board's meeting on February 19, 2019 when the Board will make summary recommendations on the Central Pond Restoration Alternatives.

5. Master Plan Implementation Discussion with Planning Board:

Members of the Planning Board convened their meeting. Loren Coons, Christine Delisio, Andrea Fish, Mary Foley, Ron Mastrogiacomo were present.

Ms. Beckmann introduced the discussion by stating the purpose of the meeting was to address where we are with the Master Plan relative to its adoption and implementation. She stated in March 2015 there was an initial charge from the Board of Selectmen with the Planning Board to advance a Master Plan project to review the Town's vision focusing on Land Use, Housing, Economic Development, Transportation, Public Facilities and Services, Open Space and Recreation and Natural and Cultural Resources.

The Master Planning Committee came together and did that work over a period of 4 years. There is a Draft Master Plan in place today. The Master Planning Committee has disbanded, and the Planning Board will formally take over the plan and implementation of the Plan. Ms. Beckmann would like to discuss the process.

Ms. Delisio stated the Planning Board had concerns about their role in implementing the Master Plan. She indicated her concerns came out of an Open House Meeting where discussions took place and the Planning Board was not informed about the content of the discussions; subsequently the Board was made aware of concerns expressed at the Open House.

Ms. Sullivan agreed with Ms. Delisio and thought there needed to be further discussions about checks and balances and oversight and implementation and the definition of roles for the Planning Board and the Town Planner.

Ms. Fish indicated the Board was still working through their questions on the Master Plan.

Mr. Federspiel stated he would provide information regarding the role of the Town Planner and the interface with the Planning Board. Additionally, Mr. Federspiel indicated the purview of the Planning Board was defined in State statutes and he would provide Planning Board members with a copy of the statute relative to Planning Boards.

Ms. Beckmann stated the Town Planner fulfills the Administrative connection with the Planning Board as the Town Administrator fulfills that role with the Board of Selectmen. Ms. Beckmann agreed Board members needed to be informed through weekly updates that summarize meetings and discussions relating to the work of the Planning Board.

Mr. Boling wanted to clarify one point – the Master Plan did not alter the structure of Town Government. The Master Plan set down priorities and guidelines to further the goals of the Town.

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February 19, 2019 6:00 p.m. Town Hall, Room 5

MEMBERS PRESENT: Chairperson, Ms. Beckmann, Mr. Boling, Ms. Jaques, Ms. Driscoll and Mr. Steinert
MEMBERS ABSENT:
STAFF PRESENT: Town Administrator, Mr. Federspiel, BOS Clerk, Ms. Hunter, BOS/TA Executive Assistant, Ms. Nathan, Interim Fire Chief Beardsley, Town Moderator, Mr. Wilson, DPW Director, Mr. Dam, DPW Manager Mr. Desrosiers and Grant Administrator, Ms. Riley
GUESTS: VHB Consultant, Ms. Domigan
PRESS: Mr. Cronin, *Gloucester Times*

At 6:00 p.m. Ms. Beckmann called the BOS Business Meeting to order noting the meeting was being video/audio-taped by a volunteer from Cape Ann TV (1623 Studios) and audio-taped by Ms. Hunter and asked if anyone in the audience was taping the meeting, to please inform the Board of Selectmen. Additionally, Ms. Beckmann asked those present to please turn off or silence their cell phones.

Ms. Beckmann asked if there were any comments or statements for the Board not on the agenda. There were none.

Ms. Beckmann extended the Boards best wishes for a speedy recovery to Paul Clark who took a difficult fall this week. Mr. Clark has been and will continue to be a great asset to the Community.

1. Central Pond, Dam & Culvert

Ms. Beckmann stated there has been a thorough review of the Central Pond, Dam & Culvert presented at the previous Board meeting and this evening the Board would vote to move the project forward.

Mr. Federspiel indicated the project has been under study for several years and through the work of Ms. Riley the Town has been awarded grants in the amount of $400K and $500K to support the project. This evening the Board would vote to approve one of the three proposed designs presented by Tighe & Bond at the February 4, 2019 meeting.

1) Low Level water impoundment – maintain permanent low-level water impoundment with a cross-channel berm upstream of Central Street bridge where channel expands
2) Stream with pools and riffles – stream restoration connecting low level pools impounded by low level riffle structures
3) Stream Restoration – unrestricted free flow water provides continuous low-level stream

Mr. Federspiel and Mr. Dam agreed construction will likely begin in a year with a lengthy permitting process taking place over the upcoming year.

Ms. Riley stated she supported the natural option of Stream Restoration as did Ms. Lamothe who represented the Stream Team.

Ms. Driscoll recognized Ms. Riley for her dedication and work on the project and on behalf of the Town.

Mr. Steinert stated he was concerned for the number of people affected by the project and believes additional information, further education and detailed maps need to be made available to help property owners who are unaware of the scope of the project.

Ms. Beckmann stated of the 3 options she supported the Stream Restoration (natural option) and if further study is warranted after completion of the project the results will be evaluated and additional consideration given to the project. Ms. Jaques expressed concern for flooding up stream and thought it important to study additional culverts in the community – while recognizing the need to start with the Central Pond Dam and Culvert.

Ms. Driscoll moved to approve the Stream Restoration option presented at the last meeting, Mr. Boling seconded the motion. The motion passed unanimously.

2. DPW Updates: Complete Streets and Compost Facility

Complete Streets:

Mr. Federspiel stated the full report and historical summary of the Complete Streets effort is on the Town's web site. In 2017 the Town went through the process of identifying and prioritizing projects for consideration, the final plan listed 18 potential projects from which 8 projects were selected for construction funding consideration. 4 were awarded funding.

The intersections and projects are:

1) Beach Street at Union Street
2) Central Street at Union Street and School Street
3) Washington Street, Summer Street and Sea Street
4) Sidewalk from Masconomo Park to Singing Beach

Mr. Dam introduced Ms. Domigan from VHB Consulting who reviewed the scope of work for the 3 intersections and sidewalk from Masconomo Park to Singing Beach.

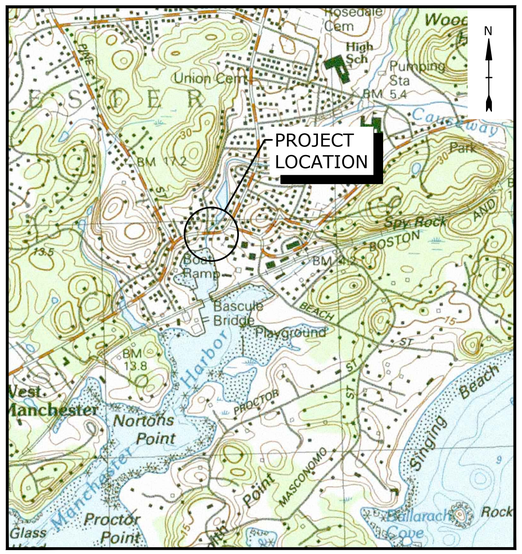
APPENDIX D

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
BAR IS 1 INCH ON ORIGINAL DRAWING
0 — 1 INCH
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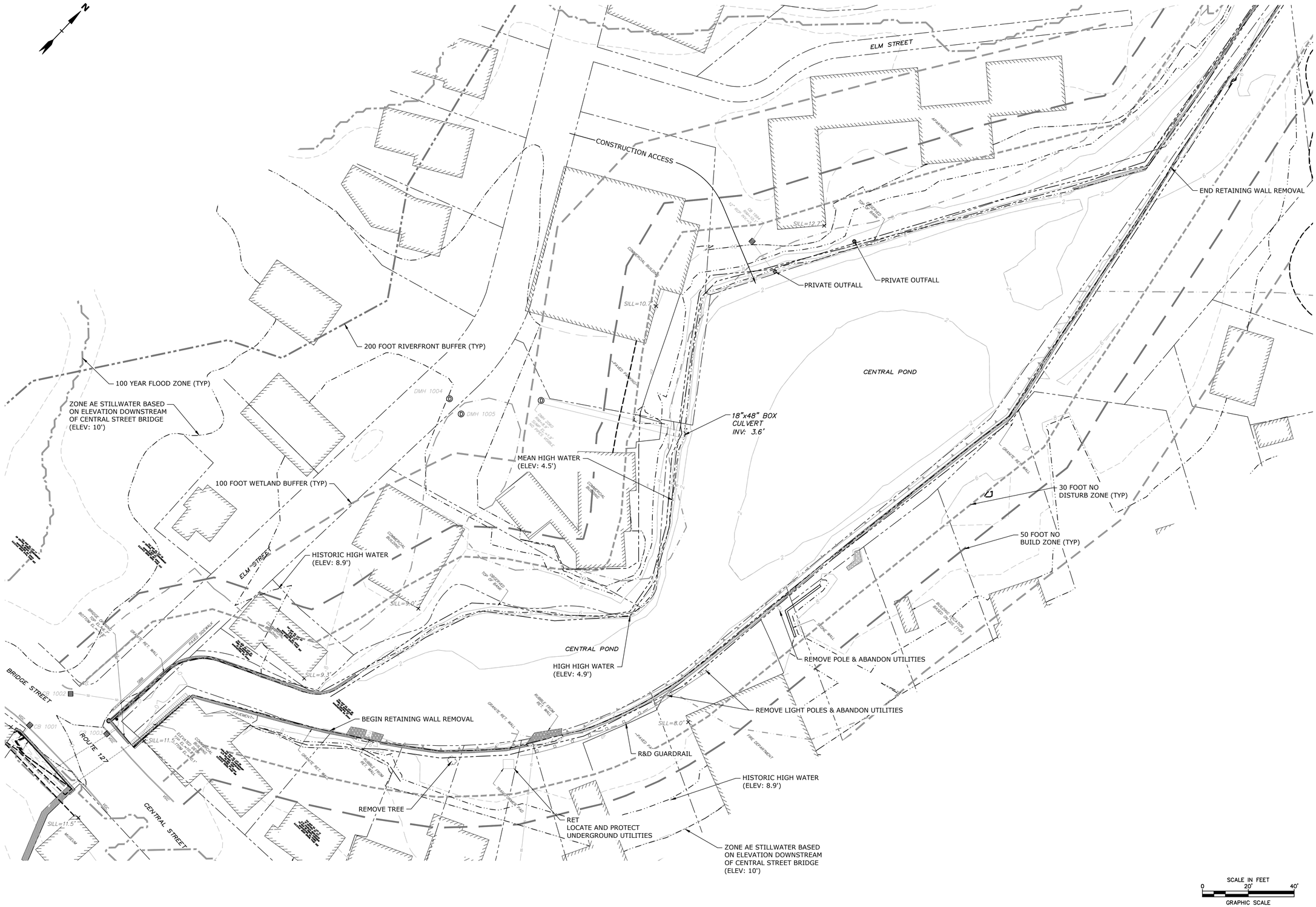
MARK	DATE	DESCRIPTION
2	FEB 2019	Issued For Bidding

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



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EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 20'

C-001

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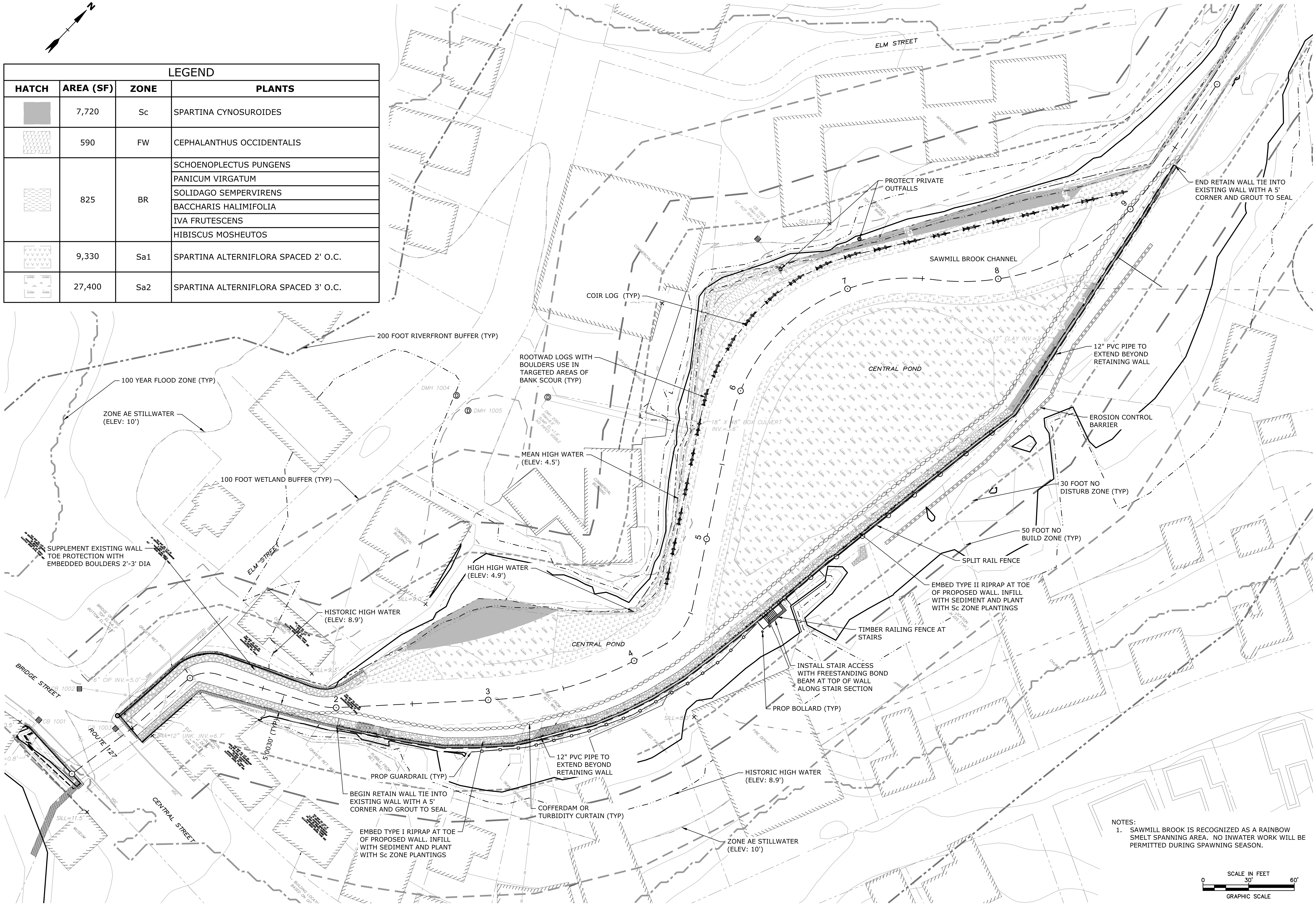
LEGEND

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.



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

PERMIT SET

CENTRAL POND RESTORATION

Central Street to Knight Circle

Manchester -by-the-Sea, MA

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SITE PLAN

SCALE: 1" = 30'

C-100

Last Saved: 6/27/2019
Plotted On:Jun 27, 2019-1:48pm By: drb
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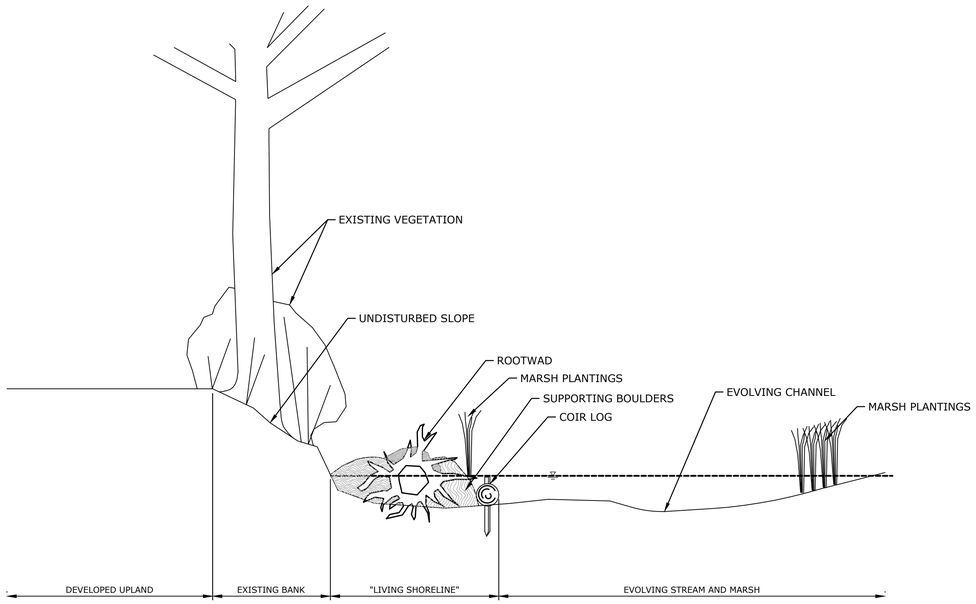

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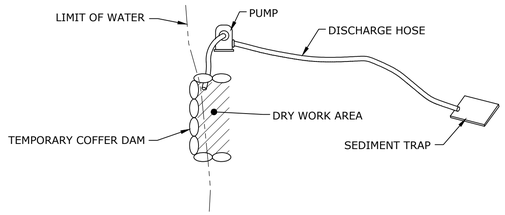
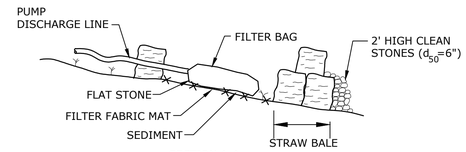
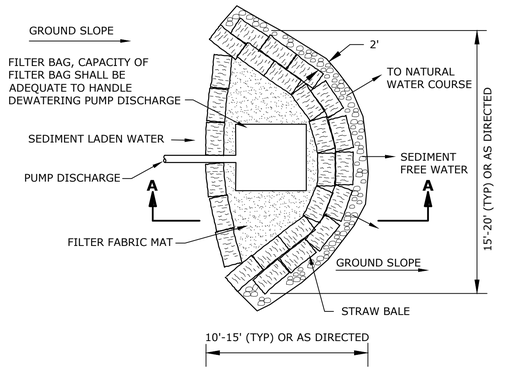


NOTES:
1. DEWATERING EQUIPMENT SHALL REMAIN WITHIN THE PERMANENTLY IMPACTED AREAS AND SHALL DISCHARGE OUTSIDE OF THE WETLAND BOUNDARY AS SHOWN ON SHEET C-001.
2. DISCHARGE HOSE SHALL NOT CROSS THE STREAM AT ANY LOCATION.



SECTION A-A



COFFERDAM AND DEWATERING
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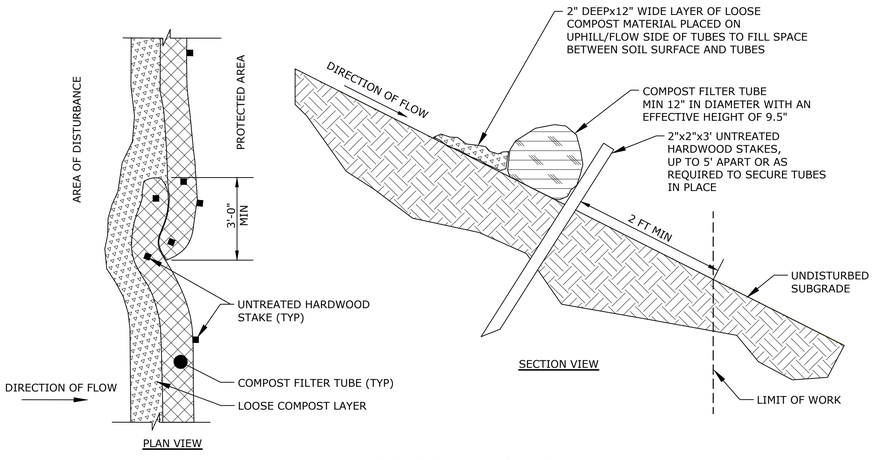

COMPOST FILTER TUBE
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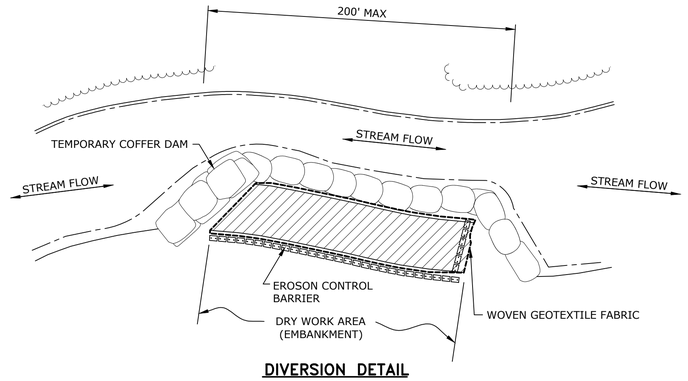

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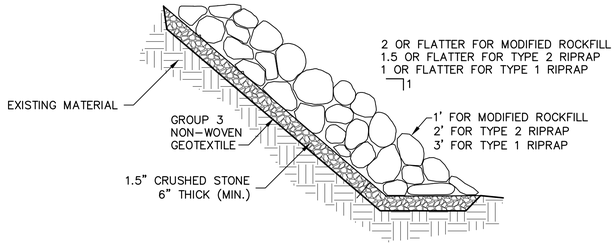

RIP-RAP INSTALLATION/SLOPE PROTECTION
NO SCALE

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CENTRAL POND RESTORATION

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CHECKED:	DRB
APPROVED:	DLL

CONSTRUCTION DETAILS

SCALE: AS NOTED

C-501

Last Saved: 6/20/2019
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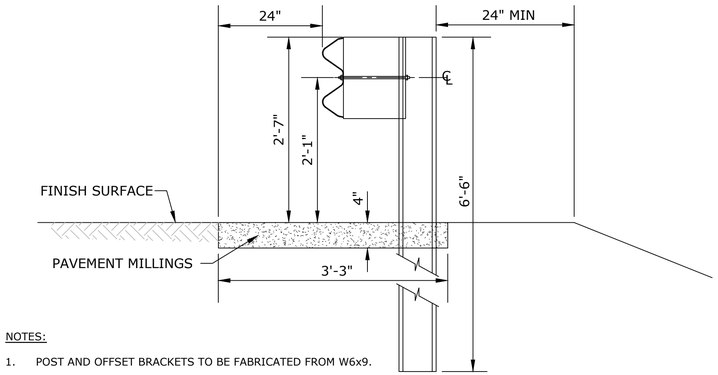
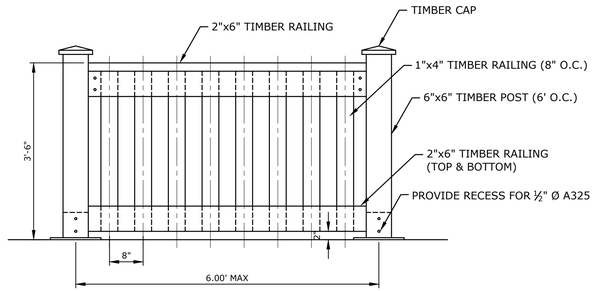


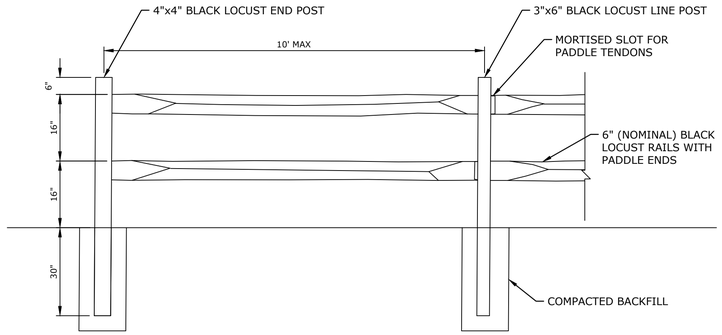
NOTES:

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.

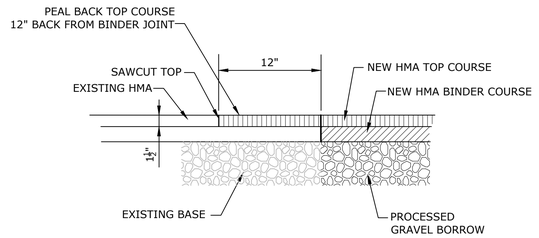
STEEL BEAM HIGHWAY GUARD W RAIL
NO SCALE



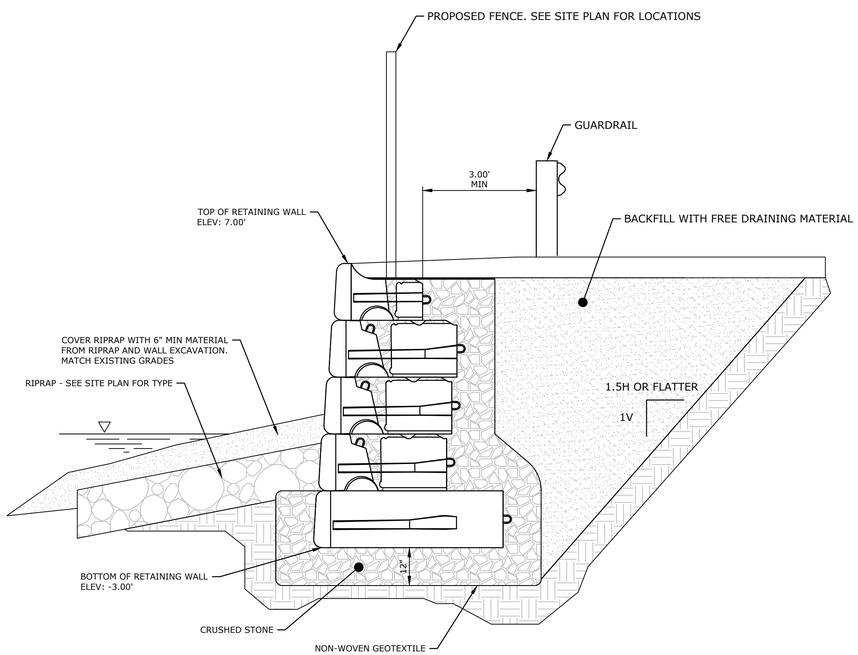
TIMBER RAILING
NO SCALE



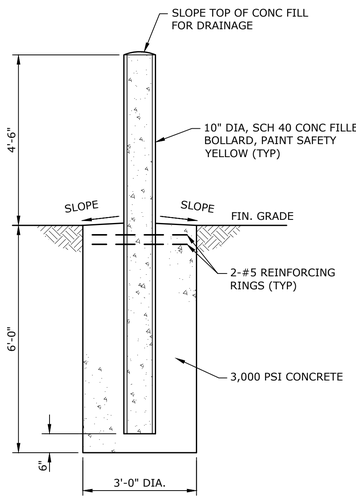
SPLIT RAIL FENCE
NO SCALE



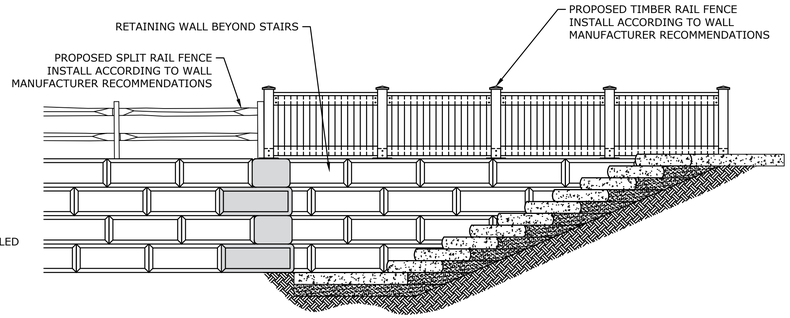
PARKING LOT PAVEMENT REPAIR DETAIL
NO SCALE



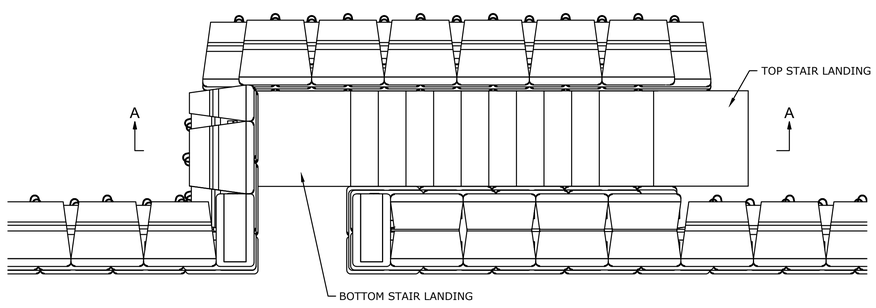
GRAVITY BLOCK WALL
NO SCALE



10" DIAMETER STEEL BOLLARD
NO SCALE



SECTION A-A



PLAN

STAIR ACCESS
NO SCALE

Tighe&Bond
www.tighebond.com

PERMIT SET

CENTRAL POND RESTORATION

Central Street
to Knight Circle

Manchester
-by-the-Sea, MA

VERIFY SCALE
BAR IS 1 INCH ON ORIGINAL DRAWING
0 — 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

MARK	DATE	DESCRIPTION

PROJECT NO:	22-1467
DATE:	2018/01
FILE:	M1476-012-C-500_Details.dwg
DRAWN BY:	DWB
CHECKED:	DRB
APPROVED:	DLL

CONSTRUCTION DETAILS

SCALE: AS NOTED

C-502

Last Saved: 6/20/2019 by: drb
Printed: 6/20/2019 2:20:51 PM By: drb
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TOWN OF MANCHESTER-BY-THE-SEA
CENTRAL POND RECONSTRUCTION PROJECT
DESIGN OPINION OF PROBABLE CONSTRUCTION COST

Prepared by: Tighe & Bond

City / Town: Manchester-by-the-Sea
Date: 6/27/2019

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
1	1	LS	Mobilization (Approx. 5% of Construction Cost)	$ 47,000.00	$ 47,000.00
2	0.66	A	Site Preparation	$ 30,000.00	$ 19,800.00
3	1,010	CY	Unclassified Excavation	$ 40.00	$ 40,400.00
4	1	EA	Tree Removal	$ 2,000.00	$ 2,000.00
5	140	FT	Remove and Replace Guardrail	$ 70.00	$ 9,800.00
6	1	EA	Remove & Reset Transformer	$ 15,000.00	$ 15,000.00
7	2	EA	Remove Light Pole and Abandon Utilities	$ 2,000.00	$ 4,000.00
8	1	EA	Remove Utility Pole and Abandon Utilities	$ 2,000.00	$ 2,000.00
9	590	CY	Redistribute Sediment from Wall/Riprap Constrution	$ 50.00	$ 29,500.00
10	1	LS	Cofferdam	$ 75,000.00	$ 75,000.00
11	1	LS	Turbidity Curtain	$ 3,000.00	$ 3,000.00
12	270	FT	Erosion Control Barrier	$ 10.00	$ 2,700.00
13	290	SY	Construction Access	$ 10.00	$ 2,900.00
14	450	SY	Construction Mat	$ 20.00	$ 9,000.00
15	1	LS	Stormwater Improvements	$ 50,000.00	$ 50,000.00
16	710	FT	5,000 psi Block Retaining Wall	$ 410.00	$ 291,100.00
17	1	LS	Access Stairs	$ 15,000.00	$ 15,000.00
18	810	TON	Crushed Stone	$ 45.00	$ 36,450.00
19	2,580	CY	Drainage Material	$ 35.00	$ 90,300.00
20	10	FT	12" Pipe	$ 80.00	$ 800.00
21	2,630	SF	Existing Wall Repair	$ 24.00	$ 63,120.00
22	310	CY	2'-3' Boulders	$ 150.00	$ 46,500.00
23	100	CY	Type I Riprap	$ 60.00	$ 6,000.00
24	200	CY	Type II Riprap	$ 60.00	$ 12,000.00
25	50	TON	Hot Mix Asphalt Binder Course	$ 130.00	$ 6,500.00
26	40	TON	Hot Mix Asphalt Top Course	$ 130.00	$ 5,200.00
27	440	FT	Living Shoreline	$ 100.00	$ 44,000.00
28	2	EA	Bollard	$ 1,250.00	$ 2,500.00
29	40	FT	Wood Guard Fence	$ 160.00	$ 6,400.00
30	400	FT	Split Rail Fence	$ 55.00	$ 22,000.00
31	1,000	SY	Loam & seed	$ 12.00	$ 12,000.00
32	2,330	EA	Planting Zone Sa1	$ 2.00	$ 4,660.00
33	3,050	EA	Planting Zone Sa2	$ 2.00	$ 6,100.00
34	860	EA	Planting Zone Sc	$ 3.50	$ 3,010.00
35	300	EA	Planting Zone FW & BR	$ 2.50	$ 750.00

Subtotal:	$	986,490.00
Contingency (20%):	$	197,290
Material Contingency (20%):	$	197,290
TOTAL:	**$**	**1,381,100**

This is an engineer's Opinion of probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of the Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost

Identification and Assessment of Permits Needed for the Central Pond Restoration Project

TO: Mary Reilly, Grants Administrator

FROM: Gabrielle Belfit, CFM; Amanda Houle, PWS, CERP, Tighe & Bond

COPY: Dave Loring, PE, Tighe & Bond

Dan Buttrick, PE, Tighe & Bond

DATE: May 31, 2019, revised June 21, 2019

This memorandum presents an overview and assessment of permitting and regulatory review needs for the Central Pond Restoration Project. Manchester-by-the-Sea is in the process of completing an MVP Action Grant for the permit level design to restore Sawmill Brook at Central Pond. The design entails replacing and/or restoring walls along the sides of the Pond, restoring the Pond interior to a tidal salt marsh, and drainage improvements. The Central Pond restoration is proceeding concurrently with the MassDOT small bridge project at Central Street, which involves widening the culvert at Central Street and removing the Sawmill Brook tide gate. This memorandum describes the permits and other regulatory review processes that are anticipated to be required for the Central Pond Restoration, including applicability, permit timelines, and studies needed to support permit applications.

1. Project Overview

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 has already begun, 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

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. In situ subsurface silt and clay layers identified while performing the geotechnical boring program favor flexible wall options, since settlement that may occur due to the compressible soils would more negatively impact rigid wall structures. 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.

Figure 1: Full stream restoration alternative at low tide

Numerous State and Federal agencies are supporting partners in this project and are providing grant funding, technical guidance, and public outreach support. Project partners include the Massachusetts Department of Transportation (MassDOT), the Massachusetts Office of Coastal Zone Management (CZM), the Massachusetts Division of Ecological Restoration (DER), the Massachusetts Environmental Trust (MET), the Massachusetts Division of Marine Fisheries (DMF), and the National Oceanic and Atmosphere Administration (NOAA) Restoration Center. The project is supported by dedicated Town Staff, the Board of Selectmen, the Manchester Coastal Resilience Advisory Group (CRAG) and volunteers through the Manchester Stream Team.

2. Overview of Permits Assessed

As part of the work completed previously, Tighe & Bond prepared a memorandum entitled *Identification and Assessment of Permits Needed for Sawmill Brook Culvert, Flood Mitigation and Green Infrastructure Projects* dated January 30, 2016. This memorandum presented, among other items, an overview of anticipated permitting and regulatory reviews that will likely be required for the combination of infrastructure improvement projects in the area. Additional direction was obtained from regulators during the feasibility and alternatives analysis for the Sawmill Brook/Central Pond restoration work completed under a FY17 Massachusetts Environmental Trust (MET) grant and the FY18 MVP action grant.

A single, comprehensive Massachusetts Environmental Policy Act (MEPA) will be filed for the Central Street bridge replacement, tide gate removal, and pond restoration. The cost for the MEPA filing will be covered through a cash match provided by the Town. Any new construction

projects or renovations to existing structures that require funding, licenses, or permits from any state or federal governmental agencies must be reviewed by the State Historic Preservation Officers, which consist of the Massachusetts Historical Commission (MHC) and the Massachusetts Bureau of Underwater Archaeological Resources (BUAR) as well as pertinent Tribal Historic Preservation Officers (THPOs) for impacts to historic and archaeological properties in accordance with Section 106 of the National Historic Preservation Act of 1966. The purpose of this review is to ensure that projects minimize or mitigate adverse effects to properties listed in the National and/or State Register of Historic Places. As part of the MEPA review, the required Historical Review for both the bridge and the pond restoration will be completed.

Both the pond restoration and bridge projects require state approval (i.e., Agency Action), which, in this case, would be a Chapter 91 Waterways License for the bridge replacement with tide gate removal, a separate Chapter 91 Waterways License for the pond retaining walls, and a Section 401 Water Quality Certificate for the pond restoration only.

The project team evaluated additional opportunities for a combined permitting approach for the bridge replacement and pond restoration. Given the varied funding timelines, permit timing, and construction logistics, the two projects could not be permitted jointly as part of the same application under all regulatory programs. The two projects will be submitted as part of the same application for the MEPA review process and will also be submitted within one single Project Notification Form with MHC, BUAR, and relevant THPOs. Based on pre-permitting agency review, the final decision will be made on additional joint permitting.

The following permit filings may potentially be done jointly for the Central Pond Restoration Project and the Bridge Project:

- Wetlands Protection Act and Manchester-by-the-Sea Wetlands Bylaw Ecological Restoration Notice of Intent (NOI)
- United States Army Corps of Engineers (USACE) Pre-Construction Notification (PCN) under the Massachusetts General Permit (Section 10 of the Rivers and Harbors Act)

The following permit filings will be done separately for the Central Pond Restoration Project:

- Massachusetts Department of Environmental Protection (MassDEP) Section 401 Water Quality Certification. This permit is only required for the Central Pond Project
- MGL Chapter 91, The Massachusetts Public Waterfront Act - Waterways License - A separate license will be required for both the Central Pond retaining walls and the Central Street bridge.

This list may be refined as the conceptual design is finalized and resource area impacts are quantified.

The following section discusses further detail on anticipated permits, including preparation time and agency review timelines, fees, and relevant references.

2.1 State and Local Permits and Other Required Reviews

2.1.1 Notice of Intent

A Notice of Intent (NOI) is required for the proposed pond restoration in accordance with the Massachusetts Wetlands Protection Act M.G.L. Chapter 131 Section 40 and its implementing regulations (310 CMR 10.00), along with the Manchester-by-the-Sea Wetlands Bylaw and

regulations (Article 17). Work associated with the project is expected to occur within Land Under Water, Coastal Bank, Riverfront Area, Land Subject to Coastal Storm Flowage, the 100-foot Buffer Zone, Bordering Vegetated Wetlands and Bordering Land Subject to Flooding, at a minimum, depending on the definition of the resources after the tide gage is removed.

Accordingly, a NOI will be prepared and submitted concurrently to the Conservation Commission and MassDEP. The NOI will demonstrate how the proposed work meets, to the extent practicable, the performance standards established for each resource area where alterations will occur. The NOI application will include the following:

- The appropriate permit application forms
- Project narrative including construction sequence
- Resource maps (e.g., USGS, floodplain, tax map)
- Site photographs
- Site plans and drawings depicting existing conditions and the proposed activities
- MassDEP Stormwater Checklist and Drainage Report
- Request for certified list of abutters and abutter notification
- Alternatives analysis
- Written response to MassDEP comments generated from NOI review
- Attendance at one site walk with the Conservation Commission
- Attendance at two public hearings with the Conservation Commission

Upon receipt of the Order of Conditions issued by the Conservation Commission, the Order will be recorded at the South Essex County Registry of Deeds by the Town and proof of recording will be provided to the Conservation Commission. Following the completion of construction activities, the Town's consultant will develop a Request for Certificate of Compliance to close out the project.

Typically, it takes a minimum of one month to prepare the NOI and then another three months to obtain the Order of Conditions. For Town projects, the fee is waived. The Order of Conditions is for three years and can be extended for up to an additional three years upon formal request.

2.1.2 Army Corps of Engineers Review (Section 10/Section 404) [1]

The New England District of the U.S. Army Corps of Engineers (Corps) regulates activities subject to Corps jurisdiction in waters of the U.S. within the boundaries of, and off the coast of the Commonwealth of Massachusetts through a permitting and review process pursuant to the Massachusetts General Permit.

The proposed project is subject to jurisdiction under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act due to work within wetlands and tidal Waters of the United States. Temporary and permanent impacts to wetlands in excess of 5,000 square feet but less than one acre, or which otherwise do not meet Self-Verification review thresholds, are subject to review under a Pre-Construction Notification (PCN) under the Massachusetts General Permits. A PCN application will be developed that includes the appropriate application forms, a detailed narrative describing the project, site photographs, project drawings and

[1] http://www.nae.usace.army.mil/Missions/Regulatory/StateGeneralPermits/MassachusettsGeneralPermit.aspx

details, resource maps and other required information. It is assumed that the pond restoration will not require an Individual Permit with the Army Corps and that it may be authorized under a PCN. The scope includes time for a site visit with the Army Corps reviewer and time for follow up correspondence with staff during application review. The Corps' SHPO/THPO Notification Form will also be prepared and submitted to the SHPO and applicable THPOs, in accordance with requirements pursuant to Section 106 of the NHPA.

There is no application fee.

2.1.3 Massachusetts 401 Water Quality Certification [2]

The Water Quality Certification regulations implement Section 401 of the federal Clean Water Act (CWA) in Massachusetts by establishing permitting requirements to ensure that dredging projects, or proposed discharges of dredged or fill material, protect the public health and the Commonwealth's water resources.

A Section 401 Water Quality Certification (WQC) 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, or if any of the other thresholds listed in 314 CMR 9.04 are met. This project is anticipated to exceed at least one of these thresholds. A WQC application will be submitted to MassDEP for review and approval. Any material greater than 100 cubic yards, that is moved or removed from below the mean annual high-water line of the site, will require sediment testing. Sediment characterization of the pond was completed as part of previous grant work.

A reasonable timeframe to expect for approval from MassDEP is on average 12 months. Application fees are waived for municipalities.

2.1.4 MGL Chapter 91, The Massachusetts Public Waterfront Act[3]

The Commonwealth's primary tool for protection and promotion of public use of its tidelands and other waterways is Massachusetts General Law Chapter 91, the waterways licensing program.

Based upon a review of jurisdictional tidelands as mapped by MassGIS, the project area is below the jurisdictional contemporary high water mark. The restoration of Central Pond will require a Chapter 91 Permit, while the retaining wall requires a Chapter 91 License; though Tighe & Bond's experience is that the Chapter 91 Program authorizes both categories under a single Chapter 91 License. Under this sub-task, a Chapter 91 application and project plans in the required format will be developed for submittal to MassDEP. Abutters will be notified and provided with copies of the filing in accordance with MassDEP's distribution requirements.

[2] http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-9-00-401-water-quality-certifications.html
[3] http://www.mass.gov/eea/agencies/massdep/water/watersheds/chapter-91-the-massachusetts-public-waterfront-act.html

Comments from MassDEP will be addressed during the review process and the plans will be recorded at the Registry of Deeds upon authorization.

Time periods are established in MassDEP's regulations (310 CMR 9.00), but on an average, the estimated timeframe for this process is one year. The ENF filing must occur before filing application for a Chapter 91 License, and the Waterways Program must be in receipt of a valid Order of Conditions from the Conservation Commission as well as the final Section 401 Water Quality Certification before issuance of the License. Following application, the process includes determining water dependency, public notice period (15 to 30 days), public hearing, written determination, appeal period, file completion, and finally recording license and paying fee, and certificate of compliance (within 60 days of recording). Application fees are waived for municipal projects.

3. Recommendations

Much of the information already gathered and determined during the analysis of design will be required as part of each permit application. Given the number of permits required, lengthy review timelines associated with each, and level of effort required to prepare each submittal, Tighe & Bond makes the following recommendations for permit application sequencing.

It is recommended that the MEPA process be initiated and completed prior to preparation and submittal of other permit applications. We have found additional information is required during MEPA review at the request of permitting agencies (that will also need to be incorporated into permit applications) and that minor design changes may also result over the course of the public comment process. Identifying information, design, or narrative deficiencies during the MEPA process allows for a more efficient permitting process, as this information may then be incorporated into permit applications and narratives at the outset, rather than at the request of the agency reviewer at some point during the review timeline, which could further stall the project. Further recommendations on proceeding with permitting for the NOI and PCN will be determined at that point.

Given the extended review timelines required for both the Section 401 Water Quality Certification and the Chapter 91 License, it is recommended applications for these authorizations are submitted following the conclusion of the MEPA process. MassDEP offers a Joint 401/91 application process, allowing the applications to utilize the same public notice and comment period and provides other minor efficiencies in review that would otherwise not be provided were they submitted separately.

We also recommend that the NOI be submitted shortly after the Joint 401/91 application, to secure an OOC for the work, as the OOC is required by MassDEP to complete both the 401 WQC and Chapter 91 processes. We then suggest submitting the PCN on or around the time of the NOI submittal. Submitting all permit applications over the course of three to four weeks commences a concurrent review from all regulatory authorities and provides more efficiency than a staggered review.